

**WHAT DO PHYSICIANS WANT? INFORMATION TECHNOLOGY ACCEPTANCE  
AND USAGE BY HEALTHCARE PROFESSIONALS.**

by

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## ABSTRACT

This study builds on the theory of planned behavior, institutional and innovation diffusion theories to investigate physicians' responses to introduction of electronic medical records (EMR) in large healthcare organizations. Using a case study methodology, we show that physicians' attitudes towards using EMR are influenced by their perceptions of EMR complexity, relative advantage, compatibility with professional beliefs and individual predisposition to change. Specifically, we found that EMR usability characteristics such as system interface, "navigation," "search" and "speed" are major dimensions underlying physicians' perceptions of EMR complexity. To the extent that navigating and searching for clinical results are seen as difficult, physicians' perceptions of the complexity of using EMR are enhanced, with the result of physicians forming more negative attitudes towards EMR and using EMR less. Accessibility to EMR (i.e. logging in) and availability of hardware are two emergent constructs. These factors are immediate barriers for physicians not using EMR or using EMR minimally. At the same time, these barriers contribute to impacting physicians' perceptions that EMR is difficult to use and disadvantageous (i.e. time inefficient) compared to the paper chart. Results also show that most EMR usage at Alpha is rather "shallow." Physicians tend to use data-retrieval EMR minimally, mainly to *supplement* the paper chart. The availability of this "competing artifact," that is much easier to use and conveniently located near a patient's room limits the extent to which physicians use EMR at Alpha. Use of an imaging EMR system (EMR3) is more committed. EMR3 is used to *replace* the "old way" of accessing films. Lack of accessibility and hardware barriers, the relative advantage of EMR3 and other system usability considerations contribute to physicians using this system more faithfully. As regards the question "what do physicians want?" it seems that physicians want a system that that is easy to access and simple to use but most importantly, a system that they can directly identify with, an EMR that is personally relevant. In order to promote a "deeper" level of EMR usage, the benefits of EMR need to be emphasized to physicians while any potential costs or barriers reduced or eliminated.

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## **LIST OF ACRONYMS/ABBREVIATIONS**

EMR	Electronic Medical Records
EPR	Electronic Patient Records
EHR	Electronic Health Records
CPR	Computerized Patient Records
IOM	Institute of Medicine
CPOE	Computerized Physician Order Entry
IT	Information Technology
IS	Information Systems
TAM	Technology Acceptance Model
TPB	Theory of Planned Behavior
ICU	Intensive Care Units
NP	Nurse Practitioners
PA	Physician Assistants

## CHAPTER ONE: 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 (Agarwal, 2000 and Venkatesh et al., 2003). However, with few exceptions (Kim & Michelman, 1990; Chau & Hu, 2001; Devaraj & Kohli, 2003; Kohli & Kettinger, 2004), IS research is scarce regarding IT adoption in a healthcare environment.

Recently, with new government regulations and other institutions (i.e. major insurance corporations) pushing towards incorporation of more IT into the healthcare arena (Thompson, 2004) especially to support physicians' clinical decisions, it becomes increasingly important to study physicians' attitudes and beliefs regarding their usage of such systems. The primary interest in this study is the individual physician's acceptance and usage of IT.<sup>1</sup>

The healthcare industry is of particular interest for several reasons. First, IS research is scarce when it comes to investigating IS acceptance and usage in a complex environment like healthcare. Several studies (Hu et al., 1999; Chau & Hu, 2001; Chismar & Wiley-Patton, 2003) have found only partial support for the widely used Technology Acceptance Model (TAM) (Davis, 1989; Davis et al., 1989) when it comes to physicians' usage of Internet-based health applications or telemedicine technology. As it will be discussed in the next paragraphs, this industry is highly complex and characterized by unique contextual issues that make it different from other environments previously looked at in IS research, such as personal computers in

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<sup>1</sup> This is a "secondary adoption" at the individual physician level rather than the hospital's decision to acquire IT which can be seen as the "primary adoption" decision made at the organizational level.

homes (Venkatesh & Brown, 2001), on-line brokerage firms (Bhattacharjee, 2001), financial institutions (Karahanna et al., 1999), the retail industry (Venkatesh, 2000) and university environments using student participants (Taylor & Todd, 1995; Mathieson, 1991; Davis et al., 1989) to name a few.

Second, adoption of IT in healthcare *to support physicians' clinical decisions* (Weiner et al., 2004) is considered to be a major problem (Treister, 1998; Leonard, 2004). 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 (Anderson, 1997), 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 (U.S. Department of Health and Human Services, 2004), physicians are reluctant and unwilling to accept these new healthcare applications in their practices (Anderson, 1997; Treister, 1998; Fitzhenry et al., 2000; Bujak, 2002; LeTourneau, 2004). Today, in many hospitals, physicians often write orders in the traditional manner, while nurses or other personnel enter them into an IS. 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 (Fitzhenry et al., 2000). Thus, understanding what drives physicians' acceptance of IT systems and how they use these systems is a major research problem.

Furthermore, IT adoption and usage seems to have been conceptualized dichotomously in the literature as adoption or rejection of IT systems and the measures employed to capture usage range from self-reported measures to frequency of use or amount of data downloaded, to name a

few. Recently, Jaspersen et al. (2005 forthcoming) called for more research into the usage construct as they pointed out it has not been investigated thoroughly. In this study, we adopt a more complex view of IT usage, viewing it as a continuum ranging from non-usage to shallow usage to instrumental or deep-level usage and investigate these different types of usage and their drivers in the healthcare context.

Recently in the organizational behavior and accounting literatures, studies have shown that that adoption of organizational practices is not uniform in nature (Kostova, 1999; Kostova & Roth, 2002) and there are in fact multiple responses to the adoption of the same practice (Saka, 2002). Even in IS, at an organizational level of analysis, it has long been implied that organizations respond differently to the introduction of the same technology. A classic study by Barley (1986) showed that in two similar hospitals, with similar team compositions and similar power distributions, CT scan technology led to quite different organizational structures. In one case, the new technology led to a hierarchy structure dominated by physicians, essentially a reproduction and reinforcing of status quo relationships. In other cases, the CT scan technology provided lower level participants with a way to gain some control in the organization, resulting in a flatter structure in which physicians and lab technicians were more nearly equal in power.

The objectives of this study are twofold:

- First, we seek to identify the factors that impact physicians' acceptance and usage (or their resistance) to EMR systems.
- We examine the nature of use of EMR among physicians by looking at IT use at a finer-grained level and isolate the factors that lead to differential usage behaviors.

Recently, Chiasson & Davidson (2004) called for pushing the "contextual envelope" for IS research in healthcare in terms of reshaping existent theories and constructs to deal with unique

aspects of the healthcare industry. Because this industry is so different from other industries (in terms of its goals, which are not mainly profit making but also societal issues such as people's welfare), adoption of IT has been slow. Hospitals lag other industries in IT adoption by 10-15 years as regards to IT spending (Burke & Menachemi, 2004). This industry provides a unique context characterized by a high degree of institutionalization (Fottler et al., 1982) in which IT can show its potential not only in reducing costs but most importantly, improving quality of care by supporting clinical decision making.

Following Chiasson & Davidson (2004), we believe it is imperative that IS research pay more attention to issues surrounding healthcare IT, as IT has much potential in improving the overall quality of care primarily by reducing medical errors and assuring data consistency and data sharing for a patient's medical record. However, it is up to the individual physician to use or not to use and how to use clinical IS. It is also the individual physician that drives as much as 80% of the hospital costs (Chilingirian & Sherman, 1990) and the quality of care. This is the reason why we focus on the individual level of analysis, rather than organizational or inter-organizational levels. Furthermore, while we acknowledge there are a variety of players in the healthcare industry ranging from major hospitals to small physicians' practices, insurance companies and others, we are concerned with individual physicians that operate in large hospitals.

This study attempts to contribute by filling some of the existent gaps in the literature by analyzing individual physician's acceptance and usage of IT. The following two main research questions are investigated:

*RQ1: What are factors that impact physicians' attitudes and usage behavior regarding electronic medical records?*



*RQ2: Are there different levels at which individual physicians use electronic medical records? If so, why?*

In order to answer these questions, we use a research framework based on the theory of planned behavior (TPB) (Ajzen, 1985; 1991; Taylor & Todd, 1995). We chose this framework as TPB is a very general but widely accepted model from social psychology designed to explain virtually any human behavior. Given the fact that there is no solid theoretical explanation of the phenomenon of IT acceptance and usage in healthcare, we felt that it was prudent to start with a more general theoretical framework. In this context the behavior of interest is physicians' usage of EMR. Due to the complexity of the phenomenon under investigation, we supplement this framework with additional constructs from institutional economics literature (Ayres, 1944, Bush, 1986, 1987), diffusion theory (Rogers, 1995; Moore & Benbasat, 1991) and psychological theories (Kelman, 1958; O'Reilly & Chatman, 1986) in order to get a more complete view of the phenomenon of interest. The framework is presented in Chapter 3.

This dissertation is organized into six chapters. Chapter 1 presents an introduction to the context of the study and the research questions. Chapter 2 presents a literature review by focusing on the general background for this study in terms of the healthcare environment and preliminary issues related to physicians' attitudes about IT systems from the IS and healthcare literatures. Chapter 3 elaborates in detail on the research framework used in this study. The research framework triangulates three main theoretical underpinnings such as the theory of planned behavior (Fishbein & Ajzen, 1975; Ajzen & Fishbein, 1980; Ajzen, 1985, 1991; Taylor & Todd, 1995; Klein & Sorra, 1996), institutional economics (Veblen, 1899/1912; Commons, 1931; Ayres, 1944; Foster, 1981; Junker, 1982 and Bush, 1986, 1987) and innovation diffusion theory (Rogers, 1995; Moore & Benbasat, 1991). Chapter 4 elaborates on the research

methodology, specifically sampling strategies, data sources and the methods used to analyze the data. Chapter 5 presents the results of a case study by focusing on each element of the proposed theoretical framework and also accommodating any new, emergent themes (i.e. theory building). Chapter 6 contains a discussion of the findings and a proposed causal model regarding physicians' acceptance and usage of EMR in a large hospital setting. It also contains contributions and implications of this research for both research and practice.

## CHAPTER TWO: LITERATURE REVIEW

This section provides a general background of this study. First, we discuss several characteristics that make the healthcare environment an interesting context to study, second, we define and describe the technology of interest (the EMR), third we talk about preliminary evidence from the literature regarding physicians' attitudes towards IT systems.

### **The Healthcare Environment**

Recently, Chiasson & Davidson (2005, forthcoming) argued that the healthcare industry receives little attention in IS research and theory; this is evident both in the narrow range of industries examined in IS research and the infrequent consideration of industry in theory. They 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. These same authors (Chiasson & Davidson, 2004) highlighted important distinct elements of the healthcare environment that makes it such a unique context for research.

First, the healthcare industry is highly institutionalized; there are many sources of regulative authority over hospitals (and physicians) including government regulations<sup>2</sup>, common law (negligence and liabilities, hospitals' contractual agreements), hospital and physicians'

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<sup>2</sup> It is worth mentioning here the latest push in 2004 for integrating more IT in healthcare which is part of a national program aimed at achieving interoperable electronic medical records in the next 10 years (see the report by U.S. Department of Health and Human Services “*The Decade of Health Information Technology: Delivering Consumer-Centric and Information-Rich Health Care. A Framework for Strategic Action*” July 21, 2004).

licensure and other certifications (Ruef & Scott, 1998) and payers such as Medicare and Medicaid.

As most US hospitals operate in such highly institutionalized environments, they are subject to powerful forces regarding their primary adoption decision at the hospital level in acquiring IT-based systems. Implicitly, individual physicians may be subject to many of these pressures regarding their decision to adopt and use healthcare IT systems (which we refer to as the secondary adoption decision). For example, often times, major payers in the industry will not accept any form of billing documentation other than electronic, thus healthcare professionals have to conform to these influential sources in order to get paid.

A second element that makes the healthcare industry quite unique is the high degree of professionalism. The healthcare arena is subject to strong professional norms as evidenced by organizations such as the American Medical Association and the American Hospital Association. These associations engage in regular and systematic efforts to evaluate the conformity of hospital organizations to industry-wide professional standards (Ruef & Scott, 1998). Furthermore, physicians also have memberships in professionals groups as evidenced by their specialty and membership in different specialty groups. To the extent that physicians are part of these groups and interact in different forums, they are subject to different normative influences regarding the adoption and usage of healthcare IT systems.

The healthcare arena is also operationally and technically complex (Scott, 1987). Most hospitals in the US exhibit a dual organizational structure composed of hospital administrators that operate at the hierarchical level (in charge of overseeing the management of the hospital itself including the primary adoption decision of healthcare IT systems) and medical personnel (including physician groups, nurses and staff) that are practicing in the hospital. Typically in a

hospital environment, very few physicians are directly employed by the hospital itself; the majority of physicians are part of a hospital's customer base (Triester, 1998).

These physicians are the ones that bring the "business" to a hospital, which only provides an arena for physicians to practice. It is estimated that a physician with a \$200,000 income can generate revenue as high as \$1 million for the hospital (Fitzhenry et al., 2000). Although hospital administrators do not have direct control over the physicians' behavior through mechanisms such as reward systems (present in most other organizations), they can certainly exert strong influences on physicians to adopt and use clinical IT through diverse mechanisms such as granting or revoking privileges or clan-based controls (Kohli & Kettinger, 2004).

Finally, another difference between the healthcare and other for profit-industries is that for hospitals, outputs are not limited strictly to profitability and costs (Chiasson & Davidson, 2004) but also quality of care, health and safety issues. While these goals are shared by both hospital administrators and physicians the path towards this goal is seen differently by the two stakeholder groups. While hospital administrators view clinical IS as a means to control hospital's costs and standardize healthcare, physicians may view these systems as a direct attack to their autonomy (Fitzhenry et al., 2000).

## **The Potential of IT in Healthcare**

Healthcare is a critical social and economic component of modern societies (Chiasson & Davidson, 2004). In the US, healthcare spending accounts for about 14% of the GDP.

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) (Wholey, 2000). However, the potential of IT to improve the healthcare system is far greater.

According to a report by the U.S. Department of Health and Human Services (2004), IT has the potential to save the US economy \$140 billion a year or 10% of current healthcare costs and at the same time reduce medical errors in hospitals. The same report estimates that about 98,000 deaths occur each year as a result of preventable medical errors in hospitals (such as patients receiving the wrong medication or not getting the right treatment or test). An electronic record should have far less errors in this regard. The traditional paper chart provides only about a third of the data a physician needs when providing patient care (Anderson, 1997). Lab results and other summary data may be missing. Furthermore, the lack of structure of the patient data may make it difficult to access a patient's information in a timely manner.

An EMR is a structured and integrated approach to managing patient data with the end result of improving care by reducing the number of incomplete charts, reducing the waiting time for paper-based test results and enhancing clinical decision making with real-time or on-line access to patient information. This way, a physician can have a complete view of a patient's medical history, which may allow him or her to check for duplicate prescriptions, overdosing, over treatments and such, thus reducing medical errors. At the same time, a nurse can access the same patient record, without waiting for the chart to be physically transferred. Among other benefits that IT can bring to healthcare are also reduction of paper handling and inefficient use of resources by lowering test charges, lab and radiology tests and hospital admissions (U.S. Department of Health and Human Services, 2004).

While the promise of IT is immense in a healthcare setting and the costs are substantial (Wholey, 2000), an area of concern seems to be the impact of these systems on healthcare professionals and their clinical practices. Healthcare IT applications are highly complex (Chiasson & Davidson, 2004) and may involve substantial changes in clinical practices and operations. These IT systems thus seem to be quite different from the ones previously investigated in IS research. As Venkatesh et al (2003) point out, in most technologies employed in past studies of IS adoption and usage have been quite simple, individual-oriented technologies as opposed to complex, organizational technologies.

### **EMR as a Disruptive Innovation**

An EMR is a very complex and unique technology. It is different from any other clinical technology (such as MRI for instance). In some forms (i.e. computerized physician order entry or CPOE) it requires physicians to enter medical orders and also may embed decision support tools or expert rules. Synonyms for EMR used in the medical literature are EPR (electronic patient record), EHR (electronic health record), and CPR (computerized patient record).

An Institute of Medicine (IOM) report (1991) 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 (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). The final benefit of an EMR is clinical decision-support; however, not many healthcare facilities have this functionality today with EMR. This is because, often times, an EMR is implemented in phases, with the decision support function being usually the last phase of implementation of EMR.

An EMR may be considered a disruptive innovation. Disruptive innovations are often the outcome of new architectures that deviate radically from existing ones by incorporating novel architectural principles. Examples include changing telecommunication service from circuit switching to packet switching, or transforming imaging from an analog to a digital process (Lyytinen & Rose, 2003). This distinguishes disruptive innovations from incremental innovations that constitute small but constant improvements to an existent product or process. Incremental innovations reinforce existent capabilities by refining and extending an established design (Henderson & Clark, 1990) while radical, disruptive innovations substantially depart from existent designs. An example of an incremental innovation is an information system that organizes healthcare reference information (i.e. literature, peer physician contact information) to make it easily accessible to different physicians' groups. These systems will not radically change a physician's behavior, as instead of going to a manual or reference book, a physician can access the desired information on a computer.

An EMR may be viewed as a disruptive technology as its implementation involves major changes in clinical operations from a paper-based system to an electronic medical system. An EMR constitutes a radical change in organizational and individuals' workflows and ways of practicing medicine. With an EMR, the core work of a physician changes from diagnosis to



treatment (Fitzhenry et al., 2000). An EMR shifts the responsibility to document the clinical encounter to the physician. With EMR, physicians have to spend time entering data into a computer “that never went to medical school and doesn’t have the flexibility to make nuanced judgment calls” (Fitzhenry et al., 2000).

Before the EMR artifact came into play, a physician would go to the hospital, ask a nurse for the patient’s chart, scan through quickly, scribble in the fields and move on to the next patient. An EMR challenges these long-standing physicians’ practices. The content, sequence and format of the information in an EMR are far from the ones a physician is used to in the paper chart. With EMR, a physician would first need to find an available computer, log in<sup>3</sup> and begin to check boxes in many different categories to indicate patient’s symptoms, allergies, diagnosis tests and medications. If this task usually takes about three minutes with a paper chart, with an EMR, this task becomes about thirty to forty minutes (Connolly, 2005).

We argue that EMR is a disruptive innovation that radically and pervasively impacts people and processes in a healthcare organization by creating major changes in workflows and practices. Disruptive innovations are truly transformative (Abernathy and Clark 1985) and radical (Zaltman et al. 1977) in that they significantly depart from existing alternatives (Lyytinen & Rose, 2003) and new cognitive frames need to be deployed to make sense of the innovation (Bijker 1987). A disruptive IT innovation creates a radical shift in how adopting organizations and thus individuals view, operate, and utilize IT so that their subsequent use of computing capability will be different after adopting the IT innovation (Lyytinen & Rose, 2003). Such a disruptive innovation radically impacts adopters’ behaviors, which need to depart significantly

from existing alternatives (Iivari 1986; Zaltman et al. 1977) in order to make use of the innovation. This implies that disruptive innovations, besides bringing process change, also bring significant behavioral changes. For example, physician data entry in an EMR disrupts current procedures and usually takes more time than entry in a paper based record.

This is the reason why investigating the impacts of this new disruptive technology on physicians' attitudes and usage of such technology is a major research challenge. In the next paragraphs, we present some of the existing literature on physicians' interaction with new IT systems, both from scholarly and practitioner journals.

## **Physicians and IT**

While clinical healthcare IT systems seem to hold a great promise for improving overall patient care, not many physicians have been willing to adopt and use these technologies. In fact, as Fitzhenry et al. (2000) noticed, there is a very limited degree to which the medical profession has adopted these systems. The use of IT in clinical functions remains low. Physicians' use of IT systems to enter data or for expert advice is very low (6% to 8%) according to a survey by Fitzhenry et al. (2000). The same study also found that physicians' hands-on use of information systems for viewing data is also low (although higher than data entry, about 28%). As previously mentioned, physicians are the drivers of care. As long as they do not accept and use these systems in their clinical work, the benefits of an EMR cannot be realized.

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<sup>3</sup> Also note that many times, for security reasons, an EMR system would have an automatic log out set time and physicians have to log in again and again, which is disturbing for many physicians.

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, Chau & Hu (2001) used a model comparison approach (comparing TAM, theory of planned behavior and the decomposed theory of planned behavior) to investigate the adoption of telemedicine by healthcare professionals. They found that attitudes, together with system usefulness are major determinants of physicians' acceptance of telemedicine. However, perceived ease of use, a major construct in the IS literature was not found to be significant. The same study also pointed out compatibility of a system with a physicians' practice routine as a significant predictor of technology acceptance. Furthermore, results from the same study showed that physician' groups "may differ from subjects commonly investigated in previous IS studies (such as clerical, administrative, knowledge workers, system developers) in areas such as adaptability to new technologies, mental and cognitive capacity and work arrangement" (Chau & Hu, 2001).

Another study by Chau & Hu (2001) used TAM to assess physicians' acceptance of telemedicine. Their results show perceived usefulness as an important factor in telemedicine acceptance while perceived ease of use had no impact. Several other authors found similar results (Hu et al., 1999; Chismar & Patton, 2003) in investigating physicians' acceptance of telemedicine or Internet-based applications. These results suggest TAM is not entirely applicable in a healthcare setting when investigating physicians' technology acceptance. These results also 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. Telemedicine refers to the use of information and telecommunication technologies to deliver

timely healthcare services through electronic transmission of expertise among geographically dispersed parties, including physicians and patients (Chau & Hu, 2001). A disruptive technology such as an EMR may trigger different dynamics and attitudes.

Several practitioner reports have drawn attention to the fact that the critical issues that affect physicians' use of IS are not necessarily technical but social (Fitzhenry et al., 2000). Physicians may resist using such systems because they may see them as a threat to their professional autonomy, or they may view IT as a clerical or nursing task. Physicians have been socialized for centuries to guide their practices from personal knowledge and experience. EMR systems are a direct attack on these physician values. These systems also interfere with traditional practice routines (Anderson, 1997) and require physicians to change the *traditional ways* they have recorded, retrieved and utilized clinical data. The paper record reflects a clinical reasoning process, its content, sequence and format of information reflect a work practice (Anderson, 1997). The loss of these individual characteristics when a paper chart is replaced by an EMR has been seen to be a major barrier towards full acceptance and usage of clinical systems (Anderson, 1997).

Another issue is that these systems do not directly benefit the individual physician but rather benefit the hospital as a whole and the patients. Physicians are not rewarded in any way for using these systems. In fact these systems are quite complex and may take more time to use than the paper chart. Thus, physicians may not perceive any direct, visible benefits (Treister, 1998) to warrant changing their long-standing practice patterns. They may actually suffer a cost without sufficient offsetting benefits.

A study by Devaraj & Kohli (2003) identifies IT usage as a key determinant of organizational performance in healthcare. They found that technology usage was positively associated with measures of hospital revenue and

quality such as mortality, revenue per admission and revenue per day. Thus, the final benefits from IT seem to be determined by its users. However, if a physician never enters orders into a clinical system or does not access other patient related information - perhaps asking a nurse to provide all this information - the system will not produce the intended benefits and value not only in terms of cost-reductions but also in terms of reducing medical errors, which are the two main goals for implementing EMR. Furthermore, EMR systems cross a variety of organizational functions such as nursing and pharmacy. Such information systems must be thus used by all stakeholder groups (especially physicians) involved in a hospital setting if the benefits from EMR are to be realized. Furthermore, as the report by the U.S. Department of Health and Human Services (2004) points out, EMR systems can also harm patients if “underused or used improperly.” This present study attempts to grasp some of the complexities surrounding the phenomenon of acceptance and usage of EMR in healthcare organizations.

## CHAPTER THREE: RESEARCH FRAMEWORK

This research builds on the Theory of Planned Behavior (TPB) (Ajzen, 1985; 1991) and augments it with institutional theories (Veblen, 1899/1912; Commons, 1931; Ayres, 1944; Foster, 1981; Junker, 1982 and Bush, 1986, 1987), diffusion theory (Rogers, 1995; Moore & Benbasat, 1991) and psychological theories (Kelman, 1958; O'Reilly & Chatman, 1986) to present a framework for studying the adoption and usage of EMR in a healthcare environment.

Given the lack of solid theoretical explanations regarding physicians' acceptance and usage of EMR, we begin with a general framework. 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 (Venkatesh & Brown, 2001). 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 (Fishbein & Ajzen, 1975; Ajzen & Fishbein, 1980; Ajzen, 1985, 1991). The technology of interest in this framework is the electronic medical record (EMR). This technology is complex and relatively new and it has not been intensively researched in past studies.

TPB posits that a person's performance of a specified behavior (e.g. usage of EMR) is primarily determined by his or her behavioral intention to engage in the activity related to the behavior. Behavioral intention is determined by the person's attitudes, subjective norms and perceptions of behavioral control concerning the behavior in question. *Attitudes* capture an individual's positive or negative feelings about performing the target behavior. *Subjective norms* capture an individual's assessment of the extent to which important referent others would desire the performance or nonperformance of a specific behavior (Fishbein & Ajzen, 1975). *Perceived*

*behavioral control* refers to perceptions about internal and external factors that may facilitate or constrain performing the target behavior (Ajzen, 1985, 1991). Attitudes, subjective norms and perceptions of behavioral control reflect underlying cognitive beliefs.

Attitudes towards performing a specific behavior are formed based on an individual's salient beliefs about the behavior weighted by an individual's evaluation of the outcomes of the behavior. These salient beliefs reflect a subjective probability that performing a behavior will lead to a certain outcome. Thus, an individual who believes that performing a certain behavior will lead to more positive outcomes will hold a favorable attitude towards performing the behavior while an individual who believes that performing the behavior will lead to negative outcomes will hold a negative attitude (Fishbein & Ajzen, 1975).

Subjective norms are a function of individuals' beliefs that other important referent individuals (friends, co-workers or other individuals with which the referent has contact) approve or disapprove performing the behavior weighted by their own motivation to comply. Individuals who believe that most referent others with whom they are motivated to comply think they should perform the behavior will perceive social pressure to do so (Fishbein & Ajzen, 1975). Individuals who believe that referent others with whom they are motivated to comply would disapprove their performance of a behavior will have a subjective norm that makes them avoid performing a certain behavior (Fishbein & Ajzen, 1975).

Perceptions of behavioral control reflect beliefs regarding access to resources and opportunities needed to perform a behavior (Taylor & Todd, 1995). Access to using a technology and perceptions of organizational support in using a technology impact perceptions of behavioral control (Taylor & Todd, 1995; Klein & Sorra, 1996). Taylor & Todd (1995) found perceived behavioral control to significantly influence individuals' behavioral intention to use a

technology. They concluded that perceived behavioral control together with normative beliefs and attitudes are important determinants for a successful deployment of IT. In particular, perceived behavioral control can alert management to possible barriers to using a technology in the process of system implementation (Taylor & Todd, 1995).

TPB has been previously applied in IS research in a variety of domains (Mathieson, 1991; Taylor & Todd, 1995; Chau & Hu, 2001). Ajzen (1985, 1991) in the original TPB points out that individuals' beliefs should be elicited anew for each setting. Taylor & Todd (1995) however, suggested that existent research on technology adoption provides a strong conceptual base for a wide variety of individual beliefs, which minimizes the need to elicit new belief structures for each setting. Consistent with TPB and also the work of Taylor & Todd (1995), we propose a decomposed belief structure by drawing from additional theoretical bases from diffusion theory, institutional theories and psychological theories.

Table 1 presents the main constructs forming the theoretical framework along with their definitions. In the next sub-sections, we describe in more detail the proposed elements of the framework and we develop the theoretical justification.



**Table 1: A TPB-based Framework for Studying Physicians' EMR Acceptance and Usage**

Construct	Definition
<b>1. Beliefs</b>	Reflect a subjective probability that performing a behavior (use EMR) will lead to a certain outcome (Fishbein & Ajzen, 1975; Ajzen & Fishbein, 1980; Ajzen, 1985, 1991).
a. Beliefs about the Technology	Reflect individual physicians' assessments of EMR.
- Perceived Complexity	Refers to the degree to which an EMR are viewed as being difficult to use (Rogers, 1995).
- Perceived Relative Advantage	The degree to which adopting or using an EMR is perceived as being better than using the existent practice (Rogers, 1996; Karahanna et al., 1999).
- Perceived Compatibility	The degree to which an EMR fits with a potential adopter's existing values, beliefs and experiences (Rogers, 1995).
b. Beliefs about the Medical Profession	Reflect the degree to which individual physicians believe an EMR fits with their medical values.
c. Individual Predisposition to IT-based Change	Reflects the way individual physicians are predisposed to react to EMR-based change (Ayres, 1944; Bush, 1987; 1991).
<b>2. Attitudes</b>	Refer to an individual physician's positive or negative feelings about performing the target behavior (Fishbein & Ajzen, 1975; Ajzen & Fishbein, 1980).
<b>3. Social influences</b>	Refer to an individual physician's assessment of the extent to which important referent others (i.e. hospital administrators, other peer physicians) would desire the performance or nonperformance of a specific behavior (Fishbein & Ajzen, 1975; Fulk et al., 1987).
<b>4. Perceived behavioral control</b>	Refers to perceptions about internal and external factors that may facilitate or constrain performing the target behavior (Ajzen, 1985, 1991; Taylor & Todd, 1995).
- Facilitating conditions	Reflect availability of resources needed to engage in a behavior such as time, money and other specialized resources (Taylor & Todd, 1995).
<b>5. Behavioral Intention</b>	Refers to the fact whether individual physicians intend to use (or continue to use EMR) in the future (Fishbein & Ajzen, 1975, Ajzen & Fishbein, 1980; Ajzen, 1985, 1991; Davis, 1989; Davis et al., 1989).
<b>6. Usage</b>	EMR usage is seen as a continuum ranging from non-use to shallow use and deep-level use.

In the next sub-sections, we describe in more detail the elements of the framework and we state propositions related to physicians' acceptance and usage of EMR.

## **Attitudinal Belief Structure**

TPB includes attitudes as a major determinant of technology acceptance and usage. According to TPB, attitudes towards using a specific IT system reflect an individual's positive and negative evaluations towards performing the specified behavior (i.e. using an IT system). Attitudes are a critical factor (Brown et al., 2002) because they represent the internal psychological processes that produce the behavior as a response to different social influences (Kelman, 1958).

The role of attitudes in influencing behavioral intention to use an information system has been consistently supported across studies in both voluntary and mandatory settings. Attitudes have been shown to influence both initial usage and long term usage (Davis et al., 1989; Karahanna et al., 1999; Bhattacharjee, 2001). Thus, we propose:

*P1: Physicians' attitudes about EMR systems will influence their usage of EMR.*

TPB posits that attitudes are primarily driven by the beliefs individuals form about a particular behavior (Fishbein & Ajzen, 1975). This theory is general with regards to the types of beliefs that impact attitudes. We posit two main sets of beliefs may be important in a healthcare context, namely beliefs about the IT artifact (EMR) 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 and show how elements from these two theories help inform different parts of the framework.

## **Beliefs about the EMR Artifact**

Fishbein & Ajzen (1975) recommend that salient beliefs should 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 (Karahanna et al., 1999). This is consistent with the method employed by Taylor & Todd (1995).

Innovation diffusion theory (Rogers, 1995) offers a rich set of beliefs, called perceived innovation characteristics, that concern potential adopters' beliefs regarding the characteristics of the innovation in question (in this case EMR). These characteristics of an IT innovation offer a useful set of stable beliefs that can be applied within a TPB framework (Agarwal & Prasad, 1997). Other authors have included beliefs from innovation diffusion theory as determinants of IT-related attitudes (Taylor & Todd, 1995; Karahanna et al., 1999).

Based on a meta-analysis of existent research, Tornatzky & Klein (1982) found that three perceived innovation characteristics, namely, perceived relative advantage, compatibility and perceived complexity 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 (Rogers, 1995). Moore & Benbasat (1991) view this construct as the conceptual opposite of perceived ease of use (Davis, 1989; Davis et al., 1989), which refers to the degree to which the prospective user expects the target system to be free of effort. Even though these two

constructs are very similar in their meaning, in this research we will focus on the perceived complexity of an EMR artifact. The reason is that considering the inherent inertial ceremonialism of users in most organizations (Kelly & Amburgey, 1991) and the complexities brought about by any disruptive technology with which users are not familiar, individuals may be more likely to (at least initially) perceive more the difficulties associated with a system rather than its ease of use.

*Perceived relative advantage* is the degree to which adopting or using an IT innovation is perceived as being better than using the existent practice (Rogers, 1996; Karahanna et al., 1999). This construct is seen as similar to perceived usefulness (Davis et al., 1989; Davis, 1989) which refers to a prospective user's subjective probability that using a specific application system will increase job performance. However, we see relative advantage to be more comprehensive a construct than perceived usefulness which is rather narrowly focused towards a specific task. In our view, relative advantage involves a comparison of the newly introduced system with the old existent system. To the degree the new system it is perceived to be superior, users may form positive perceptions about it.

*Perceived compatibility* is the degree to which an innovation fits with a potential adopter's existing values, beliefs and experiences (Rogers, 1995). Despite not being included in the widely used TAM, this construct has been shown to consistently influence innovation adoption (Moore & Benbasat, 1991; Rogers, 1995; Prescott & Conger, 1995; Van Slyke, Belanger & Comunale, 2004). Agarwal & Karahanna (1998) extended compatibility to a multidimensional construct referring to compatibility with an individual's experiences, work style, work practices and individual values. Klein & Sorra (1996) talk about an innovation-value fit that is important in the context of innovation implementation and thus individual acceptance.

This construct refers to the extent to which targeted individuals perceive that the use of an innovation will foster (or inhibit) the fulfillment of their values and thus it is very close in meaning with Rogers' compatibility. Klein & Sorra (1996) theorized this construct to be one of the most important ones in determining usage of an innovation and the way individuals use an innovation (i.e. types of usage behaviors).

Thus, in concert with TPB, we posit that this initial set of beliefs about an EMR artifact may impact physicians' attitudes regarding acceptance and usage of EMR. Thus, we propose:

*P2: Physicians' beliefs about EMR will influence their attitudes towards using the system.*

## **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. This element of the framework is informed primarily by institutional theories. This theoretical lens helps inform how strong existent institutionalized (or ceremonial) individual beliefs may be a barrier to adoption of new technologies. While there are different branches of institutional theory (Scott, 1987), one in particular, Institutional Economics offers important considerations with regards to the interplay between technology and existent institutionalized behavior in the process of social change.

Institutional Economics (Veblen, 1899/1912; Commons, 1931; Ayres, 1944; Foster, 1981; Junker, 1982 and Bush, 1986, 1987, 1989, 1994) posits that technology brings about change in any economic system. The process of accumulation of technical knowledge has an internal dynamic of its own and this process is not primarily controlled by such an outside

motivation as the profit motive. On the other hand, the institutions in which society is organized (e. g. medical profession) are characterized by a high degree of ceremonialism (based on institutionalized ways of doing things, Meyer & Rowan, 1977) and adjust slowly and reluctantly to assimilate and use new technical knowledge and to accommodate and adjust behavioral norms to better utilize this new knowledge. Economic progress is due to technological change, which requires a breakage in existent institutions (Ayres, 1944).

In this context, we see the current ways of practicing medicine as an institution. Veblen (1889/1912/1953) defined institutions as “prevalent habits of thought with respect to particular relations and functions of the individual and the community.” The emphasis here is on institutionalized behavior of different groupings of people rather than on objects or artifacts (i.e. buildings, organizations). Institutions thus connote a way of thought or action which is embedded in the habits of a group or the customs of people (Hamilton, 1932). The “habit of thought” feature of institutions is given a cognitive dimension reflecting culturally-based social norms, rules and embodiment of habituated behaviors. 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” (Camic, 1986). Institutions thus involve concealed habits (Hodgson, 1993), which gives them a stable and inert quality over time.

The medical profession has long had an established tradition regarding its own identity as a profession (Starr, 1982). Healthcare professionals are accustomed to a certain way of practicing medicine, based on specialized training (Chau & Hu, 2001) that usually does not involve use of computers but rather practice, experience and intuition. An EMR radically disrupts these institutionalized beliefs and practices, which may lead to negative attitude formation. As a

physician put it in a hospital group meeting “that’s not like a doctor would do it” referring to an EMR’s functionality.

Although institutions may be perceived as highly constraining, it is worth noting that institutions have both constraining and enabling qualities. An enabling function of institutions has to do with the information they carry and provide for its members. Institutions are strong “carriers of information, knowledge and skills” (Hodgson, 1993). Ways of action and behavioral norms are learned and transmitted over time, which provides continuity in human activities. However, in time, institutions become very difficult to alter when new ways of performing an activity become available (constraining role). Institutions are customs and canons of behavior which establish and reproduce a set of rules and behavioral norms which prescribe patterns of human action such that regular and predictable behavior is possible. Ayres (1944) noticed that institutional arrangements provide “much of the stability for organizing human activities.” Institutions thus, have a static function in regulating human behavior (Ayres, 1944) and they are highly resistant to change.

To clarify the meaning of the term “institution”, and isolate a particular aspect of behavior that is non-dynamic and habit-oriented, Ayres also used the term “ceremonial function.” The emphasis here is on the content of habitual behavior that is difficult to change because of its non-reflective character. Ayres (1944) posits that all institutions are derived from the past and contain a certain ceremonial residue that is based on institutionalized beliefs that perpetuate the institutionalized “way of doing things.” Ayres (1944) also refers to institutions as learned behaviors, the product of past circumstances and “never in line with the requirements of the present...institutions do not entirely fit the situation of today...they tend to persist indefinitely except as some circumstances enforce a change.” This is why, in a healthcare

context, achieving all the benefits of implementation of EMR requires a change in physicians' "habits of thought."

However, institutions do not remain totally static over time, they do change (in response to different forces such as new technology) but at the same time they provide much of the stability for organizing human activities. Change in an institution occurs when its members are willing and able to change their "habits of thought." (Waller, 1988).

The institutionalized beliefs about practicing medicine are based on a sense of social identity of physicians reflected by the "white coat" artifact (Fiol & O'Connor, 2004). Physicians' social identity is rooted in a high professional differentiation as the "healing class." Physicians' beliefs about the profession thus, may take heightened importance because healthcare organizations are viewed as professional bureaucracies (Anderson & McDaniel, 2000) characterized by a high degree of professionalism. The medical profession is based upon main values such as professional autonomy, status role and expertise (Blumenthal, 2002). Such values in time become institutionalized and serve as a basis for individual behavior (Redmond, 2003).

Professional expertise is conferred based on the fact that healthcare professionals possess certain specialized skills (that enable them to diagnose, treat and cure people) acquired through specialized training (Blumenthal, 2002) that other individuals from other professions do not have. This confers physicians, nurses and other healthcare professionals professional authority in their field (Blumenthal, 2002), which is based on an asymmetric competence between healthcare providers and patients. EMR and other healthcare IT systems may be perceived as a direct attack on these values (Fitzhenry et al., 2000).

Professional status is another important value in medicine. This is derived from the identification of healthcare professionals as having the "a validated power to heal" (Blumenthal,



2002). The social status of a doctor for instance, is highly institutionalized to manage illness. Upon completion of the medical requirements, healthcare professionals are conferred the degree, Medical Doctor (MD), Physician's Assistant (PA) or equivalent and they become legitimated to practice medicine. Status is symbolically represented in medicine by the "white coat" artifact (Fiol & O'Connor, 2004) which is based on values of professional distinctiveness. An EMR may be perceived as lowering a physician's status especially if the system brings with it a series of clerical tasks that are not relevant to a physician's primary clinical duties. For instance, the perception that a physician is not supposed to do clerical work as a nurse does may lead to negative attitude formation. Thus, the emergence of a competing artifact (the EMR) (Fiol & O'Connor, 2004) may be seen as a direct threat to physicians' institutionalized values and beliefs. The EMR artifact that is supposed to bring a centralized approach to patient care by providing a single, comprehensive source of data for all parties involved in healthcare delivery may trigger physicians' resistance as this new artifact may not be compatible with existent, institutionalized medical values that are part of the way of practicing medicine or "this is not how a physician would do it."

Thus, based on existent literature regarding underlying beliefs and values of the medical profession, we identified certain values that may be important in a healthcare context. However, we may expect other salient beliefs about medical profession to emerge from the qualitative interviews that are to be conducted in a hospital setting.

*P3: Physicians' beliefs about the medical profession will influence their attitudes towards using an EMR system.*

## **Individual Physician's Predisposition to Change**

Institutional Economics posits that the introduction of any new technology may bring about change in existent practices (Ayres, 1944). Thus, an important consideration in this study is an individual's predisposition to change. The organizational change literature also points out that individuals differ from one another in their willingness to support or resist change across issues and time (Dunham et al., 1989). These authors refer to a general predisposition to change and a predisposition to a specific type of change. A general predisposition to change is defined as consisting of a person's cognitions about change, affective reactions to change, and behavioral tendency toward change. A predisposition towards a specific type of change (i.e. IT-based change) is seen as consisting of a person's cognitions about that change, affective reactions to that change and behavioral tendency toward that change (Dunham et al., 1989).

Based on institutional economics and the change literatures, we posit that individuals may exhibit two main orientations towards changes brought about by a new EMR system: a ceremonial predisposition and an instrumental predisposition. Institutional Economics posits that individuals apply two distinct models of social valuation based on which they perform a specific behavior. These models of valuation are based on differential values which can range from ceremonial to instrumental (Bush, 1986, 1987).

*Instrumental values* are derived from the systematic application of knowledge and reason to the problem-solving processes (Bush, 1987). They emerge from a process of inquiry and technological innovation. The operative criterion of judgment here is efficiency-based, the extent to which a new technology contributes to problem-solving processes.

*Ceremonial values* on the other hand, are based on habitual modes of thought and behavior embedded in traditional practices (Bush, 1987). They are product of cultural norms and institutionalized beliefs (Hickerson, 1987; Zucker, 1987). Ceremonial values incorporate values based on status and hierarchies and they also rationalize power relationships and patterns of authority (Bush, 1987). The emphasis is not on finding solutions to enhance problem-solving processes but on conformance to institutionalized beliefs and/or existent power relations. Thus, ceremonial values are “past binding” (Bush, 1986, 1987) and highly resistant to change. The operative criterion of judgment here is “ceremonial adequacy” (Bush, 1986, 1987, 1989, 1994) or the extent to which a new technology is consistent with institutionalized norms and practices. Thus, in the context of deciding to adopt a new technology, individuals can be said to apply different modes of valuation based upon their individual predisposition.

Individuals that are more instrumental would make an evaluation based on “instrumental efficiency” of the technology in question. To the extent that a new technology is posited to bring enhanced efficiency (instrumental valuation), it will be assimilated and behavior adjusted to make full use of the technology. In this case, an individual’s behavior is said to be “instrumental.”

Individuals that are predominantly ceremonial in their predisposition would make an evaluation based on the “adequacy” of the technology to institutionalized ways of doing things (existing behavior or “ceremonies”). Very often, a new technology will bring a new set of values that may clash with existent, ceremonial ones. To this extent, a technology is said to be “encapsulated” by strong ceremonial beliefs and change is resisted because it is not consistent with existent ceremonial values. In this case, behavior is “ceremonial” as it is based on strong institutionalized beliefs based on legitimacy of existent practices.

Thus, based on the above theories we can infer that some individuals are more instrumental in the sense that they are more open and willing to adjust their behavior to make use of the new technology. Some other individuals are more ceremonial in the sense that they obey their ingrained habits, institutionalized norms and way of doing things and are not willing to change their behavior to adjust to the new technology.

More specifically, *instrumental individuals* are open to change and support change. They are usually the ones that are forward-looking, like new ideas and believe change is beneficial for themselves and the organization (Dunham et al., 1989). Often times these individuals are the ones supporting and promoting new ideas or new ways of doing things. When it comes to IT, instrumental individuals have a predisposition to be more open to the technology, and promote it throughout the organization to other peers with which they interact. They are more inclined to try out new technologies and believe technological change is beneficial to themselves and the organization in terms of improving their work processes and organizational processes. Often times, instrumental individuals suggest new approaches and domains to using the technology. Underlying this attitude is an instrumental mode of valuation (Bush, 1986, 1987) that focuses on technological values based on an economic potential of improved efficiency and reduced costs. To the extent a new technology provides an economic basis of evaluation, an instrumental individual will adapt his or her behavior to make use of the technology in question. An instrumental individual may also obey altruistic values (Kohli & Kettinger, 2004), to the extent that a new technology is seen as benefiting other important stakeholders such as other community members or the organization as a whole, behavior will be changed towards incorporating and making use of the technology. Instrumental individuals may be equated with

Rogers' (1995) categorization of innovators or early adopters that often times initiate change by taking roles of opinion leaders or change agents.

*Ceremonial individuals*, on the other hand, tend to resist change and adapt poorly to change (Dunham et al., 1989). They strongly obey engrained beliefs and habits of doing things (Bush, 1987) and they are not willing to adjust their behavior easily as a response to economic issues. In terms of their orientation towards IT, ceremonial individuals dislike changes brought by IT, they see IT-based change to be risky thus they do not believe in the value from changing to adapt and incorporate the new technology in their work. Such individuals tend to use their power to resist change, they are often times frustrated by IT-based change and they are committed to the status quo. Because ceremonial values are “past binding” (Bush, 1986, 1987) and highly resistant to change, ceremonial individuals thus, are not ready to easily change their behavior in response to an outside force (such as a new technology) and they strongly maintain adherence to their institutionalized ceremonial values underlying the status quo. This distinction in individual predisposition to change is an important one, as it can clearly inhibit or drive acceptance of new IT systems among individuals or groups of individuals. Thus, we propose:

*P4: Physicians' predisposition to change will influence attitude formation regarding the use of an EMR system.*

## **Normative Belief Structure**

According to TPB, normative pressures are an important element influencing individuals' intentions to use a technology. The influence of this construct on behavioral intention to use a technology and further on usage has been supported by previous studies of technology

acceptance (Taylor & Todd, 1995; Karahanna et al., 1999). Subjective norms refer to the normative beliefs that an individual attributes to what important relevant others expect him or her to do regarding technology use weighted by the individual's own motivation to comply to the source of influence. Subjective norms are a form of social influence (Fulk et al., 1987). Social influence is the perceived pressure to perform the behavior in question.

In a healthcare context that is highly institutionalized and subject to strong professional norms (Ruef & Scott, 1998), we believe it is important to consider many different influence sources not only from the hospital administrators, individuals' professional networks (other physician groups), but also influences coming from the institutional environment itself (i.e. regulations) and influences coming from major payers in the industry (i.e. Medicare, Medicaid).

Institutional theories (DiMaggio & Powell, 1983, 1991) stressed the importance of environmental influences beyond the ones from one's immediate circle of influence. This is especially the case when physicians and healthcare organizations operate in highly institutionalized environments where many sources of influence are present. Institutional theories of organizations posit different sources of social pressure such as coercive, normative and mimetic (DiMaggio & Powell, 1983).

*Coercive pressures* may arise from government regulators, hospital administrators or other dominant actors. There are many regulative sources in a healthcare environment including the government, state and local governments, common law, labor law, Medicare and Medicaid to name a few. Although currently, there is no formal mandate in place in most healthcare systems on the healthcare professionals operating in different hospital systems, there are certainly strong influences exerted upon physicians to adopt and use new healthcare IT systems. One source of influence comes from the institutionalized environment itself. With new regulations strongly

pushing for an integrated healthcare system in the US, individual physicians and groups may be very likely to perceive pressures towards using IT systems. Furthermore, healthcare IT systems are often times multi-million dollar systems thus a hospital's management is likely to exert strong pressures (through creating a strong climate for implementation of such systems, Klein & Sorra, 1996) and make use of many different influence methods to promote such systems throughout the organization (e.g. opinion leaders, Rogers, 1995).

Another source of pressure on physicians to use healthcare IT systems comes from other key players in the industry, such as Medicare or Medicaid. These organizations have recently demanded more control over healthcare spending and tightened their requirements regarding electronic billing. They are thus pushing the use of electronic information by physician groups. For instance, in most cases, Medicare will accept only submission of 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 are subject to different normative influences that may lead them to act in a certain way.

*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 (DiMaggio & Powell, 1983). Institutional theory may explain the diffusion of healthcare IS throughout the healthcare arena due to complex linkages between the healthcare organizations, physicians' groups and the government.

The above sources of influence may be grouped into two types of social influences: *intra-organizational influences* stemming from interactions among healthcare professionals and

hospital administrators, physicians and other staff (e.g. the MIS department) and interactions among peer healthcare professionals in the same hospital and *extra-organizational influences* arising from outside influences such as new regulations or pressures exerted by major payers and insurance companies in using EMR. We are also considering that physicians are part of different professional organizations that cross a hospital's boundaries (such as membership in different professional associations). Such interactions that are part of normative influences may determine formation of individual perceptions about an EMR (either positive or negative). We propose:

*P5: Social pressures on individual physicians arising from both intra and inter-organizational influences will influence their behavioral intention to use an EMR system.*

## **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 (Ajzen, 1991). Perceived behavioral control reflects the presence of factors that can interfere with or facilitate the performance of a specific behavior (Fishbein & Ajzen, 1975). Facilitating conditions, or the availability of resources needed to engage in a behavior such as time, money and other specialized resources (Taylor & Todd, 1995), have been identified as a major factor constraining performance of a behavior (e.g. using an IT system).

One way in which perceived behavioral control has been viewed is through “perceived implementation climate” (Klein & Sorra, 1996). This construct refers to individuals’ perceptions of the extent to which their use of a specific innovation is rewarded, supported and expected within a setting (Klein & Sorra, 1996). According to the same authors, a strong innovation



implementation climate fosters usage by ensuring skills for the innovation's usage, providing incentives for an innovation's usage and removing obstacles to an innovation's usage. In contrast, perceptions of a weak implementation climate would discourage usage of an innovation by creating an impression that the innovation is not supported and promoted in an organization.

In a healthcare environment, creating a favorable climate for implementation of EMR may include among others, customized training aimed at the individual physician, a help-desk for physicians to call and provide timely assistance, adequate hardware resources (e.g. sufficient computers available for physicians to use or different types of devices available to physicians to choose from<sup>4</sup>), ongoing assistance via physicians' advocates<sup>5</sup> in charge of providing continuous support for the use of an EMR, making sure that concerns or complaints regarding the EMR are responded to and corrective action is taken. To the extent that these concerns are responded to adequately, physicians may form different perceptions about an EMR implementation climate and thus about using an EMR system.

As regards the implementation climate, it is worth mentioning that in some large hospital settings, there is a "Physician Technology Committee" that meets monthly where issues related to physicians' usage of EMR systems are discussed. This committee on one hand, is a forum where physicians can voice their concerns regarding their usage of EMR systems such as design of different forms and other functionality issues and on the other hand, a forum for

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<sup>4</sup> Preliminary observation in a hospital environment indicates that the hardware strategy is not as clear as the software strategy (e.g. implement EMR). This is evidenced by the number and the type of devices available to use (tablets, computers on wheels, computers in a patient's room, computers in the wall and such) and the differential amount of money the hospital spends of software versus hardware. At present, the hospital provides physicians access only to computers on wheels located in the hall-ways that they have to share with nurses. This issue is important in a hospital setting as physicians do not have a physical office in the hospital and thus constant access to a computer.

administrators to inform physicians regarding the status of implementing EMR and other changes that are constantly being made to the system. The Physician Technology Committee is also a means for administrators to seek physician approval for different issues related to implementation and functionality of EMR. Based on the above arguments, we posit that the more supportive a physician perceives an implementation climate to be, the more he or she is likely to use the EMR system. Thus, we propose:

*P6: Physicians' perceptions of the implementation climate will impact their intention to use an EMR system.*

## **Differential Usage Intentions and Behaviors**

In this section we elaborate on physicians' usage intentions and behaviors regarding EMR. As we showed in the previous paragraphs, usage intentions are primarily determined by attitudes, normative beliefs and control beliefs. At the same time, according to TPB, behavioral intention to use a technology leads to actual usage (Fishbein & Azjen, 1975; Azjen, 1991). This link is supported by much of the prior IS research in technology acceptance and usage (Davis et al., 1989; Taylor & Todd, 1995; Venkatesh et al., 2000). We conceptualize EMR usage behaviors as a continuum ranging from non-usage to shallow use and deep-level use.

We start our discussion of differential usage intentions and behaviors with the premise that an IT may be understood and used by individual users differentially. Some individuals may adopt and use an IT system while at the same time developing positive attitudes about it, while other individuals may simply comply with a source of influence (i.e. coercive, normative,

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<sup>5</sup> Physicians' advocates are usually registered nurses with some technical background that are in charge of supporting physicians with using EMR while in the hospital. They are also available upon request to provide

mimetic) regarding a new IT system without necessarily developing positive attitudes about it. To this extent, psychological theories (Kelman, 1958) and research on conformity and commitment (O'Reilly & Chatman, 1986) distinguish between compliance and internalization.

*Compliance* occurs when an individual conforms to a source of influence in order to get specific extrinsic rewards or avoid punishments (O'Reilly & Chatman, 1986). In this case, an individual decides to perform a behavior because of the rewards he expects to get rather than an intrinsic belief based on the content of the behavior in question. In this case, the attitude is externally based (and internally negative), an individual simply conforms to the source of influence in order to avoid disapproval. The satisfaction derived from compliance is due to a *social effect of conforming* (Kelman, 1958), for appearing legitimate in one's environment. The effects of compliance are usually public, social conformity without private acceptance of the idea or innovation in question (Kelman, 1958).

*Internalization* of an innovation occurs when the innovation is congruent with one's value system (Kelman, 1958). In this case, the attitude is internally based – on the *content* of the idea or innovation (Kelman, 1958). The effects of internalization go beyond public conformity towards private acceptance of the innovation. Furthermore, when an individual adopts a response based on internalization, he or she tends to perform a behavior under conditions of relevance to the issue regardless of any surveillance pressures (Kelman, 1958). Thus, internalization reflects the positive attitudes and perceptions about the value of a practice (Kostova & Roth, 2002). Internalization also reflects an individual's commitment to the use of an innovation (O'Reilly &

Chatman, 1986; Klein & Sorra, 1996). Internalization of an innovation's value has been posited to be a major limit to system implementation and usage (Klein & Sorra, 1996).

Thus, it seems that individuals may more or less internalize the value of an IT artifact which we posit will result in differential usage intentions and thus differential usage behavior. To this extent, we believe that it is the strength of the attitudinal component (internalization) that will determine *how* an IT system will be used.

We view IS usage on a continuum ranging from non-use to shallow use and instrumental (deep-level or committed) usage. To this extent, we posit that perceptions of strong implementation climate or strong social pressures to adopt are only a necessary condition to ensure IT usage. In the absence of formation of positive attitudes about a system (or internalization of the value of the IT innovation to the individual physician), the "best" outcome would likely be "shallow" use. This idea is consistent with previous work in innovation adoption (Klein & Sorra, 1996; Kostova & Roth, 2002). In turn, the absence of any pressures to adopt or individuals having perceptions of a weak implementation climate would lead to non-usage, as individuals may feel no need to even consider the technology for adoption (Klein & Sorra, 1996). To the extent that there is a strong implementation climate in place, strong positive social influences regarding the use of the technology and the individual physician sees the value of the technology to himself or herself and the work practices, the outcome is committed or deep-level usage. This idea is consistent with Klein & Sorra (1996) who posit that the degree of internalization or "innovation-value fit" determines an individual's commitment to the use of an innovation.

Table 2 presents the different outcomes from the interplay of the three major factors of the TPB, namely, attitudes or the degree of internalization, social influences and perceived

implementation climate on intentions to use an IT system. Note that in the table, we label only the starting point, middle and end point of the usage continuum (namely, non-usage, shallow usage and deep-level usage). All other points represent different levels of intentions and usage along the continuum in between the three main ones.

**Table 2: Theorization of Differential EMR Usage Intentions and Behavior**

<b>Perceived Implementation Climate</b>	<b>Internalization (Attitude)</b>	<b>Perceived Social Influence</b>	<b>Levels of IT Usage Intentions and Usage Behaviors</b>
Weak	Low	Weak	Non-Usage
Weak	High	Weak	
Strong	Low	Weak	
Weak	Low	Strong	
Strong	Low	Strong	Shallow usage
Strong	High	Weak	
Weak	High	Strong	
Strong	High	Strong	Committed (deep-level) usage

In a healthcare context, physicians who do not internalize the value of an EMR artifact and base their individual acceptance decision on pure compliance with an influence source may form a behavioral intention to solely comply to using the technology. Thus their behavior (system usage) may be simple compliance with the source of influence (shallow usage). In turn, individuals who attach a symbolic meaning based on value-congruence with the technology being introduced, and value the technology beyond simple compliance with an influence source view the system more favorably and become committed to its usage (Klein & Sorra, 1996; Kostova & Roth, 2002). The deep-level usage may lead to what Cooper & Zmud (1994) call “infusion” of the technology referring to the fact that increased organizational effectiveness

obtained when an IT system is used in a more comprehensive and integrated manner to support higher levels of the organizational work.

Thus, we posit it is not enough for an organization to set the goal of achieving “IT usage” in general but rather focus on these subtle levels of usage as increased organizational effectiveness is to be achieved and maintained over time only if usage is instrumental.

The organizational behavior and accounting literatures have long implied that in fact there exists a multiplicity of adoption responses to implementation of organizational or accounting practices (Saka, 2002). It has been shown by different authors that usage of different management practices or accounting practices are not uniform in nature and different responses have been uncovered.

For instance, Wood & Caldas (2002) talked about a ceremonial type of behavior manifested by a Brazilian enterprise to institutional pressures to adopt ISO 9000 standards. The organization did not see the value of these standards as their existent ones were perceived to be more functional and flexible. The result was maintenance of parallel records, one for auditors and one for internal operations.

Kostova & Roth (2002) showed evidence of a ceremonial response elicited by a multinational’s subsidiary to the implementation of total quality management practices (TQM) by the parent corporation. The practice was not consistent with the cognitive beliefs of the subsidiary and was used ceremonially or superficially, just enough to assure compliance with the implementation.

Joshi (2001) investigated the adoption of new accounting practices in two different organizations, one Indian and one Australian. He found differences in adoption patterns of accounting practices between Indian and Australian organizations that were traced to a strong

traditional Indian value system. Indians did not change their established values and practices in response to newer accounting practice innovation and kept adopting older accounting standards while Australian organizations adopted newer ones.

Sangster (1994) analyzed the adoption of an expert system by management accountants and found that they only adopted it partially. The study concluded that “no matter how suitable the technology, it will not be used until individuals affected by it understand its potential and believe it is feasible” (Sangster, 1994).

We define *shallow usage* as minimal or partial usage aimed at solely “satisfying” different influence sources (management, regulatory, normative) or as a response to a strong implementation climate that supports and promotes IT usage. If individual physicians do not value EMR, or they do not find it relevant to themselves or their work practices (low internalization), they may use EMR in a shallow manner. In this case, most clinical activities are carried out as far as possible in the same manner as before having the EMR system. The tendency here is to maintain the status-quo and perform the job requirements involving minimal use of the system (e.g. involve the system in the minimum number of tasks or only the tasks required). Besides using the system minimally, individual physicians that use an EMR system in a shallow manner, also tend to be very procedural in their usage behavior, that is, physicians may log in and out, hit the same keys every time and go to the same menus every time. This type of system usage can be seen as a very subtle form of resistance as individual attitudes may be negative (individual physicians do not see the value of the system to themselves or their work). The EMR system is not consistent with physicians’ own values and/or professional beliefs and thus the view may be formed that EMR is inefficient and of little value (Kohli & Kettinger, 2004).

Determinants of this type of usage may be a strong perceived social mandate towards using a technology (Kostova & Roth, 2002) or perceptions of a strong implementation climate (Klein & Sorra, 1996) through creation of a strong organizational support dedicated to EMR combined with strong negative attitudes that the system is not valuable.

*Deep-level usage* in turn, reflects a strong commitment towards the EMR artifact where individual physicians fully and consistently use the system in as many tasks as the system can be applied. In this case, individual physician behavior does not only reflect the influence of a strong implementation climate or social pressures to adopt but also an internalized belief in the value of the system, the EMR system has relevance to an individual physician and his or her work. A strong implementation climate or strong social pressures to adopt together with formation of positive attitudes about the technology foster this type of usage (Klein & Sorra, 1996). This type of usage can also be thought of as a more creative type of usage, or more exploration based (March, 1991) with individuals actively exploring the applicability of the technology to more and more aspects of their work. In the spirit of TPB, we propose:

*P7: For a given level of perceived behavioral control and social influence, physicians attitudes (level of internalization) about an EMR system will influence the nature of their EMR usage.*

*P7a: A weak level of perceived behavioral control and social influence combined with a low level of internalization leads to non-usage of EMR.*

*P7b: A strong level of perceived behavioral control and social influence combined with a low level of internalization leads to “shallow” usage of EMR.*

*P7c: A strong level of perceived behavioral control and social influence combined with a high level of internalization leads to “deep” usage of EMR.*



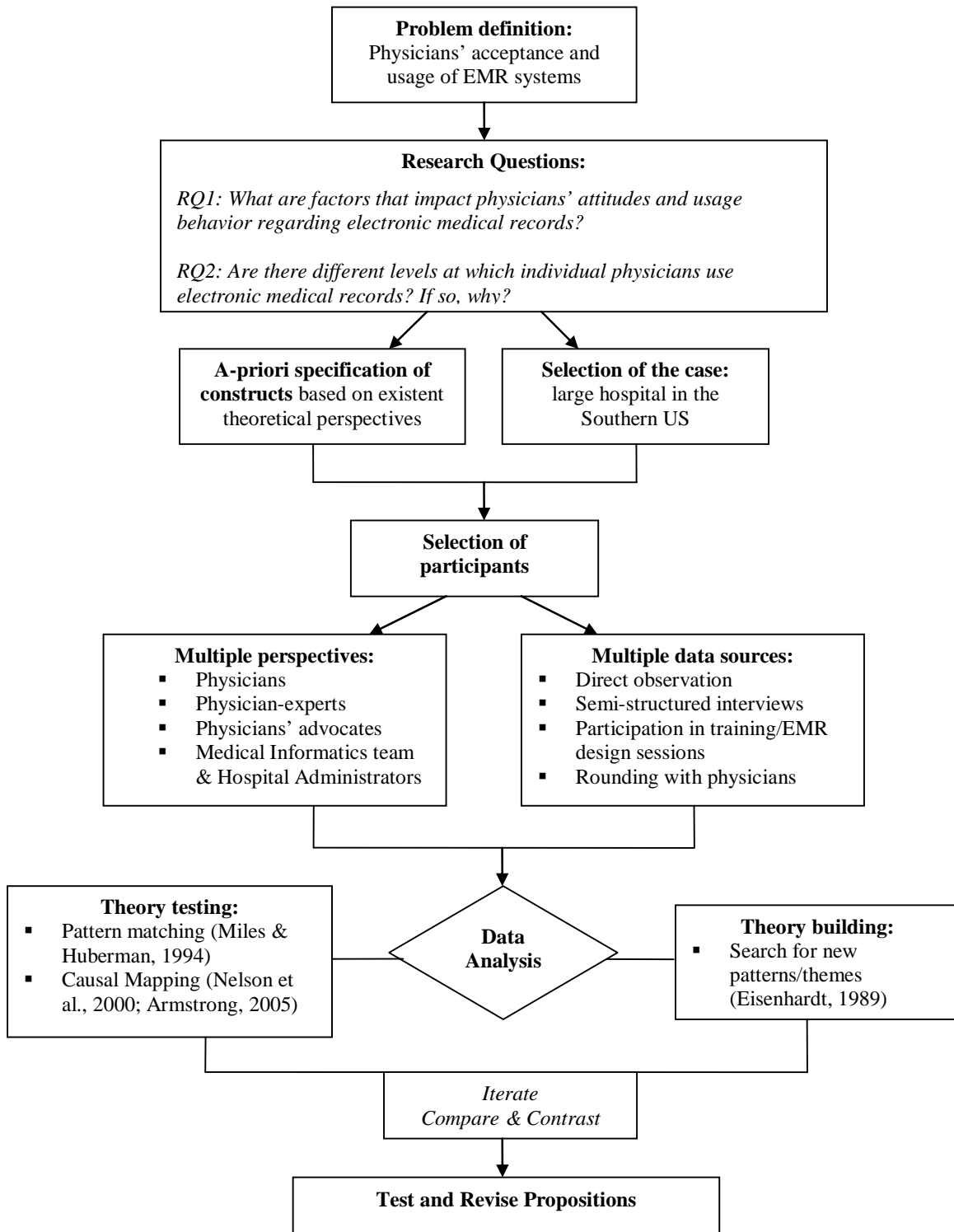
## CHAPTER FOUR: METHODOLOGY

This chapter presents the methodology employed in this study, the sampling strategy that was followed in selecting physician participants, the data sources that were used to collect the data. It also addresses sampling and validity issues as they relate to sample size and validity checks. Finally, this chapter presents the steps that are followed in analyzing the interview data, including coding the data and assessing causal relationships among elements of the initial framework. Specifically individual physician matrices (Miles & Huberman, 1994) and causal mapping (Nelson et al., 2000 and Armstrong, 2005) are described as part of the data analysis strategy.

### **Method**

The method of analysis is qualitative (Yin, 2003; Miles & Huberman, 1994; Eisenhardt, 1989). Specifically, a case study approach has been used.

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 (Benbasat et al, 1987). This approach is well-accepted in studying complex and contemporary phenomena (Benbasat et al, 1987) with strong contextual dependencies (Yin, 2003). Case studies can be used to accomplish different goals (Eisenhardt, 1989; Yin, 2003) such as description, testing theory or generating theory. Figure 1 depicts the proposed methodology.



**Figure 1: Proposed Methodology**

We begin our investigation by defining the phenomenon of interest, namely physicians' acceptance and usage of EMR systems. We base our inquiry on two main research questions, *“What are factors that impact physicians' attitudes and usage behavior regarding electronic medical records?”* and *“Are there different levels at which individual physicians use electronic medical records? If so, why?”*

Miles & Huberman (1994) and Eisenhardt (1989) suggested that case study research begins with a-priori specification of constructs if existent theoretical bases are strong. We use the TPB-based theoretical framework as presented in the previous section. The main constructs of interest are individual physicians' beliefs about EMR, beliefs about the medical profession, attitudes towards EMR, perceived social influence, perceived behavioral control, behavioral intentions to use and actual usage of EMR. These constructs have been identified in prior studies as important in studying technology acceptance and usage (Fishbein & Ajzen, 1975, Ajzen, 1991; Taylor & Todd, 1995).

## **Sampling Strategy**

Participants in this research were physicians from a wide range of specialties that practiced in a large hospital facility.

Selection of the physician participants for the case was done based on a purposive sampling approach (Patton, 1990). Unlike random sampling, a purposive sampling allows select participants whose study will provide in depth information regarding the research questions under study (Patton, 1990, p. 169). This way, a researcher can learn a great deal about issues of central importance to the purpose of the research by studying a smaller number of carefully

selected individuals rather than gathering standardized information from a statistically representative sample (Patton, 1990, p. 169).

We based our sampling strategy on the principle of maximum variation (Patton, 1990) and a snowball sampling strategy (Patton, 2002). Participants were selected such that we captured data from a wide range of physicians with a wide range of attitudes about EMR systems. Patton (1990) describes this sampling strategy as purposefully picking a wide range of variation on dimensions of interest (p. 182). The idea is to select participants so as to maximize variation in a group while also investigating core elements and shared outcomes (Patton, 1990, p. 172). By using this strategy we captured a wide range of physicians' attitudes about EMR systems. Thus, our final sample included physicians that did not use, used minimally or were heavy users of EMR systems across the two cases of interest.

We initially worked with physicians' advocates to start our sample selection such that to ensure a representative range of physicians with a wide variety of attitudes about EMR systems. Each of the three physician advocates suggested ten physicians to be contacted by the researcher to participate in the study. The ten physicians selected by the advocates in each group were selected such that they were either heavy users of the system, non-users or marginal users. After few interviews with the initial physicians selected by the advocates, a snowball sampling strategy (Patton, 2002) was also used. After each interview, we asked the respective physician for references to other physicians that were known to him or her that either used or did not use the EMR systems. The final sample had thirty practicing physicians.

The interviews lasted from twenty-five minutes to two-three hours. All interviews started with a general question that allowed respondents to express their general opinions about the specific EMR system they were familiar with (in terms of how what they like about the system

or what they saw as problems with the system). More specific questions were asked following the generic questions according to the interview guide presented in Appendix A such that to ensure most interviews covered similar material and allow for comparisons at the analysis stage (Miles & Huberman, 1994).

Data collection ended at the point of redundancy, where no new information was being added. Lincoln & Guba (1985, p.233) describe the point of redundancy as the point where “efforts to get additional members cannot be justified in terms of the additional outlay of energy and resources.”

## **Data Sources**

Multiple data sources were used such as semi-structured interviews with physicians, direct observation in the hospital environment and archival documents (Dube & Pare, 2003). Data gathered through direct observation and archival documents was used to complement and validate the interview data.

Direct observation is a powerful tool (Yin, 2003) that allows the researcher to study phenomena in the natural setting of interest, absorb and note details and actions that take place. Direct observation included several sources.

First, the researcher has participated for a nine-month period in meetings such as “Physician Technology Committee,” “SME” (Subject Matter Expert) and other departmental meeting where physicians and physicians-experts meet with administrators and system designers to discuss issues related to current and future implementation and design of EMR systems in the hospital.

At these meetings, physicians express their views about the current EMR system and how the system should be improved. At the same time they are involved in the design decisions of a future EMR system (EMR4).

Second, the researcher has been rounding with physicians in the hospital in order to observe how physicians perform their daily work.

Third, the researcher has participated in a week long seminar (8 hours a day) regarding the design process for a new multi-million dollar EMR system to be implemented at Alpha. These observations were helpful in understanding physicians' workflows and also served to make a preliminary assessment of physicians' attitudes towards EMR systems.

Finally, informal discussions with physicians and physicians' advocates in different settings took place.

Different archival documents have been analyzed, such as minutes from meetings and other statistics related to current EMR usage levels (based on number of log-ins) among physicians.

Many authors have suggested multiple data collection methods because this strategy allows the researcher to get a better grasp of the problem at hand (Yin, 2003; Benbasat et al., 1987) with the goal to obtain a rich set of data surrounding the specific research issue (Benbasat et al, 1987). Appendix A also shows the type of data collection method for each construct.

## Sampling and Validity Issues

As previously described, a purposeful sample (Patton, 1990) was used in this study to ensure a broad and diverse range of attitudes and usage behaviors. In IS research, Lyytinen & Rose (2003) used this approach.

As regards the physician sample size, Patton (1990) points out that there are no clear cut rules for sampling in qualitative inquiry (p. 184). Lincoln & Guba (1985) recommend sample selection to the “point of redundancy.” These same authors mention that in purposeful sampling, the size of the sample is determined by informational considerations; if the purpose is to maximize information, sampling is terminated when no new information is forthcoming from new sampled units, thus *redundancy* [emphasis added by author] is the primary criterion (p.202). Thus, based on this recommendation, we sampled physicians to the point that no new information emerged from the interviews.

In terms of construct validity, Yin (1994) recommends that in the data collection stage, a researcher triangulates from multiple sources of evidence. This approach was used in this study. Data was collected from multiple sources such as direct observation, semi-structured interviews and document analysis as described above.

Internal validity refers to the accuracy of the information and whether it represents reality (Creswell 1994; Creswell & Miller, 2000). Assuring internal validity is part of data analysis. The goal is to see the degree to which findings correctly map the phenomenon in question. Pattern-matching techniques (Miles & Huberman, 1994) are used in order to check the extent to which the qualitative data fits a construct of interest. Furthermore, collecting rich data from a field

study helps improve internal validity as this enables data to be understood in context, which can preclude alternative explanations (Lyytinen & Rose, 2003).

Triangulation, using multiple lines of inquiry to get broader and better results is also used as an alternative method of addressing internal validity, and identifying and explaining data distortions (Berg, 2004; Fontana & Frey, 1994). We used data from multiple data sources as described previously (data triangulation). We also used theory triangulation, as our framework for analysis incorporates multiple theoretical perspectives. Triangulation is recommended as no single method ever adequately solves the problem of rival causal factors and each method reveals different aspects of empirical reality (Denzin, 1978, p. 28). Furthermore, we used data-analysis triangulation by employing two different qualitative methods for data-analysis, namely pattern-matching techniques (Miles & Huberman, 1994) and causal mapping (Nelson et al., 2000; Armstrong, 2005).

Finally, external validity refers to whether research findings can be generalized to other situations. Qualitative approaches and the use of case studies are less generalizable because they provide such a unique and detailed interpretation of specific events. Results from this study may be generalized with caution only to the population of physicians operating in large hospitals. Replication of the findings in similar settings will better establish external validity of these findings. Table 3 summarizes the above discussion.



**Table 3: Validity Issues in a Case Study based on Yin (1994)**

Tests	Definition	Case study tactic	Research Phase
Reliability	Consistency in the data	Adequate use of interview questions (flexible enough to capture the local story but structured enough to build consistency)	Design
Construct Validity	The validity of inferences about the correspondence between operational definitions of the constructs and the actual constructs.	Use multiple sources of evidence	Data collection
Internal validity	The degree to which findings map the phenomenon in question	Use purposeful sampling Pattern-matching Triangulation (provides evidence through multiple methods (interviews, observation, documents))	Case selection Data analysis Data analysis
External validity	The degree to which findings can be generalized to other settings similar to the one in which the case is conducted	Replication in future research	Case selection

## **Data Analysis**

Data analysis will be performed in four main stages as presented in Table 4.

**Table 4: Steps in Data Analysis based on Eisenhardt (1989), Miles & Huberman (1994), Nelson et al. (2000) and Armstrong (2005)**

<b>Step 1: Preliminary Analysis of the Interviews (Summarizing the Data)</b>
<ul style="list-style-type: none"> <li>▪ Read and code each interview based on the preliminary theoretical framework</li> <li>▪ Build initial individual respondent matrices mapped for each construct of interest</li> <li>▪ Document new themes for each interview that are not part of the initial theoretical framework</li> </ul>
<b>Step 2: Read and Interpret Individual Matrices</b>
<ul style="list-style-type: none"> <li>▪ Look for common themes across each individual physician matrix and assess any preliminary causal relationships</li> <li>▪ Prepare the ground for Step 3 in building individual causal maps</li> </ul>
<b>Step 3: Identify Causality and Create Individual and Aggregated Physicians' Causal Maps</b>
<ul style="list-style-type: none"> <li>▪ Identify causal statements on the interview transcripts</li> <li>▪ Identify conceptually relevant concepts and constructs</li> <li>▪ Construct individual concept-level causal maps</li> <li>▪ Construct individual construct-level causal maps</li> <li>▪ Aggregate individual causal maps for each of the individual physician group</li> <li>▪ Aggregate cognitive maps into a general model regarding physicians' attitudes and their usage of EMR</li> </ul>
<b>Step 4: Validate and/or Extend existing Theoretical Framework</b>
<ul style="list-style-type: none"> <li>▪ Test the theoretical propositions for the three physician groups</li> <li>▪ Extend the framework with any new constructs that may emerge in the setting of interest</li> </ul>

### **Step 1**

First, as suggested by Miles & Huberman (1994) a within-case analysis is performed. Data reduction and presentation techniques will be used at this stage based on Miles & Huberman (1994). The starting point for this analysis is the general theoretical framework. A checklist matrix will be used here (Miles & Huberman, 1994 p. 105) in order to organize the data according to the construct of interest. Each interview will be coded in a table-based format according to the initial theoretical framework. At the same time, any new issues emerging from

the interview data will be coded. Eisenhardt (1989) suggests this strategy in order to complement concepts in the past literature with emerging concepts with the final goal of both theory testing and theory building. Table 5 presents the general structure of the table used to code each interview. Appendix B presents the interview coding.

**Table 5: Coding Scheme**

<b>Construct</b>	<b>Quotes</b>
<b>Beliefs about the Technology</b>	Coded Items
<b>Beliefs about the Medical Profession</b>	Coded Items
<b>Predisposition to IT-based Change</b>	Coded Items
<b>Attitudes</b>	Coded Items
<b>Social influence</b>	Coded Items
<b>PBC</b>	Coded Items
<b>Behavioral Intention/Usage</b>	Coded Items
<b>New Construct 1,2,3</b>	Coded Items

## **Step 2**

The next step is to identify common themes and trends across interviews (Carney, 1990). Each interview will be read in order to identify causal statements that are used in Step 3 to build the individual physicians' causal maps.

## **Step 3**

After a preliminary assessment of the data, at Step 3 of data analysis, the interest is to assess relationships among the initial theoretical constructs and emergent ones. In order to achieve this goal, a causal mapping approach is used (Nelson et al., 2000; Armstrong, 2005).

A cognitive map displays a person's representation of concepts about a particular domain, showing the relationships among them (Miles & Huberman, 1994, p. 134). Nelson et al. (2000) used this methodology in an exemplary IS research piece. They defined a causal map as a network of causal relations embedded in an individual's explicit statements. This technique allows a researcher to capture the cognitive structure of an individual by representing how domain knowledge is linked in his or her mind (Armstrong, 2005).

The causal mapping process involves a series of steps (Armstrong, 2005). The starting point is identifying relevant concepts from statements (already achieved at Step 1 & 2). Next, the interview text will be scanned for causal statements. Causal statements are any statements that imply a cause-effect relationship. Armstrong (2005) and Nelson et al. (2000) suggests looking for key words such as "if-then", "because" and "so". Some other possible keywords such as "think", "know", "use" and "believe" can be used to look for causality, according to the same author. Causal statements will be used in the next step in order to construct individual causal maps at a concept and construct level.

Individual physicians' construct-level maps will be aggregated by specialty (where there are four or more physicians from one specialty). This process involves combining the individual level causal maps of each physician specialty. Furthermore, these specialty maps will be aggregated further into a single causal model (Armstrong, 2005).

#### **Step 4**

The goal at this step is to test the theoretical propositions and extend the initial framework with any new constructs that may emerge based on the previous analysis. We are conducting both theory testing (Miles & Huberman, 1994) and theory building (Eisenhardt, 1989). The goal is to

test our initial propositions and generate new theoretical conjectures based on existent and emergent new theory to better explain the phenomenon of physicians' acceptance and usage of EMR in large hospital settings.

## CHAPTER FIVE: FINDINGS

### Overview

This chapter presents the results of a case analysis regarding physicians' acceptance and usage of electronic medical records (EMR) in a large hospital facility, Alpha, which is part of a billion-dollar health system and operates in seven different campuses throughout a major metropolitan area in the southern US. Alpha is an acute-care health care system with 3,025 beds throughout the region, and experiences more than one million patient visits each year. Alpha has about 2,000 physicians on the medical staff that practices in a wide variety of specialties across the seven different campuses.

Alpha currently operates three different EMR systems but it is not entirely paperless. All three systems are for data retrieval while data entry (i.e. progress notes and orders) is still documented on the paper chart throughout the hospital.

The first system, which we refer to as EMR1, is a system developed in-house. It contains patient care management tools such as real-time patient lists, a clinical summary, lab results, current medications, transcribed reports, pathology and microbiology reports and other patient-related information such as insurance and basic demographics. The system also provides links to drug alerts and interactions, email and access to the Internet.

The second system, referred to as EMR2 was acquired from an outside vendor and performs similar data retrieval functions as EMR1. The main difference between the two systems is that EMR1 contains twelve years worth of clinical data while EMR2 stores only six months of patient data. EMR2 also provides physicians information about patients vital signs and nurses'

notes. Both of these EMR systems are menu driven, although EMR2 is designed based on a menu-submenu system of accessing the data rather than a simple pull-down menu (EMR1). EMR1 is accessible remotely from outside the hospital while EMR2 is accessible only on the hospital's premises.

The third system, EMR3 is a film-less radiology system. Although this system is accessible via a link on the EMR1, it is a separate system which requires a different log in. This system provides a physician access to any X-rays a patient has had done at any of the seven Alpha campuses and also at several other hospitals in the region. This system allows a physician to search for a patient's X-rays based on the patient identification number, name, date or location. Physicians are also able to compare multiple images side by side.

While conducting this research, Alpha was in the process of transitioning towards designing and implementing another system designed to replace the three above mentioned systems within the next few years. We refer to this as EMR 4. EMR 4 is a large integrated enterprise system bought from an outside vendor. This new system is to be implemented in phases, the last phase being computerized physician order entry (CPOE) which will require physicians to enter clinical orders. Currently, Alpha is working on customization and design issues to adapt the system to fit the organization.

Semi-structured interviews with thirty physicians from thirteen different specialties have been conducted (see Table 6). Informal discussions with other physicians in several different meetings have also been conducted. Throughout this chapter, we will be using various quotes to illustrate physicians' beliefs, attitudes and their usage of EMR. The quotes in the chapter are illustrative of the full transcripts which can be found in Appendix B.

**Table 6: Physician Specialties**

<b>Specialty</b>	<b>Number of Physicians Interviewed</b>
Cardiology	4
Family Practice	1
General Surgery	5
Gastroenterology	1
Internal Medicine	8
Nephrology	2
Neurology	1
Oncology	1
Physical Medicine & Rehabilitation	1
Pediatrics/Surgery	2
Pulmonary Disease	2
Orthopedic Surgery	1
Plastic surgery	1
<b>Total</b>	<b>30</b>

The majority of the interviews have been conducted at the main hospital campus which is the largest one; a few other interviews have been conducted at two other campuses. Six of the thirty physicians interviewed for this study were heavily involved with Alpha's technology-related committees, which deal with development and testing of new technologies and clinical information systems. These physicians are also referred to as physician-experts, due to their involvement with the hospital's medical information systems. These physicians meet in different forums for making design decisions for current and future EMR systems (EMR4). Some of these physicians also work on the functionality of order sets for CPOE. Table 7 presents the SME physicians' specialties.



**Table 7: Physician-Experts**

<b>Specialty</b>	<b>Number of Physicians Interviewed</b>
Cardiovascular disease	1
General Surgery	1
Gastroenterology	1
Nephrology	1
Oncology	1
Pulmonary Disease	1
<b>Total</b>	<b>6</b>

We start the analysis regarding physicians' attitudes and their usage of EMR systems with our general theoretical framework which was described in Chapter 3. The framework involves main constructs such as beliefs about the technology, beliefs about the medical profession, perceptions of behavioral control (or implementation climate), individual physician predisposition to change, physicians' attitudes towards EMR and their intentions/usage of EMR systems. At the same time, we carefully consider any new themes and issues arising from the interview data that can be relevant in shading light on the complex phenomenon of physicians' engagement and physicians' usage of EMR. This can be thought of as a grounded approach (Eisenhardt, 1989). The analysis is thus conducted for both theory testing and theory building. In the next sections, we elaborate on each element of the proposed framework and other emergent themes.

### **Physicians' Beliefs about EMR**

The diffusion of innovation literature (Rogers, 1995; Moore & Benbasat, 1991) discusses three main beliefs about the technology as being important determinants of technology acceptance and

usage, namely complexity, relative advantage and compatibility with existent practices. In this section we discuss these individual physician beliefs about Alpha's EMR systems. Twenty four out of thirty physicians identified system navigation and EMR search capabilities as major considerations underlying their perceptions of complexity of Alpha's EMR. Most physicians in this sample were also concerned with the overall "friendliness" of the EMR system or its ease of use.

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 Alpha's EMR is an important consideration for most physicians in this sample. Difficulties in navigating through the EMR systems at Alpha 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.

Physicians in many different specialties such as Cardiology, Surgery, Nephrology, Family Practice, Pulmonary disease, Physical Medicine and Rehabilitation, Pediatrics, Oncology, Internal Medicine, Orthopedic surgery and GI pointed out difficulties in navigating and searching through EMR for clinical results.

We present the results in this section by focusing on different physicians' groups. We do not intend to specifically draw any conclusions about each specialty, especially in cases where the sample is too small and includes one physician from a specialty. This format is adopted primarily to organize and present the findings related to physicians' beliefs about EMR.

## **Consultant Physicians: Cardiologists, Surgeons and Pulmonary Specialists**

The four consultant physicians in the cardiology group either used EMR1 (data retrieval system), EMR3 (the radiology system) or did not use any system at all. The Cardiology group is concerned with having a physician friendly system which they did not feel they had. One cardiologist was concerned with the complexity of the EMR1 in terms of navigation issues or the steps required getting the desired information from the system.

*“When you access the labs, it doesn’t show you all the labs in one page, you have to go from one page to another, so the labs are split ...you have to go from one window to another” (Cardiologist1)*

Similar concerns about having a physician friendly system were shared by other cardiologists who pointed out that the ease of using the system is a prerequisite to physician use.

*“The system has to be very fast and easy otherwise physicians will not take the time to use it” (Cardiologist3)*

The relative advantage of an EMR system refers to whether using the system is perceived as being better than using the paper chart. All cardiologists found that using EMR3 is advantageous over the old way of accessing films. The alternative to seeing the X-rays on the EMR3 system would be going to the Radiology department located usually on a specific floor and look at the films there. At the same time, EMR3 is seen as more compatible with the practice of cardiology. Compatibility refers to the degree to which an EMR innovation fits with a potential adopter’s needs and work practices (Rogers, 1995; Karahanna et al., 1999). Although most cardiologists did not find Alpha’s data retrieval EMR (EMR1 & EMR2) very compatible

with their work practices, all cardiologists in this sample viewed EMR3 as being very beneficial to their work.

*“I am more efficient with the part of the system that I use [EMR 3] because I don’t have to go downstairs to Medical Records and have them pulled; it saves me a lot of time”*  
(Cardiologist3)

*“The most helpful system that they have is [EMR 3]...I am a cardiologist, I do pace makers, implants I look at chest X-rays, CT scans. I like accessing from the part of the building where the patient is rather than going down to X-rays and look at hard copy films”* (Cardiologist4)

Another physician had strong negative beliefs about EMR at Alpha. These beliefs are primarily due to a perceived lack of compatibility of EMR with the practice of cardiology. Lack of an immediate “need” for EMR is a primary barrier to EMR use.

*“I don’t really need them [computers] for what I do...I do heart cath and angioplasties. I don’t need them in my day to day job to be a proficient doctor ... it’s not important to what I do...I don’t need them”* (Cardiologist2)

Although this cardiologist had very strong negative beliefs about computers and EMR in general, he was using EMR3 to see patients’ X-rays in certain areas of the Intensive Care Unit (ICU). It seems thus that a high relative advantage of EMR3 (in terms of its location near a patient’s bed and its ability to allow physicians to see X-rays where the patient is rather than at a central location i.e. Radiology department) makes this system more accepted and used. At the same

time, higher compatibility of EMR3 with the practice of cardiology (i.e. cardiologists need to look at X-rays regularly) contributes to a wider acceptance of this system.

Data retrieval EMR systems (EMR1 & EMR2) do not entirely seem to fit the way a cardiologist practices as well as the X-ray system (EMR3) does. Cardiologists are a group that is known for working closely with personnel such as physician assistants and/or nurse practitioners. These personnel help them in their daily work with tasks such as dealing with the computer system and other patient-related issues. As a result, these cardiologists do not feel it is their job to go to the computer to access and find information.

*“Things like labs, I do not access on the computer, I have somebody else do that for me”*

*(Cardiologist3)*

*“I have my rally nurse with me and she can look up the information and have it ready for me when I get there. Cause I’m busy, I go see you, then I go back do a heart cath and I come back to see him and her and her...then I go back upstairs and do something else”*

*(Cardiologist4)*

Surgeons are another specialty group (i.e. consultant physicians). Consultant physicians are more specialized in treating a particular disease (i.e. cardiologists, surgeons, pulmonary disease) as opposed to more clinical specialties (i.e. internists, family practitioners) that treat a variety of diseases before a consultant is called in.

Initial observations in a general surgery meeting (with about 30 surgeon-participants) pointed out surgeons’ reluctance to take advantage of the EMR systems at Alpha. Informal discussions with a group of surgeons at the same meeting uncovered their non-usage of EMR. At the same time, surgeons did not seem to be entirely aware of the EMR capabilities at Alpha.

For instance, when asked what he thought about EMR at Alpha and what features or which of the three systems he used the most, one surgeon could not provide any answer as he was not familiar with any of the systems at Alpha (General Surgery3). Another general surgeon interviewed for this study was somewhat aware of EMR3, however not enough to make use of the system.

*“I only use EMR1, the only thing it doesn’t have is the X-ray pictures, for this you have to go to another program, that program I don’t know well, so I’m not using that yet.”*

*(General Surgeon2)*

Several surgeons pointed out they did not feel any need to use the computer in their daily work.

*“I have not found that I really need it yet” (General Surgeon1).*

*“I don’t need it - none of this pertains to me because I don’t have patients in the hospital. I don’t have hospitalized patients to follow, I don’t have labs - I have outpatients or overnight patients, so I don’t need to check X-rays or labs. For me it is not helpful, I don’t need it” (Plastic Surgeon)*

This idea seems to go back to what Rogers (1995) recognized as one of the first stages of innovation diffusion, namely recognizing a problem or a need. Rogers (1995, p.164) defines a “need” as a state of dissatisfaction or frustration that occurs when one’s desires outweighs one’s actualities, when “wants” outruns “gets.” Same author points out that a perceived need precedes the knowledge/awareness stage and the adoption decision stage in the innovation diffusion process. Thus, it seems important that implementation strategies should focus on creating and emphasizing perceptions of “need” of an EMR system to the individual physician and at the

same time stressing the importance of the adoption decision at the individual physician level rather than at the hospital level alone.

These observations also imply that Alpha needs to raise awareness of the EMR capabilities and make their benefits known to physicians, especially to physicians in the surgical specialty. Informing physicians how the EMR systems and their different functionality can help physicians in their clinical work is important to expose physicians to and raise their awareness about EMR systems at Alpha. Awareness about an innovation is the first and one of the most important phases in the innovation diffusion process (Rogers, 1995). Lack of awareness about the EMR capabilities can stop the entire individual physician adoption decision process and have far more reaching consequences in terms of “lock-in” for the present state or ways of doing things (i.e. paper chart). Informing physicians in different forums (i.e. specialty meetings) and using different methods of information dissemination (presentations, mail, direct contact) are some of the ways to raise awareness about EMR capabilities at Alpha.

Except for one physician that was heavily involved with technology-related committees at Alpha (General Surgeon5), most surgeons in this sample did not use EMR or used it minimally (i.e. primarily to access the patient list). At the same time, surgeons believed it was much easier to look at the paper chart versus accessing the computer to get at clinical results.

*“It’s so much easier for me to open up the paper chart versus having to log in the computer to get it” (General Surgeon3)*

On the other hand, similarly to the peer cardiologists, surgeons did not believe data retrieval EMR systems are compatible with the way they like to work. Availability of nurse practitioners to support their clinical work and a belief that their “*practice can do so well without*

*computers at this point” (General Surgeon3) contribute to emphasizing the incompatibility of EMR to surgeons’ practices. Furthermore, the computer is perceived as being a “cold and inanimate object” (Plastic Surgeon) which cannot possibly substitute for face-to-face communication with another specialist regarding a patient’s state.*

*“We have a nurse practitioner that works for us, every morning she gets the patient list from the computer” (General Surgeon1)... “If the latest labs are not in the chart, I ask the nurse practitioner to do it” (General Surgeon3)... “My time is spent mostly in the operating room, rather than trying to access the computer” (General Surgeon3)*

Although some surgeons found the EMR systems not very difficult to use, they did not see the system as advantageous relative to the paper chart in order to view certain clinical graphs that they needed to access.

*“I don’t think it’s a big improvement...for example temperature charts, on the chart you have an actual graphic on the temperature, what it’s doing, you can’t have access to that in the computer” (General Surgeon4)*

Interestingly, although one surgeon perceived EMR to be advantageous “in theory” because of availability of clinical data in the computer, he did not make very much use of the system, other than accessing his patient list. In this case, accessibility issues that will be discussed later on in this chapter are a major barrier to this physician’s non-use of EMR.

Like previously mentioned by other consultant physicians in the cardiology group, the limited search capabilities of Alpha’s data-retrieval EMR are also acknowledged by the surgeons interviewed in this sample.



*“You can’t search for a patient unless you have the exact name after they’ve been discharged” (General Surgeon4)...You have to know the exact name, number, everything has to be exact” (Orthopedic Surgeon)*

Other surgeons found EMR3 very beneficial to them. EMR3 is considered beneficial as it provides physicians the capability of looking at X-rays without having to go the Radiology department, on a different floor, in order to view films. EMR3 is thus perceived as providing time savings benefits. Time savings are a direct result from EMR3 as this computerized system provides physicians with the ability to see X-rays wherever a computer terminal is available, which is a major advantage over the regular films. At the same time, EMR3 can be accessed remotely via EMR1 such that physicians can view X-rays from their home of office.

*“As far as the [EMR3] system is going, I am able now to instead of going down to X-rays, finding the films, looking at the films - which can take half an hour for one film - now I can look at it in the ICU, it’s right there near the patient. The [EMR3] system is a tremendous advance because the quality of the reports; it has the advantage you can scan through the films instead of looking like this on a view-box, you can look through hundreds of pictures, can make them kind of like movies...you can easily access the old films, so you can do comparisons... in the past when you requested 10 X-rays after about two hours you had four old films on patients - now everything is there...that is absolutely spectacular” (Pediatrics Surgeon)*

*“I never go to the Radiology department anymore, it used to be I had to go look up the X-rays and have them pulled – now I can look them up in the computer – it’s better*

*because I can do it on the floor, I can do it in the lounge, at the office” (Orthopedic Surgeon)*

Other consultants also found EMR3 to be extremely beneficial to their practice to the extent physicians can see patients’ images from any location they happen to be where a computer terminal is available rather than one single, centralized location. To this extent, individual physician’s work efficiency is positively impacted by using EMR3. As with cardiologists and surgeons, EMR3 is also perceived as being very compatible with the work of pulmonary specialists as they *”see X-rays all the times.”*

*“EMR3 saves me time to go downstairs to the radiology department and look at X-rays there. It’s time consuming...So, the fact that I can be on the floor, access EMR3 and look at my X-rays right there saves me time from going downstairs and back up” (Pulmonary Disease1)*

*“We have quick access to the [EMR3] system so that we can look at images or x-ray studies. ...wherever you happen to be which it’s a great advantage... otherwise I would have to leave where I am, go to the x-ray dept, find the X-rays, wait for them to be pulled, I don’t have to do that...that takes a long time, so definitely it improves our efficiency” (Pulmonary Disease2)*

### **Other Consultant Physicians**

Another group of consultant physicians are from the nephrology, neurology, oncology and gastroenterology specialties. This group of physicians is somewhat more clinically oriented than

the other consultant specialties such as cardiologists and surgeons discussed above. Although this group of physicians found that in general, data-retrieval EMR systems are beneficial in terms of providing them access to patients' clinical history and timely access to the latest clinical information,<sup>6</sup> in practical terms, using the EMR is perceived as time consuming. Technology-related issues such as difficulty in navigation, search issues and system's speed contribute to emphasizing the time-related disadvantages to these physicians.

*“It’s much easier to pull a patient’s old record and see what already has been done, what the previous diagnoses were...what previous tests have been done; that tells you what doesn’t need to be repeated. You can get information faster from the computer rather than wait for somebody to print it and put it in the chart...the radiology reports would be in the computer almost 24 hours before the paper report reaches the chart –it’s very useful to get that information” (Neurologist)*

*“I think the computer system is beneficial because you can get access to clinical results, the problem is that it is difficult to go from admission to admission, it’s time consuming to click on that, and you cannot get all data in front of you easily...there is no way to get the radiology exam for one patient in chronological order. You have to go back to the admission record, click on it and then click on different things that you are interested in” (Nephrologist3)*

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<sup>6</sup> Lab results and other reports first appear in the computer before they are printed and placed in the paper chart. The EMR system contains the latest clinical information about a patient at any point in time.

Other physicians also identified issues related to the quality and functionality of the EMR such as navigation from window to window, system speed and search capabilities as major barriers to their use of EMR. At the same time, the data-retrieval EMR at Alpha are perceived as not being very easy to use and slow, in particular EMR2, which makes the paper chart more attractive than the computer. In fact when asked what he would suggest to hospital administrators in order to improve the current system, one physician mentioned that *“We have to look for a way to make it easy for the physicians”* (Nephrologist3). As regards EMR2, this system is also perceived as being more limited because of its inability to store prior patient records (EMR2 was designed such that to store only six months of patient data). Furthermore, some physicians in this group are not aware of EMR1 and its ability to hold much more patient-related historical data.

*“The system is very slow... you load the program, put the password, go to the next screen, put name of a patient, you get several patients with the same name, click on the patient that you need...then it comes a screen, this is something that you usually don't want, you want something specific, so you have to go to the next screen...Some particular screens (for example microbiology reports) are very cumbersome...you have to go 7-10 screens in order to get a report. Microbiology reports are the worst thing in the world... we have to go screen by screen, it is horrible”* (Nephrologist2)

*“I got to a point where I like [EMR1] better [than EMR2]. I think the way you have to get to the information is awkward...I can't just click on lab data and see it... I have to click here, then I have to click there...and then I can get my lab data. It's not as user friendly as it should be... it's faster for me to just flip a page and look at it...again going*

*back to the computer being slow. “The problem with [EMR2] is that it’s got only got 6 months of data... that’s not enough...you got to be able to go back in time. [EMR1] solves that problem but neither program is ideal...specifically time, they’re both too slow” (Oncologist)*

*“...say you’ve been in the hospital and you’re in my office today, your blood count is low, so I want to know what your blood count was in the past, so I pull up under 1<sup>st</sup> yr your MRI no, you’re in the hosp in June for 10 days, outpatient in June, in May you were in the hosp for 17 days ... in order to find what your blood count was this year I have to open up each one of those, then go into the labs find that CBC...I can’t just say CBC date” (GI)*

*“They need to make it user friendly so that you can scroll easily and there are systems that do that. EMR2’s ability to obtain prior studies is limited, I have to ask the nurses to get like a year ago admission, I can’t pull up a lot of old reports” (Physical Therapist)*

These findings point to the fact that many barriers to physicians’ use may be technical in nature. Improving the friendliness of the EMR and making it easy for physicians to find clinical results in the computer may improve physicians’ attitudes about EMR, which in turn will result in more consistent EMR usage. At the same time, as previously mentioned for other specialty groups, it seems that there is a lack of awareness about the capabilities of the EMR among physicians at Alpha. This may indicate that actions need to be taken in order to make physicians better understand the features of each system at Alpha. As previously mentioned for the surgeon-group, emphasis should also be given thus to creating what Rogers (1995) calls “awareness-knowledge” or providing information that the innovation exists for this physician group. On the

other hand, the idea of system integration comes to mind, the fact that there are three different systems in place in the hospital, each with different log-ins and passwords may limit a physicians' understanding and usage of these systems, considering the limited time a physician has. This issue will be explored in a separate section.

In terms of the fit of the EMR with these physicians' practices, it seems that data-retrieval EMR (EMR1 & EMR2) are more compatible with the practices of the more clinically-oriented consultants, than with the practices of cardiologists and surgeons.

*"...A heart surgeon operates on a patient's heart; he doesn't really care what happened three yrs ago. For me, as a neurologist, that info is very useful" (Neurologist)... "For us, clinicians, we really need this data" (Nephrologist2)*

Another interesting finding is related to the idea of direct, personal benefits from using an EMR for a physician versus the perception that the benefits from EMR are acquired entirely by the hospital. Although they were not directly opposed to the idea of EMR systems in general, some physicians saw no personal benefits in using any of the hospital's EMR systems. They perceived that by using the EMR system they would benefit the hospital, but at the same time impose a burden on their work by increasing the time they spend per patient.

*"I like the idea of EMR systems but I am completely opposed to the idea of making physicians work harder. I don't see an advantage for me, for my type of work. If I use the computer system, I think I'm going to save the hospital money, I don't think I am going to save myself time. I think the EMR saves a lot of money to the business that is implementing it...I am not the hospital, I am a physician, I am a client, it is gonna make*

*the work of hospital more efficient at the expense of paying for the users”*

*(Nephrologist1)*

The idea of “personal benefits” is an important consideration as physicians are hospital’s clients; they are entrepreneurs that are not directly employed by the hospital. Their relationship with the hospital is that of a client who brings revenues to the hospital through the patients they see and admit to the hospital. Therefore, physicians are concerned more with their own work efficiency as their revenue is directly related to how many patients they see daily. While some physicians may be directly employed by the hospital, the majority of the 2,000 physicians at Alpha are not. The above finding implies that Alpha needs to spend more time and resources to emphasize to physicians how they can directly benefit from using the EMR. Presentations about the computerized systems to different physician groups needs to stress the idea how the EMR systems can help physicians perform their clinical work, or the idea of “what’s in it for me.”

Although improving patient care seems to be a common goal for both physicians and Alpha’s administration, lack of a perceived direct benefit to a physician for EMR versus the paper chart may contribute in diminishing perceptions of this common goal. As one physician concluded,

*“You have to offer me a very good deal that obviously has a lot of advantages for me to accept it!” (Nephrologist1)*

One other important issue that emerged from the interviews seems to be the way these beliefs about the EMR technology are communicated to hospital’s administrators and how physicians perceive their concerns are taken by administrators. One particular physician interviewed for this study was heavily involved with the Physician Technology Committee in the

hospital where hospital administrators, MIS and physicians meet monthly to discuss EMR and other technology related issues. Although he pointed out similar system problems many times at several such meetings (i.e. difficulties in navigation and search), he did not feel that his voice was heard. He did not feel that in follow-up meetings, administration or MIS had any response to any of his complaints he brought up before.

*“... We talked with the people for the computer system, 6 months we discussed this in the committees... They have to pay attention to what we say...this is the main thing doctors criticize” (Nephrologist2)*

### **Clinical Specialties**

Another group of physicians are very clinical-oriented specialties such as family practice and internal medicine. As opposed to consultant physicians, these clinicians treat a variety of diseases at a general level before other specialists are called in, if necessary for a patient. Five family practitioners<sup>7</sup> and eight internists were interviewed for this study.

EMR2 in particular, is believed not to be as doctor friendly to family practitioners. As some physicians put it,

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<sup>7</sup> Although only one family practitioner was formally interviewed for this study, structured discussions have taken place between the researcher and four other family practitioners at an outpatient clinic at Alpha. These four family practitioners also practice and see in-patients at Alpha and at the same time they are in charge of a residency program at Alpha. Field notes have been taken and included in this chapter.



*“I use [EMR2] but I found it to be a little bit more difficult to use. I use it and to be honest I don’t know everything... I cannot find records; there are too many windows in there. So I’m not too happy about that program” (Family Practitioner2)*

*“I don’t think that at this point the interface is quick and easy enough for physicians ...the time it takes to go through and find something make the system too difficult... the system is not easy to use at this point” (Family Practitioner1)*

Navigation between multiple windows and menus and searching for clinical information in the EMR systems also seem to be for these physicians, major contributors to their perceptions that the system is too complex and difficult to use.

*“It’s not easy to navigate...it is very cumbersome to try to find information in there” (Family Practitioner4)*

On the other hand, perceptions about the EMR1 seem to be more positive; this system is perceived as being easy to use and intuitive to a physician.

*“For the most part [EMR1] is pretty user-friendly. It seems intuitive. It’s not confusing. It seems basic enough for me to understand what I’m looking for” (Family Practitioner5)*

At the same time, EMR1 is perceived as being advantageous in terms of providing physicians the ability to retrieve up to twelve years of patient records without having to call or go to the Medical Records department. At the same time, data-retrieval EMR systems in general seem to be quite compatible with the work of such clinically-oriented specialties, who need to look at more clinical data in order to make a clinical decision for a patient.

*“It’s quite helpful to go back into the records to find out how many times a patient has been in the hospital before, when is the last time they had a stress test, a major big exam they had done...Whereas without that we’d have no way of knowing that...rather than just taking the patients word that their stress test was normal two years ago....and normal to them may mean something different to us... Or we could go to Medical Records and having them trying to find them...but that could be hours or days...to get information that you need now! ...It would be impossible!” (Family Practitioner4)*

*“With the current system you can look at multiple previous admissions, dating back years...whereas you would literally need every single one of those paper charts to take a look at. So just time-wise it’s definitely speed up and made it at least for me to get a clear picture of the patient’s previous medical history” (Family Practitioner5)*

Internal medicine physicians, as their family practice counterparts, specialize primarily in diagnosing and treating a variety of diseases as opposed to other specialists that have advanced training and experience in identifying and treating certain diseases and conditions of particular parts of the body (i.e. cardiologists, surgeons, pulmonary specialists).

One internist, who is also the president of a local medical society, found EMR1 not to be user friendly. His beliefs were based on system quality issues such as the quality of the information provided by the system and navigation and search issues such as *“writing something three times to get at it.”* Perceptions and experiences with other systems that this physician has encountered while practicing at other hospitals also seem to influence his perceptions about the EMR system at the hospital facility of interest in this study.

*“The other system I encountered was with [Beta Healthcare System] ...they had a system which was very user friendly, easy to get at information, quick, you didn’t have to get through multiple screens...” (Internist1)*

This idea seems to be related to the construct of perceived observability (Rogers, 1995) or the degree to which the results of an innovation are visible or easily observed. Interestingly, observability of an EMR system in one hospital seems to influence beliefs about other EMR systems in a different hospital. Many times physicians practice at more than one hospital which most of the times have a different computer system.

Another internist’s beliefs about EMR1 and EMR2 seem to also be influenced by perceptions of observability in a different hospital setting (Delta).

*“The EMR system at [Delta] is very friendly, they have a box for clarifications, so you type in whatever is missing or if you want to make a correction you can correct... here at [Alpha] if you want to make a correction you have to go to Medical Records and ask them for the printout then correct or re-dictate again” (Internist4)*

Other physicians also mentioned Delta’s EMR ability to provide more complete clinical information, although the system was not perceived as being as fast or as use-friendly as Alpha’s EMR.

*“I go to other hospitals [Delta] [Gama] ...At [Gama], you don’t get the information as fast as you get it at Alpha. Same at [Delta], it’s not as fast, but you can get all sorts of information” (Internist3)*

*“I’ve used other computer systems in the past at other hospitals. The computer system here[at Alpha] is very user friendly, you navigate easily compared to other systems. It’s much faster compared to other computer systems” (Internist6)*

Thus, the demonstrable consequences from using an EMR system at the other hospital facilities where these internists also practice seem to impact the way they think about the EMR systems at Alpha. For instance, Delta’s EMR is seen as being more comprehensive in its capability to provide physicians with much more information such as scanned progress notes. This system also provides physicians with more flexibility in terms of being able to electronically sign reports and access typed dictations which is a clear advantage versus having to re-dictate or asking someone else that changes be made. These additional system’s capabilities at Delta emphasize more the limited capabilities of the EMR systems at Alpha.

*“The information is limited in [EMR2]... also, with dictations... I can only retrieve but cannot make changes in the computer to dictated notes” (Internist1)*

It seems thus that internists would like to Alpha’s EMR to contain more features and more clinical data that is easily available. As some physicians pointed out *“it would be nice if I can look at more information in the computer” (Internist2, Internist3).*

Other physicians seem not to be entirely aware (awareness/knowledge, Rogers, 1995) of all the EMR features. One internist for instance, did not know he would be able to retrieve X-ray films in the computer, with the result of him not using EMR3.

*“I don’t know where to find X-ray films in the computer...I look at the reports but not the films” (Internist3)*

Other internists found the EMR1 system at Alpha fairly simple to use and “straightforward.” This system is perceived to be advantageous as physicians can get reports faster by accessing the computer without having to rely on nurses and floor secretaries to get them the results.

*“You don’t need to rely on other people –you can read it yourself. You never trust what somebody else tells you...you need to see the report yourself” (Internist3)*

Similar benefits from being able to use an EMR1 system were perceived by another internist in terms of the ability to access records personally, however at the expense of spending more time.

*“I know what I’m looking for and I can just go directly to it, whereas I can say something to the unit secretary, she may not know what I want, she may come back to ask, is this what you need? No, I need this you know...so it’s a little more efficient for me to do it myself, but it also takes more time for me...” (Internist5)*

Some internists expressed their concerns about search and navigation issues with EMR at Alpha. Physicians found it difficult to search for patients and most importantly search and sort through a multitude of microbiology cultures. EMR inability to provide physicians with an organized view of the microbiology cultures (i.e. positive versus negative) contributes to physicians’ perceptions that the system is inefficient.

*“When you’re looking for a patient and you don’t know the exact spelling where you have a last name but you don’t have a first name, the system would say there is nobody under that name but it won’t give you a close spelling ...So it won’t come up with*

*anything, it would say... "there is no patient in the system with this name" ...it wouldn't say "here are your options" ..."* (Internist5)

*"One of the biggest drawbacks with the system that we have is the Microbiology...and we have patients here, who have been here for along time. They have 20-30 microbiology cultures from blood cultures, urine cultures, you name it... you have to click on every one just to get the results...which takes a very long time...that's the thing that frustrates me the most about this system. There's really no way to just get what's positive and have it all on one screen. Like for example, say someone has 10 blood cultures and 3 of them are positive. You're not going to know it till you click on every one of them. If there was way you could just click and it shows you, you know day 1, day 5 or day 7 are positive and these were the results, that would be great, instead of having to click on all of them. And some of these patients have 20 or more cultures because they've been here a longtime when they're very sick ...it takes a long time"* (Internist8)

Despite some disadvantages of Alpha's EMR systems, internists generally believed the computer system made their work more efficient in terms of them being able to get to patients' reports faster, follow up on patients and discharge patients faster.

*"I am lot more efficient with the computer... when a patient gets admitted, if I need to look up something, I can look up old history so I am not repeating myself, old orders, redundant stuff, I can progress from that point on"* (Internist6)

One of the advantages of the computer system is real time access to latest clinical information as compared to the limited information provided by the paper chart. At the same

time, data-retrieval EMR seem to be more compatible with the work of internists that are more clinically-oriented and need to look at more information about their patients.

*“You don’t have to wait 24/48 hrs to look at a test result ...so that you can make your decisions. Some of the lab results are in the computer before they are printed by the secretary and put in the chart, so it’s much more real time” (Internist6)*

*“Well it makes me more efficient because anything that’s not on the paper chart I know I can look it up on the computer as far as labs, reports” (Internist7)*

*“It’s definitely more efficient because the paper charts usually don’t have everything I need and I like to look at everything on a patient” (Internist8)*

In sum, data-retrieval EMR systems are perceived by clinicians as being more efficient than the paper chart. This is because EMR provides a good clinical repository where physicians can look up patients’ history and get access to the latest clinical data that would not be very easily accessible otherwise. Being able to retrieve previous patient records in a timely manner is important as it enhances a clinician’s capacity to make decisions about a patient. It seems thus, that despite some technical-related, system problems, a high work-related compatibility (i.e. clinicians need to look at more clinical information about a patient) better emphasizes the benefits of an EMR to clinically-oriented specialties. In general, clinical specialties seem thus to have more positive beliefs and attitudes about the data-retrieval EMR systems, with the result of them using more data-retrieval EMR at Alpha.

Ease of access to Alpha’s EMR also underlies physicians’ perceptions of the complexities involved with using EMR. Accessibility issues are to be discussed in a separate section. The

relationship between difficulties in accessing EMR at Alpha and physicians' perceptions of EMR complexity are to be discussed in Chapter 6. Table 8 summarizes the underlying dimensions of the perceived complexity of EMR.

**Table 8: Physicians' Perceptions of the Complexity of EMR**

Specialty	System used	EMR is doctor-friendly (overall)	What factors determine these perceptions
Cardiologist1	EMR1	Yes	Navigation (going from one window to another to get results)
Cardiologist2	EMR3 EMR1, EMR2	Yes (certain areas) No (EMR1&EMR2)	Ease of access to clinical info
Cardiologist3	EMR3  EMR1, EMR2	Yes (certain areas)  No in general	Ease of access to clinical info Navigation (multiple steps to access clinical info)
Cardiologist4	EMR3, EMR1	Yes (EMR3) No (EMR1)	Ease of access to clinical info Ease of access to clinical info
General Surgeon1	No use	No	No data available
General Surgeon2	EMR1	No	System integration/Ease of access to clinical info
General Surgeon3	No use	No	Ease of access (Paper chart is easier to access)
General Surgeon4	EMR2	Yes	Ease of navigation (I can find things easily) Ease of Searching for info (have an exact patient name – for outpatients only)
General Surgeon5	EMR1, EMR3	Yes	User friendly
Nephrologist1	No use	No	Ease of access to clinical info
Nephrologist2	EMR1, EMR2	No	Navigation (multiple screens to access a report) Ease of Searching for info Ease of access to clinical info
Nephrologist3	EMR1	No	Data is not easy to retrieve Ease of navigation (from admission to admission) Ease of Searching for info/Sort (get radiology results in chronological order) Ease of access (also remotely)
Pulmonary Specialist1	EMR3	No on the floors  No	Ease of access (including log-out problem for EMR3)  Ease of access



Specialty	System used	EMR is doctor-friendly (overall)	What factors determine these perceptions
			System integration issues (you have to change from one site to another which is cumbersome)
Pulmonary Specialist <sup>2</sup>	EMR3	No (EMR1)  Yes (EMR3)	System integration/Ease of Access Navigation and speed (bring up a patient name & look at reports quickly)  Ease of access in certain areas
Family Practitioner <sup>1</sup>	EMR2	No	Navigation (the time it takes to go through to find something) Ease of access
Neurologist	EMR1	Yes	The system is user friendly
Physical Therapist	EMR1	No	System is not user friendly Navigation & search (access patients in a specific unit)
Pediatrics Surgeon	EMR2, EMR3	Yes	System is user friendly Navigation (easy to find info)
Oncologist	EMR1	No	System is not very user friendly - Interface characteristics (menu system) Navigation (I have to click here & then I have to click there to get my data – have to go through all these menus) Ease of access (versus paper chart) Screen customization/Sort/Search (only one way to look at results)
Orthopedic Surgeon	EMR3	No	Ease of access (it's a struggle) Search issues (everything has to be exact)
Plastic Surgeon	No use	No	Ease of access
Internist <sup>1</sup>	EMR1	No	System is not user friendly (ease of getting at info) Navigation (multiple screens) Ease of access
Internist <sup>2</sup>	EMR1, EMR2	Yes	System integration (info in one place)
Internist <sup>3</sup>	EMR1, EMR2	Yes	Simple to use
Internist <sup>4</sup>	EMR1, EMR2	Yes	System integration Ease of access
Internist <sup>5</sup>	EMR2, EMR1	Yes	Ease of navigation (have to look at labs one at the time) System integration (go to multiple systems) Search issues (need a patient's full name to search)
Internist <sup>6</sup>	EMR2, EMR3	Yes	The system is user friendly, fast to get at info Easy to navigate
Internist <sup>7</sup>	EMR1	Yes	Search issues (for labs cannot compare

Specialty	System used	EMR is doctor-friendly (overall)	What factors determine these perceptions
			side by side, need to open one at the time) System integration Navigation (number of screens)
Internist8	EMR2	Yes	The system is intuitive (organization of info that makes sense to a physician, easy to learn) Navigation (number of clicks) for microbiology reports Search issues (go through each culture, cannot sort)
GI	EMR1	Yes	Ease of access Navigation/Search

Table 9 summarizes the most important themes that underlie physicians' perceptions about the complexity of the system or its "friendliness."

**Table 9: Main Themes underlying Physicians' Perceptions of EMR Complexity**

Core Issue	Total number of instances the issue was mentioned across interviews	Number of physician specialties who had mentioned an issue
Navigation	16	10
Search/Sort	11	9
Ease of access	19	13

Table 10 summarizes physicians' perceptions regarding the relative advantage of EMR and the reasons underlying such beliefs.

**Table 10: Physicians' Perceptions about the Relative Advantage of EMR at Alpha**

Specialty	System used	Belief EMR is beneficial	Dimensions underlying RA
Cardiologist1	EMR1	No	Time inefficiencies (spend more time vs paper chart)
Cardiologist2	EMR3 EMR1, EMR2	Yes No	Availability of real time X-rays; Ease of Access Perceived Need of EMR for clinical tasks Importance of EMR to one's job

Specialty	System used	Belief EMR is beneficial	Dimensions underlying RA
Cardiologist3	EMR3  EMR1, EMR2	Yes	Ease of access (system is online all the times) Ease of Navigation (list of patients, names, X-rays) Time efficiency vs asking Medical Records (can see multiple patients' X-rays)  Perceived Need of EMR for clinical tasks (nature of clinical work) Time inefficiencies (I don't have the time)
Cardiologist4	EMR3, EMR1	Yes (EMR3) No (EMR1)	Time efficiency vs asking Medical Records Perceived Need of EMR for clinical tasks (nature of clinical work) Ease of access (access EMR from the part of the building where the patient is)  Nature of work (does procedures, rounds, other things) Time inefficiencies in retrieving info Look at both paper & computer "EMR does not help me get through my time"
General Surgeon1	No use	No	Perceived Need of EMR for clinical tasks (nature of clinical work)
General Surgeon2	EMR1	Yes	Availability of clinical data in the computer Relative advantage over calling lab/asking nurses
General Surgeon3	No use	No	Perceived Need of EMR for clinical tasks (nature of clinical work)
General Surgeon4	EMR2	Yes	Personal benefits/work efficiency (I don't think it's a big improvement over charts – i.e. temperature charts)
General Surgeon5	EMR1, EMR3	Yes	
Nephrologist1	No use	No	Benefit to the hospital vs personal benefits EMR makes physicians work harder
Nephrologist2	EMR1, EMR2	Yes	Perceived Need of EMR for clinical tasks (nature of work - clinician) Advantage over asking Medical records for historical charts (compared to 10 yrs ago) → EMR provides easy access to patient historical records (previous admissions)
Nephrologist3	EMR1	Yes	EMR has real time info RA of EMR depends on the complexity of the case
Pulmonary Specialist1	EMR3	Yes	RA over going to radiology dept. → EMR3 is time efficient (time savings over the "old way") Importance of EMR to clinical work (nature of work) – that's very important because I see X-rays all the times

Specialty	System used	Belief EMR is beneficial	Dimensions underlying RA
		No (EMR1&EMR2)	Ease of access (I can't spend time to do that for each patient) No RA because most info that he NEEDS is in the paper chart – inefficient to look at both
Pulmonary Specialist2	EMR3	Yes	EMR3 is advantageous over going to radiology dept. → EMR3 is time efficient (time savings over the old way) Access X-rays from “wherever you happen to be” EMR3 is more efficient in the ICU (access)
Family Practitioner1	EMR2	No	Ease of access (it's a matter of time...I can't do that) Location of computers vs paper chart at the bed side
Neurologist	EMR1	Yes	Nature of work EMR provides Real time info
Physical Therapist	EMR1	No	Time inefficiencies - Data is spread in 2 places
Pediatrics Surgeon	EMR2, EMR3	Yes	Perceived need (I need the info to take care of my patients) RA over calling the lab for a test Quality of the reports Ease of accessing films & time efficiency over waiting for radiology
Oncologist	EMR1	Yes	Improved access to old records
Orthopedic Surgeon	EMR3	Yes	RA over going to Radiology dept. Access to films from anywhere a computer is available
Plastic Surgeon	No use	No	Perceived need (nature of work) EMR is more work for him
Internist1	EMR1	No	Ease of access Computer is not at the bed side Perceived need (info is already in the paper chart)
Internist2	EMR1, EMR2	Yes	Easier to find info in the computer than paper chart
Internist3	EMR1, EMR2	Yes	Get results faster Remote access Does not need to rely on nurses to get reports
Internist4	EMR1, EMR2	Yes	VS not in the computer
Internist5	EMR2, EMR1	Yes	Access to clinical info versus asking a nurse
Internist6	EMR2, EMR3	Yes	Easy to look up old records & time efficiency versus waiting on Medical Records Access to real time info
Internist7	EMR1	Yes	Access to info to supplement paper chart

Specialty	System used	Belief EMR is beneficial	Dimensions underlying RA
Internist8	EMR2	Yes	Nature of work (clinician) RA over paper chart depends on the complexity of the case
GI	EMR1	Yes	Improved access to clinical info

## Physicians' 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 whether by using any of the hospital's EMR systems they had to make any changes in the way they are used to performing their medical tasks. They were also asked how EMR systems impacted the profession of medicine and the way they like to work. As in the previous section regarding physicians' beliefs about the technology, we present the results in this section by focusing on different physicians' groups.

### Consultant Physicians: Cardiologists, Surgeons and Pulmonary Specialists

Cardiologists, surgeons and pulmonary specialists are consultant specialties that have very established work practices both in their private practices and hospital. These physicians are known to employ physician assistants (PAs) and nurse practitioners (NPs) that work with them and help them do their clinical work. To this extent, physicians in these specialties did not find that Alpha's EMR systems changed much in the way they perform clinical activities. Most of data accessing from the computer is performed by either PAs or NPs who either print out the clinical results from the computer or write down on a piece of paper a summary of specific results the physician requested. These physicians did not change their established norms and activities to personally take advantage of the computer system. They perceived that accessing

data in the computer is not primarily their responsibility once they have these other personnel available to them to deal with such tasks. Furthermore, the nature of work of a surgeon that is concerned more with performing surgical procedures rather than accessing patient data seems to contribute and emphasize existing beliefs that specialized personnel should deal with the computer system for data retrieval.

*“Surgeons and cardiologists have always had - and I’ve been here for 20 yrs now - people that we pay to work with us to make the work go faster and more efficient. This personnel deal with the computer” (Cardiologist1)*

*“I’m mostly in the operating room, my time is spent mostly in the operating room than trying to access info on the computer” (General Surgeon3)*

Other surgeons and pulmonary specialists did not find that the EMR system changed anything in a major way in their clinical practice, except for making information more accessible from the hospital or remotely. This is because the current EMR systems at Alpha are primarily data retrieval. At the same time physicians still have a choice to use the paper chart and they still write their progress notes and orders manually on paper.

*“From a surgery standpoint it [EMR] hasn’t changed at all how you practice medicine ...it made it a little bit easier to access the information especially if you are at home and you want to look at something...I don’t think it changed the quality of the medicine practice” (General Surgeon4)*

*“I think it’s changed for the better... I can access patient list, medical records from home...if I get a call from the ER I can log on and get the information in front of me”*

*(Cardiologist1)*

*“It really hasn’t changed the way I practice because we do the same things...you have to examine the patient, we have to write orders...It hasn’t really changed anything. It changed the way things are recorded, instead of the paper it’s recorded on the computer. It really hasn’t changed much for me at all” (Pulmonary Specialist2)*

However, despite the recognized benefits of EMR, having the information more available does not seem to encourage cardiologists or surgeons to personally use the computer to retrieve clinical information.

*“The NP writes down whatever I am interested in on a blank piece of paper. The lab shows this, etc. A lot of times the PA accesses a lab or an x-ray report that’s not already in the chart and writes it in his note. I read that myself. These notes are about half a page long” (Cardiologist3)*

Furthermore, other physicians thought that EMR systems cannot and should not make any changes in a way a doctor practices medicine because they are “cold and inanimate objects.” Computers are not seen by some surgeons as being capable of providing personalized information about a patient that can only be derived from a face-to-face conversation with another doctor or nurse.

*“The computer can’t tell us that personal evaluation made by a radiologist or another specialist- it’s nothing like calling up the physician and talking to him...because there is a certain feel a doctor gets about a patient that can confer to you” (Plastic Surgeon)*

Most physicians in this group recognized a positive change in the way they practice medicine from EMR3. This system has helped physicians get easier access to patients’ X-rays in a timelier manner. Because of this perceived positive change and also compatibility with these physicians’ practices, EMR3 is used far more than the data-retrieval EMR1 and EMR2.

*“I never go to the radiology department anymore...I can access the X-rays on the floors or from my office” (Orthopedic Surgeon)*

### **Other Consultants Physicians**

Improved data availability is a change the EMR systems brought at Alpha. This change is perceived as positive by more clinically-oriented specialties such as nephrology, neurology and oncology. These physicians thought that the current data retrieval EMR system changed their practice of medicine for the better in terms of providing them with access to medical information that they did not easily have before. The EMR systems positively impacted this physician group by providing an improved ability to access patients’ historical information and avoiding duplication of tests. As opposed to cardiologists and surgeons, nephrologists see the ability to personally access and review patients’ records in the EMR as highly beneficial. These physicians are more clinically oriented, which means their specialty requires them to look at more clinical data in assessing their patients. This seems to be the reason why physicians in this group may



value this functionality of the EMR more than the other specialties presented in a previous section.

*“When I worked in the hospital 5-10 yrs ago, I got a consult to see Joe Smith ... I was coming to medical records, come down here [lounge] ask the employee to get me the records, 5-6 volumes, I have to sit down review to find what I am looking for. Now it is a piece of cake, I click on previous admissions, look for specific things I want (X-rays, blood tests, etc) –that is a beauty. That improves the quality of care, save money and save time for admission per patient” (Nephrologist2)*

*“For example, I get a consult from somebody and I go see the patient, find out that one of my partners saw the patient 2 years ago...so I am really curious what did my partner see the patient for and why. With [EMR1] you can go look it up - but again you have to go through all these menus to get there - but then you can get to the medical records, find my partner’s name click on his consult and... there...I can see exactly what my partner said. That’s a biiiig change from the paper-world. In the paper-world, I would have to tell the secretary I need old records on this patient, she’d call up Medical Records, Medical Records would have to dig it up on microfilm, usually it would take 1 or 2 days to get those old records. That’s unacceptable. Here I am ...within 5 minutes I can have all the information that I need all the prior lab results” (Oncologist)*

Some physicians such as an oncologist and a GI physician have pointed out the impacts of EMR on the practice of medicine from a historical perspective. These physicians are very involved with various technology-committees and design of EMR at Alpha. From a historical perspective, changes that have been observed are improved access to patient records and

timeliness of the information that is reported in the EMR system. Compared to how clinical data retrieval used to be performed in the past, the computer system has significantly improved data recording and retrieval.

*“When I started at Alpha, if you had to order a CBC, there would be a piece of paper 2.5 inches high and maybe 7 inches long and that would get pasted into the chart. That would come back the next day after you ordered it maybe mid morning...if you wanted the report before that you called up the lab and stayed on hold for a long time until a lady that has had so many calls like that during the day - with the attitude that she had so many calls that day – gave you the result. And if you needed a report of an x-ray before the printed report came to the chart probably the next day and you had to call down to radiology and have one of the radiologists take the film and look at it, read your report because there was no way to access that dictated report... now I can get to the computer – I can not only get the report in the computer, I can see the films. So if you look at the system as we have it today compared with the system that we had 15-20 yrs ago, it’s dramatically better...but...the process is still the same, see the patient, talk to them, examine them, order tests, get the results back, act upon those test results, order more tests and meds. That really hasn’t changed with the system” (GI)*

## **Clinical Specialties**

Similar to physicians in other specialties, some internists and family practitioners pointed out the fact that the computer is making clinical information more accessible to them which in turn leads

to fewer repeated tests for the same patient as all clinical history is available and retrievable from the EMR system.

*“All prior investigations are already there [in the EMR], you have no repeats - if a doctor saw the patient 2 years ago and same problem is coming again, we don’t have to repeat everything again and again” (Internist4)*

*“EMR speeds up information. For me that I am more on the cognitive side of medicine, if you can get more information to me quicker; it also reduces the time to make a decision and reduces sometimes the tests that I have to order” (Family Practitioner1)*

Other internists did not believe the EMR system has changed their practice of medicine as it does not provide the ability to enter or view progress notes (i.e. doctor’s notes) or orders.

*“It hasn’t really changed much cause we don’t do orders or progress notes” (Internist5)*

*“I don’t think it really changed the way you practice. Just changed the way you get information” (Internist7)*

Some physicians believe the paper chart should be the main data source for information retrieval. One physician in particular strongly thought that having to spend time retrieving patients’ data from the computer is not something he should be doing. It is worth mentioning here that the hospital, in order to encourage more computer usage has decided to print certain labs and reports only once a day, in the morning, such that if a physician needs the latest lab results or other reports in the afternoon for example, he or she needs to either access the computer or ask another party to provide this information. In this context, some internists believe

that it is the hospital's responsibility to get all the latest reports in the paper charts at any given time, such that physicians do not have to spend time retrieving clinical data. Thus, the computer has changed to some extent the way a physician retrieves clinical data, although this particular change brought by the EMR system is "encapsulated" to some extent by the availability of workarounds (floor nurses and secretaries) and a strong belief that a physician should not do data retrieval.

*"In the old days, the lab would be in front of the chart and you'd read it – a doctor shouldn't have to take his time to try to get the lab work in his hand" (Internist1)*

*"As a physician I can see I'm doing more of stuff the unit secretary used to do" (Internist5)*

Another factor that seems to contribute to the "encapsulation" of the EMR technology seems to be the belief that the EMR system cannot provide the same quality evaluation about a patient as that of another nurse or physician.

*"I like to talk to the nurses because they're taking care of the patients, a doctor does better if he talks to the nurse who took care of the patient the last 8 hrs, he can get more information that he can get from anywhere else" (Internist1)*

In conclusion, Alpha's EMR systems seem not to have brought significant changes in terms of a physician's routine in taking care of patients. Most specialties agreed that the main change has been observed in the EMR's ability to provide a physician with better access to historical information. However, not all specialties seem to take advantage of this EMR capability equally. There seem to be some differences in the way different specialties perceive

that patient data retrieval is indeed a benefit to them. Surgical and cardiology specialties have more established work practices with NPs and PAs, also, they do not need to look at many lab reports. Their every day work revolves around the operating room where they perform different procedures. On the other hand, access to previous clinical information is seen as beneficial to more clinical specialties such as neurology, nephrology and internal medicine. The ability of the EMR systems in providing access to more real time information than the paper chart is another impact that has been documented by physicians interviewed for this study although other physicians believe that data retrieval is not the primary responsibility of a physician. They perceived that Alpha's EMR systems have in fact brought more work to a physician who now has to look in two different places (paper chart and computer) in order to get complete information about a patient as some information is in the chart but not in the computer and some information is in the computer and not in the paper chart. Some other physicians believed it is Alpha's responsibility to provide them with personnel that should be doing data retrieval while other physicians believed the computer would never provide the same quality information as they would get from interacting with another physician or nurse that takes care of a patient.

Interviews and direct observations in different meetings at Alpha pointed to the fact that EMR systems can potentially have two major impacts to the medical profession, specifically on physicians' time and expertise. Current EMR systems seemed to have impacted primarily physicians' time. Almost all physicians interviewed for this study indicated that using data-retrieval EMR1 and EMR2 has negatively impacted their work efficiency by increasing the time it takes to access clinical results.

*“Right now this learning curve has made it very cumbersome, harder to see as many patients as efficiently...it doesn’t help me get through my time. Right now I am less efficient with the computer, I hope to get back to neutral” (Cardiologist4)*

On the other hand, as previously shown, EMR3 has positively impacted physicians’ practices by decreasing the time it takes to see patients’ X-rays. This is one reason why EMR3 is more used than the other two systems by certain specialties. Furthermore, computerized physician order entry and the movement towards evidence-based medicine have the potential to impact a physician’s expertise and ability to “think”. As a physician expressed his concern in a meeting, “this is not how a physician thinks” referring to evidence-based medicine and orders sets. Implementation of future computerized physician order entry should thus be done carefully such that physicians do not find them a threat to one of their major resources: their expertise and ability to treat patients.

Table 11 summarizes physicians’ perceptions about the way EMR fits with their beliefs about how their professional work is organized and the dimensions underlying these perceptions.

**Table 11: Physicians’ Perceptions of how EMR impacted their Profession**

<b>Specialty</b>	<b>System used</b>	<b>Beliefs about EMR changing the profession</b>	<b>Beliefs about the medical profession</b>
Cardiologist1	EMR1	Positive	Better access to clinical info Access clinical info remotely
Cardiologist2	EMR1, EMR2	Negative	It’s just fine the way I do it now
Cardiologist3	EMR3	Positive	Organization of work (NP & PA are in charge of dealing with EMR) Better access to clinical info (through workarounds) Access clinical info remotely
Cardiologist4	EMR3, EMR1	Negative	EMR decreases work efficiency in seeing patients EMR is labor intensive

Specialty	System used	Beliefs about EMR changing the profession	Beliefs about the medical profession
			EMR does not work well with physicians
General Surgeon1	No use	Negative	No data available
General Surgeon2	EMR1	?	?
General Surgeon3	No use	Negative	My practice can do well without computers at this point
General Surgeon4	EMR2	No change/ Somewhat Positive	EMR makes it easier to access clinical info (especially remotely)
General Surgeon5	EMR1, EMR3	?	?
Nephrologist1	No use	Negative	EMR makes physicians work harder
Nephrologist2	EMR1, EMR2	Positive	EMR makes it easier to access patient records remotely Advantage over asking Medical records for historical charts (compared to 10 yrs ago)→ EMR provides easy access to patient historical records (previous admissions) EMR makes clinical info available (don't repeat tests, learn about patient)
Nephrologist3	EMR1	Positive	Time advantage over asking Medical records for old charts EMR is a good repository of clinical info (but not easily accessible)
Pulmonary Specialist1	EMR3 EMR1, EMR2	No change/Negative	Belief nurses are responsible to print out a medication list & out it in the chart Belief docs should not be "running around" trying to find pieces of clinical info)
Pulmonary Specialist2	EMR3	No change/Positive	Same data, same diagnoses EMR is a good repository of clinical info
Family Practitioner1	EMR2	Positive	EMR is a good repository of clinical info Has EMR in his office
Neurologist	EMR1	Positive	EMR makes clinical info available (don't repeat tests, learn about patient)
Physical Therapist	EMR2	?	Don't depend on nurses as much as before
Pediatrics Surgeon	EMR2, EMR3	Positive	Improved access to clinical info vs paper charts (various people utilize charts – they're not always in place)
Oncologist	EMR1	Positive	Advantage over asking Medical records for historical charts – time efficiency over waiting for old charts Improved access to old info
Orthopedic Surgeon	EMR3, EMR1	Positive	No data available
Plastic Surgeon	No use	Negative	Computers do not serve patients better

Specialty	System used	Beliefs about EMR changing the profession	Beliefs about the medical profession
			Computer is a cold, inanimate object
Internist1	EMR1	Negative	A doctor should not have to take time to try to retrieve clinical info Beliefs a doc should talk to nurses who take care of the patient
Internist2	EMR1, EMR2	Positive	Improved access to clinical info
Internist3	EMR1, EMR2	?	Don't depend on nurses as much as before
Internist4	EMR1, EMR2	Positive	Improved access to info
Internist5	EMR2, EMR1 (remotely)	Not much change (no orders, progress notes) Somewhat Positive	Shift of responsibilities – I can see I am doing more stuff the unit secretary had to do
Internist6	EMR2, EMR3	?	No data available
Internist7	EMR1	No change/ Somewhat Positive	Changes the way info you get info
Internist8	EMR2	Somewhat Positive	No data available
GI	EMR1	No change in processes yet Positive	Improved access to clinical data (data repository) Potential for evidence based medicine

## Physicians' Predisposition to Change

Any new technology may bring about change in existent practices (Ayres, 1944). Thus, an important consideration in this study is an individual's predisposition to change and how individual physicians react to changes brought by an EMR system. Physicians were asked to evaluate how comfortable they felt with the changes brought by the EMR technology, more specifically whether they would support or resist EMR-related change. Physicians were also asked about their general predisposition to change in terms of adopting new treatments and courses of actions in their clinical work.



Preliminary discussions with physicians' advocates and a few IT consultants at Alpha emphasized the idea that physicians are in general resistant to change. Most physicians believe that the current system (i.e. paper) "works fine" and "there is no need to change" an established way. Interview data showed predisposition to change may vary by specialty and that predisposition to change can be altered by emphasizing the benefits of change.

### **Consultant Physicians: Cardiologists, Surgeons and Pulmonary Specialists**

Cardiologists and surgeons seem to be very conservative in their beliefs about both changes in medical practices (i.e. new treatments and techniques) and EMR-based change. They acknowledged their resistance to change and their reluctance to incorporate change in both medical procedures and clinical work. The surgical model, as expressed by a physician is the following:

*"Perfect is the enemy of good. If it's good and it's working, don't mess with it."*

*(Cardiologist3)*

This idea seems to point to the highly ceremonial nature of work of these two specialties (Ayres, 1944; Bush, 1989). They seem to obey very well defined sets of procedures and treatments and do not readily give up their established norms for treating or seeing patients in order to incorporate new techniques or technologies.

*"Surgeons are especially conservatives...because they know that with change comes death, if something doesn't work, then somebody is gonna die" (Cardiologist3)*

Furthermore, the idea of *“If it’s good and it’s working, don’t mess with it”* provides further evidence to the fact that these two specialties are highly resistant to change. The paper chart is perceived to be a good way of having clinical data organized and they do not perceive any need to change this established way. This same idea is supported by another cardiologist’s statements that *“it’s just fine the way I do it now”* referring to the paper charts and *“we don’t cut people with computers.”*

Some physicians that had this reluctant predisposition to EMR-based change seemed to have not had much interaction with computers in their everyday lives or through medical training.

*“I’ve never had any interest in computers...I’ve never sent an email in my life ...if I want to talk to you I’ll call you” (Cardiologist2)*

Overall, cardiologists and surgeons seem to be more on the traditional side of practicing medicine. They do not appear that they are readily embracing change both in their own medical practices or computer-related change. The result of their predisposition to change is mostly negative attitudes and not much use of EMR in their clinical work.

*“I don’t like computers... I have people in my office that work around computers but I personally don’t use computers” (Cardiologist2)*

*“I tend to be a surgeon, I do not use the computer as much as I should to access things” (Cardiologist3)*

*“My practice can do so well without computers at this point” (General Surgery3)*

Another surgeon highlighted the fact that in general, doctors are resistant to change and acknowledged his own resistance to change. Perceptions of the individual costs involved from changing, including the learning curve that comes with change are major considerations in physicians' resistance to change. However, this physician seemed somewhat instrumental in his behavior to the extent he perceived some benefits from change.

*“I think doctors are very resistant ... I am a little resistant, I just don't want anything that means more work for me, that takes more time, time is very valuable to me...time is the most important commodity that I have... I like to try certain things and I like certain old things. I like electronics and gadgets, but I value things that I used for a long time also”*  
*(Pediatrics Surgeon)*

Unlike their counterparts, other surgeons seemed to be more open to change in medical procedures and EMR-related change. One surgeon had more instrumental beliefs about EMR-based change, which seemed to be primarily due to more interaction with computers in his years of training and practice. In fact, he was willing to get an EMR system for his office but met with the reluctance of his “old-fashioned” partners who did not want to give up paper charts. Another surgeon pointed to the fact that he likes change “ *if it benefits: my patients, my practice and myself*” Although this physician was very instrumental regarding medical innovations, as regards the EMR systems at Alpha, he did not believe in their ability to improve care and benefit him in his clinical work. This dissonance between predisposition to new treatments and predisposition to EMR systems seemed to be due to this physician's lack of perceived “need” for EMR and lack of any benefits from using EMR.

*“I am always trying new things for my specialty - any new advancement that comes along, I use new technology for liposuction all the times... if I look at it, evaluate it from a surgical standpoint—this technique is worth trying. If that technique has any potential complications, why would I try it and run into more problems? I change cars, brands of cars - because it is better than what I have” (Plastic Surgeon)*

*“For me, the computer system is not helpful, I have enough to keep up with in my specialty...it’s never gonna help me practice. It’s creating more and more work for my office staff to try to save records that would be easily saved in a chart” (Plastic Surgeon)*

Direct observations in a surgery meeting with thirty surgeon participants and informal discussion with another group of surgeons at the same meeting enforced the idea of this group’s resistance to EMR. One physician expressed a very negative predisposition to EMR by saying that even *“nurses are not nurses anymore because of this computer system.”*

### **Other Consultant Physicians**

Other consultant physicians from more clinically-oriented specialties such as oncology, and GI seemed to be rather instrumental in their predisposition although they recognized the challenges involved with change. Both the oncologist and the GI physician interviewed for this study were actively involved with various technology-related committees at Alpha and they were rather instrumental in promoting EMR.

*“I clearly I made a commitment to the computer system at Alpha because I believe in it. I think there are a number of things the future computer system can and should do for us” (GI)*

Although some physicians acknowledged the difficulties involved with change in terms of physicians' engrained habits and other learning costs involved with change, their active involvement with the EMR system at Alpha contributes to them having a more favorable predisposition towards EMR.

*"I don't think it's necessarily because I am physician but everybody gets used to doing things one way... You go to school and learn your way how to get from class A to class B so you learn one way and you tend to keep it on the same way because if you go some other way you might get lost... It's the same thing... you learn your way around the computer program, know how to go from here to there to everywhere and then somebody gives you a whole new building, a whole new computer system ... oh my God I have to re-learn everything. It's just an annoyance even though the new system or the new building may be much better, you still have to learn it... and everybody hates doing that"*

*(Oncologist)*

At regards a physician's predisposition to try new treatments, same oncologist pointed out to physicians' resistance to change in general. He identified a lag that exists between the time a new treatment comes along and the time it generally takes physicians to consider it. At the same time, the positive benefits of the new treatment or technique seem to overcome to some extent some of the physicians' resistance.

*"Physicians get used to treating disease A this way and some new treatment comes along and they'll have to think about it for a while before they'll go to the new treatment especially if the new treatment requires a lot of work from their part. If the old treatment is easier, they'll stick to it for 5 or 10 years before it becomes readily acceptable... the*

*only exception is if something is a giant leap forward like chronic myelogenous leukemia –we have this way of treating the disease and it worked for a while and... after 4-5 yrs everybody died. Then a new pill came along...it was easy... you just swallow one pill a day and the disease went away...it was so much easier and it worked so much better...everybody switched over night. But they [physicians] don't do that very often”*  
*(Oncologist)*

Thus, although it seems that although in general physicians may be somewhat reluctant to embrace change, if a new EMR system has clear benefits to a physician in terms of being easy to use and/or advantageous (i.e. improve work efficiency), it seems plausible that physicians may be more accepting of the system.

### **Clinical Specialties**

Internal medicine physicians, because of their highly clinical orientation seem more instrumental in their behavior to the extent that a new procedure or technology provides them with clear benefits.

*“If it's something that's gonna help, then sure I'll look into new things. If it's something that's gonna make things easier, make life easier, then sure, why not?” (Internist8)*

Another internist that was involved with different technology-related committees at Alpha also seemed to be instrumental in his beliefs that *“I think the hospital needs to update the computer system as it is now” (Internist7).*

Although interview data was quite limited for fully assessing internists' predisposition to change, observations and other informal discussions with several other internists and family practitioners pointed to the rather instrumental predisposition of the physicians in this group. They did not seem very resistant to the idea of EMR and some physicians already acquired EMR for their offices.

It seems thus, that with the exception of cardiologists and surgeons, most physicians in this sample do not seem to strictly obey to ingrained habits and beliefs. This seems to imply that as long as the new computer system does not pose insurmountable costs (in terms of extra amount of time) and provides physicians with some benefits over the paper chart, physicians may form more positive attitudes towards the EMR system and use it more. Thus, an individual physician's predisposition to change (or resistance) may in fact be altered by emphasizing the benefits from using an innovation such as EMR. At the same time, involving and informing physicians more regarding EMR may serve to diminish their "fear" of computers and computerized systems with the end result of making physicians aware of the benefits of change from paper chart to EMR. This strategy may also work to engage more traditional specialties such as surgeons. One general surgeon (General Surgeon5) that was actively involved with technology-related committees at Alpha was an active promoter of EMR systems, despite his concerns about some of the EMR design issues for a new system at Alpha.

Table 12 summarizes physicians' predisposition to change and the motives underlying such a predisposition.

**Table 12: Physicians' Predisposition to Change**

Specialty	System used	Predisposition to Change	Reasons underlying such predisposition
Cardiologist1	EMR1	?	
Cardiologist2	EMR3	Ceremonial	It's just fine the way we do it now.
Cardiologist3	EMR3	Ceremonial	We are especially conservative because we know that with change comes death.
Cardiologist4	EMR3, EMR1	Instrumental	Involved with EMR in his office
General Surgeon1	No use	Ceremonial	
General Surgeon2	EMR1	?	
General Surgeon3	No use	Ceremonial	
General Surgeon4	EMR2	Instrumental	The years you practiced medicine one way does matter. Exposed to computer throughout his career.
General Surgeon5	EMR1, EMR3	Instrumental	Involvement with EMR at Alpha Interest/exposure in computers, big promoter of change.
Nephrologist1	No use	?	
Nephrologist2	EMR1, EMR2	?	
Nephrologist3	EMR1	Instrumental	Interest/Exposure to computers
Pulmonary Specialist1	EMR3 EMR1, EMR2	Instrumental	
Pulmonary Specialist2	EMR3	Instrumental	If benefits from change overcome costs (i.e. learning the system)
Family Practitioner1	EMR2	Instrumental	Acquired EMR for his office based on efficiency considerations.
Neurologist	EMR1	?	
Physical Therapist	EMR2	?	
Pediatrics Surgeon	EMR2, EMR3	Instrumental	I don't want anything that means more work for me, that takes more time
Oncologist	EMR1	Instrumental	Everybody gets used to doing things one way If a system is so much easier and so much better, it will be accepted instantly
Orthopedic Surgeon	EMR3, EMR1	?	
Plastic Surgeon	No use	Instrumental	I like change if it benefits my patients, my practice and myself
Internist1	EMR1	?	
Internist2	EMR1, EMR2	?	
Internist3	EMR1, EMR2	?	
Internist4	EMR1, EMR2	?	
Internist5	EMR2, EMR1 (remotely)	?	
Internist6	EMR2, EMR3	?	



Specialty	System used	Predisposition to Change	Reasons underlying such predisposition
Internist7	EMR1	Instrumental	Involved with technology-related committees
Internist8	EMR2	Instrumental	If it's something that's going to make things easier
GI	EMR1	Instrumental	I think the computer system can and should do more for us

## Physicians' Perceptions of Behavioral Control

Perceived behavioral control reflects the presence of factors that can interfere with or facilitate the performance of a specific behavior (Fishbein & Azjen, 1975). Availability of hardware resources and physicians' perceptions of the available support regarding their EMR usage 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. Furthermore, physicians were interviewed regarding their perceptions of whether they had sufficient training with the EMR systems such that they feel comfortable using any of the three EMR at Alpha.

As regards hardware, Alpha has two types of devices in place in the hospital, computers on wheels and desktop computers. Computers on wheels are laptops on rolling carts that can be

rolled throughout the floor to a certain patient's room. Desktop computers are located at the nurses' stations<sup>8</sup> and also in the physicians' lounge<sup>9</sup>.

In general, most physicians did not find they had enough hardware resources available to them while in the hospital. Other logistics problems regarding the physical location of computers and hardware characteristics such as speed and age of computers contributed to the general perception that hardware is a major barrier to physicians' usage of EMR at Alpha. Next, we elaborate on physicians' perceptions of behavioral control based on specialty groups.

### **Consultant Physicians: Cardiologists, Surgeons and Pulmonary Specialists**

As previously presented, consultant specialties such as cardiologists and surgeons are not heavy users of the EMR systems at Alpha. These two specialties mainly access the EMR in the physicians lounge to print out their patient list or in the Intensive Care Unit areas where computers are easily available to view patients' XX-rays. Most of the times, these specialties employ NPs or PAs to access the computer.

Cardiologists pointed to the lack of availability of computers in the physicians' lounge.

*"In the physicians lounge there is a problem...everybody walks in, in the morning and wants to access the computer and there are only 3 terminals here [lounge]"*

*(Cardiologist1)*

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<sup>8</sup> Nurses' stations are areas on the hospital floors similar to a cubical office, where nurses usually sit and document patient data on the computer. Similar to an office layout, these areas have a desk and a place to sit in front of the computer.

<sup>9</sup> The physician's lounge is a break room where physicians usually come in, in the morning, to have breakfast and start their day at the hospital. This area is used throughout the day by physicians for dining and other breaks during the day.

Other cardiologists pointed to the speed of the computers on the floors and situational issues such as the physical space around the computer where a paper chart could not be easily placed. As previously mentioned, Alpha is not entirely paperless, such that physicians need to access both paper chart and computer in order to get complete information about a patient. This is the reason why the physical space around a computer is an important consideration to be able to work efficiently.

Surgeons pointed to the fact that a simple solution to the computer problem is to “*take the nurses’ ones*” referring to the fact that most of the times on the hospital’s floors computers are usually taken by nurses. Other surgeons complained about “old computers that don’t always work” which contributes to increased inefficiencies in terms of the time it takes to use EMR versus the paper chart.

As regards support in the EMR usage, the hospital employs about four physicians’ advocates that are in charge of personally working with physicians and supporting their EMR usage. These advocates cover seven different campuses and are usually located in the physician lounge on certain days and times where they introduce physicians to the EMR system on an appointment basis. Mainly, the advocates train physicians so that they are able to access the system remotely from their home and/or office and also present them with a manual regarding the functionality of the EMR system.

The presence of the physicians’ advocates in the lounge was felt by some of the cardiologists who perceived they had support available in their EMR usage. Surgeons also noticed that “there are people always around” for support. Other surgeons pointed to the fact they have not been into a situation requiring EMR support other than getting the initial physician log in for the EMR system. This seems to be because as previously mentioned, most surgeons and

cardiologists do not personally use Alpha's EMR systems to access patient information. It is through their staff (NPs and PAs) that the majority of physicians in these two specialties access the computer system.

Other physicians acknowledged the presence of support, however they did not feel that support was helpful in solving a physician's practical problems.

*"The people are very nice but they are not solving my problem! I am the one stuck here 13-14 hours a day doing my job while they go home" (Pulmonary Specialist1)*

### **Other Consultant Physicians**

Another group of consultant physicians are from the nephrology, neurology, oncology and gastroenterology specialties. All physicians in this group believed that the availability of computers at Alpha is *"always a problem."*

*"There's never gonna be enough computers, there could be more of them. Also, the nurses are sitting on the computer writing notes so there are very few available for the doctors" (Nephrologist3).*

The fact that there are no computers specifically allocated for physicians' use makes it difficult for a physician to find an available computer on the hospital's floors such that physicians *"have to run for a terminal" (Neurologist)* and *"wait to get a computer" (Physical Therapist)*. Other hardware barriers are related to the physical space around the workstations on the floors as there is *"not enough room to have a chart there [on the cart]" (Physical Therapist)*

and “*preventive maintenance*” (*Neurologist*) on the laptops on the wheels such that often times when physician go access a computer, that computer is not working.

One physician who is part of technology-related committees and heavily involved with EMR initiatives for the hospital also pointed to the fact that “*they just don’t have enough computer terminals and they’re not readily accessible*” (*Oncologist*). Theoretically, the hospital has about 1,500 terminals available for physicians and nurses to use, however, as the same physician mentioned:

*“the reality is that there are 5-6-7 computers on the floors and half of them are gonna be in use at any given time. You’ve gotta find one that’s not being used ...I’ve gotta walk all over the place.”* (*Oncologist*)

In terms of support, physicians in this group did not feel that they needed much support in using the EMR systems at Alpha. Getting support means allocating time and time for a physician is very important such that looking for support on the floors is not perceived as being very efficient.

*“It’s usually time consuming to try to get support...when I’m doing rounds I don’t have time to wait to talk to a support person”* (*Neurologist*)

Furthermore, another physician found that Alpha’s systems were “*self-explanatory*” such that he did not feel he required much support beyond the five-ten minutes system introduction that physician advocates do for every new physician when they start practicing at Alpha.

*“It’s like learning Windows, you click on each and every function to see what it does. Having somebody trying to teach you the features of the system when you’re on a*

*continuous move – it's not gonna happen. When you first apply to the hospital they give you log in and token, that's fine for about 5 minutes" (Nephrologist3)*

## **Clinical Specialties**

More clinically-oriented specialties such as family practitioners and internists also found hardware to be a problem at Alpha. One family practitioner believed that *"there are certainly not enough computers available"* and most importantly, computers are not at the bed side. These situational issues create access problems (to be discussed later on) that contribute to this physician not making much use of EMR.

Internists think that finding a computer available is a problem at times, especially at the change of shifts when nurses are using the computers more to document and update clinical data. Furthermore, it is especially certain hospital's floors that are known for their limited number of computers.

*"There are 2-3 floors where there is a lack of computers...9<sup>th</sup> floor, 10<sup>th</sup> floor where you have to push the nurses out of the way" (Internist6)*

*"You gotta look sometimes especially if you're getting close to changing shifts and all the nurses are getting on typing up stuff" (Internist7)*

Other internists did not find the hospital has enough computers available for physicians' use. At the same time, the fact that computer terminals are being used by someone else (nurses and/or other physicians) and the computer terminal's state (on or off or the fact that the computer

may be on a sleep mode) contribute to these physicians' general perception of the poor availability of computers at Alpha.

*“There not enough computers here maybe two or three on the floors that are being used or the machine may be off, and I don't have time to reboot it” (Internist1)*

*“There are certain floors where you kind of have to walk around to get to a computer and sometimes the computers aren't turned on” (Internist8)*

Similar concerns about the number of computer stations available at Alpha, the fact that often times computers are already in use by other parties (nurses and/or floor secretaries) and that computers are not “on” are shared by other internists. Furthermore, computers' speed is another issue that physicians are not satisfied with. Computers being slow may in fact contribute to the perception of the time it takes for a physicians to utilize the computers at Alpha and also their perception of work efficiency. As previously mentioned, time is “the most important commodity’ a physician has, and slow computers or not readily available computers seem to be barriers for a physician’s use of computers at Alpha.

*“The nurses are on the floor constantly and the doctors just come in and out. So even the areas that are set aside for us to do our dictation, they still use that area too” (Internist7)*

*“It would be nice to have more computers and when you get there [floor] have the computers turned on and all you have to do is click on it and you get going. And it would also be nice if all the computers were functioning at the same speed” (Internist8)*

In order to overcome the availability barriers, other internists use computers in the physicians' lounge to access patient information. These computers are stationary and are available exclusively for physicians' use.

*"I usually use the computers down here in the lounge. Computers are available on the floors but they are already in use" (Internist2)*

Other internists believed that more computer stations would certainly help physicians get better accessibility to Alpha's EMR systems. At the same time, the availability of computer stations is a concern when it comes to a future system to be implemented at Alpha (EMR4).

*"This is the biggest hospital in town and when everybody uses the system, nurses, secretaries... more units would help" (Internist2)*

*"If we're gonna have just few stations like we have today, it's [EMR4] gonna be a mess" (Internist3)*

As regards support, most internists acknowledged the presence of support thorough physicians' advocates in the lounge, although this support has diminished in the last few months. This is due to increased advocates' responsibility to cover more of Alpha's campuses and the limited number of advocates available for direct physician support. However, some internists did not feel they needed a lot of support beyond the original orientation to the system.

*"They have a good orientation system" (Internist4)*

*"The system is user friendly, self-explanatory" (Internist6)*



*“There are people who introduce you to the system when you start working, but it’s not difficult to use, you pick up how to use the system pretty easily. It hasn’t really been a problem...for me or for anyone I know” (Internist8)*

In sum, most internists agreed that Alpha currently does not have an adequate number of computer stations available on the floors. Direct observations in the hospital setting pointed to the limited number of the available computers in the physicians’ lounge as well. Currently there are only three terminals available in the main campus’ lounge and physicians have to wait in order to access the computer especially at peak times early morning or right after lunch (before getting ready to go back to doing rounds on the floors). Furthermore, issues related to computers being in use at most times and the speed of the computers on the floors, also contribute to physicians’ perceptions of a rather weak implementation climate at Alpha.

The availability of hardware thus seems to be a multi-dimensional one. It is not only the number of terminals that is available for physicians to use but also the physical location of the computers, the fact that computers are being used by multiple parties and are not always available and also the proximity of the devices. Computers on wheels that are located on the hospital’s floors are not in a fixed location at all times and thus are perceived as being not readily accessible. Furthermore as one of the administrators mentioned in several hospital meetings, most of the times these computers get pushed to the end of the hallways, forgotten about and not readily available for use.

Table 13 presents the main hardware barriers as identified by physicians in each specialty at Alpha.

**Table 13: Physicians' Perceptions regarding the Availability of Computers at Alpha**

<b>Specialty</b>	<b>Belief Availability of Computers is a Problem</b>	<b>Type of Problem</b>
Cardiologist1	Yes	Number of computer terminals in the lounge Number of computer terminals on the floors
Cardiologist2	Non-user	
Cardiologist3	Yes	Computers are slow
Cardiologist4	Yes	Space considerations Computer speed Number of computer terminals in the lounge
General Surgeon1	Non-user	
General Surgeon2	Yes	Computers in use by nurses/secretaries Type of devices Number of computer terminals in the lounge
General Surgeon3	Non-user	
General Surgeon4	No	
Nephrologist1	Non-user	
Nephrologist2	Yes	Number of computer terminals available on the floors Computers in Use
Nephrologist3	Yes	Number of computer terminals available on the floors Computers in use by nurses/secretaries
Pulmonary Specialist1	Yes	Proximity/Computers spread out on the floors Number of computer terminals available on the floors Time spent finding a computer Computers are not working Space/Seating considerations
Pulmonary Specialist2	No	
Family Practitioner1	Yes	Find a computer Number of computers available on floors Proximity/Computers not at bed side Type of devices Speed of access
Neurologist	Yes	Find a terminal Computer maintenance
Oncologist	Yes	Proximity Type of devices Speed Number of computer terminals available on the floors Computers in use by nurses/secretaries Time spent finding a computer
Physical Therapist	Yes	Computers in Use/Wait for a computer to become available

Specialty	Belief Availability of Computers is a Problem	Type of Problem
		Type of devices Space considerations
Pediatrics Surgeon	No	
Orthopedic Surgeon	Yes	Age of computers Maintenance issues Number of computer terminals in the lounge
Plastic Surgeon	Yes	Number of computer terminals available on the floors
Internist1	Yes	Number of computer terminals available on the floors Computers in use by nurses/secretaries Computer state (on/off) Proximity/Computers at bed side
Internist2	Yes	Computers in use by nurses/secretaries Type of devices Number of computer terminals in the lounge
Internist3	Yes	Number of computer terminals available on the floors Computers in use Type of computers
Internist4	Yes	Computers in use Type of devices
Internist5	Yes	Computers in use
Internist6	Yes	Number of computer terminals available on the floors Computers in use by nurses/secretaries
Internist7	Yes	Computers in use by nurses/secretaries Speed Age Find a computer Proximity/Computers at bed side Type of devices
Internist8	Yes	Find a computer Number of computer terminals available on the floors Computer state (on/off) Computers' speed
GI	Yes	Number of computer terminals available on the floors Type of devices

Table 14 aggregates the availability of hardware concepts into broader themes in order to identify the strength of this emergent barrier across physician specialties.

**Table 14: Main Themes regarding Hardware Barriers at Alpha**

<b>Core Issue</b>	<b>Total number of instances the issue was mentioned across interviews</b>	<b>Number of physician specialties who had mentioned an issue</b>
Availability of physical computers	18	13
Available terminals on the floors	13	8
Available terminals in the lounge	5	4
Computers in use	13	6
Type of devices	9	6
Hardware characteristics	12	7
Maintenance (working computers, on/off)	4	4
Speed of access	6	4
Age of the computers	2	2
Situational characteristics/Ease of access	13	6
Time to find a computer	6	5
Physical proximity	4	4
Space considerations	3	3

### **Accessibility Considerations**

One emergent theme in the case study relates to accessibility issues. Unlike perceptions of behavioral control, which refer to hardware issues such as the physical computers, accessibility refers to issues related to how physicians log-into the EMR system from the hospital or remotely. Other difficulties in accessing the software such as multiple log-ins per patient or per floor or multiple insertions of passwords also comprise the accessibility construct. As we discuss throughout this section, difficulties in accessing any of the three EMR systems at Alpha are major barriers in physicians' usage of EMR.

Accessing the EMR systems at Alpha can be achieved from either within the hospital or remotely. Once a physician starts practicing at Alpha, he or she is assigned a unique log-in ID based on letters and numbers that is used to access the EMR systems from within the hospital. Alpha's three EMR systems are not part of an integrated system. This means that each system is accessed separately and physicians have to enter a log-in and a password to access each individual system. Furthermore, EMR1 is accessible remotely. EMR3 can also be accessed remotely through the link provided in EMR1. In order to be able to access Alpha's EMR remotely, physicians need to establish contact with one of the physicians' advocates who can provide physicians with a token<sup>10</sup> that is used to generate a random number every time a physician accesses the EMR remotely. In addition to the token, physicians are instructed to install a small program and configure their computer at home or in the office in order to be able get through the hospital's firewall into Alpha's EMR system. Almost all thirty physicians in this sample identified access to EMR as a major barrier.

### **Consultant Physicians: Cardiologists, Surgeons and Pulmonary Specialists**

Most cardiologists identified problems related to accessing the EMR remotely.

*“If I access the computer from home, that's a problem. Because given the token, every time you have to put in a number it takes a little longer to access it from home”*

*(Cardiologist1)*

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<sup>10</sup> A token is a small device that is used by physicians to access Alpha's EMR system remotely. Physicians enter their unique identifying number and the token (which looks like a small pocket calculator) displays a random number that is used to access the EMR system. This operation needs to be done any time a physician accesses the EMR system remotely. A different random number is generated for any new log-in.

*“I have not done that yet [remote access]. It is complicated to set this up on the computer. You have to have somebody from the medical informatics here work with you on the phone, you have to have a disk, so it is not simple” (Cardiologist3)*

Furthermore, time considerations are also important to physicians. Through direct observations in the physicians’ lounge, the main researcher observed the interaction between one physician and one of the physicians’ advocates. When approached by one of the advocates that he could be introduced to the EMR systems at Alpha, the first question a cardiologist asked was *“How long would this take?”* Furthermore, same physician pointed to the fact that physicians, in general, *“do not have enough time to deal with a web-based system that deals with a lot of steps to access the information that they want” (Cardiologist3)*

Perceptions of the difficulty of remotely accessing Alpha’s EMR system are accentuated by the fact that other hospitals where some physicians practice at do not have the same high security requirements as Alpha.

*“For [Hospital Beta] I can use EMR at home without having to put on my personal computer any special software that allows me secure access to the clinical data at the hospital” (Cardiologist3)*

Another cardiologist who is also the president of the Medical Staff for the largest campus at Alpha pointed out that the main reason why he does not personally use EMR while in the hospital has to do with multiple log-ins. Having to sign on every time, for each patient, on every floor in order to view clinical results is a major barrier in using the EMR system at Alpha. Common workarounds to overcome log-in issues are accessing the EMR once in the lounge, in the morning, and trying to remember the results once on the floors. Another workaround to

minimize the number of log-ins is asking floor nurses and/or secretaries to retrieve latest clinical data from the computer.

*“What I do sometimes, if I don’t have many patients, when I come in the lounge, I get my coffee and look up labs for all my patients through EMR2 ...but when I go to the floor I can’t remember them all...I just know if they are abnormal” (Cardiologist4)*

General surgeons believed that changing the password every so often is frustrating. Security requirements at Alpha require physicians to change their passwords every six months. However as different physicians mentioned, the EMR system does not prompt them to change the password ahead of time and, if this happens, physicians have to spend additional time calling for password resets.

*“When the password is about to expire, it [the system] doesn’t tell you ahead of time so that you can change it and if it happens on the weekend, you have no access and you have to call for it” (General Surgeon4)*

*“The other thing I don’t like is that they change the password every six months and I couldn’t get in the system for a couple of days till they gave me a new password” (General Surgeon2)*

These same physicians also pointed to accessibility issues on the floors, while hoping that in the future Alpha will provide them with tablet computers so that they can avoid log-ins on the floors. Interestingly, while one surgeon found that being able to access the EMR remotely would be very important to him, he was not aware that he could do this at the moment. This seems to point to the fact that Alpha needs to raise awareness among physicians that remote access is in

fact possible but at the same time, remote access needs to be simple enough for a physician so that he or she takes the time to learn about and, most importantly, use this EMR function.

*“In the future we’ll hopefully carry our own computer in the pocket so that we don’t have to log in a computer on the floor, access that from outside the hospital hopefully...that would be the most important thing, access the system from home see the X-ray that I ordered immediately” (General Surgeon2)*

Other surgeons pointed to difficulties in accessing the EMR remotely. Issues related to having to carry the token around for being able to log in remotely or difficulties in configuring the token to work with a particular computer contribute to physicians’ formation of negative attitudes about using Alpha’s EMR. Concerns related to accessing EMR at Alpha are evident from one physician’s quote, who compares remote access at Alpha with a “dial-up” service. At the same time, physicians hold strong beliefs that a token should not be required when accessing EMR remotely. Comparisons with electronic-banking systems that need to be maintained equally secure but do not require individual users of the system to make use of a token, strengthen physicians’ formation of negative perceptions towards using EMR remotely.

*“With EMRI, my problem is that if you’re out of the hospital, you have to use this token, that I can’t stand...because I don’t always have the token with me, sometimes it takes a couple of times to get it going, you want something that’s fast...it’s like dial-up versus cable” (Pediatrics Surgeon)*

*“I don’t want to go through a cookie and all this other garbage just to get access to my patient information. I want to go to a chart and pick it up and find what I need. Why*



*would have to go through all this hassle because of firewalls and attempts to keep it private?” (Plastic Surgeon)*

*“I completely believe in electronic data but when u sign on e-banking, you don’t need a token” (General Surgeon5)*

Alpha’s EMR are also seen as difficult to access from within the hospital. Logging in multiple systems and multiple insertions of passwords in order to access patient information are seen as being time inefficient.

*“It’s cumbersome to go through the system – for you to get to EMR3 you have to re-enter your passwords 2-3 times, so it’s a struggle. So, the issue is having multiple insertions of passwords and codes to get in. Does it take a long time? Yes. We constantly complain about this to the IT people, trying to get them to correct that” (Orthopedic Surgeon)*

Availability of secretaries in one orthopedist’s office helps him workaround accessing Alpha’s EMR systems remotely and overcome time-related disadvantages.

*“At my office I ask my secretary to look up X-rays when patients come in ... it’s time efficient this way” (Orthopedic Surgeon)*

Other physicians expressed very strong views regarding accessing EMR at Alpha. One of the most influential physician experts at Alpha expressed his concerns about accessing the computer in multiple occasions, both in the initial interview and also in different hospital meetings the main researcher attended. In addition to issues associated with the physical location of the computers which are not at the bed side but rather spread out between corridors and

nursing stations, other difficulties are associated with the ease of accessing the EMR system at Alpha. These accessibility barriers contribute to physicians' work-related inefficiencies in terms of increased time to retrieve patient data.

*“One of the major drawbacks of the system is that access is not easy. There is a delay, a problem with access. It takes a minute or two to get in. For me to log into the computer— if the computer is right here - takes a minute and a half. If I have 40 patients multiplied by 1.5 min you got at least one hour for that every day...The computer is not there always, the computer doesn't work all the times, so it's an average of 2 to 3 minutes. If I have 40 patients, then it's 2 to 3 hrs extra— **it is unacceptable for us to do that!**”*

*(Pulmonary Specialist1)*

At the same time, the fact that a physician needs to access patient information from three different systems, each requiring a different log-in every time, is seen as difficult and time-inefficient.

*“Not all the information is on ONE web site, you have to change from one site to the other which takes more time...that's cumbersome” (Pulmonary Specialist2)*

One other major complaint regarding access that physicians noted is system's log-out problems on the floors. EMR3 does not have an automatic log out time, so if a physician forgets to log out EMR3 on one floor, he or she is not able to log-in EMR3 on any other floor at Alpha. Physicians need to remember where they left themselves logged in and go back and log out before they can access EMR3 again. This creates major inconveniences to physicians that do not

work in a typical static work environment but rather a dynamic one where they go from floor to floor in seeing their patients.

*“The other problem with EMR3 is that if you looked at one picture for one patient on the second floor and then you go up to the 10<sup>th</sup> floor to look at another patient and try to go into the EMR3 again, if you didn’t log off, it won’t let you log back on. So, sometimes I don’t remember where I left and where I didn’t log out, then I am stucked!!! I can’t log on again...big problem...So what do you do then? I don’t do...I wait, or I call all the floors where I was and have them look at the computer and sometimes they log me off...but it’s a big problem. You have to trace yourself backwards...it’s pathetic!”*  
*(Pulmonary Specialist1)*

The pulmonary physician expert also expressed similar accessibility concerns to administrators in various hospital meetings while reminding administrators that his concerns are not responded to. He stated in multiple occasions that various accessibility barriers are a major hurdle in physicians not taking full advantage of the EMR systems at Alpha.

*“For me if I log in one time, is ok... logging in 40 times that’s a problem. Physicians just want to do their work and get out of here...quickly and efficiently without having to stop ten times for one patient to gather the information”* *(Pulmonary Specialist1)*

Furthermore, in another meeting, the same pulmonary expert, using an interesting analogy, pointed to Alpha’s Medical Informatics Officer the difficulties physicians have in accessing the computer system at Alpha. The following statement enforces the difficulties physicians associated with multiple log-ins and a desire that log-in process be simplified.

*“Right with the EMR system they are making it difficult for you to get it...it’s like building a new tower, now we are creating a new office for [Dr. T] but now you, [Dr. T]... instead of having one key...you’re gonna have to have 10 keys to get in...and you have to use all 10 keys to get in” (Pulmonary Specialist1)*

At a follow-up discussion between this physician and the Medical Informatics Officer at Alpha the researcher noted, further strengthened the idea that such accessibility barriers must be addressed prior to the implementation of the new EMR system at Alpha. As we will discuss in Chapter 6, accessibility barriers are not only directly impeding EMR usage, but they are also affecting physicians’ beliefs and attitudes towards EMR which can have longer lasting effects.

*“Let me tell you what I envision...this is very important...when a doctor comes and sees the patient, the computer should be either outside the room or in close proximity so that we have the data in an easy access. For example, one click and the chart would be open...I don’t care how...one or two hits...it has to open...I don’t have to punch one million things, then you’ll have immediately the basic things that you need...you’ll have labs, vital signs, meds, just there. You have to make sure that this happens. How your computer system is gonna do that...I don’t know...but anything that’s short of that, it’s not gonna do it” (Pulmonary Specialist1)*

### **Other Consultant Physicians**

Other consultant specialties such as nephrology, oncology, neurology and GI also identified major problems with accessing Alpha’s EMR systems.

These physicians believe that accessing the EMR systems at Alpha is not an easy task. The problem of multiple log-ins is a major contributor to these physicians' perceptions of difficulty of access to EMR. On one hand, the initial log-in process that needs to be performed for each individual patient in order to access that patient's records is a problem, as it interferes with physicians' work efficiency in seeing their daily number of patients. On the other hand, Alpha's EMR ten minutes automatic log out leads to physicians having to log in the computer multiple times for the same patient in order to get all the desired information. Overall, accessibility to the EMR system seems to impact perceptions of physicians' work efficiency and formation of negative attitudes towards Alpha's EMR systems.

*“Something extremely irritating is that every time you go see a patient you have to open the computer, go to the computer, put in a password, and go to three-four screens till you get to a patient. Then, you go talk to the patient and when you come back – everything is gone (the system logs you out)...you have to start again, very time consuming. Also because you have 20 patients in the hospital, every time you go do this operation, you slow down horribly. I think the only way to deal with that is one computer per patient—always open like a chart” (Nephrologist2)*

Another accessibility-related barrier is the fact that each of Alpha's three EMR systems is accessible separately. In other words, physicians have to log in three different systems in order to get the clinical data that they need for a patient. For instance, if a physician needs to check current vitals on a patient, he or she needs to access EMR2. At the same time, in order to check whether the patient has had a previous history with the hospital, a physician needs to log in EMR1 which holds up to twelve years of patient data. EMR3 also needs to be accessed if the

physician needs to see actual X-rays pictures for a patient, not only the reports that are stored in EMR1. Furthermore, it is not possible for a physician to be logged on the three different systems at the same time. Clinical results from each system can be accessed and viewed once a physician is logged on that system only. These multiple sign-ons the EMR system per patient and/or per floor are a major barrier in physicians' usage of EMR systems at Alpha while rounding. Having to log into each system in order to get a piece of clinical information is seen as cumbersome and inefficient.

*“Logging in from one system to another, makes you get off from your screen – you have to close it then you have to go open the [EMR3] system to see the X-rays, you have to log on to that, do again the name search, you have to find again the 3-year summary for the same patient ...so the information is there but the way they [the systems] don't pull together – you have to know where to run and get it” (Nephrologis3)*

*“The programs are not very smoothly integrated. For instance I have to go into one program to access old records, a different one to see what medications the patient received yesterday then a third program if I want to look at X-ray pictures from the nursing stations. And for each program I have to sign on individually...that's time consuming...If I'm on call I see 15-20 patients in a day...my patients are scattered throughout the hospital because I am a consultant so I have patients that are not all on one floor, so whenever I have to look up a patient I am in a different location and I have to sign up the computer again. I'd like to see some kind of a proximity detector, if I approach a computer, the computer recognizes me and signs me in automatically, rather than me typing in the user name and password for authentication” (Neurologist)*

In addition to multiple log-ins, there is also a lot of repetitive work a physician has to go through in searching for patient records from one system to another in order to get to all the desired results for a particular patient. Overcoming such accessibility barriers at Alpha becomes even more important as the average number of patients a physician can see daily can be as high as twenty or thirty, depending on the physician's specialty.

Other physicians use workarounds in an attempt to overcome the accessibility barriers and minimize the number of log-in times while rounding.

*“You know what I had to do while I was rounding? If I am in room 8201 and next person I see is in 9209, according to my list, while I am logged in, in 8201, I try to look up their labs, then I try to remember them till I get to room 8209. 90% of the times what would happen is I would get there and I would realize that there was something I haven't looked at and I'd have to log in again. Every once in a while it worked, but most of the times it didn't...cause what happens, you' get to some chart and it would be some progress note that would say something like “I'm sure that Dr. [GI] has seen the CT scan from March of 04” and you're going “the CT scan from march of 04...? What the hell are you talking about?” So you have to sign in, go back to the hospitalization from March of 04, bring it up...every time I would try to do that, it never worked” (GI)*

As cardiologists and surgeons, other consultants found that accessing EMR remotely is cumbersome. First, physicians do not feel comfortable carrying a small device with them at all times in order to be able to log-in remotely from either their home or office. Second, in order to be able to use the EMR system remotely, physicians need to install special software and make changes in the settings of the computer they are going to remotely access EMR on. Although

physicians' advocates provide physicians with a CD and detailed instructions on how this can be achieved during an orientation session, physicians seem reluctant to take advantage of this EMR capability. Other complexities associated with potential loss of the device used for random ID generator do not make it worthwhile for physicians to start using EMR remotely or take advantage of this function on a regular basis.

*“If I cannot use it from home why use it at all? I need to carry this thing [token], which I am not going to carry...I carry enough electronic devices to bother about one more. I go to several hospitals; I don't want to deal with that. I was very enthusiastic to sign up, the moment, they told me they were going to give me a token, have to sign a form that if I lose it I have to report... I don't need that...so I said “keep it”” (Nephrologist1)*

*“With remote access, probably some of the Java applets contravene most of the security measures people have in their PCs at home, it's difficult to realize why your computer is not working, is it the firewall, is it because something is enabled or disabled...I cannot use it well from home remotely because of Java applets and the security. I'd like to have an easier run of the program so that medium security settings of my home PC don't interfere with the program” (Nephrologist3)*

Furthermore, physicians' perceptions regarding the difficulty of remote access at Alpha seem to be influenced by their perceptions of remote access at other hospital where they practice. At a different hospital (Beta) which is the second largest in the region, it is not necessary to either have a random ID generator or install special software to be able to access its EMR remotely. Beta's EMR system can be accessed remotely from any computer that is available.



Thus, the ease of remote access seems to make a difference in physicians' using this functionality of EMR at two different hospitals. Because remote access is perceived as being less complex at Beta and involving fewer steps, some physicians that did not use Alpha's EMR, used Beta's EMR remotely.

*"I signed up for a password at [Beta] - their system is much more convenient, you can access it from many computers and you can access it from home. You don't have to carry a password generator...I don't want to change my password every 5 minutes, why should I?" (Nephrologist1)*

### **Clinical Specialties**

Other clinical specialties such as family practitioners and internists also identified problems with accessing Alpha's EMR systems both from with the hospital and remotely, although internists did not relate these access problems to their use or non-use of EMR as strongly as other specialties did. System configurations that are required for remote access for physicians' computers at home or in their office are a barrier in physicians' usage of EMR from outside Alpha. Furthermore, time constraints prevent physicians from seeking support in their remote EMR usage.

*"I have broadband and Windows XP but when I am looking for information, sometimes it would say "physician error" call help desk...and you go ok...I don't want to do that"*  
*(Family Practitioner1)*

Logging in from within Alpha is also a hurdle because of the multiple log-ins for each patient on per each floor, which negatively impacts physicians' work efficiency. As some physicians mentioned, logging in issues alone can potentially add one to two hours to a physician's day. Situational characteristics such as physical location of the computers on the floors and nurses' stations, contributes to emphasizing the advantage of using the paper chart versus the EMR. The paper chart is usually located right outside a patient's room and physicians can easily access it before they go and see the patient.

*"...right now you have to go find a computer, you got to log in, look up the results...you go to another floor and need to log in somewhere else. It's a matter of time, I gotta go there, I got to log in, I got to look it up...that's taking 3-4 minutes, versus I go see the patient and I'm ready to go. The time it takes to sign in the system to get the information, you wasted 4-5 minutes and the time you add that up patient after patient...I can't do that. I've got to have quicker access, where I pick up the chart and flip through pages look at something and go" (Family Practitioner1)*

*"One problem with this is - and the other doctors have brought it up in the past - is that you have to login every time and ...it sounds silly... but you know what? If you do it 20 times a day takes 5 minutes to log-in, well that 100 minutes just logging in time. That is a lot of your time. It doesn't only take 5 minutes but it can take... I mean some of the computers will take 3 minutes. So...that's an hour of your time that you're just sitting looking at a computer. Because you know ...your patients are spread out everywhere. You can't just look them all up at one time" (Internist7)*

Time constraints associated with accessing EMR for each patient and complexities associated with remote access are major barriers for internists' usage of EMR at Alpha. One internist that is also the president of a local medical society noticed:

*“You have to do multiple passwords, I would like to use it more from the outside but the protection system is so great that is cumbersome and its not worthwhile to use it...If a physician has to go to the computer every time he sees another patient, re-enter his password and wait for the computer to pull out the information, he loses his precious time” (Internist1)*

Other internists have similar concerns regarding logging in multiple systems at Alpha and accessing EMR1 remotely. The fact that other hospitals where physicians practice do not require them to use a token to access EMR remotely also contribute to strengthening internists' perceptions of difficulty of remote access at Alpha.

*“Logging in is very tedious...very difficult...I would like a tablet PC...if I have my own screen, I don't have to log in or use the token. At [Hospital B] I can access EMR at home without having to use a token” (Internist4)*

*“You have to switch back and forth... in EMR2 you cannot retrieve the prior HMPs and dictations, so if you want to go back to a prior consult 3-6 months ago, you have to go to EMR1. So, you have to log into two different systems” (Internist4)*

On the other hand, internists' perceptions of the ease of accessing another EMR system at a different hospital (Beta) also contribute to accentuating the difficulty of accessing the EMR systems at Alpha.

*“At [Hospital Beta] the system is very friendly, I can access it from home...without any token... and I don’t have to double log in —there are tabs for each system” (Internist4)*

Although some internists identified accessibility to EMR to be a problem, they did not feel as strongly as other specialties that access was a major barrier to their usage of EMR. This may be because internists spend more time in the hospital, doing primarily clinical work. At the same, higher compatibility and relative advantage of data retrieval EMR to internists’ clinical practices (as EMR is perceived as helpful and needed for these physicians’ clinical work) seem to diminish perceptions accessibility barriers for this group.

Table 15 presents a summary of accessibility considerations as identified by each physician specialty at Alpha.

**Table 15: Physicians’ Perceptions regarding Accessibility to Computers at Alpha**

<b>Specialty</b>	<b>Belief accessing EMR at Alpha is a problem</b>	<b>Type of Problem</b>
Cardiologist1	Yes	Remote access (token) Speed of access
Cardiologist2	Yes	Ease of log-in (uses EMR3 where no log in is required)
Cardiologist3	Yes	Ease of log-in (uses EMR3 where no log in is required) Remote Access (difficulty of remote set up)
Cardiologist4	Yes	Multiple log-ins on the floors
General Surgeon1	Yes	Remote access (token, set up issues)
General Surgeon2	Yes	Multiple log-ins on the floors Individual log-ins for each of the three EMR Changing passwords without notice Remote access (awareness)
General Surgeron3	Yes	Ease of log-in the computer (versus paper chart)
General Surgeon4	Yes	Changing passwords without notice
Nephrologist1	Yes	Multiple log-ins on the floors Having to change passwords Remote access (carrying a token) Ease of log in
Nephrologist2	Yes	Multiple log-ins on the floors

<b>Specialty</b>	<b>Belief accessing EMR at Alpha is a problem</b>	<b>Type of Problem</b>
		Multiple log-ins per patient System Log out problems Easy access to the EMR system
Nephrologist3	Yes	Remote Access (set up concerns, computer security settings) Individual log-ins for each of the three EMR Can't be logged-on multiple systems at the same time
Pulmonary Specialist1	Yes	Individual log-ins for each of the three EMR Multiple log-ins on the floors (work inefficiencies) Multiple log-ins per patient (time inefficiencies) System Log out problems on the floors (being "stucked") Ease of access Speed of access
Pulmonary Specialist2	Yes	Individual log-ins for each of the three EMR
Family Practitioner1	Yes	Multiple Log-in on different floors (work inefficiencies) Multiple Log-in per patient (time inefficiencies) Speed of access Remote access (set up concerns, computer security settings)
Neurologist	Yes	Individual log-ins for each of the three EMR (time inefficiencies) Multiple Log-in on different floors
Oncologist	Yes	Ease of log-in (versus paper chart)
Physical Therapist	Yes	Remote Access (token)
Pediatrics Surgeon	Yes	Remote access (carrying the token around, token not working all the times) Speed of remote access
Orthopedic Surgeon	Yes	Individual log-ins for each of the three EMR
Plastic Surgeon	Yes	Remote access (token, security settings)
Internist1	Yes	Individual log-ins for each of the three EMR Remote access (security settings, token) Multiple Log-in on different floors (work inefficiencies)
Internist2	Yes	Individual log-ins for each of the three EMR
Internist3	No	
Internist4	Yes	Individual log-ins for each of the three EMR Remote access (token) Ease of access
Internist5	Yes	Individual log-ins for each of the three EMR Remote access (security settings)
Internist6	No	
Internist7	Yes	Multiple Log-in on different floors (work inefficiencies) Multiple Log-in per patient (time inefficiencies)

Specialty	Belief accessing EMR at Alpha is a problem	Type of Problem
Internist8	No	
GI	Yes	Multiple Log-in on different floors (work inefficiencies) Multiple Log-in per patient (time inefficiencies)

Table 16 aggregates the individual perceived accessibility barriers into broader themes in order to identify the strength of the emergent barrier across physician specialties.

**Table 16: Main Themes regarding Accessibility Barriers at Alpha**

Core Issue	Total number of instances the issue was mentioned across interviews	Number of physician specialties who had mentioned an issue
Number of log-ins	25	12
Individual log-ins for each EMR	11	7
Multiple log-ins on floors	9	7
Multiple log-ins per patient	5	4
Complexity and speed of log-in	19	12
Ease of log-in	8	7
Time to access EMR	4	4
Password change	3	2
System log-out time	2	2
Can't be logged-in multiple systems	2	2
Remote access	18	8
Token	8	8
Set up	4	7
Security settings	6	5

## Physicians and Social Influences

According to the TPB, social influences from one's environment are an important element influencing an individual's intentions to use a technology (Fishbein & Ajzen, 1975). Social influences refer to an individual physician's assessment of the extent to which important referent

others (i.e. hospital administrators, other peer physicians in different forums) would desire the performance or nonperformance of a specific behavior such as using an EMR system (Fishbein & Ajzen, 1975; Fulk et al., 1987).

Although the proposed theoretical framework included different sources of social influence as an important determinant of physicians' usage of EMR, evidence from the case study did not support the existence of the proposed influence sources in the current hospital context.

Preliminary interviews with physicians in different specialties were conducted and questions were asked about whether they felt any type of influence from hospital administrators and/or their peers regarding the usage of the EMR systems at Alpha. Physicians were also asked whether anybody else except for the two previously mentioned entities was exerting any influence regarding their usage or non-usage of EMR at Alpha. The initial set of interviews revealed no perceived source of influence that physicians could relate to either from hospital administrators or their peers. As several physicians mentioned,

*“We just don't talk about the computer systems much in the lounge – in some meetings there is discussion about that but not in our every day encounters” (Pulmonary Specialist2)*

*“There is not much of the discussion going on about the computers in the hospital... In terms of other physicians, I don't recall many people saying much about it” (Oncologist)*

Direct observations by the main researcher in the hospital environment (i.e. physicians' lounge where physicians meet to have breakfast, lunch and informally talk about different issues) strengthened the fact that physicians do not talk much about computerized systems at Alpha in

their daily encounters. Generally, physicians' discussions in such an informal forum tend to focus around cases in the hospital and/or other personal issues. Often times, physicians just briefly stop by the lounge just have lunch and then go back to the floors to do more rounds or go back to their offices to see more patients. Discussions about the EMR system have been observed in several technology-related meetings such as the Physician Technology Committee, Subject Matter Expert meetings and other specialty (departmental) meetings (only if a representative from the Medical Informatics team attended that meeting).

One potential form of social influence that was observed by the researcher was administrators giving presentations about the EMR initiative for the hospital where the reasons for a future implementation of EMR and its functionality were presented and where attending physicians were encouraged to think about promoting the system in their respective groups. However, most of the attending physicians were active members of such meetings and further discussions with selected physicians pointed to the fact they, because of their membership in such forums, were more engaged with EMR initiatives at Alpha and committed to promoting the system to their peers.

As regards other departmental meetings the researcher attended, discussions about current and future EMR systems at Alpha have been noticed but it did not lead to identifying any type of social influence source. These meetings are specialized around a specialty topic and sometimes towards the end they had an open discussion forum between the physicians present and a representative from the Medical Informatics team. However, the discussions were oriented such that the Medical Informatics officer could gather physician feedback regarding current and forthcoming implementation of EMR rather than trying to influence or promote EMR to the attending physicians.



A second round of interviews with other physicians at Alpha also did not seem to indicate physicians were aware of any particular influence sources with the present EMR system.

*“I’ve never heard anything. I’ve never had anybody mentioning anything ...hospital management or my peers” (Internist6)*

An interview with a physician-expert member of technology committees at Alpha indicated that while he was not aware of any present source of influence, he was actively seeking information about EMR in different forums because of his interest in EMR.

*“There is not much coming into me on a regular basis about computer stuff. I like to read about EMR because I am interested in the technology” (GI)*

In sum, physicians did not perceive many influences from their close intra-organizational environment regarding the current EMR systems at Alpha.

One interesting influence source that was identified by some physicians was the Federal Government. However, this influence was not seen by physicians as directed towards their current use of EMR at Alpha but rather towards them acquiring an EMR for their office. As one physician pointed:

*“The Federal Government will give physicians extra reimbursement money for physicians that will get EMR for their offices to encourage physicians more towards the computer. My office is looking at new computer management systems about how to organize the demographics, billing and med records. When we get the new software and probably it will be easier to use I’ll be able to access from home the data that I need ...then I’ll use it more” (Cardiologist3)*

While another physician agreed that the future belongs to EMR and recognized the government efforts to promote EMR, he noted that his office did not decide on getting an EMR system yet because of the uncertainties involved with acquiring the system and the “stories” he learned from other peers that have gotten EMR. The same physician also noticed that in general, physicians may adopt a “wait and see” attitude in terms of first observing other’s positive results from other office-based EMR implementations before making a decision to acquire their own system. This is mainly because office-based EMR are expensive and physicians do not have much IT knowledge to invest in the initial decision to acquire office-based EMR. Although one GI physician has heard positive experience of a peer physician that has gotten an EMR, he mentioned that cost and other considerations are keeping his office from acquiring an EMR just yet.

*“Everybody’s afraid of what’s out there, we hear horror stories from people... nobody wants to buy the beta cause they don’t want to have a beta system 5 years from now and they have to through it away; also the expense of buying the beta - buying the wrong system...plus it’s a land that’s pretty foreign to most docs – this medical technology, IT stuff” (GI)*

## **Physicians’ Attitudes about EMR**

TPB includes attitudes as a major determinant of technology acceptance and usage. According to TPB, attitudes towards using an EMR system reflect an individual physician’s positive or negative evaluations towards performing the specified behavior (i.e. using the EMR system). In this section we describe in general lines physicians’ attitudes about Alpha’s EMR systems. More

details about factors impacting these attitudes and how they affect physicians' usage of EMR will be presented in Chapter 6 which contains more detailed discussion regarding relationships among various elements of the framework.

### **Consultant Physicians: Cardiologists, Surgeons and Pulmonary Specialists**

Cardiologists believe the EMR systems at Alpha are a “good idea” to have such that their medical staff can take advantage of it and get to clinical results in a timely, efficient manner. As previously mentioned in this chapter, certain specialties such as cardiologists and surgeons work closely with nurse practitioners and/or physicians assistants who help them in their clinical work.

Thus, although cardiologists have somewhat positive attitudes towards Alpha's EMR systems, most of them do not use it personally to access clinical results. Their positive attitudes emerge from the fact that the EMR systems are perceived to be helpful to their staff such that physicians can get up to date clinical results faster from their NPs or PAs.

*“The computer system helps... I can get the results faster from the computer (through my staff). It used to be we had to spend time on the phone, now it is faster. My staff likes it because they can access things easier” (Cardiologist3)*

EMR is seen by cardiologists as something their medical staff need to deal with primarily because of the nature of their work. Cardiologists are perhaps more concerned with time efficiencies and clear separation of responsibilities than other specialties. One cardiologist pointed to one of his regular days of work.

*“I come in around 7-7:30 am, then we start surgery for 4.5-5 hours...then we break out of surgery, make rounds, take a look at people's X-rays... see patients...after we come*

*out of the 1<sup>st</sup> operation we eat lunch, up in the operating room or come here in the lounge. Then we make more rounds, then get ready to do a 2<sup>nd</sup> operation, then we do the 2<sup>nd</sup> operation, we come out of that, we finish rounds, then I may have to go to another hospital to do the same thing over there...or if I have to go to a 3<sup>rd</sup> hosp, I make rounds there, look at their patients' X-rays, then that goes till the evening. 6 p.m. or so I may have to go to a meeting, up to 8-9 p.m. Last week I worked till 4 a.m. for two nights. I see about 30 patients a day. At the clinic I have office hours once a week—I see about 15 patients” (Cardiologist3)*

Other cardiologists agreed that “*computers are good for retrieving data*” (Cardiologist4). Factors that seem to contribute to such attitudes are primarily the “friendliness” of the EMR, and the advantage it provides physicians over going to Medical Records to retrieve such data.

All cardiologists agreed that EMR3 is a “*great system*” to view patients' X-rays as it provides a clear benefit to them of not having to go to a different floor, at the Radiology department to look at films. Because of EMR3, cardiologists can access films in the operating rooms, intensive care units or wherever a computer terminal is available.

One particular cardiologist had quite negative attitudes about the EMR systems at Alpha. “*I don't like computers...they're not important to what I do*” (Cardiologist2). His attitudes seem to stem from a personal interest in and proficiency with computers. “*I've never sent an email in my life...if I want to talk to you, I'll call you.*” This physician takes full advantage of the medical staff to help him retrieve data from the computer systems at Alpha.

The surgeons interviewed for this study had split attitudes about the EMR at Alpha. Some surgeons had very strong negative attitudes about the computer system as it is seen as being *“too much of a pain.”* These physicians were not too much aware about the different systems at Alpha and did not have any interest in computing technology in general. Like their peer cardiologists, surgeons also believed that their staff (nurse practitioners or physician assistants) or even the hospital’s staff (floor secretaries) should be responsible to deal with the computer. A lack of perceived need is also a cause of this negative attitude for certain surgeons: *“I haven’t found that I really need it yet” (General Surgeon1)* or *“I don’t see a need for me” (General Surgeon3).*

Furthermore, EMR are perceived as creating more work for physicians and their office staff and such costs are not seen as being offset by any immediate benefits.

*“Computers are creating more and more work...computers do not serve my patients better...it doesn’t help me at all. If I had to access patient records all day long on the computer I’d kill myself...” (Plastic Surgeon)*

However, EMR3 is perceived as being a *“tremendous advance” (Pediatrics Surgeon)* as it provides physicians with the ability of accessing any X-rays and scan through multiple films simultaneously, which is seen as *“absolutely spectacular” (Pediatrics Surgeon)* compared to the old way of doing things by going to a separate department and looking at films there. The relative advantage of EMR3 over the actual films contributes to creating favorable attitudes about this system among physicians.

Other surgeons had more positive attitudes about the EMR systems at Alpha. *“I do like EMR1” (General Surgeon2); “I think it is very good for inpatients” (General Surgeon4).* This is

mainly because the EMR is seen as providing the benefit of physicians not having to call the lab to get results, as data is now available for retrieval in the computer system. These surgeons have also had more exposure to computers in general which seem to impact the way they think about the EMR systems at Alpha.

*“Since I started medicine and training there were a lot of computers, information around, so I’ve been exposed my whole career to that. For people who haven’t it becomes a little bit harder” (General Surgeon4)*

Other surgeons believe that data retrieval EMR at Alpha are “*not bad*” (*Pediatrics Surgery*), despite the learning curve involved with getting accustomed with them. Benefits of instant data retrieval over calling the lab to get results contribute to formation of more positive attitudes about EMR at Alpha.

*“I like having the system available so that we can check labs and other physicians’ dictations” (Orthopedic Surgeon)*

Other consultant physicians also have very positive attitudes about EMR3, which is the X-ray system. This system is seen as providing a very important advantage to them over going to another department, on a certain floor to retrieve patients’ X-rays. This advantage is even more important as the nature of work of these physicians requires them to see films very often.

*“It’s very nice I can see the X-rays in EMR3 rather than go downstairs to Medical Records. It’s very nice I can pull an HMP from the computer and not have to wait for a medical record to be brought up” (Pulmonary Specialist1)*

As regards the other two EMR systems, one physician-expert thinks that *“the hospital has got something pathetic and they want us to use it!”* (Pulmonary Specialist1). Such strong negative attitudes stem primarily from perceptions of difficulty in accessing the EMR system at Alpha which in turn are seen as altering physicians’ workflow efficiency. This physician’s beliefs that clinical information should be also included in the paper chart (as often as three times a day) such that physicians do not have to spend time retrieving data from both paper chart and computer.

*“I think we’re all working very hard...I think that spending time trying to get data, just basic data...is... crazy...It’s a lot of running around trying to find stuff from the chart to the computer to the chart again to the nurse for finding something that’s not anywhere... it is unacceptable for us to do that!”* (Pulmonary Specialist1)

Another physician has somewhat more positive attitudes about EMR1.

*“I think it’s a great advancement, improvement than we did before... we have quick access to all kind of info about our patients”* (Pulmonary Specialist2)

Although this physician has acknowledged similar accessibility problems with the computer system like his peer mentioned above, his more positive attitudes seem to be due to the fact that this physician works closely with a nurse practitioner who helps him retrieve data from the computer system.

## **Other Consultant Physicians**

Other consultant specialties such as nephrology, neurology, oncology, physical therapy and GI physicians also had somewhat positive attitudes about EMR, particularly EMR1. The fact that the system is user friendly and it provides physicians with a repository of real time clinical information contribute to formation of these positive attitudes. Also, the more clinically-oriented nature of work of these physicians, who more complete data about a patient seem to contribute to these positive attitudes, especially for EMR1.

*“For me as a neurologist, that information is very useful, I need to know what happened three years ago with a patient” (Neurologist)*

Although the EMR systems are seen as posing certain costs to physicians in terms of accessibility issues and availability of computers, in general this group of physicians is quite positive about the EMR systems at Alpha.

*“Overall I like the system... I make critics in a context but I like the system”  
(Nephrologist2)*

*“The computer system is good because the data is available but it’s not easily retrievable” (Nephrologist3)*

One particular physician had quite negative attitudes about the EMR systems at Alpha. This physician’s attitudes are a result of his perceptions that there are no direct benefits to him as a physician from using EMR but rather it is only the hospital which benefits from implementing



the EMR system at the expense of physicians having to assume additional responsibilities (such as dealing with the EMR system).

*“I am completely opposed to the idea of making physicians work harder (secretarial work) for doing EMR. If they [the hospital] can figure out a way that they would spare me the inconvenience of an EMR and increase the convenience of EMR that would be great” (Nephrologist1)*

Other physicians in this group believe that the EMR systems at Alpha have problems in terms of system characteristics such as speed of accessing clinical data, interface and navigation issues, especially EMR2. As one physician mentioned, *“The system has a lot of holes in it” (Physical Therapy)*. However, some of the system’s problems, tend to somewhat be offset by the benefits EMR provide over the old way of doing things, that is, calling Medical Records in order to get historical information on a patient and wait for the results to come in.

*“I don’t like EMR2 because I think the menu system is poorly designed and EMR2 is too slow. EMR1 isn’t fast either. The menu is a little better...I got to a point where I like EMR1 better” (Oncologist)*

*“It’s better to have a computer system than not have one...In general, I am pretty positive, the system [EMR2] has to be more user friendly though” (Physical Therapist)*

Furthermore, from a historical perspective, current EMR systems at Alpha are perceived as being *“dramatically better”* compared with the system from 15-20 years ago. As one physician put it:

*“When I started at Alpha, if you had to order a CVC, there would be a piece of paper 2.5 inches high and maybe 7 inches long and that would get pasted into the chart and that would come back the next day after you ordered it maybe mid morning...if you wanted the report before that you called up the lab and stayed on hold for a long time until a lady that has had so many calls like that during the day with the attitude that she had so many calls that day and she gave you the result. And if you needed a report of an X-ray before the printed report came to the chart probably the next day and you had to call down to radiology and have one of the radiologists take the film and look at it and read your report because there was no way to access that dictated report. So if you look at the system as we have it today compared with the system that we had 15-20 years ago, it’s dramatically better. If you look at it in that perspective I see what we have now as a dramatic improvement” (GI)*

At the same time this physician is heavily involved with EMR design and implementation at Alpha which makes the case that involvement with EMR is highly related to formation of positive attitudes about EMR.

*“The system we have now is reasonable...for what it is, it’s good. Clearly I made a commitment to the computer system at Alpha because I believe in it. I think there are a number of things the future computer system can and should do for us” (GI)*

Alpha should thus consider to better engage other physicians with EMR such that EMR benefits should be clearly communicated and physicians be kept informed of EMR progress at Alpha. Informal conversation with other physicians in the physicians’ lounge pointed to the fact

that physicians felt they were not properly informed about Alpha's EMR initiatives and their opinions were not asked regarding current and future EMR at Alpha.

### **Clinical Specialties**

Another category of physicians are clinicians. Some family practitioners seem to have quite negative attitudes about the EMR systems at Alpha. Although family practitioners acknowledged some benefits of the computerized systems such as the system making the information more available to them, certain accessibility barriers and time considerations seem to contribute to formation of more negative attitudes about Alpha's EMR systems.

*"The time it takes to sign in the system, get the information, you wasted four-five minutes... the time you add that up patient after patient...I've got to have quicker access, where I pick up the chart and flip through pages, look at something and go. If I go down the hallway log in etc that's 5-8 min and...I can't do that" (Family Practitioner1)*

Another family practitioner had similar comments about EMR2. System considerations (interface and navigation issues) seem to contribute to this physician's attitudes about the EMR system.

*"I tried to log in and there is always a problem. I cannot find records; there are too many windows in there. So, I'm not too happy about that program" (Family Practitioner2)*

Other physicians have more positive attitudes about EMR1 mainly because of its ability to store up to twelve years of patient data and the ability of accessing patient records remotely.

*“With the current EMR system you can look at multiple previous admissions, dating back years. The ability to login from home and check on those labs, medical records from home is probably the most important benefit. To get the paper chart you actually have to be in the hospital” (Family Practitioner4)*

*“I love EMR systems. I think they’re very beneficial. It allows you to have easy access from home as opposed to just one chart. So, I’m absolutely for EMR” (Family Practitioner3)*

Most internists (six out of eight) think positively about Alpha’s EMR systems. Their attitudes are due to the fact that the EMR systems provide a good repository for retrieving clinical data about patients. This becomes a very important benefit to internists as they are more clinically oriented than any other specialty and they need to access a variety of clinical data to be able to make an assessment about a patient. The perceived ease of use of the system, non-availability of workarounds on the floors and timely access to clinical information also contribute to these physicians’ positive attitudes about EMR at Alpha.

*“I think the system is pretty good, I think it’s a great system because you don’t have to depend on nurses to get the reports...you can go in and check everything, X-rays, see the films, check the results on the blood work, all the dictated reports, it’s very convenient... so it’s very good, you get all the info through the computer... I love it” (Internist3)*

*“What I like about the system is easy accessibility, access relevant patient information right away, everything is in the computer so that I can read it easily” (Internist6)*

*“I really like EMR1. I think it’s very easy to use. It has almost all the information you need” (Internist7)*

*“The good thing is everything is very well organized on both systems EMR1 and also EMR2. Everything is organized in a way where you can get to it easily ...it’s intuitive” (Internist8)*

Other internists had somewhat negative attitudes about Alpha’s EMR. Accessibility to the EMR software and other hardware barriers make the systems *“not worthwhile to use”* to these physicians.

Table 17 presents each individual physician’s attitudes regarding the EMR systems at Alpha and the main reasons for such attitudes in terms of EMR benefits and costs.

**Table 17: Physicians’ Attitudes regarding EMR at Alpha**

Specialty	System used	Attitudes towards Alpha’s EMR	Main reasons for such Attitudes (Benefits)	Main reasons for such Attitudes (Costs)
Cardiologist1	EMR1	Somewhat Positive	EMR1 is user friendly Able to access patient records from home if needed	EMR is time consuming Availability of computer terminals
Cardiologist2	EMR3 EMR1, EMR2	Positive Negative	Relative advantage of EMR3 over going to Radiology	Importance to one’s job No experience/interest in computers Time to learn to operate a computer
Cardiologist3	EMR1, EMR2 EMR3	Somewhat positive Positive EMR3	Get clinical result in a more timely fashion (through his staff) Efficiency of EMR3 over going to Radiology	Nature of work/workarounds Time
Cardiologist4	EMR3, EMR1	Positive EMR3 Somewhat negative EMR1	EMR3 is advantageous over Radiology dept. EMR1 allows for data retrieval	Accuracy of patient list in EMR1 Availability of computers/Accessibility (log ins) for EMR1

Specialty	System used	Attitudes towards Alpha's EMR	Main reasons for such Attitudes (Benefits)	Main reasons for such Attitudes (Costs)
				Data in two places
General Surgeon1	No use	Negative		Perceived need
General Surgery2	EMR1	Somewhat Positive	Relative advantage over calling the lab Data retrieval	System integration/Accessibility
General Surgeon3	No use	Negative		Perceived complexity Limited experience/interest in computers
General Surgeon4	EMR2	Somewhat Positive	System is user friendly Exposure to computers since medical school	Information Quality (completeness)
General Surgeon5	EMR1, EMR3	Positive	Involvement with EMR Interest in computers	
Nephrologist1	No use	Negative		No perceived benefits Accessibility issues Perceived work inefficiencies (physicians working harder)
Nephrologist2	EMR1, EMR2	Somewhat positive	Data availability/Relative advantage for accessing old records	Accessibility Availability of computers Navigation/Search for reports
Nephrologist3	EMR1	Positive	Data availability	Difficulty in retrieving data/Accessibility
Pulmonary Specialist1	EMR3	Somewhat Negative EMR1, EMR2 Positive EMR3	Relative advantage over going to Medical Records	Relative disadvantage of EMR1 Accessibility/System integration
Pulmonary Specialist2	EMR3	Somewhat Positive EMR1 Positive EMR3	Data retrieval Relative advantage over going to Radiology	Accessibility/System integration
Family Practitioner1	EMR2	Mostly Negative	Availability of information	Perceived complexity/Accessibility
Neurologist	EMR1	Positive	Availability of old records EMR1 is user friendly Real time information	Accessibility/System integration
Oncologist	EMR1	Mostly positive	Data availability in EMR1 Involvement with EMR	System characteristics(Speed/Interface/Navigation) Perceived complexity
Physical Therapist	EMR2	Somewhat positive	Data availability	EMR2 is not user friendly Data in two places
Pediatrics Surgeon	EMR2, EMR3	Somewhat positive EMR2	Relative advantage over paper chart	Time efficiencies Finding paper charts (various

Specialty	System used	Attitudes towards Alpha's EMR	Main reasons for such Attitudes (Benefits)	Main reasons for such Attitudes (Costs)
		Positive EMR3	EMR2 is easy to use Relative advantage over requesting films	people utilize charts)
Orthopedic Surgeon	EMR3	Positive EMR3	Relative advantage over requesting films	Accessibility Hardware considerations
Plastic Surgeon	No use	Negative		Perceived need Perception computers can create more work Computers are inanimate objects
Internist1	EMR1	Somewhat Negative		EMR is in its infancy Ease of use/user friendly system Accessibility Work compatibility
Internist2	EMR1, EMR2	Somewhat Positive	Data accessibility Timely results	
Internist3	EMR1, EMR2	Positive	Ease of use Visibility (other systems) Does not have to depend on nurses	
Internist4	EMR1, EMR2	Somewhat Positive	Ease of use Data accessibility	Limited information in EMR2 Visibility (other systems) Accessibility Would like the system to do more
Internist5	EMR2, EMR1	Somewhat positive	Accessibility of data Ease of use Non-availability of workarounds	System issues/Navigation/Search Accessibility/System integration Time considerations
Internist6	EMR2, EMR3	Positive	Data accessibility Visibility (other systems) Timeliness of information Relative advantage versus old charts	Accessibility
Internist7	EMR1	Positive	Ease of use Data retrieval SME member/involvement	Accessibility/System integration Data in two places (paper & computer)
Internist8	EMR2	Positive	Ease of use Nature of work: clinician	System issues/Navigation/Search Microbiology

Specialty	System used	Attitudes towards Alpha's EMR	Main reasons for such Attitudes (Benefits)	Main reasons for such Attitudes (Costs)
GI	EMR1	Positive	Relative advantage over old records Membership in PTC, SME/involvement	Accessibility Design issues

## Physicians' Usage of EMR

In this section we discuss physicians' usage of the EMR systems at Alpha. We conceptualize EMR usage as a continuum and we look at how physicians vary in their usage of EMR along the continuum.

### Consultant Physicians: Cardiologists, Surgeons and Pulmonary Specialists

Cardiologists vary in their usage of EMR from almost non-use (Cardiologist2) to minimal use (Cardiologist1) and moderate use (Cardiologists3, 4). In general, surgeons did not make much use of data-retrieval EMR while they seemed to use more EMR3.

One cardiologist does not use any of the data retrieval systems at Alpha (i.e. EMR1 and EMR2). Lack of a perceived need for using the computer system combined with availability of workarounds and a strong belief that *"things are fine the way they are now"* make this physician not use the EMR systems.

*"I don't use the computer... but this doesn't mean that I can't do other things (perform a surgery)...I have people in my office that work around computers but I personally don't use computers"* (Cardiologist2)



Despite this cardiologist's non use of EMR1 or EMR2, he finds EMR3 beneficial to access patients' X-rays and uses the system in certain areas of the hospital, where no log-in is required (i.e. low accessibility barriers).

*"I am using that computer system [EMR3] in the viewing areas. The unit has them up and running...I punch in a person's name and see the X-ray. That's the one thing I do with computers...pull up X-rays at certain big EMR3 view boxes"* (Cardiologist2)

Other cardiologists use EMR minimally at Alpha. One cardiologist uses EMR1 almost exclusively to get his patient list from the computer and would like to keep using paper charts in the future. Time inefficiencies in using the computer system are the main reason why this cardiologist does not use the EMR at Alpha.

*"I don't use the computer system too much. I use it to access my list and then when I'm on the floor seeing patients if I need any lab that wasn't put up in the chart. I would like to stick to the paper"* (Cardiologist1)

Other cardiologists make more committed use of EMR at Alpha, especially EMR3. These physicians are using EMR3 in certain viewing areas as it provides them with a relative advantage over viewing the films in the radiology department (usually located on a different floor). These cardiologists believe that time considerations and the nature of their work (such as doing pace makers or performing surgery) does not require them to make much use of the computer. These physicians work around the computer by employing nurse practitioners and physicians assistants to take advantage of the computer system and provide them with clinical results.

*“I tend to be a surgeon; I do not use the computer as much to access things. Things like Labs, I do not access on the computer, I have somebody else do that for me...I don’t have the time. I use the EMR3 system through work stations in different areas (ICU) where these systems are online all the times” (Cardiologist3)*

*“The most helpful system that they have is EMR3, I am a cardiologist, I do pace makers, implants I look at chest X-rays, CT scans. I like accessing it from the part of the building where the patient is rather than going down to X-rays and look at hard copy films” (Cardiologist4)*

Interestingly, one cardiologist felt he needed to use certain features of EMR1 such as email because of his status as the president of the medical staff at Alpha’s largest campus. His non-usage of other EMR features was due primarily to accessibility barriers such as having to log in the computer every time to access patients’ records.

*“I have to use EMR1 because I am president of the Medical Staff here for this campus. I use it for email for meetings, bylaws, look up doctors’ privileges” (Cardiologist4)*

Thus, cardiologists as a group use data retrieval EMR minimally. Almost all cardiologists use EMR3 in certain areas of the hospital to see patients’ films because of the direct benefits over going to a different location to access the films.

Surgeons’ usage of EMR at Alpha varies from non-use (General Surgeon1, General Surgeon3, Plastic Surgeon) to moderate use of EMR1 and EMR2 (General Surgeon2, General Surgeon4) and more committed use of EMR3 (Pediatrics Surgeon, General Surgeon5, Orthopedic Surgeon).

Some surgeons are opposed to EMR and do not use EMR primarily because they do not see a “need” to do so. Nature of their work *“my time is spent mostly in the operating room”* (General Surgeon3) and a belief that *“my practice can do well without computers at this point”* (Plastic Surgeon) are other reasons why certain surgeons do not use EMR. Accessibility considerations combined with no perceived benefits from using EMR and also a belief that the computers *“cannot tell you that personal evaluation made by another specialist”* are main factors that contribute to these physicians non-usage of EMR.

*“I don’t use it...it’s too much of a pain... I haven’t found that I really need it yet”*  
(General Surgeon1)

*“Right now I don’t see a need for me ...It’s so much easier for me to open up the chart”*  
(General Surgeon3)

*“I don’t want to go through a cookie and all this other garbage just to get access to my patient information. I want to go to a chart and pick it up and find what I need. I am not using and I am really not gonna use computerized systems...I access my patients by calling the front desk and have them bringing me the chart. Why would I want to complicate my life more than it is?”* (Plastic Surgeon)

Other surgeons seem to use EMR a little more, although they mostly use paper chart while in the hospital. These physicians use EMR to access their patient list that they need to do rounds in the hospital and other patient records only if these records are not already in the paper chart. EMR’s perceived user-friendliness and the fact most of these physicians’ work is done at Alpha are two main reasons why these physicians use EMR.

*“I only use EMR1... When I come in the hospital, I get a cup of coffee, get on one of the three computers in the lounge, get the patient list” (General Surgeon2)*

*“I look at the paper chart first; if I’m missing something then I look in the computer. If the labs are in the chart, I just look at them there” (General Surgeon4)*

*“I go to [Hospital B] and [Hospital C]. I just ask the nurse to get whatever I need...I’m not there enough to be worth learning the system. I just tell the nurse “I need this”” (General Surgeon4)*

Data retrieval EMR are not widely used by other consultant physicians mainly because accessibility barriers (i.e. having to log in every time for each patient), perceived time inefficiencies and a strong belief that nurses are responsible to ensure clinical data are available to physicians. Furthermore, some physicians work with nurse practitioners who help them retrieve data from the computer system.

*“I don’t look at other clinical information (except for X-rays) in the computer, again because of those access issues...The nurses are responsible to print out a medication list, and so I look at that. I can’t spend time to do that on EVERY patient” (Pulmonary Specialist1)*

Usage of EMR3 seems to be more committed. EMR3 in fact is seen as extremely advantageous over the old ways of accessing the films which in turn leads to a more committed use for this system. EMR3 is found to be “*spectacular*” and used by physicians both from within the hospital and remotely. Availability of EMR3 wherever a computer terminal is available and lower accessibility barriers in certain areas of the hospital make EMR3 used more faithfully.

*“As far as the EMR3 system is going, I am able now to instead of going down to X-rays, finding the films, looking at the films which can take half an hour for one film...now I can look at it in the ICU, it’s right there near the patient” (Pediatrics Surgeon)*

*“I start every morning in the lounge and pull up my list then if I get a consult I look up patients’ history and review their X-rays in EMR3 before I go see them” (Orthopedic Surgeon)*

Other consultant physicians also use EMR3 more faithfully to see patients’ X-rays, despite certain accessibility barriers such as system log-out time on the floors. EMR3 is seen as very beneficial because the nature of the specialty requires them to look at patients’ X-rays on a daily basis. Despite accessibility issues with EMR3 (such as log-in and log-out problems on the floors), EMR3 is still being used because of its advantages. Often times, physicians try to actively overcome these accessibility barriers by using EMR3 in dedicated areas where no log-in is required.

*“The system that I use the most is EMR3, I don’t use EMR1 almost at all because most information for me that I need is already in the chart and some that isn’t I ask the nurse to get it for me ...I just don’t waste my time to go into the computer and do it myself” (Pulmonary Specialist1)*

*“I access the films in ICU...it is more efficient because they have dedicated areas where films are available in EMR3...it’s already logged in” (Pulmonary Specialist2)*

In sum, there seems to be quite a continuum of usage among physicians in this sample. Data retrieval EMR are used moderately or not used at all while EMR3’s use is more committed.

Among physicians that use data retrieval EMR, their usage is quite limited to patient list or certain lab results (but only if the results are not already in the paper chart<sup>11</sup>).

### **Other Consultant Physicians**

Physicians in other consultant specialties such as nephrology, neurology, physical therapy and oncology used data-retrieval EMR at Alpha. This is mainly due to the more clinical nature of these physicians' work that requires them to look at much more clinical information about a patient (i.e. patient history and other labs).

Availability of data in the computer, its relative advantage compared to the old way of having to call someone to get a clinical result and also the timeliness of clinical information in the computer, contributes to these physicians' use of EMR. Furthermore, perceived need to access an EMR seems to play a role in influencing these physicians' usage of EMR and their level of EMR usage.

*"I use the EMR for labs and reports mostly. It depends what kind of data you need. When you evaluate the patient in the beginning, the computer is much faster, if it's a follow up visit and you have the paper chart and you know the patient and not much is going on and you have the data in front of the chart then it's easier to flip through – goes very quickly. It depends on the complexity of the case. The more complex the case, the less the chart is helpful" (Nephrologist3)*

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<sup>11</sup> It is worth mentioning here that Alpha prints clinical results every morning around 5-6 am. However if a physician needs more up to date labs or other tests about a patient during the day, he or she needs to log in the computer to get access the latest results (or ask someone to get the results such as nurses, floor secretaries and such). This is highly judgmental; it is up to the individual physician to decide whether the results in the chart are sufficient to help inform a clinical decision.

*“I am seeing more patients than I used to see five years ago, and without the computer system I couldn’t take care of the number of patients I am taking care of now... except if I ignored everything that happened in the past” (Neurologist)*

When asked why a physician would go into the computer himself rather than asking a nurse to do it, some physicians pointed to the following:

*“It’s very frustrating to ask the secretary/nurse to get something from the system, they don’t have access to the same programs that we have. If you ask them to get something, it’s usually time consuming and slow and they may not pull up everything you want to pull” (Neurologist)*

*“The main thing I do is looking for lab work, test results - that’s more efficient, because you have to call somebody to get it if it’s not in the chart” (Pediatrics Surgeon)*

It seems thus that usage of EMR is seen as beneficial to some consultant physicians, as the system is empowering physicians to get the clinical information that they need in a timely fashion without having to depend on other hospital personnel.

Other consultant physicians use EMR<sup>1</sup> on a daily basis, although their usage of EMR is limited to mainly accessing the patient list or supplementing the paper chart. Accessibility barriers and time inefficiencies in using EMR make some physicians not take full advantage of the system.

*“I use EMR<sup>2</sup> every day to pull up my patients” (Physical Therapist)*

*“I always check the paper chart first because if a lab is already there, it’s faster for me to just flip a page and look at it...again going back to the computer being slow”*

*(Oncologist)*

Although one physician had quite positive attitudes about EMR systems in general, he did not make use of any of Alpha’s systems. His non-usage of EMR seems to be directly related to accessibility barriers of having to log in the computer every time and having to carry a token to be able to access the system remotely. Furthermore while this physician saw monetary benefits for Alpha from implementing EMR, he did not perceive any particular need or advantage for himself in order to make use of EMR at Alpha.

*“I like the idea of EMR systems yet I don’t use it because they told me I can use only if I carry a token that will generate pass-codes... If I cannot use it from home why use it at all? They have to offer me a very good deal that obviously has a lot of advantages for me to accept it” (Nephrologist1)*

## **Clinical Specialties**

Clinical specialties such as family practitioners and internists make use of data-retrieval EMR at Alpha. Their usage though is moderate; EMR is primarily used to supplement the paper chart, if physicians find it necessary.

Most family practitioners (four out of five) use EMR at Alpha to see patients’ medical history. They also make use of the remote access function of the EMR. This may be primarily because these four physicians work closely with residents in the hospital and they are very much involved with Alpha’s residency program.



*“I use EMR1 a lot...especially for each patient admission. It’s quite helpful to go back into the records to find out how many times they’ve been in the hospital before, when is the last time they had a stress test, a major big exam they had done... Whereas without that we’d have no way of knowing that...rather than just taking the patients word that their stress test was normal two years ago...and normal to them may mean something different to us” (Family Practitioner2)*

*“My use of EMR is more of the EMR1. Because as one of the hospital physicians that’s that I use mostly, EMR1. But yeah, I love it, it’s easy to access. I can access it from home” (Family Practitioner3)*

*“I use EMR1 because it’s easier to screen, to look for old labs” (Family Practitioner4)*

One family practitioner makes almost no use of Alpha’s EMR. This physician is not involved with Alpha’s residency program. Although this physician thinks positively about EMR in general and has recently acquired an EMR system for his office, he makes almost no use of EMR at Alpha. Time inefficiencies while rounding and log-in issues are major barriers in this physician’s use of EMR in the hospital.

*“In the hospital I use more the paper chart at this point. I rarely log in, I usually ask somebody to get things for me...I go to the room , see the patient, they’ll get the info for me, you don’t have enough time to keep doing all that [log in the computer], you go to another floor and need to log in somewhere else” (Family Practitioner1)*

Almost all internists use EMR1 and/or EMR2. Most internists used combinations of systems rather than a system alone. Nature of internists’ work as clinicians that requires them to

look at a variety of patient related data on a daily basis, timely access to clinical information and non-reliance on nurses and other personnel for getting patient-related records are major determinants of these physicians' use of EMR.

*"I use both EMR1 to print out the census, I use EMR2 while in the hospital. ... The computer system helps a lot...you get results faster, you don't need to rely on other people, you can read it yourself" (Internist3)*

*"I use a computer in two specific situations. One is pulling up the patient list... I use the computer on the floor on the rounds if information is not on the chart...or sometimes I'll use it if there's a certain lab value that I want to see has been done. Say someone's been here for a month. I don't wanna flip through all that paper just looking for that one lab value. It's pretty easy to look it up on the computer and see if it's been done. Although I have found that people who've been in the hospital a long time the lab values actually scroll out. And then I use it also on the floor for that didn't make it to the chart... which is actually close to probably 40% of it....and then the third place where I use it is the ER to look up old records. In the ER someone is new and you don't know what's happening...all you do is look up old records" (Internist7)*

*"The reason I use the computers... I'm the internist, so I have to know everything that's going on. So that's why when I get on the computer I make sure that I look at everything. I like to check out the labs for today and also go back to previous labs... and a lot of times what's on the paper is incomplete. A lot of times they'll print out labs early in the morning when all the labs aren't there. So... on the paper printout everything may not be there. So... when I go see a patient I always log onto the computer and like I said I*

*always like to go back to previous labs for previous days and previous weeks and it's all there. And it's not always there on the chart. I do just hospital work so for me it's easy. I use the computer all the time" (Internist8)*

Table 18 provides a detailed view of physicians' usage of EMR at Alpha, the main reasons why they use or not use EMR and which features of EMR are used more for each physician's specialty.

**Table 18: Physicians' Usage of EMR at Alpha**

Specialty	Physicians Usage of EMR	Main reasons for Use/Non-Use	What the EMR is used for
Cardiologist1	Minimal use EMR1	Time considerations	Patient list Labs if not in the chart
Cardiologist2	Almost no use/ No Intention to use (EMR1, EMR2)  Use EMR3	Perceived need Nature of work Availability of workarounds Belief "things are fine the way I do it now"	EMR3 in the viewing areas (easy access)
Cardiologist3	EMR3	Relative advantage versus going to Radiology Availability of workarounds/Time considerations Nature of work	EMR3 in the viewing areas (easy access)
Cardiologist4	Minimal use EMR1  EMR3	Relative advantage versus going to Radiology Perceived need – some info is in the chart Availability of workarounds for what is not in the chart	X-rays in EMR3 Email (because he is president of the medical staff for the main campus) Look up doctors' privileges, bylaws
General Surgeon1	No use	Perceived need Availability of workarounds Perceived complexity	
General Surgeon2	Moderate use EMR1	Data accessibility Relative advantage over calling lab/asking nurses	Patient list Other records (Labs) if info not in the paper chart
General Surgeon3	No use	Perceived need Accessibility (versus paper chart) Availability of workarounds	

Specialty	Physicians Usage of EMR	Main reasons for Use/Non-Use	What the EMR is used for
		Belief "I can do well without computers at this point"	
General Surgeon4	Moderate use EMR2	System is user friendly Most of the work done at Alpha Does not use EMR at Beta	Paper chart first If info is not available, EMR2 for labs
General Surgeon5	Use EMR1, EMR3	Involvement with EMR design and implementation Personal interest in computers	
Nephrologist1	No use	No personal benefits Perceived benefits for the hospital alone	
Nephrologist2	Moderate use EMR1, EMR2	Data retrieval Nature of work: clinician, looks at more info about a patient	Microbiology reports
Nephrologist3	Moderate use EMR1	IQ/Data in paper chart is outdated Use is dependent on the data needed/complexity of the case Accessibility problems	Labs Other reports
Pulmonary Specialist1	EMR3	Accessibility issues Belief nurses are responsible to ensure data is available EMR3 saves time versus going to Radiology	X-rays in EMR3
Pulmonary Specialist2	EMR3	Relative advantage versus going to Radiology NP retrieves other results	X-rays in EMR3 in the viewing areas Patient list
Family Practitioner1	Very minimal use EMR2 ("I rarely log in")	Time inefficiencies Accessibility issues Availability of workarounds	Remote access EMR1
Neurologist	Use EMR1	Nature of work: clinician, looks at more info about a patient Data retrieval	
Oncologist	Moderate use EMR1	Used if info not in the paper chart Access old records	
Physical Therapist	Minimal EMR1	Access patient list	Patient list
Pediatrics Surgeon	Moderate use EMR2, EMR3	Relative advantage over Radiology Ease of use of EMR	EMR3 in ICU EMR2 for labs

Specialty	Physicians Usage of EMR	Main reasons for Use/Non-Use	What the EMR is used for
		Advantage of data retrieval over calling the lab	
Orthopedic Surgeon	EMR3	Relative advantage over Radiology	EMR3 in the lounge Patient list
Plastic Surgeon	Almost no use	Perceived need Computer is a cold object Computers create more work for physicians	Email
Internist1	Almost no Use	Info is in the chart Likes to talk to nurses who take care of patient Difficulty of use Accessibility	Email
Internist2	Moderate use EMR1, EMR2	Data availability Accessibility/System integration	Labs, reports
Internist3	Use EMR1, EMR2	Ease of use Timely access to information Does not need to rely on nurses	Patient list, other tests (EMR2)
Internist4	Moderate use EMR1, EMR2 (if info not in paper chart)	Data retrieval Nature of work: clinical specialty	No VS because nurses keep more accurate track
Internist5	Moderate use EMR2, EMR1 (remotely)	Accessibility of clinical data Ease of use of EMR Non-availability of workarounds	
Internist6	Moderate use EMR2 (if info not in paper chart) EMR3	Data accessibility Visibility (other EMR systems at other hospitals) Timeliness of information Relative advantage versus old charts	
Internist7	Moderate use EMR1 (if info not in paper chart)	Ease of use of EMR Data retrieval SME member/involvement	Patient list Labs Old medical history
Internist8	Moderate use EMR2 (if info not in paper chart)	Ease of use of EMR Nature of work: clinician Complexity of the case	
GI	Limited use EMR1	Percentage of work done at the hospital Involvement in committees	

## CHAPTER SIX: DISCUSSION AND CONCLUSIONS

In this chapter, we discuss how the proposed elements of the TPB-based framework influence physicians' usage of EMR systems at Alpha. Our theoretical framework posited that an individual physician's usage of EMR is determined by three main factors, namely attitudes one forms towards using the system, perceptions of behavioral control and social influences.

TPB includes attitudes as a major determinant of technology acceptance and usage. According to TPB, attitudes towards using an EMR system reflect an individual physician's positive and/or negative evaluations towards performing the specified behavior (i.e. using the EMR).

Perceived behavioral control refers to how perceived presence of certain constraints on behavior can inhibit performance of a behavior such as using an EMR system (Ajzen, 1991). Facilitating conditions or the availability of resources needed to engage in a behavior such as time, money and other specialized resources (Taylor & Todd, 1995) have been identified as a major factor constraining IT usage.

Social influence refers to the perceived pressure to perform the behavior in question. There are a multitude of influence sources an individual can be potentially subject to, in healthcare, primary sources of influence have been proposed to be peers physicians may interact with, hospital administrators and other influences coming from the environment physicians are part of (such as their membership in different professional associations) and the government.

Physicians' attitudes towards EMR are said to be primarily determined by their beliefs about the EMR technology and beliefs about their medical profession. According to the diffusion of innovation literature (Rogers, 1995), beliefs about the technology include perceptions of

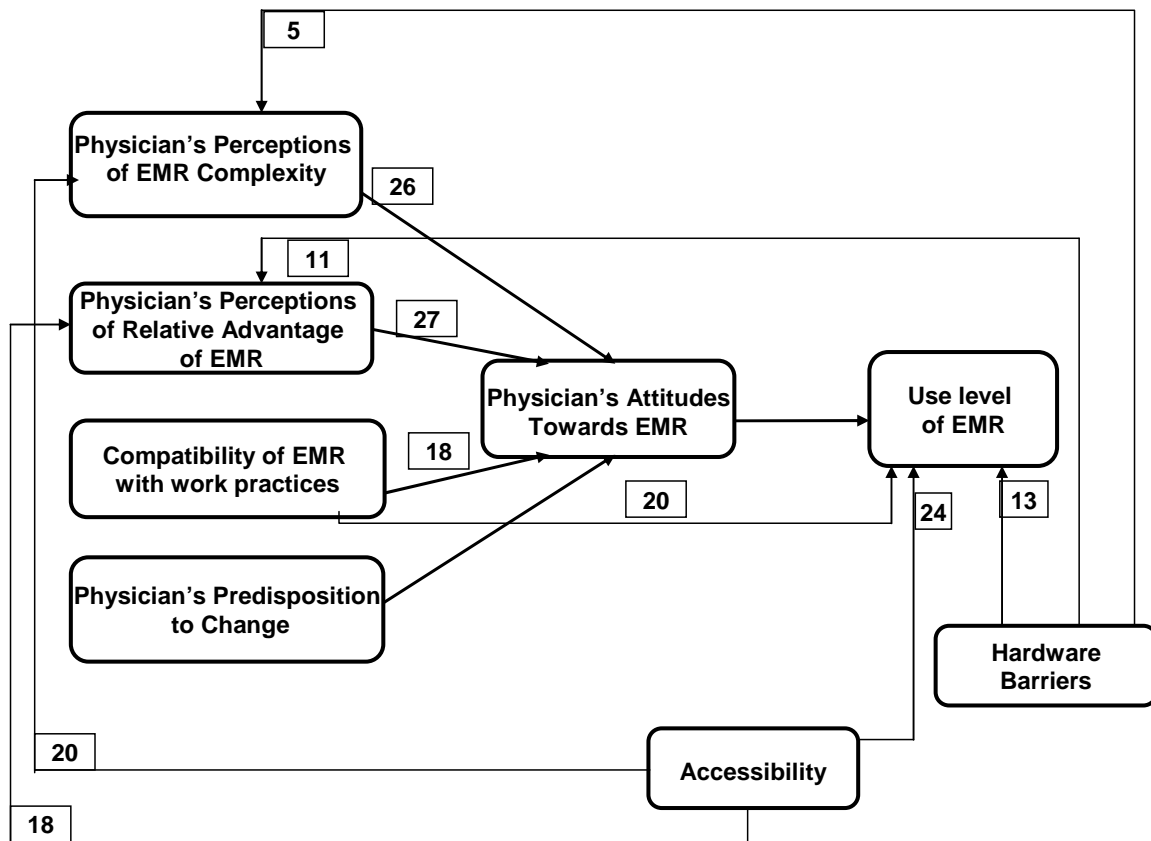
complexity in using an EMR, perceptions about the relative advantage of the EMR and perceived compatibility with current practices. Beliefs about the medical profession refer to the institutionalized ways of practicing medicine that physicians follow in their daily work. In the following sections, we explore each of the proposed relationships in the theoretical framework but at the same time we look for any new emergent relationships that may shed light on the complex phenomenon of physicians' acceptance and usage of EMR systems.

In order to test for the existence of any causal relationships among the elements of the proposed framework, a causal mapping analysis was conducted (Nelson et al., 2000 and Armstrong, 2005). A causal map is a representation of the causal relations embedded in an individual's explicit statements. This technique allows a researcher to capture the cognitive structure of an individual by representing how domain knowledge is linked in his or her mind (Armstrong, 2005).

Representation of physicians' cognitive maps has been performed in five stages. First, the researcher read and coded each interview transcript according to each element of the theoretical framework and also the emergent themes (Appendix B). Second, the interviews were read again in order for the researcher to identify any causal statements to be used in representing connections between concepts and constructs on physicians' revealed maps. Third, a concept-level causal map has been constructed for each individual physician that was interviewed. Concepts refer to the dimensions of the constructs of interest (i.e. EMR navigation and search issues). Appendix C presents the thirty individual physician maps. These maps reflect individual physicians' representation of concepts about a particular phenomenon (i.e. using EMR) and the relationships among them (Miles & Huberman, 1994, p. 134). Fourth, the individual concept-level maps have been aggregated at a higher level by combining concepts identified at step3 into

constructs (i.e. the concepts of EMR navigation and search have been identified as dimensions of EMR complexity construct). Last, these construct-level maps have been further aggregated for all thirty physicians in the sample.

Figure 2 below presented the integrated causal model regarding physicians’ attitudes and their usage of EMR based on the thirty individual construct-level causal mapping. The numbers on the arrows indicate the number of causal statements identified in the text between each pair of constructs.



**Figure 2: A Model of Physicians’ Acceptance and Usage of EMR**



## **Beliefs about the EMR and Attitudes link**

In this section, we discuss physicians' beliefs about the EMR systems at Alpha and their impact on EMR attitude formation. Causal maps revealed a strong link between the perceived complexity of using the EMR and physicians' attitudes about EMR.

The aggregated causal model (Figure 2), based on the individual physicians' causal maps, showed that twenty six out of thirty physicians interviewed for this study made a causal connection between the perceived complexity of the system and their attitudes towards Alpha's EMR.

EMR's perceived complexity is derived from several sources. First, system navigation considerations are a main determinant of the physicians' perceptions of complexity in using EMR. System navigation refers to "moving" through the system, specifically going through multiple windows in order to get at clinical results or the ability to readily and easily find a desired patient test within the system. Multiple screens and the number of clicks a physician performs to get at a clinical result are major navigation considerations. Sixteen physicians from ten different specialties identified system navigation issues as a major consideration that makes EMR systems at Alpha complex (Table 8 in Chapter 5).

*"I think the way you have to get to the information is awkward [Attitudes]...I can't just click on lab data and see it... I have to click here, then I have to click there...and then I can get my lab data... you have to go through all these menus to get there [Navigation]"*  
*(Oncologist)*

System navigation problems in turn, influence physicians' attitude formation regarding Alpha's EMR. An example in this regard that also illustrates the way coding was performed in the individual physicians' causal maps is presented below:

*“Some particular screens (for example microbiology reports) are very cumbersome ...you have to go 7-10 screens in order to get a report [Navigation issues]. Microbiology reports are the worst thing in the world... we have to go screen by screen [Navigation]... it is horrible [Attitudes] (Nephrologist2)*

This example shows how this physician's belief that EMR2 is difficult to use (“some screens are cumbersome”) impacts his attitude formation (“it is horrible”).

Second, the ease of searching for clinical information also contributes to physicians' perceptions that Alpha's EMR systems are complex. Searching for clinical information refers to a physician's ability to sort through clinical results and customize reports in the desired manner. Eleven physicians from eight different specialties identified “search” issues as a major difficulty with Alpha's EMR systems (Table 8 in Chapter 5). For example, one surgeon pointed to the fact he could not search for a patient unless he had the exact patient's name. Perceptions of the complexities associated with searching for patient results seem to determine attitude formation regarding Alpha's EMR. The following quotes show such a causal relationship.

*“When you're looking for a patient and you don't know the exact spelling where you have a last name but you don't have a first name, [Search issues] the system would say there is nobody under that name but it won't give you a close spelling. So it won't come up with anything, it would say... ”there is no patient in the system with this name” ...it wouldn't say “here are your options” ...that's a problem [Attitudes] (Internist5)*

*“One of the things I don’t like about EMR2 in particular is Microbiology [Attitudes]. There’s really no way to just get what’s positive and have it all on one screen. Like for example, say someone has 10 blood cultures and 3 of them are positive. You’re not going to know it till you click on every one of them. If there was way you could just click and it shows you, you know day 1, day 5 or day 7 are positive and these were the results, that would be great, instead of having to click on all of them [Search]. And some of these patients have 20 or more cultures because they’ve been here a long time when they’re very sick’ (Internist8)*

A similar logic as presented in the two examples above has been used in coding each relationship between constructs or each path on the individual physicians’ causal maps.

Third, difficulty of accessing the EMR systems at Alpha is a major determinant of physicians’ perceptions of the complexity of the system. Twenty physicians from all thirteen specialties pointed to difficulties in accessing Alpha’s EMR as they relate to the overall perceived complexity of the system (Figure 2). The following examples illustrate how difficulties of access influence physicians’ perceptions of complexity in using EMR.

*“If it can be all combined in one program to get labs, patient locations, list, X-rays [difficulty of Access]... that would be a lot easier” [Perceived Complexity] (General Surgeon2)*

*“Access to it is not handy which delays our work and makes our work more difficult [Relative disadvantage] Also, not all the information is on ONE web site, [difficulty of access] you have to change from one site to the other which takes more time...and it’s cumbersome” [Perceived Complexity] (Pulmonary Specialist1)*

This last quote also shows how difficulties in accessing EMR at Alpha influence physicians' perceptions of the relative disadvantage of EMR in terms of time and work inefficiencies which will be discussed later in this section. Twenty causal links relate perceptions of difficulty in accessing EMR at Alpha and physicians' perceptions of EMR complexity. To the extent that access is perceived to be a major barrier (in terms of ease of logging into Alpha's EMR and the number of log-ins per floor or patient), physicians' perceptions of EMR complexity are enforced.

At the same time, perceptions of the lack of availability of hardware at Alpha seems to influence physicians' perceptions of the ease of use of EMR, although not as strongly as accessibility barriers. Five paths from implementation climate (hardware considerations) pointed to physicians' perceptions that EMR systems are difficult to use at Alpha. For instance one physician mentioned the following:

*“The computers are spread out and there is not enough for the doctors to come around, so we have to look for a computer [**Hardware barriers**], once I find a computer, there is no seat, so you have to stand and it makes it very difficult for me [**Perceived complexity**] to hold the chart in one hand, trying to connect to the computer with my free hand because the computer doesn't have a desk to it, so that's very uncomfortable and cumbersome [**Perceived complexity**] (Pulmonary Specialist1)*

These results show that physicians' perceptions of complexity regarding EMR are mainly due to system related or technical factors rather than individual psychological factors and such as computer self-efficacy, computer anxiety and playfulness (Venkatesh, 2000). These results imply that changes in technical functionality of the EMR system, such as improved navigation within the system and increased system search capabilities may contribute to physicians increased

perceptions of the ease of use of the EMR. On the other hand, reducing accessibility barriers associated with logging in the EMR (by having a common platform for all three EMR systems at Alpha such that physicians do not have to log in multiple systems) can contribute to reducing physicians' perceptions that EMR systems are difficult to use. Reducing or eliminating these technical barriers is even more important as the majority of physicians in this sample are concerned with EMR's friendliness or ease of use.

These results have implications for design of EMR systems. Design of EMR should focus on enhancing ease of navigation and provide physicians multiple ways of sorting through clinical data. Focusing on these system characteristics is perhaps even more important in a healthcare context, as an EMR is a repository of clinical information that contains a multitude of patient records and a multitude of test results per patient and physicians are not the typical "clerical worker." Enhanced system functionality regarding navigation and search capabilities will help reduce physicians' perceptions of the difficulties related to using the system which in turn will lead to more favorable attitudes formation regarding EMR.

Relative advantage is another individual belief (Rogers, 1995) and reflects physicians' perceptions of the extent to which the EMR systems at Alpha are beneficial to them and/or helpful in their clinical work. Relative advantage of EMR is a major factor influencing physicians' attitudes and, at the same time, their usage or non usage of EMR.

Twenty seven links from perceived relative advantage to attitudes about EMR have been identified on the final causal model (Figure 2). Overall, all thirty physicians have identified a certain aspect of relative advantage as a major consideration in their attitude formation and/or usage of EMR (Table 10). Twenty-two physicians believed EMR provides them with some advantages over the paper chart while ten physicians believed EMR does not provide them with

any direct benefits (Table 10). The ability to access patient history reports and get real time clinical information are main advantages EMR provide physicians over the paper chart.

Specifically, EMR systems at Alpha provide physicians with a clinical data repository that can be accessed by physicians in order to get patients' medical history. This theme has been mentioned fourteen different times across interviews. EMR1 contains up to twelve years of patient-related information while EMR2 contains more recent patient information up to six months old. This is a major advantage over the paper chart which does not always have all the information available about a patient, especially if the patient has a long history with the hospital. *"I like having the system available so that we can check labs and other physicians' dictations. Also you can go into their past treatment history for all their previous visits and that's all excellent"* (Orthopedic Surgeon)

It is worth mentioning here that Alpha prints clinical results daily (i.e. test results, clinical summary, medication list). These results are placed in the paper chart early morning, however once a test result is back from the lab, the results are automatically placed in the EMR systems, which makes the EMR a real time data repository.

Another advantage of EMR is that EMR is empowering physicians to get clinical results themselves rather than ask a nurse or secretary for retrieving different tests. This is advantageous because as a physician mentioned:

*"I know what I'm looking for and I can just go directly to it, whereas I can say something to the unit secretary, she may not know what I want, she may come back to ask - is this what you need? and I may say no, I need this you know - so it's a little more efficient for me to do it myself, but it also takes more time for me"* (Internist5)

Almost all physicians in this sample pointed to time inefficiencies in using EMR.

Although EMR provides doctors with certain advantages as mentioned above, one main relative disadvantage of the EMR is time-related inefficiencies.

Time is one of the main physician resources. EMR seems to seriously impact this precious resource. The end result is physicians' perceptions of work inefficiencies from using EMR. Time is a major consideration to physicians as most physicians are consultants and are not directly employed by the hospital. The hospital only provides an arena for them to practice but it is individual physicians that bring patients to the hospital and contribute to the hospital's revenues.

Furthermore, individual physicians' revenues are directly dependent on the number of patients they see daily such that they can bill the respective insurance providers. *"You don't have enough time (Family Practitioner1)...the computer system doesn't help me get through my time (Cardiologist4) ... you slow down horribly (Nephrologist2)...I don't waste my time to go to the computer (Pulmonary Specialist1)...that's time consuming (Neurologist)"*

Interestingly, technical factors such as accessibility barriers and implementation (hardware) barriers seem to influence these perceptions of relative disadvantage of the computer systems at Alpha. Causal mapping revealed eighteen links relating accessibility barriers and relative advantage and eleven links relating perceptions of availability of hardware and relative advantage of the EMR.

Accessibility barriers refer to the number of log-ins physicians have to do for each of the three EMR systems at Alpha, multiple log-ins per floor and/or per patient, issues associated with the ease of logging-in, multiple passwords, system log out time and remote access. To the extent that accessing Alpha's EMR is made difficult, physicians' perceptions of the relative

disadvantage of the EMR (in terms of time inefficiencies) are enhanced. The following quotes help illustrate this proposition.

*“Every time you go see a patient you have to open the computer, go to the computer put in a password, go to 3-4 screens till you get to a patient [Accessibility]. Then, you go talk to the patient and when you come back – everything is gone, the system logs you out and you have to start again, which is very time consuming [Relative disadvantage]. Also because you have 20 patients in the hospital, every time you go do this operation, you slow down horribly [Relative disadvantage]” (Nephrologist2)*

*“The time it takes to sign in the system [Access], get the info, you wasted 4-5 minutes ...you go to another floor and need to log in somewhere else [Access]...and the time you add that up patient after patient... I can't do that [Relative disadvantage]. I've got to have quicker access, where I pick up the chart and flip through pages, look at something and go [Relative advantage of the paper chart]” (Family Practitioner1)*

*“The problem is that the access to it is not handy [Access], which delays our work and makes our work more difficult [Relative disadvantage]. For me to log into the computer, if the computer is right here, takes me a minute and a half. If I have 40 patients multiplied by 1.5 min you got at least one hour for that every day [Relative disadvantage-work inefficiency]” (Pulmonary Specialist1)*

*“The only way a computer is going to help me practice [Relative advantage of EMR] is if it is easily accessible and I won't have to wait [Access] (Pulmonary Specialist1)*



Another factor that diminishes perceptions of the relative advantage of EMR versus the paper chart is availability and placement of hardware devices at Alpha. Availability of devices and their physical proximity to a patient's room are main barriers that enhance physicians' perceptions of the relative disadvantage of EMR versus the paper chart. As previously mentioned in an earlier chapter, Alpha is not entirely computerized, paper charts are still available for physicians' use and are placed conveniently near each patient's room. To the extent that hardware devices are not easily available on Alpha's floors and to the extent they are not in a physical proximity of the physician or patient's room, or often times they are already in use by other clinical personnel, physicians seem to perceive EMR as being less advantageous than the paper chart. The following quotes illustrate this proposition.

*“They just don't have enough computer terminals, there are 5-6-7 computers on the floors, half of them are gonna be in use at any given time so you gotta find one that's not being used [Availability of hardware] ...I gotta walk all over the place [Relative disadvantage]” (Oncologist)*

*“The computers are spread out, some of them in the nurses stations, some of them in the corridors and there is not enough for the doctors to come around, [Availability of hardware]... so we have to look for a computer, many times we find a computers and it's not working, and we have to go around with the chart, find a computer and put the things together [Relative disadvantage]” (Pulmonary Specialist1)*

An interesting observation from the causal maps shows that availability of hardware seems to impact physicians' perceptions of relative advantage of EMR differently by specialty. Looking at two very different specialties, cardiology (which is highly specialized) and internal

medicine (which is highly clinical), it seems that cardiologists perceived the availability of hardware to impact more their work efficiency than internists did. 75% (3 out of 4) of cardiologists that mentioned hardware problems also thought that EMR makes them less efficient, while only 37% of the internists (3 out of 8) that found a problem in available hardware on the floors thought this impacted their clinical efficiency. In other words, the three internists, although they found hardware availability to be a problem, that was not enough for them to offset other EMR benefits such that availability of clinical data. This seems to imply that higher compatibility of EMR with the work of the internists that need more clinical data to take care of patients seem to diminish the impact of hardware barriers on the relative advantage of EMR.

Furthermore, internists, in general, have not found hardware and accessibility barriers to be as high as other specialties did in impacting their EMR use. Internists are mainly hospitalists that spend a lot of time in the hospital and do not usually have a private practice such that their focus is mainly hospital patients. The fact that internists do mainly hospital work, gives them more time to deal with computer availability and accessibility.

Direct observations in the hospital environment for a nine month period also helped enforce this claim. Only three out of eight internists specifically mentioned accessibility (i.e. log-in the computer) as a barrier in their computer usage. The other internists, although they pointed to some access or hardware availability, they did not find them to be a major problem at Alpha. On the other hand, cardiologists are consultants, they come to the hospital, see patients, and then they go do procedures or see more patients in their office, thus a readily accessible computer is much more important to them. All four cardiologists in this sample found accessibility to be a major barrier in their EMR use.

In sum, technical considerations such as hardware and accessibility barriers seem to influence physicians' perceptions of the relative advantage of EMR over the paper chart. The implication of this finding is that diminishing such barriers by having more available computers on Alpha's floors and making log-in easy for physicians, will help enforce the real EMR benefits such as its ability to real time information.

The type of hardware devices is also an important consideration. Many physicians mentioned that they would prefer a tablet computer such that to avoid multiple log-ins. The implication here is that Alpha needs to be considering a good hardware strategy in order to address such hardware and accessibility considerations and improve both physicians' perceptions of relative advantage and their EMR usage. Investing more in hardware and making different types of devices available to satisfy any physician's needs are some elements that may be part of the hardware strategy. The implication here is that a good piece of software that is advantageous and easy to use is not sufficient to ensure its use. As we discussed above, accessibility to software and hardware considerations can significantly reduce both these perceptions with the end result of the EMR not being used or used minimally.

Unlike the two main data retrieval EMR (EMR1 and EMR2), EMR3 (the imaging system) is unanimously believed to be extremely beneficial to physicians in different specialties over the old way of accessing X-rays. Before EMR3 was available, in order for a physician to see a patient's x-ray, that physician had to go to a separate department on a different floor to be able to look at X-rays. EMR3 provides physicians the ability to access patients' films wherever a computer terminal is available.

*For me, being able to look at the EMR3 system on the floor is very beneficial because it saves me time to go downstairs to the radiology dept and look at X-rays there [RA]. It's very nice I can see the X-rays in EMR3 rather than go downstairs to Radiology [Attitudes] (Pulmonary Specialist1)*

*"The most helpful system that they have is EMR3 [RA]. I like accessing the system [Attitudes] from the part of the building where the patient is rather than going down to X-rays dept. and look at hard copy films" (Cardiologist4)*

*The EMR3 system is a tremendous advance [Attitudes]... it has the advantage you can scan through the films, you can look through hundreds of pictures, can make them kind of like movies...[RA]. You can easily access the old films, so you can do comparisons. In the past when you requested 10 X-rays after about two hours you had 4 old films on patients [RA], now everything is there...that's is absolutely spectacular [Attitudes] (Pediatrics Surgeon)*

It is worth mentioning here that EMR3 can be used in certain areas such as Intensive Care Units (ICU) or operating rooms, without requiring physicians to enter a log-in or a password. These areas have computers with large monitors where physicians can easily access to view any patient film. It seems thus, that a lack of accessibility and hardware barriers as regards EMR3 in these special areas contributes to enhancing the value of EMR to physicians in terms of its relative advantage over the basic films (real time access to films at patient's location) and at the same time leads to physicians using EMR3 much more than EMR1 or EMR2.

The case of EMR3 that is easily accessible and does not meet with high hardware barriers illustrates how important accessibility and hardware considerations are in determining

perceptions of ease of use and relative advantage of EMR and also EMR use. At the same time, EMR3 is much easier to navigate through. It primarily contains a list of patients, their X-rays and the date. Physicians can easily click on patient name and pull up the films. Because of its time efficiencies, EMR3 is used in these areas, even by a cardiologist that has very negative attitudes about computers and does not use computers for anything else (including email).

*“I think EMR is wastet of money. I think it’s stupid! [Attitudes]. I’ve never had any interest in computers. I’ve never sent an email in my life. If I want to talk to you, I’ll call you... I am using that computer system (EMR3) in the viewing areas. The unit has them up and running...I punch in a person’s name and see the X-ray” (Cardiologist2)*

*“The EMR3 system here I access through work stations in different areas (ICU). These systems are online all the times [Access]. The system has a list of patients and their names and X-rays. I can see the X-rays on 10 patients in 7-8 minutes [RA]” (Cardiologist3)*

The first quote above also shows how perceptions of relative advantage of EMR3 directly impact that cardiologist’s usage of EMR, even in the presence of strong negative attitudes about EMR systems. The second quote above reinforces the discussion regarding how lack of accessibility barriers enhances physicians’ perceptions of the relative advantage of EMR. The case of Cardiologist3 who uses EMR3 in ICU areas shows how lack of accessibility barriers reinforced his perceptions of the EMR’s advantages rather than diminishing them as in the cases of EMR1 and EMR2 presented above.

Another example shows how accessibility barriers for an X-ray system similar to EMR3 at a different hospital lead to reduced perceptions of ease of use and enhanced perceptions of relative disadvantage with the result of the system not being used at that hospital.

*“At the other hospital where they are using a web based system, I cannot look at the patient’s X-rays so **easily and quickly [RA]**. I have to go into the system put in my name and password to log in [**Access**]. Once I get the first screen, the system has to be activated because it may be on hibernate, then I have to hit the EMR portal button which takes you into the radiology system. Once I get into that system I have to look at each person I want to see (their name) one by one. I put a name, look at it. I put another name, look at it [**Navigation**]. As a result, we don’t look at X-rays at those hospitals which may result in malpractice [**EMR use**]. We wait for the report to come in which makes the patient stay in the hospital longer” (Cardiologist3)*

Furthermore, based on the causal model in Figure 2, accessibility barriers seem to be stronger determinants of physicians’ beliefs about EMR than hardware barriers. Eighteen and twenty different causal links have been identified between accessibility barriers and physicians’ beliefs about EMR. Only five and eleven links respectively connected implementation (hardware) barriers and physicians’ beliefs about EMR.

Results from comparing three EMR systems (two data retrieval EMR and an imaging EMR) show how the imaging EMR3 is by far more accepted and used than the other two EMR systems at Alpha. Accessibility and hardware barriers are primary determinants of physicians’ perceptions of ease of use of EMR and its relative advantage with the end result of one system

being used fully where no barriers are present and the other two systems used minimally in the presence of such barriers.

Proposition 1 in the theoretical framework posited that physicians' beliefs about the EMR (perceived complexity of EMR and its relative advantage) influence their attitudes towards EMR. This proposition is supported by the interview data in this study. Causal mapping showed twenty six and twenty seven links respectively relating these two constructs. Other propositions seemed to have emerged from the interview data in the hospital context of interest based on the discussion above. The following two propositions are related to accessibility barriers:

*P1a: High accessibility barriers to the EMR system will tend to lower physicians' perceptions of the ease of use of EMR.*

*P1b: High accessibility barriers to the EMR system will tend to lower physicians' perceptions of the relative advantage of EMR over the paper chart.*

Propositions related to hardware barriers:

*P1c: High hardware barriers in using EMR will tend to lower physicians' perceptions of the ease of use of EMR.*

*P1d: High hardware barriers in using EMR will tend to lower physicians' perceptions of the relative advantage of EMR.*

Propositions related to both accessibility and hardware barriers:

*P1e: Accessibility barriers tend to be more important than hardware barriers in influencing both perceptions of ease of use and relative advantage of EMR.*

## **Beliefs about Compatibility of EMR with Clinical Practices and Attitudes**

In this section we discuss the extent to which physicians believe EMR fits their work practices and beliefs about specialty and at the same time we explore how physicians think that EMR have changed or how EMR have the potential to change the medical profession.

Rogers (1995) posits that in the innovation diffusion process, the degree to which an innovation fits with a potential adopter's existing values, beliefs and experiences is an important consideration. He calls this perception "compatibility." Agarwal & Karahanna (1998) extended Rogers' conceptualization of compatibility to also include a fit with an individual's work style and work practices. In IS research, this construct has been shown to consistently influence innovation adoption (Moore & Benbasat, 1991; Rogers, 1995; Prescott & Conger, 1995; Van Slyke, Belanger & Comunale, 2004). We aim at investigating whether this perception is important in healthcare and how it relates to physicians' attitudes about EMR systems.

Individual physicians' causal maps revealed eighteen relationships between compatibility of EMR with physicians' nature of work and their attitudes towards EMR. A direct relationship between compatibility with specialty and EMR usage has also been observed from the causal maps in twenty cases.

Two dimensions of the compatibility construct have been observed in the current hospital context. One dimension of compatibility refers to the extent to which EMR fits with a physician's clinical work or clinical specialty. This dimension may also be expressed as a physician's "perceived need" for using an EMR system. The second dimension of compatibility refers to the extent to which physicians believe it is the job of other medical personnel (i.e. nurse practitioners, physicians' assistants, floor nurses and/or secretaries) to work with the computer.



Data retrieval EMR systems at Alpha (EMR1 and EMR2) do not seem to fit well with the way cardiologists and surgeons do their clinical work. It is by far that two specialties in this sample have very strong professional beliefs when it comes to the way their work is organized. Cardiologists' and surgeons' work revolves around doing cardiac procedures and/or surgeries and using a data retrieval EMR system does not seem to fit very well with the way they do their daily clinical work. Other parties (i.e. nurse practitioners) are seen as being in charge of doing data retrieval from the computer or even paper chart such that physicians can focus on their main clinical responsibilities.

*“Surgeons and cardiologists have always had... and I’ve been here for 20 yrs now [Attitudes] people that we pay to work with us to make the work go faster and more efficient. This personnel deal with the computer [Beliefs about the profession]”*  
(Cardiologist3)

A very strong quote from one cardiologist non-user of EMR at Alpha also helps illustrate this point. This cardiologist's belief of the non-fit of the EMR with his clinical work seems influence in turn, his attitude formation regarding Alpha's EMR with a result of a negative attitude and this physician not using data retrieval EMR at Alpha.

*“I don't really need computers for what I do...I do heart cath and angioplasties. I don't need it in my day to day job to be a proficient doctor [Compatibility]. It's not important to what I do [Attitudes]”* (Cardiologist2)

Furthermore, the same physician believes that nurse practitioners and/or physicians' assistants are responsible to provide physicians with the clinical information that they need.

*“I have people in my office that work around computers [Compatibility, Workarounds] but I personally don’t use computers. The unit secretary helps me too...In the office is the same way, in the hospital, the nurses, secretaries do it...All I care is the information; I don’t care to punch it up myself [Attitudes]” (Cardiologist2)*

Same cardiologist indicated that he does not even access the paper chart, his nurse practitioner writes down only certain clinical results he needs on a daily basis.

*“The NP writes down whatever I am interested in on a blank piece of paper...this lab showed this... it’s only half a page” (Cardiologist3).*

An interesting case is that of a cardiologist who seemed to have somewhat more positive attitudes towards Alpha’s EMR systems. This was mainly because he believed EMR helped his staff get more real time clinical information to him, also in a timelier manner. In this case, this physician did not believe that EMR fits with his specialty and thus he did not use EMR personally, although his attitudes towards EMR were positive. This shows a rather direct link from EMR compatibility with the specialty and EMR use which does not necessarily imply negative attitudes towards EMR.

*“I tend to be a surgeon [Compatibility with specialty], I do not use the computer as much as I should to access things [Use]. The computer system helps... I can get the results faster from the computer through my staff [Attitudes]” (Cardiologist3)*

A similar pattern linking perceptions of compatibility of EMR with clinical work and EMR usage seems to emerge from the following statement of a general surgeon.

*“I’m mostly in the Operating Room, my time is spent mostly in the Operating Room than trying to access info on the computer [Compatibility]...If the latest labs are not in the paper chart, I tell the NP to do it [Non-use]” (General Surgeon3)*

General surgeons tended to exhibit similar beliefs that organization of their work does not fit very well with EMR systems. In the case of another surgeon, compatibility with his work is expressed in terms of the “perceived need” for EMR which in turn, seems to contribute to formation of negative attitudes about EMR with the end result of this physician not using EMR. The following quote illustrates the case where lack of compatibility with a physician’s clinical specialty influences formation of negative attitudes about EMR which in turn leads to non-use of EMR.

*“I haven’t found that I really need it yet [Compatibility]... We have a NP that works for us [Compatibility]. I don’t use EMR [Use], it’s too much of a pain [Attitudes]” (General Surgeon1)*

Interestingly, both cardiologists and surgeons found EMR3 very much compatible with their work. This is because these specialties rely heavily on seeing patients’ X-rays and EMR3 has brought a significant and relevant change in their practice of going to another department, often times on a different floor to view X-rays. EMR3 seems to fit more with how physicians in these two specialties practice with the result that physicians that used EMR3 in this sample had positive attitudes about it and used it more.

*“The most helpful system that they have is EMR3 [Attitudes], I am a cardiologist, I do pace makers, implants I look at chest X-rays, CT scans [Compatibility]” (Cardiologist4)*

Interestingly, even a cardiologist mentioned above that had strong negative attitudes about EMR1 and EMR2 at Alpha and did not use any of these systems, used EMR3. Although not overtly referred to, a strong perceived need to access patients' X-rays because his specialty, leads to this physicians' usage of EMR3.

These results indicate how perceptions of compatibility with clinical specialty influence physicians' attitudes and their acceptance and usage of EMR systems. Among three different systems, two data retrieval EMR and an imaging EMR, the one that fit the most with a physician's specialty and work practices (EMR3) was accepted and used the most. These results point to a more fundamental barrier in physicians' acceptance and usage of EMR (i.e. perceived compatibility with physicians' work practices) as compared to more technical barriers presented in a previous section.

Pulmonary specialists also found EMR3 compatible with the way they do their work. Both physicians interviewed in this sample pointed to how EMR3 has helped them in their practice. It seems from the following quote below that both relative advantage and compatibility seem to work together in influencing strong positive physician's attitudes towards EMR3.

*“For me, being able to look at the EMR3 system on the floor is very beneficial because it saves me time to go downstairs to the radiology department and look at X-rays there [RA]. So, the fact that I can be on the floor, access EMR3 and look at my X-rays right there saves me time from going downstairs and back up[RA]. So, for me that's very important [Attitudes] because I see X-rays all the time [Compatibility]” (Pulmonary Specialist1)*

The same pulmonary specialist also indicated in the interview towards a non-compatibility of EMR1 and EMR2 with his work. He believed it was the nurses' responsibility to print out a medication list and/or a clinical summary and place it in each patient's chart rather than him having to access it through the computer.

*“The nurses are responsible to print out a medication list [**Compatibility**], and so I look at that [**Non-use of EMR**]. They provide the list and put it in the chart every day — I am not interested to go into the computer just to look at something [**Attitudes**]” (Pulmonary Specialist1)*

As the specialty becomes more clinically-oriented, EMR1 and EMR2 seems to be perceived as more compatible with physicians' work. At the same time, these physicians use far less nurse practitioners and/or physicians' assistants to help them with their work. The following examples illustrate how physicians' perceptions of compatibility with EMR influence both their attitudes and usage of EMR (and also the level of use of EMR).

*“Overall I like it... I make critics in a context but I like the system [**Attitudes**]. For us clinicians, we really need all this data [**Compatibility**]” (Nephrologist2)*

*“I'm an internist [**Compatibility**], so I have to know everything that's going on. So that's why when I get on the computer [**Use**] I make sure that I look at everything [**Level of use**]” (Internist8)*

However, not all internists seem to believe that EMR fits with the way they like to work. One internist, who is also the president of a local medical society, believed that “a doctor should not spend the time trying to get the lab work in his hand” (Internist1). Furthermore, he also

pointed to the fact that he “likes to talk to the nurses because they are the ones who take care of the patient. A doctor does better if he talks to the nurse who took care of the patient the last 8 hrs, get more info that he can get from anywhere else” (Internist1). These physician’s professional beliefs were so strong that they determined a rather negative attitude towards EMR and almost non-use of EMR.

Such a difference in beliefs and attitudes between the internists above may be traced to individual differences such as age and perhaps predisposition to change (which is to be discussed in the next section). The first internist was in his thirties and was much more instrumental in his predisposition to computers or more readily open to computer-related change if the change was perceived as being beneficial. The second internist mentioned above, was rather in his mid sixties and his individual predisposition seemed to be rather ceremonial or more resistant, based on the way he was used to do things in the past.

In sum, the proposition linking physicians’ beliefs about the compatibility of EMR with their professional specialty and their attitudes towards EMR is supported. Another emergent and more exploratory proposition is also presented, based on the results of causal mapping and the examples presented above.

*P2a: Physicians’ positive beliefs about the compatibility of EMR with their clinical specialty influences their usage of EMR (even in the presence of negative attitudes)*

As regards physicians’ beliefs about how current EMR systems have changed the way a physician practices medicine, most physicians in this sample did not find that any of the EMR systems at Alpha has changed dramatically the way physicians practice medicine over the paper chart. This is mainly because physicians at Alpha do not write progress notes or orders electronically via a CPOE system yet. Alpha has plans in works for an implementation of a

CPOE system by 2007. Our initial claim in the theoretical framework about EMR being a rather “disruptive innovation” does not seem to be supported by current EMR systems at Alpha.

Current systems (EMR1, EMR2 and EMR3) are data retrieval EMR and play somewhat a “support” function to augment the paper chart with latest clinical information. Data retrieval EMR systems differ from CPOE systems to the extent that physicians do not enter orders electronically or write progress notes.

Our initial theoretical framework identified a physician’s expertise and status as strong physician professional values that may be an obstacle and impede changes brought about by EMR implementations in healthcare. Interview data pointed that another main resource a physician values is “time.” Almost all physicians in this sample identified “time” as a major consideration and have indicated that EMR systems at Alpha have affected this important resource in mostly a negative manner. “Time” seems to be an even more important resource than expertise or status to the extent that physicians are reimbursed based on the number of patients that they see rather than a fixed income generated from the hospital as it is the case in other industries. Physicians are thus more concerned with their individual work efficiency in terms of carrying out their clinical work and seeing the number of patients they have to see daily. This is the reason why “time” is a very important consideration in using EMR. The following quotes illustrate physicians’ concern with time efficiencies in their clinical work.

*“The disadvantage of the computer system is that you have to spend more time”*

*(Cardiologist1), “Things like Labs, I do not access on the computer, I don’t have the*

*time” (Cardiologist2), “Right now, the computer system does not help me get through my*

*time” (Cardiologist4), “If you have 20 patients, you slow down horribly”*

*(Nephrologist2), “If I have 40 patients multiplied by an average of 2-3 minutes to get into the computer, that is two to three hours extra per day” (Pulmonary Specialist1), “I rarely log in, I don’t have enough time” (Family Practitioner1), “If I have to go through the computer every time I see a patient to pull up information, I lose precious time” (Internist1).*

These quotes indicate how concerned physicians are with their “time” and how current data retrieval EMR at Alpha pose a threat to this important physician resource.

Physicians’ “*expertise*” is another important resource that did not seem much affected by current data retrieval EMR at Alpha. The emergence of CPOE applications and their future implementation at Alpha and throughout the entire US healthcare system seem to pose a threat to both these resources of “time” and “*expertise*.” CPOE requires physicians to enter order in an EMR often times using order templates that are built in for each case. Conversations with physicians and direct observations in the hospital environment seem to indicate that this is a very lengthy and time consuming operation.

Furthermore, CPOE has the potential to promote and enforce a new trend in medicine, that of “*evidence-based medicine*.” Evidence based medicine involves practicing and diagnosing based on common accepted standards in medical care. This seems to pose a threat to physicians’ autonomy in making a clinical decision and *expertise* in treating patients. Evidence-based medicine, as the name suggests is based on extensive research regarding what is the best way to treat a particular disease. This information can be easily stored in a CPOE for physicians’ use.

We speculate that the extent to which this information will be used is heavily dependent to the extent that physicians perceive they can maintain an “*independent thinking*” as mentioned



by a physician in a meeting the main researcher attended. One physician in the current sample already indicated his resistance to CPOE by mentioning:

*“This (data retrieval EMR) is the 1<sup>st</sup> step, if we accept this, the next step is that they are gonna ask us to enter information ourselves, if that’s going to come, we’ll delay it as much as possible –it may be inevitable but it is a big difference of it comes tomorrow or in 10 yrs from now” (Nephrologist1).*

Investigating the important role these professional beliefs play in EMR acceptance and use and EMR impacts on physicians’ time and expertise is certainly a topic that should be investigated more extensively in future research.

## **Individual Physicians’ Predisposition to Change and Attitudes**

This section presents the results of how physicians feel about change and how this predisposition influences their attitudes towards using EMR. According to the theoretical framework, especially institutional theories, individuals may exhibit two main predispositions towards change, instrumental or ceremonial.

Instrumental individuals are more open to change and welcome change based on instrumental reasons such as efficiency of a new technology or its perceived benefits.

Ceremonial individuals on the other hand, value more “the current way of doing things” and do not easily alter this belief to take advantage of a new technology or technique (Bush, 1986, 1987).

Physicians' predisposition to change could be assessed in fifteen of the thirty cases. In most cases, physicians seemed to have a rather instrumental orientation to change. With the exception of cardiologists and surgeons, all the other specialties were rather instrumental in their orientation to change.

In order to test whether physicians' predisposition to change is related to formation of attitudes towards EMR, pattern-matching techniques have been used (Miles & Huberman, 1994). Causal mapping techniques could not be used to determine whether a relationship exists between these two constructs as causal mapping is based on identifying explicit causal statements in the interview text. In general, physicians did not make such explicit causal statements linking their predisposition to change to attitudes (i.e. I do not like change; therefore I do not like EMR). This may be one limitation of causal mapping, especially when dealing with individual psychological factors, which can be addressed by using pattern-matching tables.

Table 19 shows a pattern matching table for physicians' predisposition to change and their attitudes. With three exceptions that will be discussed separately, there seems to be a correspondence between a physician's predisposition to change and his or her attitudes.

Twelve of the fifteen respondents had a correspondence between their predisposition and attitudes. For instance, if a physician had a more ceremonial predisposition to change (i.e. *"things are fine the way we do it now"* - *Cardiologist2*), he also had a negative attitude about EMR at Alpha.

Most cardiologists and surgeons interviewed for this study seemed to be rather ceremonial or more resistant to change than other specialties in their belief that EMR-based change is not necessary. *"I think it is a mistake ... the present system works fine the way it is"*

(*Cardiologist2*). This seems to be because strong professional work patterns and beliefs make that change look dangerous. As another cardiologist/surgeon mentioned that:

*“Surgeons are especially conservatives...because they know that with change comes death, if something doesn’t work then somebody is gonna die. We have a model “Perfect is the enemy of good” that’s the surgical model...If it’s good and it’s working, don’t mess with it!”* (*Cardiologist3*)

Furthermore, interviews revealed that cardiologists and surgeons are also very conservative in their predisposition when it comes to new treatments and techniques. They do not easily take advantage of innovative ways of doing things as they perceive the risk to be too high, especially if there is no major fault in the present way of treating a disease.

*“Surgeons may be interested more in innovative ways of doing things probably for the first time in 50 years, even though we are conservative; we tend to do it reluctantly”* (*Cardiologist3*).

Physicians in other specialties seem to be more instrumental or open to change provided they perceive some benefits from change. Physicians in five different specialties (*Pulmonary, Internal Medicine, Family Practice, Pediatrics, Oncology specialties*) pointed to the fact that they are ready to change in case a new system “*would work so much better*” and/or it “*would help make things easier.*” This finding seems to imply that a strategy to overcome potential resistance to change for these specialties may be as simple as emphasizing how the EMR would be more beneficial to physicians and how it will help them perform their daily work in a time efficient manner.

There are three interesting instances regarding the relationship between physicians' predisposition to change and their attitudes towards EMR that are worth mentioning.

The first case is that of a cardiologist (Cardiologist3) that despite the fact of being so much ceremonial in his beliefs about change in general and computer-related change, he exhibited quite positive attitudes and used EMR3. He also thought quite positively about Alpha's data retrieval EMR (EMR1 and EMR2). As previously mentioned, EMR3 is very beneficial over the old way of doing things, in that it provides physicians the advantage of being able to see X-rays right where the patient is (i.e. operating room or ICU). At the same time, the nature of work of a cardiologist that is based heavily on seeing patients' films seems to enforce more positive attitudes. This case illustrates how attitudes towards EMR are determined by a weighted sum of physicians' beliefs based on their relative strength. In this case, relative advantage of the EMR and high compatibility with this physician's work practices overcame his negative predisposition towards change with the end result of this physician forming positive attitudes towards EMR3 and using it.

A second case in Table 19 is that of a family practitioner who was quite instrumental in his thinking about change and EMR-based change. He recently acquired an EMR for his office and was actively involved with implementing it. At the same time, his attitudes towards Alpha's EMR were quite negative. These negative attitudes were primarily based on a high perceived relative disadvantage in using EMR at Alpha in terms of time inefficiencies and high accessibility barriers. Although the EMR seemed to be quite compatible with this physician's work who was more on the cognitive side of medicine, high relative disadvantage of EMR to this physician and high perceived accessibility barriers seemed to have overcome both compatibility of EMR with his practices and his favorable predisposition to change. This case seems to also

provide support for the interplay between individual beliefs and their relative strength in determining attitudes towards EMR.

The last case is that of a plastic surgeon that was very instrumental in his beliefs towards change. He was always trying new techniques for his specialty; he was actively involved with FDA for a brand new technology for liposuction and actively participated in a research team to have it approved. On the other hand, his beliefs about EMR in terms of its benefits are quite negative. He believed that computers bring more work to a physician. At the same time, his perceptions of MER compatibility with his work were quite low: *“the computer can’t tell you that personal evaluation made by a specialist...I don’t need it.”* Thus, instrumental beliefs towards change may be a necessary but not a sufficient condition in determining favorable attitudes towards EMR. The joint effect of negative beliefs about EMR and work compatibility overcame this instrumentality and created strong negative attitudes towards EMR.

In sum, the proposition relating individual predisposition to change and attitudes (P3) seems to be supported by this data. In most cases, a favorable predisposition to change was related to a favorable attitude towards EMR.

Specialty	System used	Predisposition to Change	Attitudes towards Alpha's EMR
Cardiologist1	EMR1	?	Somewhat Positive
Cardiologist2	EMR3	Ceremonial	Negative
Cardiologist3	EMR3	Ceremonial	Positive EMR3
Cardiologist4	EMR3, EMR1	Instrumental	Positive EMR3 Somewhat positive EMR1
General Surgeon1	No use	Ceremonial	Negative
General Surgeon2	EMR1	?	Somewhat Positive
General Surgeon3	No use	Ceremonial	Negative
General Surgeon4	EMR2	Instrumental	Somewhat Positive
General Surgeon5	EMR1, EMR3	Instrumental	Positive
Nephrologist1	No use	?	Somewhat Positive
Nephrologist2	EMR1, EMR2	?	Somewhat positive
Nephrologist3	EMR1	?	Positive
Pulmonary Specialist1	EMR3 EMR1, EMR2	Instrumental	Positive EMR3 Somewhat Negative
Pulmonary Specialist2	EMR3	Instrumental	Somewhat Positive EMR3
Family Practitioner1	EMR2	Instrumental	Mostly Negative
Neurologist	EMR1	?	Positive
Physical Therapist	EMR2	?	Somewhat positive
Pediatrics Surgeon	EMR2, EMR3	Instrumental	Somewhat positive EMR2 Positive EMR3
Oncologist	EMR1	Instrumental	Somewhat positive EMR1
Orthopedic Surgeon	EMR3, EMR1	?	Somewhat Positive
Plastic Surgeon	No use	Instrumental	Negative
Internist1	EMR1	?	Somewhat Negative
Internist2	EMR1, EMR2	?	Somewhat Positive
Internist3	EMR1, EMR2	?	Positive
Internist4	EMR1, EMR2	?	Somewhat Positive
Internist5	EMR2, EMR1	?	Somewhat positive
Internist6	EMR2, EMR3	?	Positive
Internist7	EMR1	?	Positive
Internist8	EMR2	Instrumental	Positive
GI	EMR1	Instrumental	Positive

**Table 19: Physicians' Predisposition to Change and their Attitudes towards EMR**

## **Social Influence and EMR Usage link**

Although the proposed theoretical framework included different sources of social influence such as important referent others (i.e. hospital administrators, other peer physicians in different forums) as an important determinant of physicians' usage of EMR, evidence from the case study did not support the existence of the proposed influence sources in the current hospital context.

Three different sources of data were used in determining whether social influences play a role in the current hospital environment. An initial set of interviews with physicians revealed no perceived source of influence that physicians could point to.

Direct observations by the main researcher in the hospital environment (i.e. physicians' lounge where physicians meet to have breakfast, lunch and informally talk about different issues) helped informed the idea that physicians do not talk much about computerized systems at Alpha in their daily encounters. Other departmental meetings the researcher attended, where discussions about current EMR systems at Alpha took place, have not established any manner physicians may be influenced towards using EMR systems at Alpha. At these meetings, it was rather physicians that were trying to influence the hospital administration regarding current problems with the EMR system that needed attentions.

A second round of interviews with other physicians at Alpha also did not seem to indicate physicians were aware of any particular influence sources with the present EMR system.

We believe, based on related observations in the hospital environment that this may be because physicians (at least in this context of a large hospital) seem to have very independent thinking; their opinions do not seem to be easily altered by influence sources. A conversation the main researcher observed between a physician and the Medical Informatics Officer at Alpha

showed physicians employ quite an “individualistic” thinking process based on their own experiences and beliefs about the EMR system rather than what they hear from other sources. In this discussion, influence was rather exerted from this physician towards the Medical Informatics Officer when he was pointing towards things that in his opinion needed to change such that physicians make more use of EMR.

Although this study did not find support for the proposition relating social influences to EMR usage (P4), it may be that the context (a large hospital) or the method (qualitative) may be responsible for such results. Future studies should explore this relationship further, perhaps with a survey method to uncover whether social influences do or do not impact physicians’ usage of EMR.

### **Attitudes, Perceived Behavioral Control and EMR Usage link**

This section explores the question of “what makes physicians use or not use EMR?” TPB posits that individual physicians’ attitudes towards an EMR system are a main determinant of physicians’ acceptance and usage of EMR. According to the same theory, perceived behavioral control is another factor that is said to influence EMR use directly.

### **Physicians’ Attitudes towards EMR and their Usage of EMR**

In an attempt to assess a causal relationship between physicians’ attitudes about EMR and their usage of EMR, we started off with a causal mapping approach in order to identify any respondent’s causal statements relating attitudes and usage.



The majority of physicians did not reveal such a linkage through their causal statements. This may be because attitudes imply an affective response which is difficult to express directly in causal statements. Often times, individuals do not directly think about their attitudes in order to link them with behaviors in statements such as “I like EMR, therefore I use it.” Attitudes seem to be rather implicit in overt statements and casual mapping methodology could not uncover such internal psychological reactions. This is the reason why pattern matching techniques (Miles & Huberman, 1994) have been used in order to determine whether there is a relationship between physicians’ attitudes and their EMR usage. Table 20 presents such a synopsis.

Specialty	System used	Attitudes towards Alpha's EMR	Physicians Usage of EMR
Cardiologist1	EMR1	Somewhat Positive	Minimal use
Cardiologist2	EMR3	Negative	EMR3 in certain areas Almost no use/ No Intention to use
Cardiologist3	EMR3	Positive EMR3 Somewhat positive EMR1,2	Moderate (EMR3) No Use EMR1, EMR2
Cardiologist4	EMR3, EMR1	Positive EMR3 Somewhat negative EMR1	EMR3 Minimal (EMR1 – because president of medical staff)
General Surgeon1	No use	Negative	No use
General Surgeon2	EMR1	Somewhat Positive	Moderate Use EMR1
General Surgeon3	No use	Negative	No use
General Surgeon4	EMR2	Somewhat Positive	Moderate Use
General Surgeon5	EMR1, EMR3	Positive	Use
Nephrologist1	No use	Somewhat Positive	No use
Nephrologist2	EMR1, EMR2	Somewhat positive	Moderate Use EMR1, MR2,
Nephrologist3	EMR1	Positive	Moderate EMR1 (depends on the complexity of the case)
Pulmonary Specialist1	EMR3 EMR1, EMR2	Positive EMR3 Somewhat Negative	Use EMR3 No use EMR1, EMR2
Pulmonary Specialist2	EMR3	Somewhat Positive EMR3	Moderate Use EMR3 (ICU)
Family Practitioner1	EMR2	Mostly Negative	Very minimal use (“I rarely log in”)
Neurologist	EMR1	Positive	Use EMR1
Physical Therapist	EMR2	Somewhat positive	Minimal (EMR1) - Patient list
Pediatrics Surgeon	EMR2, EMR3	Somewhat positive EMR2 Positive EMR3	Moderate (EMR2) EMR3
Oncologist	EMR1	Somewhat positive EMR1	Moderate EMR1 (if info not in the chart)
Orthopedic Surgeon	EMR3, EMR1	Somewhat Positive	Moderate Use
Plastic Surgeon	No use	Negative	EMR1 (almost no use)
Internist1	EMR1	Somewhat Negative	Limited (EMR1)
Internist2	EMR1, EMR2	Somewhat Positive	Moderate use
Internist3	EMR1, EMR2	Positive	Use EMR1, EMR2
Internist4	EMR1, EMR2	Somewhat Positive	Moderate Use EMR2
Internist5	EMR2, EMR1	Somewhat positive	Moderate Use EMR2, EMR1
Internist6	EMR2, EMR3	Positive	Use (if info not in paper chart)
Internist7	EMR1	Positive	Use (if info not in paper chart)
Internist8	EMR2	Positive	Use (if info not in paper chart)
GI	EMR1	Positive	Limited EMR1

**Table 20: Physicians’ Attitudes and their Usage of EMR**

Table 20 shows a direct relationship between attitudes and EMR usage in twenty seven out of the thirty cases. A pure negative attitude about EMR at Alpha leads to physicians not using EMR. Positive attitudes about Alpha's EMR lead to physicians' using EMR and somewhat positive attitudes about EMR lead to physicians using the system moderately.

There are few cases in this data set that are worth exploring a little further. One cardiologist had very strong negative attitudes about Alpha's EMR systems. He explicitly expressed his complete opposition to using computers by saying "*I think they're a waste of money... I think they're stupid*" (Cardiologist2). Despite these strong negative attitudes, this physician used EMR3 to look at patients' X-rays. This result seems to imply that this physician's EMR usage is based primarily on the high benefit (relative advantage) of EMR3 and ease of access to EMR3 (i.e. in ICU areas where no log into EMR is required). Easy access to patient's X-rays and the ability to view real time X-rays at the patient's location rather than at different department are strong benefits of EMR3 which seem to determine physicians to use EMR even in the presence of strong negative attitudes about EMR.

Another cardiologist had somewhat positive attitudes about Alpha's EMR1 and EMR2, although he did not personally use any of these systems. This rather positive attitude was based on a belief that Alpha's data retrieval EMR were beneficial to his staff (nurse practitioner and physician assistant) that he worked with. This physician could get these EMR benefits indirectly, through his staff who presented him with the latest clinical labs and other reports. The following quote shows such a sequence of positive attitudes and non-use of EMR.

*“The computer system helps [Positive Attitudes]. I can get the results faster from the computer through my staff...I do not use the computer as much to access labs and other things [Non-Use]” (Cardiologist3)*

Another case is that of a nephrologist, who had positive attitudes about EMR in general, however he did not use EMR at Alpha. His non usage of EMR at Alpha was primarily based on a combination of a lack of perceived personal benefits from using EMR and high accessibility barriers to EMR. These positive attitudes about EMR could not compensate for such high costs with the end result of this physician being a non-user of EMR.

*“I like the idea of EMR [Attitudes] systems yet I don’t use it [Non-Use]” (Nephrologist2)*

The next case is that of a plastic surgeon who held strong negative attitudes about Alpha’s EMR based on a lack of perceived personal need for EMR and also accessibility barriers. Although he was primarily a non-user of EMR, he did use one of the features of EMR1, that of email. Email is perceived as being highly beneficial over writing a letter.

*“I do email because it’s instant and I don’t mind doing that - but if I had to do that all day long with patient records I’d kill myself...” (Plastic Surgeon)*

This case points to the fact that EMR is used to the extent that there are certain benefits it provides physicians over the alternate ways of doing things (i.e. paper chart).

The last case is that of a GI doctor who is heavily involved with EMR-related committees and design at Alpha. He has very strong positive attitudes about EMR and is a promoter of EMR at Alpha. He also believes that EMR systems hold a lot of promise and opportunities to improve care beyond what the current EMR systems at Alpha are capable of doing. This physician is also

directly involved with design and testing of a new EMR at Alpha and CPOE. If we look at the relationship between his attitudes and usage of EMR, it is rather weak. His usage of current EMR systems is limited at Alpha because of high involvement in committee work and the fact that he practices part time at the hospital. Although his high involvement with EMR led to positive EMR attitudes, his usage of EMR does not seem to be based primarily on such high positive attitudes.

In sum, with some exceptions discussed above, the proposition relating physicians' attitudes and EMR usage seems to be supported by the case study data.

### **Physicians' Perceptions of Behavioral Control and EMR Usage**

Perceived behavioral control in TPB is a general construct that refers to the presence of factors that can interfere with or facilitate the performance of a specific behavior such as using an EMR (Fishbein & Azjen, 1975).

Availability of hardware resources and physicians' perceptions of the available support regarding their EMR usage are part of the perceived behavioral control construct (Taylor & Todd, 1991). This construct is posited to directly impact physicians' usage of EMR (Fishbein & Azjen, 1975).

In this study, we started off with Taylor & Todd's (1991) general categories regarding hardware issues and support in using EMR. Because Taylor & Todd's study was performed in a different setting (a university), we seek to identify what are the major underlying dimensions regarding physicians' perceptions of "behavioral control" in this particular healthcare environment.

It is often the case in IS literature that hardware considerations are "taken for granted." Most organizations would provide their employees with an office and computers to use. In a

hospital environment, physicians do not have a physical office and computers are spread out on the hospital's floors. There are no dedicated computers for physicians to use; all other medical staff such as floor nurses and secretaries, use the same computers stations on the floors. This is the reason why availability of physical hardware emerged as a major determinant of physicians' usage of EMR in this hospital environment.

Following the general theoretical framework, hardware barriers (or implementation climate) impede physicians' usage of EMR. Based on the general causal map, thirteen direct connections have been identified between perceptions of the availability of hardware and EMR usage. Although not all physicians have directly related hardware considerations with their usage of EMR, almost all thirty physicians in this sample have identified problems with hardware at Alpha (Table 13, Table 14).

Table 14 (in Chapter 5) summarized the main hardware barriers that physicians identified as impeding their use of EMR at Alpha. Availability of physical computers is a major barrier as it was mentioned eighteen different times across interviews by physicians in all thirteen specialties. Computers that are already in use by nurses and other parties on Alpha's floors when a physician is trying to access a computer and other situational characteristics such as physical proximity of the computer stations, space considerations around the station or the time required to find a computer are other major dimensions of the difficulties involved with using EMR at Alpha. Other hardware characteristics such as speed and age of the computers and the type of the devices available to physicians' use are other dimensions underlying the perceived behavioral control construct.

These barriers become even more important as physicians are very concerned with their individual work efficiency. Taking the time to find a computer, find out that the computer is not

working or often times not being able to find a computer on Alpha's floors are major considerations in these physicians' usage of EMR.

Interestingly, the other dimension of behavioral control identified by Taylor & Todd (1995) that is, the support available to physicians in using EMR did not show much significance in this sample. Most physicians agreed that they "*do not have time to look for support*" beyond the initial orientation to the system physicians receive on a one to one training basis.

Although Alpha provides physician support, through physicians advocates that work closely to physicians, physicians interviewed for this study did not feel they needed additional support while working with EMR in the hospital. This may be again, because physicians do not feel they need to spend time to look for support. If a situation occurs that requires them to get support, physicians simply go to a nurse or secretary and ask for the clinical results.

In sum, the proposition relating behavioral control and EMR usage is supported, however only one dimension of behavioral control (i.e. hardware barriers) seem to impact physicians' usage of EMR. P5 is revised as follows:

*P5: Physicians' perceptions of hardware barriers in the usage of EMR influence their EMR usage.*

### **Accessibility and Physicians' Usage of EMR**

An emergent construct from this case is "accessibility." Unlike, perceptions of behavioral control which refer to hardware issues such as the physical computers available on the floors, accessibility refers to issues related to physicians' logging-in the EMR system from the hospital or remotely. Multiple difficulties in accessing the EMR software such as multiple log-

ins per patient or per floor and multiple insertions of passwords comprise the accessibility construct.

This construct seems to be even more important than perceptions of behavioral control (hardware issues) in influencing physicians' usage of EMR. Twenty four direct causal links from accessibility to EMR use have been identified across individual physicians' causal maps, which seems to indicate the importance of this construct in influencing physicians' usage of EMR.

There are three main themes that underlie the accessibility construct. The most important consideration physicians pointed out to regarding access is the "number of log-ins." This theme comprises the individual log-ins physicians have to perform for each of the three Alpha's EMR, the multiple number of log-ins per floors and the multiple number of log-ins per patient in order to access clinical results. This theme has been mentioned twenty-five times across interviews by twelve different specialties (Table 16).

Equally important is the complexity and speed of logging-in which was mentioned nineteen times across twelve different physician specialties and remote access problems which was mentioned eighteen times by eight different specialties according to physicians' causal maps (Table 16). Complexity of logging-in is also an important consideration in directly influencing physicians' perceptions of the relative disadvantage of EMR, as previously mentioned in a separate section. The examples below show how accessibility barriers influence physicians' non-use of EMR at Alpha.

*"I don't look at clinical information in the computer [Non-use], again because of those access issues [Accessibility]. For me to log into the computer - if the computer is right here - takes me a minute and a half. If I have 40 patients multiplied by 1.5 minutes, you*



*got at least one hour for that every day...the computer is not there always, the computer doesn't work all the times, so it's an average of 2 to 3 minutes. If I have 40 patients, then it's 2 to 3 hours —it is unacceptable for us to do that!” (Pulmonary Specialist1)*

*“In the hospital I use more the paper chart at this point [Non-Use of EMR]. I rarely log in the computer. I usually ask somebody to get things for me. I go to the room , see the patient, they'll get the info for me, you don't have enough time to keep doing all that [log in the computer], you go to another floor and need to log in somewhere else [Access]” (Family Practitioner1)*

The example of EMR3 that is being used by all physicians much more than the other data retrieval EMR helps reinforce the argument of the importance of the accessibility construct in determining EMR use. EMR3 is used in areas such as ICU and operating rooms where no access barriers exist. Computers are available and “on” at all times and physicians can easily access patients' X-rays without having to enter a log-in and a password every time they need to see an X-ray.

*“I am using that computer system (EMR3) in the viewing areas. The unit has them up and running [Access]. I punch in a person's name and see the X-ray [Use]” (Cardiologist2)*

*“The EMR3 system here I access through work stations in different areas (ICU) these systems are online all the times [Access]. The system has a list of patients and their names and X-rays. I can see the X-rays on 10 patients in 7-8 minutes [Use]” (Cardiologist3)*

*“I use EMR3 in the ICU [Use]. ICU is more efficient because they have dedicated areas where films are available in EMR3...it’s already logged in [Access]” (Pulmonary Specialist2)*

Based on the above discussion, we can conclude that once accessibility barriers are removed, it seems that EMR usage increases.

Another component of accessibility of EMR is remote access. Remote access for EMR is an important benefit physicians recognized over the paper chart. Paper charts stay in the hospital, such that if a physician gets a call at home about a patient, he or she would have to go to the hospital to check on a patient. Remote access of EMR often times minimizes the need that a physician comes in the hospital to look at a test.

Remote access is also important for physicians’ offices. If a physician gets a patient that has already been in the hospital, accessing Alpha’s EMR to check on that patient’s results remotely is highly beneficial. However, remote access is not easy. As we mentioned in a previous chapter, accessing EMR remotely requires a token and setting-up the office or home computer to deal with the hospital’s firewall. Eighteen physicians identified the complexity of remote access and its impact on EMR use (Table 16).

*“I don’t use EMR [Non-use] because they told me I can use it only if I carry a token that will generate pass-codes [Access]” (Nephrologist2)*

*“I don’t want to go through a cookie and all this other garbage [Access] just to get access to my patient information. I want to go to a chart and pick it up and find what I need [Non-use of EMR]” (Plastic Surgeon)*

In sum, EMR usage seems to be heavily influenced by physicians' perceptions of being able to easily access EMR. Although this construct is not present in important theories of acceptance and usage of IS, we found "accessibility" to be very important construct in impacting physicians' usage of EMR in a large hospital context. Thus, we propose:

*P6a: The higher the perceived accessibility barriers in using EMR, the less EMR will be used.*

Although rather exploratory in nature, the following proposition reflects another finding of this case study, regarding the importance of accessibility barriers in influencing physicians' usage of EMR over hardware barriers (perceived implementation climate).

*P6b: Accessibility barriers carry a heavier weight than hardware barriers in influencing physicians' usage of EMR.*

Twenty four causal links have been uncovered based on the aggregated causal model between accessibility barriers and EMR use, versus thirteen links between hardware barriers and EMR usage. It seems thus that accessibility barriers may be more important than hardware barriers in impacting physicians' usage or non-usage of EMR. Future research should further explore this proposition.

In conclusion, accessibility barriers seem to be as important as attitudes in determining physicians' usage of EMR. The direct implication here is that reducing these barriers will favor physicians' usage of EMR (as shown with the example of EMR3 that is used in areas that do not require physicians to log in). An integrated EMR system that does not require physicians to log-in for each module, increasing system's log-out time are all measures that can be taken in order positively impact physicians' usage of EMR.

## Differential Usage Behaviors

Initial theorization of differential EMR usage behaviors included the interplay between three elements that affected usage, namely perceived behavioral control (or implementation climate), attitudes and social influence. We proposed that different combinations of these factors may lead to different types of usage (P6).

Although there seems to be quite a continuum of EMR usage at Alpha (see Table 17), interview data did not entirely support the initial theorization of such continuum. This is primarily because social influences were not identified in this sample and the implementation climate (hardware issues and accessibility barriers) was overall weak with the exception of a favorable climate for EMR3 (in certain areas of the hospital such as ICU and operating rooms). Almost all physicians in this sample pointed to either hardware considerations and/or accessibility problems at Alpha which make the point for a rather weak implementation climate.

If we look at the case of EMR3, that had low accessibility and hardware barriers (thus a favorable overall implementation climate in certain areas at Alpha), most physicians felt quite positively about the system as it provided them with significant advantages over the old way of accessing X-rays. Thus, the usage of EMR3 was more committed. Although no social influences could be uncovered in the case of EMR3, there seems to be support for the claim that a high favorable climate combined with a high level of physician internalization of EMR leads to more faithful and continuous usage.

On the other hand, a rather weak implementation climate for both EMR1 and EMR2 and also physicians' negative attitudes about these systems, led to their non-usage of EMR (the case

of Cardiologist<sup>2</sup>, General Surgeon<sup>1</sup>, General Surgeon<sup>3</sup>, Pulmonary Specialist<sup>1</sup>, Family Practitioner<sup>1</sup>, Plastic Surgeon and Internist<sup>1</sup>).

Furthermore, the same weak implementation climate and physicians' rather positive attitudes about Alpha's EMR led to physicians using EMR moderately.

The original proposition 6 in the theoretical framework can be revised to reflect these findings in the absence of social influence:

*P7a: A high level of implementation climate together with positive physicians' attitudes towards EMR will lead to more EMR "committed" usage.*

*P7b: A weak level of implementation climate together with positive physicians' attitudes towards EMR will lead to "shallow" usage of EMR.*

*P7c: A weak level of implementation climate together with negative physicians' attitudes towards EMR will lead to non usage of EMR.*

Differential usage of EMR is also evident from the systems that are used by physicians and also the features that are used. Most physicians (Fifteen out of thirty physicians) primarily used one system. The majority of physicians used EMR1 (eleven), six physicians used EMR2 and five physicians used exclusively EMR3. Nine physicians used different combinations of systems in order to get more complete clinical results. Six physicians in this sample did not use any EMR system at Alpha. These statistics also seem to make a case for different levels of EMR usage behaviors ranging from non-use to shallow use (one system only) towards more deeper use (combinations of two or three systems to get more complete clinical information). Table 21 shows such an EMR usage continuum among physicians at Alpha.

Physicians that do not use EMR seem to have low perceptions of relative advantage of EMR, low compatibility of EMR with their clinical work and are quite resistant to EMR-based change. In these cases, physicians' attitudes are primarily negative and they are based on a

cumulative set of negative beliefs about EMR. Such strong negative beliefs and attitudes regarding EMR seem to play a very strong role in determining these physicians not to use EMR.

Data from this sample revealed that certain specialties such as cardiologists and surgeons did not use data-retrieval EMR or used it minimally. Organization of their work and a strong perceived lack of compatibility of the system with their work (*"I don't need it"*) are primary considerations why these specialties seem to be more reluctant than others in using EMR. Furthermore, availability of specialized personnel (i.e. NPs and PAs) that is paid to do data retrieval and a strong belief that *"computers create more work for physicians"* contributes to this group's minimal usage of EMR. This point is enforced by direct observations and discussions with other surgeons in a general surgery meeting where the majority of physicians had negative attitudes about EMR and did not use EMR. At the same time, as previously noted, most surgeons at the same meeting were not even aware of the capabilities of the EMR systems at Alpha. Some cardiologists and surgeons however, tended to use EMR3 because of a high compatibility of EMR3 with their work, a high benefit of the system over accessing X-rays at the radiology department and low access barriers for this system (in ICU areas and/or operating rooms). This finding will be further on in this section.

Physicians in other more clinically-oriented specialties such as internists seemed to be more engaged with and make more use of data-retrieval EMR systems at Alpha. Most of these physicians had high perceptions of compatibility of EMR with their specialty (*"I'm an internist, I have to know what's going on with a patient"*) and also strong beliefs EMR are beneficial and easy to use. At the same time, internists were much more instrumental in their predisposition to EMR. These beliefs contributed to these physicians having more positive attitudes about EMR and tended to use more than one EMR system to view clinical information.

Although the clinicians' group identified problems in the accessibility to EMR and other hardware-related barriers, casual mapping showed that these barriers were not as strongly linked to their use of EMR. Furthermore, fewer internists pointed to accessibility barriers at Alpha as compared to other physicians. Although they recognized such problems existed, internists did not find it to be a major barrier in their computer use as compared to physicians in other specialties. A high perceived need for EMR to internists' clinical work combined with strong perceptions of relative advantage of EMR of making clinical data available to them seem to be more important considerations for this group.

In general, most EMR usage at Alpha is rather "shallow" and oriented towards the use of primarily one EMR; even in this case, it is often the case that EMR is used only if the clinical information is not already in the paper chart in some form. Lack of a "need" to access EMR combined with a belief that EMR are more difficult to access than the paper chart are reasons why data-retrieval EMR1 and EMR2 are not being used instead of the paper chart. At the same time, hardware and accessibility barriers discourage many physicians from accessing the computer personally to get clinical results. Availability of workarounds for certain specialties (nurse practitioners and physician assistants) also contribute to some physicians' minimal usage of EMR. Other reasons why physicians do not use EMR or use it minimally may differ by specialty but overall a lack of perceived personal benefits or a relative disadvantage to physicians in using EMR over the paper chart was a common theme across interviews.

Evidence from the case suggests a much deeper level of usage for the EMR3 system even among very traditional specialties such as cardiologists and surgeons. Unlike data-retrieval EMR, EMR3 is used to replace rather than supplement the old way of looking at films. EMR3 seems to be used by almost all cardiologists and surgeons in this sample because of its ease of

use and also its benefits over the “old way” of looking at films in the Radiology department. However, EMR3 is used primarily in areas where there are no accessibility and hardware barriers. The following quote below illustrates how the same system (EMR3) is not being used at a different hospital (Beta) by the same cardiologist that uses this system at Alpha. Although Beta also has EMR3 available for physicians’ use, differences in implementation climate and access to EMR make this system not being used at Beta. At the same time, difficulties in navigation through the system at Beta, contribute to physicians’ not using EMR3 at Beta.

*“At another hospital [Beta] I cannot look at the patients’ X-rays so easily and quickly [as at Alpha in ICU]. I have to go into the system, put in my name and password to log in.*

*[Accessibility barriers]. Once I get the 1<sup>st</sup> screen the system has to be activated because it may be on hibernate; then I have to hit the EMR3 portal button which takes you into the radiology system. Once I get into that system, I have to look at each person I want to see (their name) one by one. I put a name, look at it. I put another name, look at it*

*[Navigation]. As a result, we don’t look at x rays at those hospitals [Non-Use of EMR3] which may result in malpractice. The physicians cannot easily get access to the X-rays anymore, as a result the physicians do not look at X-rays [Non-use of EMR3] ...they wait for the report to come which makes the patient stay in the hospital longer”*

*(Cardiologist3)*

This example illustrates how different implementation strategies of the same EMR system can make a difference in physicians’ acceptance and usage of the system. EMR3 at Alpha is implemented in certain areas of the hospital such that it does not require physicians to sign-on the EMR system. EMR3 is always up and running on certain dedicated computers with large



monitors that allow physicians to see multiple patients' X-rays in a short period of time. Furthermore, EMR3 in these areas is very simple to use. It primarily contains a list of patients' names and X-rays such that physicians can easily find the result they are looking for. On the other hand, accessing EMR3 at Beta and navigating through the system to find an x-ray is seen as difficult. These barriers make physicians not use EMR3 at Beta.

Similar evidence regarding these barriers is also evident from the contrasting the cases of EMR1 and EMR2 versus EMR3 at Alpha. The data-retrieval systems cannot be easily accessed in dedicated area as EMR3 is. Accessibility barriers contribute to emphasizing time-related disadvantages to physicians and at the same time diminishing the perceptions of the real advantages of EMR versus the paper-chart.

Ease of access EMR3:

*“The EMR3 system here I access through work stations in different areas (ICU). These systems are online all the times” (Cardiologist3) [Ease of Access]*

*“ICU is more efficient [Relative Advantage EMR3] because they have dedicated areas where films are available in EMR3. Also, you have a larger monitor, you have higher quality, you can manipulate the image better” (Pulmonary Specialist2) [Hardware quality]*

Difficulties in access EMR1 & EMR2:

*“The time it takes to sign in the system, get the information, you wasted 4-5 minutes [Relative Disadvantage EMR1 & EMR2]. You add that time patient after patient... I've gotta have quicker access than that” (Family Practitioner1) [Access]*

*It's the efficiency of rounding [**Relative Disadvantage EMR1&EMR2**]...I go to a patient's room and open up a chart, then I have to drop the chart, go find a computer, that computer is not working, you got to walk around the nursing station, find one, then go back to the patient's room (Pulmonary Specialist1) [**Accessibility & Hardware barriers EMR1&EMR2**].*

Furthermore, EMR3 is easier to navigate through than EMR1&EMR2 and more advantageous. The following quotes contrast EMR3 and EMR1&EMR2 at Alpha in terms of their ease of use and relative advantage.

Ease of navigation and advantages of EMR3:

*"I punch in a person's name and see the x-ray" [**Ease of Navigation**] (Cardiologist2)*

*"The system has a list of patients and their names and X-rays [**Ease of Navigation**]. I can see X-rays on 10 patients in 7-8 minutes" [**Relative Advantage EMR3**] (Cardiologist3)*

*"I have quick access to X-rays when I am looking at a film otherwise I would have to leave where I am, go to the x-ray dept, find the X-rays, wait for them to be pulled, I don't have to do that anymore" [**Relative Advantage of EMR3**] (Pulmonary Specialist2).*

*"For me, being able to look at the EMR3 system is very beneficial because it saves me time to go downstairs to the radiology department and look at X-rays there" [**Relative Advantage of EMR3**] (Pulmonary Specialist1)*

Difficulties in navigation EMR1&EMR2 and their relative disadvantage:

*“I can’t just click on lab data and see it. I have to click here then I have to click there”*  
(Oncologist)

*“You have to go 7-10 screens in order to get a report”* (Nephrologist2)

*“For me to log into the computer, if the computer is right here, takes me a minute and a half. [Accessibility Disadvantages] If I have 40 patients multiplied by 1.5 minutes, you got at least one hour for that every day. The computer is not there always, the computer doesn’t work all the times, so it’s an average of 2 to 3 minutes. If I have 40 patients, then it’s 2 to 3 hours [Relative Disadvantage]...it is unacceptable for us to do that!”*

*[Negative Attitudes]* (Pulmonary Specialist1)

These different beliefs about the EMR systems at Alpha lead to formation of a different set of attitudes about Alpha’s different EMR systems with the result of EMR3 being used more faithfully and EMR1&EMR2 used moderately or minimally. EMR1 & EMR2 are used to primarily to supplement the paper chart rather than replace it (as the case of EMR3).

Physicians’ attitudes and usage of EMR3:

*“The EMR3 system is a tremendous advance [Attitudes EMR3]. In the past when you requested 10 X-rays after about 2 hours you had 4 old films on patients...now everything is there...that’s is absolutely spectacular” [Attitudes EMR3]* (Pediatrics Surgeon)

*“I am using EMR3 in the ICU viewing areas”* (Cardiologist2).

Physicians’ attitudes and usage of EMR1&EMR2:

*“They’ve got something pathetic [Attitudes] and they want us to use it!”* (Pulmonary

*Specialist1)*

*“I don’t look at other clinical information in the computer [Non-use EMR1 & EMR2].*

*(Pulmonary Specialist1)...In the hospital I use more the paper chart at this point” [Non-Use of EMR] (Family Practitioner1)*

Results from the case study show that in order to promote a “deeper” level of EMR usage, the benefits of EMR need to be emphasized to physicians while any potential costs or barriers reduced and/or eliminated. At the same time, other system’s usability barriers such as difficulties in navigation and search for clinical results in the EMR should be carefully considered such that EMR systems are perceived as time efficient and simple to use.

*‘The only way a computer is going to help me practice is if it is easily accessible and I won’t have to wait” (Pulmonary Specialist1)*

*“The system has to be very fast and easy otherwise physicians will not take the time to use it...” (Cardiologist3)*

*“You have to offer me a very good deal that obviously has a lot of advantages for me to accept it!” (Nephrologist1)*

Table 21 presents a summary of the usage levels of EMR at Alpha and physicians’ beliefs and attitudes towards EMR based on pattern matching techniques (Miles & Huberman, 1994).

**Table 21: Physician User-Groups and their Beliefs and Attitudes regarding EMR**

Specialty	System used	EMR is EOU (overall)	EMR is beneficial (RA)	CT with nature of work	Predisposition to Change	Availability of Computers is a Problem	Access is a problem	Attitudes towards Alpha's EMR	Physicians Usage of EMR
<b>PHYSICIAN NON-USER GROUP</b>									
Cardiologist2	No Use	No in general	No	No	Ceremonial	Non-user	Yes	Negative	No use
General Surgeon1	No use	No	No	No	Ceremonial	Non-user	Yes	Negative	No use
General Surgeon3	No use	No	No	No	Ceremonial	Non-user	?	Negative	No use
Nephrologist1	No use	No	No	No	Ceremonial	Non-user	Yes	Somewhat Positive	No use
Internist1	EMR1	No	No	No	Ceremonial	Yes	Yes	Somewhat Negative	No use EMR1
Plastic Surgeon	No use	No	No	No	Instrumental	Yes	Yes	Negative	EMR1 (almost no use)
<b>PHYSICIAN USERS OF ONE SYSTEM</b>									
Cardiologist1	EMR1	Yes	No	?	?	Yes	Yes	Somewhat Positive	Minimal use
Cardiologist3	EMR3	Yes (areas)	Yes	Yes	Ceremonial	Yes	Yes	Positive EMR3	EMR3
General Surgeon2	EMR1	No	Yes	?	?	Yes	Yes	Somewhat Positive	Moderate Use EMR1
General Surgeon4	EMR2	Yes	Yes	?	Instrumental	No	Yes	Somewhat Positive	Moderate Use
Orthopedic Surgeon	EMR3	No	Yes	?	?	Yes	Yes	Somewhat Positive	Use EMR3
Nephrologist3	EMR1	No	Yes	?	Instrumental	Yes	Yes	Positive	Moderate EMR1
Pulmonary Specialist1	EMR3	No on the floors	Yes	Yes	Instrumental	Yes	Yes	Positive EMR3	Use EMR3 (mostly in ICU)
Pulmonary Specialist2	EMR3	Yes	Yes	?	Instrumental	Yes	Yes	Somewhat Positive EMR3	EMR3 (mostly in ICU)
Family Practitioner1	EMR2	No	No	Yes (but other barriers too high)	Instrumental	Yes	Yes	Mostly Negative	Very minimal use ("I rarely log in")
Physical Therapist	EMR2	No	No	?	?	Yes	Yes	Somewhat positive	Minimal (EMR1) Patient list
Neurologist	EMR1	Yes	Yes	Yes	?	Yes	Yes	Positive	Use EMR1
Oncologist	EMR1	No	Yes	?	Instrumental	Yes	Yes	Somewhat positive EMR1	Moderate EMR1 (if info not in the chart)

Specialty	System used	EMR is EOU (overall)	EMR is beneficial (RA)	CT with nature of work	Predisposition to Change	Availability of Computers is a Problem	Access is a problem	Attitudes towards Alpha's EMR	Physicians Usage of EMR
Internist7	EMR1	Yes	Yes	?	Instrumental	Yes	Yes	Positive	Use EMR1 (if info not in paper chart)
Internist8	EMR2	Yes	Yes	Yes	Instrumental	Yes	?	Positive	Use EMR2 (if info not in paper chart)
GI	EMR1	Yes	Yes	?	Instrumental	Yes	Yes	Positive	Limited EMR1
<b>PHYSICIAN USERS OF MORE THAN ONE SYSTEM</b>									
General Surgeon5	EMR1, EMR3	Yes	Yes	?	Instrumental	No	Yes	Positive	Use
Nephrologist2	EMR1, EMR2	No	Yes	Yes	Instrumental	Yes	Yes	Somewhat positive	Moderate Use EMR1, EMR2,
Cardiologist4	EMR3,	Yes (EMR3)	Yes (EMR3)	Yes (EMR3)	Instrumental	Yes	Yes	Positive EMR3	EMR3  Minimal (EMR1 – because president of medical staff)
	EMR1	No (EMR1)	No (EMR1)	No				Somewhat positive EMR1	
Pediatrics Surgeon	EMR2, EMR3	Yes	Yes Yes	Yes	Instrumental	Yes	Yes	Somewhat positive EMR2 Positive EMR3	Moderate (EMR2) EMR3
Internist2	EMR1, EMR2	Yes	Yes	?	?	Yes	Yes	Somewhat Positive	Moderate use
Internist3	EMR1, EMR2	Yes	Yes	?	?	Yes	?	Positive	Use EMR1, EMR2
Internist4	EMR1, EMR2	Yes	Yes	?	?	Yes	Yes	Somewhat Positive	Moderate Use EMR2
Internist5	EMR2, EMR1 (remotely)	Yes	Yes	Yes	?	Yes	Yes	Somewhat positive	Moderate Use EMR2, EMR1 (remotely)
Internist6	EMR2, EMR3	Yes	Yes	?	?	Yes	?	Positive	Use EMR2, EMR3 (if info not in paper chart)

## Conclusions

This study employed a TPB-based theoretical framework to study physicians' acceptance of EMR in a large hospital setting. We used a case study methodology (Yin, 1994) to uncover physicians' attitudes and their usage of EMR at a large hospital, Alpha.

Results from the case study showed that physicians' attitudes about using EMR are influenced by their beliefs about the EMR artifact (perceived complexity and perceived relative advantage of EMR), beliefs about their specialty or compatibility of EMR with the nature of their work and their individual predisposition to change.

Physicians' usage of EMR is in turn influenced by their attitudes towards EMR, a favorable implementation climate (or availability of hardware) and ease of access to EMR. Relative advantage of EMR or its perceived benefits is a major factor influencing physicians' usage or non usage of EMR. Clinical data availability in the EMR and timely information are major dimensions that underlie perceptions of the relative advantage of data-retrieval EMR over the paper chart. EMR3 is unanimously perceived to be advantageous over the "old way of doing things" as it provides physicians time savings versus accessing X-rays at a centralized location. Accessibility to the EMR software and other hardware barriers tend to diminish physicians' perceptions of the relative advantage of EMR and perceptions of its ease of use.

We showed how physicians' attitudes and usage behaviors vary according to the EMR system at Alpha. System usability such as difficulties in navigation and access to EMR contribute to formation of a differential set of attitudes and usage behaviors for two different EMR systems at Alpha. Furthermore, we showed how differences in the implementation climate

at two different hospitals (Alpha and Beta) for the same system (EMR3) can make a difference between use and non-use of the same system.

Four out of six initial propositions were fully supported by the data in this case. Proposition 4 regarding the effects of social influence on EMR usage was not supported and proposition 6 regarding differential levels of EMR usage was supported partially. Different levels of EMR usage have been observed from the data set, although these results did not fully follow the initial proposed framework because of absence of observed social influences. Proposition 6 has been revised to reflect the findings from this case study.

We showed that combinations of different levels of implementation climate and attitudes lead to differential usage behaviors even in the absence of social influence. We also showed an EMR usage continuum based on the extent to which Alpha's three systems were used. Recall that in order for a physician to get complete clinical information about a patient, he or she needs to access more than one EMR.

Most physicians used primarily one system which makes the case for a rather "shallow" EMR use at Alpha. Data-retrieval EMR systems at Alpha are used "moderately" or "minimally." Physicians used these systems only to *supplement* the paper chart.

On the other hand, as discussed in Chapter 6, physicians' use of EMR3 is more committed. EMR3 is used to *replace* the "old way" of accessing X-rays. Even with using one EMR, most physicians use it moderately. The availability of a "competing artifact," (i.e. the paper chart) that is much easier to use and located near the patient's room limited the extent to which physicians used EMR at Alpha.

Other relationships have emerged from the data set. We found that accessibility to EMR is a major factor influencing physicians' usage of EMR. Accessibility to EMR includes the



number of log-ins per patient, per floor or per system, complexity and speed of log-in and remote access problems. These factors are immediate barriers for physicians not using EMR or using EMR minimally. We also better explored the construct of “perceived behavioral control” or “implementation climate” and its role in impacting EMR usage. Availability of computers, the type of devices, physical positioning of the computers and other situational characteristics are major components of this construct. These hardware considerations can become an important barrier to physicians’ use of EMR.

Other emergent relationships referred to the impact accessibility and hardware barriers can have on physicians’ beliefs about EMR. These barriers have been shown not only to influence physicians’ use of EMR but also their perceptions of the ease of use of EMR and its relative advantage. The more difficult the access to EMR is, the more physicians seem to view EMR as difficult to use and disadvantageous (i.e. time inefficient). At the same time, lack of easily available computers can contribute in increasing the time a physician spends to get into the EMR software.

On the other hand, we uncovered what are the underlying dimensions that make an EMR system look “complex” to a physician. System usability characteristics such as system interface, navigation issues (i.e. the number of clicks to get to a desired page), EMR “search” functionality and “speed” are major contributors to the perceived friendliness of the system. Physicians agreed that Alpha’s data-retrieval EMR have navigation and search or sorting problems which in turn made physicians believe EMR was not as easy to use. These dimensions of the EMR artifact seem to be especially important in a hospital environment where physicians do not have the time to deal with a system that *“deals with a lot of steps in accessing the information”*

(*Cardiologist3*). These EMR usability factors should thus be taken into account in any EMR design decisions. Table 21 summarizes the case study results.

**Table 22: Results**

	<b>Proposition</b>	<b>Supported?</b>
P1	Attitudes → EMR Usage	Supported
P2	Beliefs about EMR → Attitudes about EMR	Supported
P3	Compatibility of EMR with the profession → Attitudes about EMR	Supported
P4	Individual Predisposition to Change → Attitudes about EMR	Supported
P5	Social Influence → EMR Usage	Not Supported
P6	Implementation climate (hardware barriers) → EMR Usage	Supported & emergent
P7	Types of EMR Usage	Partially Supported & Emergent
P8	Accessibility to EMR → EMR Usage	Supported (Emergent)
P9	Accessibility to EMR → EOU	Supported (Emergent)
P10	Accessibility to EMR → Relative Advantage of EMR	Supported (Emergent)
P11	Implementation climate (hardware barriers) → EOU	Supported (Emergent)
P12	Implementation climate (hardware barriers) → Relative Advantage of EMR	Supported (Emergent)
P13	EMR Compatibility → EMR Usage	Supported (Emergent)

## **Contributions and Implications**

This research has significant contributions both theoretical and practical. Among theoretical contributions, we integrate various theories such as theory of planned behavior, institutional economics, diffusion theories and psychological theories in order to get a more complete view of physicians' acceptance and usage of EMR systems.

This research contributes to showing how existent theoretical IS frameworks can be applied in a new domain, the healthcare arena. At the same time, the existent framework has been extended to incorporate emergent constructs and relationships among new and existent

constructs in the healthcare arena. Accessibility and hardware considerations are two important emergent constructs.

We tested an existent theoretical framework, using a qualitative method of inquiry and showed that physicians' attitudes towards EMR systems are primarily impacted by their beliefs about the EMR technology, beliefs about their profession and their individual predisposition to change. We validated and extended the theory of planned behavior with new constructs that have not been looked at intensively in IS research.

Using innovation diffusion and institutional economics lenses, we looked at how physicians' predisposition to change impacted their attitudes towards EMR. Understanding how physicians cope with the changes brought about by new EMR systems and how these new systems impact the medical profession is a contribution of this research. This research showed that with the exception of cardiologists and surgeons that seemed more resistant to EMR and EMR-based change, most other physicians in this sample were rather instrumental in their behavior. Most physicians mentioned that they would change their workflow to take advantage of EMR, if they found EMR benefits them in some manner. In other words, to the extent that the EMR systems can bring some benefits to physicians (i.e. save time and/or provide real-time clinical data) and at the same time they are simple to use (i.e. minimum number of clicks and windows to get to clinical results), physicians can be more acceptant of EMR. This finding may imply that at least some of physicians' resistance to EMR-based change can be dealt with by emphasizing EMR benefits to the individual physician (rather than patient care in general or the hospital level alone). This finding may indicate that physicians' attitudes can be influenced and altered favorably towards EMR, by demonstrating the benefits from using EMR which in turn may lead to physicians making more use of EMR systems.

Future research should investigate more such individual differences in terms of physicians' predisposition to change and how these differences impact differential EMR attitude formation. Some physicians that had a more reluctant predisposition to EMR-based change seemed not to have had much interaction with computers in their everyday lives or through medical training. Future research should also investigate such individual differences with respect to the doctors' training as they contribute to EMR attitude formation.

Using a grounded approach (Eisenhardt, 1989) we identified the values underlying physicians' professional beliefs. Time and expertise have been identified as being two of the physicians' main professional values. We showed how EMR systems have impacted or could potentially impact these values. EMR1 and EMR2 negatively impacted physicians' perceptions of time efficiency while doing their clinical work with the result of physicians forming more negative attitudes about EMR and using EMR less. On the other hand, EMR3 has positively impacted physicians' work efficiency. EMR3 saves physicians' time versus the traditional way of looking at x-ray films. EMR3's usage is more committed even among physicians in very traditional specialties such as cardiology and surgery. Although expertise has not been yet impacted by current EMR systems at Alpha, CPOE and evidence-based medicine have the potential to negatively impact physicians' expertise. Future research in this area should focus in investigating EMR impacts on physicians' expertise in order to better understand physicians' acceptance and perhaps their resistance to EMR systems.

Using a diffusion of innovation approach, we validated the importance of constructs such as perceived complexity of EMR and relative advantage as they apply in a healthcare setting. These constructs are major considerations influencing physicians' usage of EMR and overall, they play a major role in influencing physicians' acceptance and usage of EMR systems.

Using a grounded theory approach (Eisenhardt, 1989), we also uncovered the underlying dimensions of the EMR “complexity” in a large hospital setting, namely, ease navigation and search through the system. We defined EMR “navigation” as referring to the number of windows physicians need to go through in order to get at clinical results or the ability to readily and easily find a clinical result with an EMR system. EMR “search” capabilities referred to a physician’s ability to sort through clinical results and customize reports in the desired manner.

These findings have managerial implications for the design of EMR systems. From a design standpoint, EMR navigation should be made easy such that physicians can get to patients’ results with the minimum number of clicks. At the same time, EMR systems should incorporate various ways a physician can search through and view clinical results in a desired manner. These characteristics of the EMR artifact are important as they directly affect usability of EMR. Most physicians in this sample pointed to such EMR usability considerations.

Furthermore, EMR systems should be designed such that they recognize the value of a physician’s “time.” This issue is very important as physicians are not the typical users of IT that performs most of the work in an office. Physicians are entrepreneurs whose revenue is directly dependent on the number of patients they see daily. EMR designers should thus consider the importance of a responsive EMR system to the physician group. In a typical environment such as an office, individual users may take four-five minutes longer to explore EMR and deal with navigation problems. On the other hand, physicians as a group do not take this time to deal with EMR while rounding in the hospital. Interviews and conversations with various physicians and at the same time direct observations in the hospital environment helped reinforce this argument. To the extent that an EMR system is not easy to navigate and does not have well defined search capabilities, physicians may develop quite negative attitudes about EMR with long lasting

impacts on their non-use or minimal use of EMR. EMR designers should thus carefully consider “time” as one of the main physician’s values and build EMR systems with this idea in mind.

We extended the theory of planned behavior with new, emergent constructs and relationships that seem to be very important in a large hospital setting. Hardware considerations and accessibility issues were two emergent constructs that impacted both physicians’ usage of EMR and also their beliefs about EMR (i.e. perceived complexity of EMR and EMR relative advantage). We found that lack of available hardware at Alpha (i.e. computer terminals are not easily available) and difficulties in accessing the EMR software (i.e. multiple log-ins) influenced physicians’ perceptions of the difficulties in using EMR versus the paper chart. At the same time, hardware and accessibility barriers contributed to diminishing perceptions of the relative advantage of EMR. Although EMR3 is perceived as being highly beneficial to physicians, this system is primarily being used in areas that have low such barriers (i.e. operating rooms and/or ICU).

We investigated more deeply the role that perceptions of behavioral control (or implementation climate) play in impacting physicians’ usage of EMR. This construct had not been widely investigated in IS research. Hardware availability, type of devices that are used in a hospital setting and other hardware and situational characteristics (i.e. physical location of the computers) were shown to comprise the implementation climate construct and act as barriers to physicians’ usage of EMR. Often times, in IS research, because of the context of study, the availability of hardware and the support available in case of system problems or the availability of hardware resources is taken for granted. However, in any large hospital, the majority of physicians do not have a physical office with a computer terminal always available all the times. Physicians do rounds several times a day to see patients and finding an available computer

terminal should be made easy. This is the reason why implementation of EMR software needs to be carefully coordinated with a hardware strategy in order to ensure physicians with proper access to the EMR system.

Accessibility factors are another emergent construct shown to influence physicians' usage of EMR. This construct is comprised of the number of log-ins for each EMR system, hospital floor or the number of log-ins per each patient. At the same time, complexity and speed of access to EMR (i.e. ease of logging-in and system log-out time) and remote access considerations (i.e. use of a special device to get access to EMR remotely) are also dimensions of the accessibility construct. As with hardware considerations, the construct of accessibility has received limited attention in IS literature and its impact on EMR usage has not been widely explored. We showed how difficulties in accessing EMR contributed to physicians using EMR1 and EMR2 minimally. We also showed with the case of EMR3 that when access was made easy (i.e. ICU areas), physicians used EMR more.

This research thus, expands our understanding of the role of hardware considerations and accessibility issues play in influencing physicians' use of EMR and the level of EMR use. These findings have implications for the design and implementation of EMR systems in large hospitals. Many times, implementation efforts focus on software considerations alone. This research has shown that access to EMR and availability of hardware devices may be prerequisite to EMR implementation. Deployment of EMR software in large hospital settings without a clear hardware strategy may be risky as it may lead to software failure, regardless of the quality of the software. Unavailability of devices or difficulties in accessing EMR may cause physicians not to consider EMR for usage and thus not becoming aware of the EMR capabilities and benefits. Designers of EMR should also think how to incorporate other technologies to the software such

that access is made easy. For instance, EMR could be designed to work with biometrics technologies such that to ensure easy access to EMR. Although there are various organizations (i.e. HIPAA) that impose high security requirements for patient-related data, biometrics technologies can uniquely identify a physician when logging-in and thus such technologies can meet the required security standards and at the same time make it easy for physicians to access EMR.

Another theoretical contribution refers to looking at IS usage at finer-grained levels. We showed that physicians' usage of EMR ranged from non-use to shallow level use and deep-level use. This view of usage is among the first attempts to conceptualize finer levels of use at an individual level of analysis. Future research is needed in order to explore this idea further. One path to follow is exploring the different features of EMR systems and how many of these features physicians employ in their daily work and most importantly, why.

Using a case study methodology is another theoretical contribution of this research. Case studies allow researchers not only to test existent theories but also to expand them (Eisenhardt, 1989). Thus, using this research approach we tested and expanded existent theories in IS to a new domain such as healthcare. This domain has not been intensively analyzed in IS research. Using a qualitative method, we tested a theoretical framework that has been researched primarily using quantitative methods of inquiry. Using a case study, we showed that the theory of planned behavior, institutional economics and innovation diffusion theories applied in the context of a large hospital. At the same time we extended existent theoretical frameworks on individual acceptance and usage of IT systems with additional constructs and relationships as mentioned in the previous paragraphs.



Another methodological contribution comes from triangulating from multiple research methods. We used two different qualitative methods in order to uncover the complex phenomenon of physicians' acceptance and usage of EMR. Causal mapping techniques (Nelson, 2000; Armstrong, 2005) were augmented with pattern matching matrices (Miles & Huberman, 1994) in order to overcome limitations inherent in causal mapping when it comes to representing relationships among internal psychological factors. By using both these techniques, we could better analyze relationships among theoretical constructs.

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. The main researcher has attended various technology-related meetings and also departmental meetings for many different physician-specialties. Many other informal discussions with physicians following these meetings and in different forums (i.e. physicians' lounge) have been used to inform the case. The researcher has also spent many hours daily for the four month data-collection period in the physicians' lounge, which was a good opportunity to observe physician interactions in such a forum. Participation in a week long seminar at an EMR vendor site with a team of physicians and other clinical personnel helped the researcher observe and assess physicians' attitudes towards EMR systems in the design phase.

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. Alpha has invested seventy million dollars in an integrated EMR system (not including the hardware) that is to be implemented in phases, the last phase being CPOE that will require physicians to enter orders. Understanding physicians' attitudes and

their usage of current EMR systems at Alpha can guide future implementation efforts such that EMR does not meet with physicians' resistance.

Furthermore, individual physicians control the spending of 90% of the healthcare dollars (FitzHenry et al., 2000). Devaraj & Kohli (2003) pointed out that technology usage is directly related to measures of hospital revenue and quality such as revenue per admission, revenue per day and mortality. If physicians do not use or minimally use EMR systems, benefits from such IT investments cannot be realized. In this context, we hope we shed some light on the factors promoting or impeding EMR usage in large hospital settings. The good news for Alpha is that many of the barriers to physicians' EMR usage seem to be quite technical in nature. Having more computers available for physicians' use and reducing accessibility barriers are measures that can be taken to enhance EMR usage. At the same time, changes to EMR functionality such that navigation and search through EMR are made easier, are also intervention tools that can contribute to formation of more positive attitudes regarding EMR among physicians.

This research showed that one of Alpha's three EMR systems (EMR3) was used far more than the other two EMR because of the benefits it provided physicians and the lack of hardware and accessibility barriers. Hospital administrators need to consider these factors and emphasize the benefits of EMR to the physician level. At the same time any potential usage barriers should be reduced to a minimum. Investments should be made not only in software but also in hardware. Having a hardware strategy in place seems to be very important. Making computers available to physicians both on the hospital's floors and physicians' lounge, investing in different types of devices such as tablet computers and perhaps allocating certain computers exclusively for physicians' use may help increase the level of usage of EMR.

Furthermore, reducing accessibility barriers at a minimum is very important. Physicians do not have the time or interest to log-in multiple times to access clinical data. Hospital administrators have to consider making logging-in easier for physicians perhaps by providing a common platform for all three EMR systems in the hospital. This is an important consideration as accessibility constraints not only directly impact EMR usage but also other physicians' beliefs which can have longer lasting effects on EMR attitude formation.

Results from this research have also shown that Alpha needs to raise awareness of the EMR capabilities and make their benefits known to physicians, especially to physicians in the surgical specialty. Surgeons (and cardiologists to some extent) are two specialties that seemed to be quite resistant to the idea of EMR and EMR-based change. At the same time, some physicians were not entirely aware of the potential of the current EMR at Alpha. Informing physicians how the EMR systems and their different functionality can help physicians in their clinical work is important in order to expose physicians to and raise their awareness about EMR systems at Alpha. Awareness about an innovation is the first and one of the most important phases in the innovation diffusion process (Rogers, 1995). Lack of awareness about the EMR capabilities can have far more reaching consequences in terms of "lock-in" for the present state or ways of doing things (i.e. paper chart).

Results from this research have also shown that physicians that are more involved with EMR at Alpha (i.e. physician-experts) had more positive attitudes about EMR. The IS literature has long demonstrated that user participation to design and implementation of systems can create a sense of "ownership" that reflects the importance and personal relevance of the object (i.e. EMR) or event (i.e. implementation of EMR) to the individual user (Barki & Hartwick, 1989). Systems deemed to be both important and personally relevant to physicians are more likely to

engender positive affective reactions. The implication here is that Alpha needs to engage more physicians with current implementation efforts and let the majority of Alpha's physicians know that their interests are well represented in the design and implementation of EMR. Many physicians that were interviewed for this study did not know Alpha was in the process of implementing a new EMR system. As one physician mentioned:

*“We don't participate in the development of the system, it is the hospital that is developing the system. The other hospital picked up an advisory board for the system. [researcher's comment: they have one here] I would imagine but we were not invited to participate. They select doctors that are very close to the hospital, like the ER doctors that employed by the hospital, anesthesiologists that work 100% in the hospital. There is a lot of politics on who gives the input and who doesn't. So, of they take this approach, we take the approach of “let's wait and see” ”*

Failure to engaging and informing physicians regarding EMR implementation efforts can contribute to physicians' resistance to such systems. At the same time, Alpha needs to make it clear to physicians that EMR is a joint effort between the hospital and physicians. As evident from the above quote, some physicians felt that Alpha alone had “ownership” of the EMR system. Physicians did not perceive EMR as being relevant to them on a personal level, which in turn seemed to generate resistance.

Informing physicians in different forums (i.e. specialty meetings) and using different methods of information dissemination (presentations, mail or direct, personal contact) are some of the ways to inform and involve physicians with current and future EMR implementation efforts. Getting to know the system and feeling that the hospital is involving them directly in

EMR implementation may contribute to physicians developing beliefs that the EMR efforts are important and at the same time personally relevant (Hartwick & Barki, 1994). Furthermore, involving more physicians with EMR through better communication and information dissemination to the majority of Alpha's physicians, can contribute to physicians developing a better understanding of the current/new EMR system and how EMR can help them in their clinical work.

In conclusion, to answer the question regarding "what do physicians want?" it seems that they want a system that is easy to access and simple to use but most importantly, a system that physicians can directly identify with, an EMR that is directly relevant and provides physicians with personal benefits.

*"You have to offer me a very good deal that obviously has a lot of advantages for me to accept it!" (Nephrologist1)*

*"The system has to be very fast and easy otherwise physicians will not take the time to use it..." (Cardiologist3)*

Physician engagement at Alpha should not only stress how the EMR systems have the potential to improve patient care but most importantly, focus on communicating physicians how the EMR system can benefit physicians and their clinical work.

Overall, this research has direct implications for the acceptance, use and implementation of new EMR systems in large hospitals, which is a timely effort throughout the entire US healthcare system.

This study is not without limitations. First, we build this research on a theoretical framework that spans multiple theoretical lines. However, there may be other theoretical

perspectives that have not been included in the framework that may shed light on the complex phenomenon of physicians' acceptance and usage of EMR systems.

This study uses a large hospital facility as the context of the study. Thus, results may not be fully generalizable to smaller physicians' practices. The use of a case study methodology while providing a rich context for studying physicians' attitudes and usage of IT systems, has the limitation that its results are not easily generalizable to other healthcare contexts. Future research in the area will better establish the external validity of this research and its applicability to other settings.

This study could not confirm the role social influence plays in healthcare. Although IS theories point to the important role of social influence in affecting physicians' usage of IT in general, this study did not find a direct link between social influence and EMR usage. Further studies should better test this relationship perhaps employing a more quantitative approach.

Another limitation of this research lies in data analysis. The use of one coder to analyze the interview data did not allow for assessing inter-rater reliability regarding coding of constructs and causal maps. However, this limitation may be mitigated to some extent by the use of triangulation from multiple sources of evidence (such as interviews, direct observations and participation in various meetings for a nine-month period of time) and methodological triangulation (use of two different qualitative methods to analyze the interview data). Furthermore, the lack of member checking for physicians' causal maps may be another limitation of this study. It was not feasible for the researcher to go back and ask physicians to check their own causal maps for accuracy. As previously noted, physicians are short on time and the strategy of checking each causal map with the original interviewee could not be used to fully assess the validity of physicians' causal maps.

## **APPENDIX A: INTERVIEW PROTOCOL**

Construct	Interview Questions	Method of gathering the data
Demographics and general questions	Gender _____ Specialty _____ What campus are you primarily based in? When did you graduate from the Medical school? Have you ever taken any computer classes? How many? Do you have a computer at home? If so, what do you use it for? How many years have you been using a computer?	Interview questions (physicians)
Beliefs about the technology  a. Perceived Complexity  b. Perceived Relative Advantage  c. Perceived Compatibility	<b>1. What do you think about EMR systems? What do you like about these systems? What don't you like about them?</b>  <b>2. Can you tell me about a time when you became frustrated when using an EMR? Please tell me about this experience.</b>  <b>3. Can you tell me about a time when an EMR was beneficial to you (helped you out)? Please describe this experience to me.</b>  a. Do you think EMR are difficult to use? b. Do you think EMR systems could be useful to you? c. Do you find EMR more beneficial than the paper system in performing your medical tasks? d. Do you think many other physicians are using EMR in this hospital? e. Are EMR valuable to you in treating your patients?	Interview questions (physicians)  Observation in hospital meetings  Additional discussions with physicians advocates* and Medical Informatics officers in the hospitals
Beliefs about the profession (beliefs about the practice of medicine)	<b>1. Do you think EMR would make you change the way you like to work? In what way?</b>  OR  <b>2. Are there any significant changes in your day to day operations from using EMR? If so, what are the changes?</b>  Do you think that by using EMR you would have to change the way you practice?	Interview questions (physicians)  Observation in hospital meetings  Additional discussions with physicians advocates* and Medical Informatics officers in the hospitals
Predisposition to IT-based change	<b>1. How do you feel about changes brought by IT in healthcare?</b>  <b>2. Each of us has a certain disposition towards change. How would you characterize yourself? Would you say you prefer</b>	Interview questions (physicians)  Additional



	<b>change (i.e. a new IT-based system) or you dislike change?</b>	discussions with physicians advocates* and Medical Informatics officers in the hospitals
Attitudes	<p><b>1. Do you think that using EMR is a good or bad idea for you? Why? Can you explain this to me?</b></p> <p>a. Do you think EMR are a good idea to be used in a hospital?  b. Would you promote EMR to other peer physicians?  c. Do you support implementation of EMR systems in this hospital?</p> <p><b>2. FL Hospital is going forward with implementation of EMR (Cerner systems). What do you think about this initiative?</b></p>	<p>Interview questions (physicians)</p> <p>Observation in hospital meetings</p> <p>Additional discussions with physicians advocates* and Medical Informatics officers in the hospitals</p>
Social influence	<p><b>1. How much pressure do you feel from the hospital administrators to use or not to use EMR?</b></p> <p><b>2. Do you feel in any way that anyone other than the hospital administrators is trying to influence whether or not you use EMR? Who exactly? How are they trying to influence you?</b></p>	<p>Interview questions (physicians)</p> <p>Observation in hospital meetings</p>
Perceived behavioral control	<p><b>1. Do you feel you have enough support available to you when using EMR? If not, what kind of support would you need that you are not currently getting?</b></p> <p><b>2. Also, how do you feel about the computer access available to you when needed in this hospital?</b></p> <p>a. Do you feel the hospital is promoting the use of EMR?  b. Do you think you have adequate access to computer equipment in order for you to use EMR?  c. Do you think there are enough computers in place for you to use EMR?  d. Do you feel you could use a computer whenever you need it?  e. Do you feel is there adequate computing support to help you when you have a problem in using EMR?</p>	<p>Interview questions (physicians)</p> <p>Observation in hospital meetings</p>
Behavioral Intention	Task-based measure (see Table 2 on the next page).	Interview questions (physicians)

Usage	Task-based measure. Table 2 provides a list of tasks that the system can be used in. Physicians will be asked to check the appropriate label regarding their usage of the EMR system in each of the clinical tasks.	Interview questions (physicians)  Observation in hospital meetings  Archival documents on usage levels
Other	<b>1. What are the main hurdles that you find in using EMR?</b> <b>What can the hospital do that might lead you to use EMR more?</b>	Interview questions (physicians)

Notes:

1. The questions in bold are the main questions to be asked physicians. Depending on the answer, sub-questions may be asked in order to get a comprehensive view of the respective constructs.

2\* Physicians' advocates work closely with physicians in supporting their daily EMR usage. They are a rich source of information as they have a global understanding about physicians' attitudes and usage of EMR.

**APPENDIX B: INTERVIEW CODING**

Interviewee	Beliefs about the Technology	Beliefs about the Profession	PBC	Attitudes	Intentions/Usage	Other
CARDOILOGIST (1)	<p>It's pretty user friendly [EOU]</p> <p>When you access the labs, it doesn't show you all the labs in one page, you have to go from one page to another, so the labs are split ...so you have to go from one window to another [Navigation] [CX]</p> <p>The disadvantage of the computer system is that you have to spend more time [Efficiency] [RA]</p> <p>For the Patient list - it doesn't differentiate between consults versus somebody I am asked to do read an echo. I wish there is a way....so you don't have to figure it out yourself...you have to go to the patient's room, look at the chart. [IQ]</p>	<p>I think it's changed for the better... I can access patient list, medical record from home....if I get a call from the ER I can log on &amp; get the info in front of me. [Data retrieval]</p>	<p>[Problem in the lounge]</p> <p>In the physicians lounge there is a problem...everybody walks in, in the morning and wants to access the computer here and there are only 3 terminals here [lounge]</p> <p>With so many physicians in this hospital you're gonna need a lot of computer stations [Lack of computers]</p>	<p>I think EMR1 is a great system</p> <p>It's a good idea but...</p>	<p>[Minimal]</p> <p>For me I don't use the computer system too much</p> <p>I would like to stick to the paper.</p> <p>[Used for]</p> <p>I use it to access my list &amp; then when I'm on the floor seeing patients if I need any lab that wasn't put up in the chart</p>	<p>[Remote Access]</p> <p>If I access the computer from home, that's a problem. Because given the token, every time you have to put in a number it takes a little longer to access it from home.</p> <p>[CPOE]</p> <p>I have seen a system (CPOE) some time ago, [Visibility] ...it's a pain, whatever the nurses are doing right now, we do it ourselves. Although it may reduce errors, it is time consuming. <i>Do you think a nurse should do this?</i> Yes. [belief a doc does not have to enter orders]</p>

Interviewee	Beliefs about the Technology	Change	Attitudes	Intentions/Usage	Other
C A R D I O L O G I S T (2)	<p>I don't really need them [computers] for what I do...I do heart cass &amp; engioplastics</p> <p>I don't need it in my day to day job to be a proficient doctor. ... it's not important to what I do....I don't need it...[perceived need] [RA]</p>	<p>I've never had any interest in computers.</p> <p>I've never sent an email in my life .if I want to talk to you I'll call you</p> <p>It's just fine the way I do it now.</p> <p>I like change &amp; innovation....but we don't cut people with computers</p>	<p>I don't like computers</p>	<p>I don't use the computer... but this doesn't mean that I can't do other things [perform a surgery]</p> <p><b>[Workarounds]</b></p> <p>I have people in my office that work around computers but I personally don't use computers. The unit secretary helps me...I guess I'm spoiled, I'm surrounded by people that are happy to help me pull up information</p> <p>In the office is the same way, at home my wife, in the hospital, the nurses, secretaries do it.... All I care is the info, I don't care to punch it up myself...</p> <p><i>Use computers in the future?</i> It is a low priority for me.</p> <p><b>[Very minimal usage]</b></p> <p>I am using that computer system (EMR3) in the viewing areas. The unit has them up &amp; running....I punch in a person's name &amp; see the X-ray. That's the one thing I do with computers...pull up X-rays at certain big EMR3 view boxes</p>	<p><b>[EMR4]</b></p> <p>I think it is a mistake ... the present system works fine the way it is...I think it's a waste of money. I think it's stupid!</p>

Interviewee	Beliefs about the Technology	Beliefs about the Profession	PBC	Change	Attitudes	Intentions/Usage	Other
CARDIOLOGIST	<p>The advantage is that if you have the system setup, you can access it from home. [RA]</p> <p>[CX] [Speed] The complicatedness of the system makes it not easy to use... the system has to be very fast and easy otherwise physicians will not take the time to use it.</p> <p>I am more efficient with the part of the system that I use (EMR3) because I don't have to go downstairs to Medical records and have them pulled; it saves me a lot of time. [Efficiency] [RA]</p> <p>[RA] The advantage of the computer system if we see patients in the morning 7-8 am when we start the 1<sup>st</sup> operation, the lab has drawn the labs during the night 3-4-5 am... the machines are spitting out the answers 6-7 am, but the results are not yet printed out on paper and on the floors and placed in the charts. Especially in these early times, we are looking to</p>	<p>Surgeons and cardiologists have always had... and I've been here for 20 yrs now people that we pay to work with us to make the work go faster and more efficient. This personnel deal with the comp (NPs and PAs). I hire my own PA and NP.</p>	<p>There are enough computers... sometimes they are slow though. The advocates sitting here in the lounge...yes there is support.</p>	<p>Surgeons are especially conservatives...be cause they know that with change comes death, if something doesn't work then somebody is gonna die. We have a model "Perfect is the enemy of good" that's the surgical model... If it's good and it's working, don't mess with it!!</p> <p><b>How about change in new treatments/techniques</b></p> <p>Surgeons are interested more in innovative ways of doing things probably for the 1<sup>st</sup> time in 50 years, even though we are conservative; we tend to do it reluctantly.</p>	<p>The computer system helps... I can get the results faster from the computer (through my staff). It used to be we had to spend time on the phone, now it is faster. My staff likes it because they can access things easier.</p> <p>I like the idea of accessing the medical library for clinical types of books through the computer.</p>	<p>[Very minimal use] I tend to be a surgeon, I do not use the computer as much as I should to access things.</p> <p>For every patient we look at the paper chart</p> <p>[Use for] I use the computer (the EMR3 system).</p> <p>[Workarounds] Things like Labs, I do not access on the computer, I have somebody else do that for me...I don't have the time [RA].</p> <p>The EMR3 system here I access through work stations in different areas (ICU) these systems are online all the times, [Access] The system has a list of patients and their names and X-rays. I can see the X-rays on 10 patients in 7-8 minutes. [Efficiency] [RA]</p> <p>At the other hospital [ORMC] where they are using a web based system, I cannot do that (look at the patient's X-rays) so</p>	<p>[Access] Docs do not have enough time to deal with a web based system that deals with lots of steps to access the info that you want.</p> <p>I am practicing at 4 different hospitals so I have 4 different numbers [log in numbers] for 4 different hospitals which makes it complicated.</p> <p>[Remote access] I have not done that yet. It is complicated to set this up on the computer. You have to have somebody from the medical informatics here work with you on the phone, you have to have a disk, so it is not simple again.</p> <p>For ORMC I can use this at home without having to put on my personal computer any special software that allows me secure access to the clinical data at the hospital.</p>

the computer to get the lab results before they are placed in the chart. The NP writes down whatever I am interested in on a blank piece of paper. [workarounds]

easily and quickly. [EOU] [Speed] [Access] I have to go into the system put in my name and password to log in—once I get the 1<sup>st</sup> screen, the system has to be activated because it may be on hibernate, then I have to hit the EMR3 portal button which takes you into the radiology system. Once I get into that system I have to look at each person I want to see (their name) one by one. I put a name, look at it. I put another name, look at it.

As a result, we don't look at X-rays at those hospitals [that have the web-based paperless system] which may result in malpractice. The physicians cannot easily get access to the X-rays anymore, As a result the physicians do not look at X-rays. ...they wait for the report to come in which makes the patient stay in the hosp longer...that's the disadvantage of the computer system.

Interv iewee	Beliefs about the Technology	Beliefs about the Profession	PBC	Attitudes	Intentions/ Usage	Other
C A R D I O L O G I S T (4)	<p>The most helpful system that they have is EMR3 [RA]. I am a cardiologist, I do pace makers, implants I look at chest X-rays, CT scans. I like accessing from the part of the building where the patient is rather than going down to X-rays and look at hard copy films. [RA] [Access]</p> <p>Sometimes the passwords don't work and you never know when you have to change passwords but generally you call the help desk and they help you out. [passwords]</p> <p>EMR1 is good, [Attitudes] not always accurate, [IQ] if you are the attending physician, for ex if it's my patient and my partner was the consultant, it's gonna be under my partner's name and not under my name even though I am the last physician who saw the previous admission....so my group we have our own CS and we keep our own list...sometimes it's not the same as the hospital's list, sometimes we have patients when we go to EMR1 that someone else in my group has seen and maybe my name was in the original consult and it stays in my list. So I am using the office group list.</p> <p>It's cumbersome, [CX] we have to double check and have to make sure we don't miss any patients as we cover several hospital campuses</p>	<p>Right now this learning curve has made it very cumbersome, [CX] harder to see as many patients [Efficiency] as efficiently...it doesn't help me get through my time---<i>Efficient??</i></p> <p>right now I am less efficient, I hope to get back to neutral.</p>	<p>It's not a big space to work also at the stations on the floor -- [location of the computers].... it's good if I have to pull up a lab that's not there (in the paper chart) -- <b>if I have the chart then I want the lab in the chart - I don't want both!!</b></p> <p>We still have to write in the chart, <b>we have to do both -- and doing both takes time.</b> [Efficiency] I have my rally nurse with me and she can look it up for me and have it ready for me when I get there. Cause I'm busy, I go see you then I go back do a heart cap and I come back to see him &amp; her &amp; her...then I go back upstairs and do something else.</p>	<p>I like computers for retrieving data, [data retrieval] I think they're wonderful cause I can go look up stuff. But...the system is only storing data &amp; allows us to retrieve data but you can't send it to anybody !! [data sharing]</p>	<p>I have to use EMR1 because I am president of the Medical Staff here for this campus. I use it for email for meetings, bylaws, look up docs privileges. [use for]</p> <p><i>How about when you see patients in the hosp?</i> <b>The paper chart is all I have to look at.</b> I can go to these crazy machines on the floors that are really slow [computers being slow] and what's bad about that is they're not really up to date as they should on the MAR -- that's awful. Because its not always up to date in the paper chart -- the chart copy is always behind. In the computer is better. [RA] I ask the nurse if I need to get smh more up to date....I go find the nurse [workarounds] and say ...did you give this pat this beta pace and when did you give it?</p> <p><i>What prevents you from going to the computer yourself?</i> Having to sign on every time [log in] -- what I do sometimes (if I don't have many patients) -- when I come in the lounge get my coffee &amp; look up labs...for all my patients through CA ...so when I go to the floor I can't remember them all...I just know if they are abnormal</p>	<p><i>If had a choice, paper or computers?</i> I want a CS but I don't want it to be shaved down my throat. I want it to be friendly [EOU]. I want an IT person when I'm learning a new system be there -- walk hand in hand with me down the hallway like I'm a little child -- till I say I'm ready, till I'm ready to ride that bicycle without that framing wheels. [Support]</p> <p><b>Support in the hospital is very imp -- they gotta be on the floors !!</b></p> <p>EMR4? It is very time consuming [Efficiency] &amp; very expensive [Cost]. extremely labor intensive. It does not save docs one dime. EMR4 was supposed to help us improve our efficiency &amp; quality so EMR4 should be able to help diagnose a heart failure &amp; pull up all everything we need to pull up according to best medical practices ---it ain't happening....its a pain in the butt--because it's not working!! [system quality]</p>



Interv iewee	Beliefs about the Technology	Beliefs about the Profession	Attitudes	Intentions/ Usage	Other
G S E U N R E G R E A O L N (1)	I haven't found that I really need it yet [Perceived need] [RA]	We have a NP that works for us, every morning she gets the patient list from the computer here and my office also faxes a list –they're never the same.... the computer can't keep that straight either [IQ], so there is no reason to use it.	Negative	I don't use it...it's too much of a pain...  I ask the secretary on the floor to look up the labs... [Workarounds]	<b>If mandatory?</b>  I'll practice somewhere else [laugh] that's the bottom line.  I am opposed to somebody telling me I have to do it that way, I have enough things to worry about without worrying about figuring out something else that they would want...I'm not gonna do that.  I think the hospital had forgotten that we are the ones that bring the money to them...they're not the ones that bring the money to us.

Interv iewee	Beliefs about the Technology	PBC	Attitudes	Intentions/ Usage	Other
G S E U N R E G R E A O L N (2)	I am much more efficient with the computer [RA][Efficiency] because if you come to the hospital, go to the floor you'll have to ask the nurses for the lab reports or call the lab, now everything is in the computer.	<b>Computers?</b> Just take the nurses' ones... [laugh]  <b>Support?</b> I was trained on EMRI, they gave me a password. ..there is people always around	I do like the system, it saves a lot of time to get in the computer get my patient list and get lab results.[Use] Instead of me making phone calls to the lab...it makes my day a lot quicker [Efficiency] [RA].	I only use EMRI, the only thing it doesn't have is the X-ray pictures, for this you have to go to another program, that program I don't know well, so I'm not using that yet.  If it can be all combined in one program to get labs, patient locations, list, X-ray in one that would be a lot easier.  [System integration]  [Moderate] When I come in the hospital, I get a cup of coffee, get on one of the 3 computers in the lounge, get the patient list...when I leave here I go on the floor, if I have more questions I use one of the portable computers on the floors	<b>[Access] [Security]</b> The other thing I don't like is that they change the password every 6 months and I couldn't get in for a couple of days till they gave me a new password...I understand it expires every so often.  In the future we'll hopefully carry our own computer in the pocket so that we don't have to log in a computer on the floor, access that from outside the hospital hopefully....that would be the most imp thing to access the system from home see the X-ray that I ordered, see the actual X-rays immediately.

Interviewee	Beliefs about the Technology	Profession	Change	Attitudes	Intentions/Usage
G S E U N R E G R E A O L N (3)	It's so much easier for me to open up the chart vs having to log in the comp. to get it. [RA] If not latest labs in the PC, I tell the nurse/NP to do it. [workarounds]	Why are you not using the CS? Because I'm mostly in the OR, my time is spent mostly in the OR than trying to access info on the computer. [Profession]	Do you use the comp for anything in general/Internet? Very little...	Do you think you'll have any need for the CS in the future for your work? In the future possibly but right now I don't see a need for me [need]...my practice can do so well without computers at this point.	

Interviewee	Beliefs about the Technology	Profession	PBC	Change	Attitudes	Intentions/Usage	Other
G S E U N R E G R E A O L N (4)	It is very user friendly... Every time I look for info I can find that easily. [CA] Efficiency? I think it does make it a little bit more efficient but not a lot more efficient. [Work efficiency] I don't think it's a big improvement [RA] and I've been through several phases of charts – from having to draw your old labs & get them to now having everything in the computer. I think it helps on a scale from 1-10 would improve from 5 to 7. For ex charts, temperature charts, on the chart you have an actual graphic on	From a surgery standpoint it hasn't changes at all how you practice medicine its made it a little bit easier to access the info especially if you are at home and you want to look at something... I don't think it changed the quality of the medicine practice.	Computers? – enough computers. Support? I haven't been into a situation to need support... It didn't take training to use it either, they give you a log in and then you play with it a little bit & you know how to use it.	[Resistance to change] – the years you've been practicing medicine (one way – ie. paper) does matter. Since I started medicine & training there were a lot of computers, information around, so I've been exposed my whole career to that. For people who haven't it becomes a little bit harder. My partners – if they are rounding without a PA in the wkld, they can't print a	I think it is very good for IP, on the patient that's discharged is little bit hard to track him down unless you have the full name and everything – that's hard to remember if you're just looking for a patient to send home. You can't SEARCH for a patient unless you have the exact name after they've been discharged. For IP it works very well, for labs, microbiology and all the info you	I look at the paper chart first, if I'm missing something then I look in the computer. If the labs are in the chart I just look at them there.	Frustrating? when the password is about to expire it doesn't tell you ahead of time so that you can change it and if it happens on the wkld and you have no access to your no and you have to call for it. [Access] [password issues] EMR4/orders? As long as you can verify you are the one giving the order, cause anybody can have your code but not anybody can have your signature. [Security] So I don't want smb to get access to my code & put an order under my name...so as long as that's very safely done, I think it would be fine. <b>You gotta stay with progress.</b> [change] [Other systems] – This is the only system I know how to use. I don't know how to use them (other systems). <b>About 90% of my work is here</b> so whenever I go to ORMC or Osceola regional I just

the temp what it's doing, you can't have access to that in the computer. [IRA over paper charts] So if you have a temperature today & want to look at how he was doing 2 days ago you have to go to 2 days ago...you don't see it in the same chart. - you can't look at trends easily for temperature, urine output, drain output or anything like that.

### patient list !!!!!

need. [IQ] [Attitudes]

I don't think it is up to date with I/O & nurses' notes [IQ, completeness]—that far I have not used that too much, [Use] maybe I'm not that familiar with it. I don't know how to use that efficiently enough so I get that info better from the chart.

ask the nurse to get whatever I need...**I'm not there enough to be worth learning the system.** I just tell the nurse "I need this"

*Office?* – doesn't have EMR. Do you think you're gonna get one in the future? No because my other 2 partners are very old fashioned – I think we'll stay with the paper charts. [change]

Inter view ee	Beliefs about the Technology	Attitudes	Behavioral Intention/Usage	Other
<p>NEPHROLONGIST (1)</p>	<p>I don't see an advantage for me, for my type of work. [RA]</p> <p>It is much easier to ask a nurse to pull up info for me. In the hospital, I call a hospital nurse/secretary and say can you please check in the computer and see what's happening.</p> <p><b>...you have to offer me a very good deal that obviously has a lot of advantages for me to accept it...</b></p> <p><b>Why don't you use the computer system in the hospital?</b></p> <p>Two reasons...</p> <ul style="list-style-type: none"> <li>- If I use I think I'm going to save the hospital money. [Benefit/RA to hospital] I don't think I am going to save myself time. [no RA to him]</li> <li>- This is the 1<sup>st</sup> step, if we accept this, the next step is that they are gonna ask us to enter info ourselves, [delay CPOE] if that's going to come, we'll delay it as much as possible –it may be inevitable but it is a big difference of it comes tomorrow or in 10 yrs from now.</li> </ul> <p><b>Why did your practice decide to acquire an EMR?</b></p> <p>Save money, to improve efficiency, [RA] being able to practice in many locations, being able to access the EMR from many locations at the same time, saving on storage. There are things that are coming in the future like pay for performance, the government is gonna stimulate/mandate that. [perceived government mandate]</p>	<p>I like the idea of EMR systems yet I don't use it [Use] because they told me I can use only if I carry a token that will generate pass-codes. [Access]</p> <p>I am completely opposed to the idea of making physicians work harder (secretarial work) for doing EMR. [RA] If they can figure out a way that they would spare me the inconvenience of an EMR and increase the convenience of EMR is great.</p> <p>I think the EMR saves a lot of money to the business that is implementing it... [RA] I am not the hospital, I am a physician, I am a client, it is gonna make the work of hospital more efficient at the expense of paying for the users. In the hospital I am going to enter data to save the hospital money, I am not sure I want to do that, in my office I may save myself money, so I want to do that.</p>	<p><b>No use</b></p>	<p>[Access] Log in has to be easy, right now there is a password, you have to change the password</p> <p>[Remote Access] If I cannot use it from home why use it at all? I need to carry this thing, which I am not going to carry... [CX] I carry enough electronic devices to bother about one more. I go to several hospitals, I don't want to deal with that. I was very enthusiastic to sign up, the moment, they told me they were going to give me a token, have to sign a form that if I lose it I have to report... I don't need that...so I said "keep it"</p> <p>[Access to other hospital system] I signed up for a password at ORMC, their system is much more convenient, you can access it from many computers and you can access it from home. You don't have to carry a password generator...it is a VPN system...I don't want to change my password every 5 minutes, why should I?</p> <p><b>If mandatory?</b> I am gonna take my patients elsewhere, why not? If they're gonna try to force me to do something that's gonna waste my time and shift the costs of the medical business from the hospital to the doctor.</p>

Interviewee	Beliefs about the Technology	Beliefs about the Profession	PBC	Attitudes	Other
NEPHROLOGIST (2)	<p>The reasons docs don't use the system is that because it is slow; [Speed] also there are a limited number of computers on this floor, [no of computers] so sometimes you are fighting with nurses for a computer.</p> <p>[Search] [Navigation] You load the program, put the password, go to the next screen, put name of a patient, you get several patients with the same name, click on the patient that you need...then it comes a screen, this is something that you usually don't want, you want something specific, so you have to go to the next screen.</p> <p>[Navigation] [EOU] Some particular screens (for example microbiology reports) are very cumbersome...you have to go 7-10 screens in order to get a report). Microbiology reports - the worst thing in the world... we have to go screen by screen, it is horrible.....[physician-administration issues] .we talked with the people for the computer system, 6 months we discussed this in the committees... They have to pay attention to what we say....this is the main thing the docs criticize.</p> <p>[System integration] [Time] [Efficiency]</p>	<p>[Benefits] Enrich my knowledge about the patient, I can deliver better medicine because I have more data about the patient...I can compare tests that have been done before. [Attitudes about the design] The downside is not of the computer per se but about how it is designed here in this hospital.</p> <p>For docs that practice around this area, like myself there is a significant number of patients that come to your office. 70-80% of the patients that come to our office have some history with the hospital, it is good when you connect to EMRI get all records in 5 minutes, much more that the patient will ever tell you.</p> <p>[Data retrieval] [patient care] So (1) you speed up the global action on the patient, (2) this way you learn about the patient much more, (3) then you don't repeat tests. That is probably the best thing.</p> <p>[Change the work] When you work in the hospital, the same thing, 5-10 yrs ago, I got a consult to see Joe Smith .I was coming to medical records, come down here [lounge] ask the employee to get me the records, 5-6 volumes, sometimes one, I have to sit down review to find what I am looking</p>	<p>Availability of computers is a problem</p>	<p>Overall I like it... I make critics in a context but I like the system.</p> <p>The downside is not of the computer per se but about how it is designed here in this hospital.</p> <p>Compared to 10 yrs ago—it is better for me with a computer [RA] - for an orthopedic doc it is the same, for us clinicians, we really need all this data.</p> <p>I think everybody is learning. The main critique—in this learning process there should be a more combined work between users and designers...designers get in love with their own design like with their own baby but sometimes the baby is not what you wanted...I think the hospital is slowly learning.</p>	<p>[Access] Something extremely irritant is that every time you go see a patient you have to open the computer, go to the computer put in a password, [log in process] go to 3-4 screens till you get to a patient. Then, you go talk to the patient and when you come back – everything is gone (the system logs you out)...[log out] you have to start again, very time consuming. Also because you have 20 patients in the hospital, every time you go do this operation, you slow down horribly. [efficiency] I think the only way to deal with that is one computer per patient—always open like a chart.</p> <p>I think it's an open adventure [CPOE] but the prerequisite is that we have to have easy available convenient way to get into the computer. [Access]</p>

If u have an X-ray report, you have to go to the desktop, minimize the current program and open the EMR3 program , put another password, put the name of the patient again-that is 5 minutes...when you finish with that and go back to CA—the program is gone [log out] and you have to start again. If you have 15 patients—can u imagine how long it takes you?

We need better links between programs [System Integration] and common passwords [Password Integration] (like I said, we see all data, labs and dictations, you have to minimize a program, go to the other program, EMR3 and then come back). Also, the issue of having to open the computer every time per patient sometimes 2-3 times per patient. [Access]

We have to look for a way to make it easy for the physicians [EOU]

for. **Now it is a piece of cake**, I click on previous admissions, look for specific things I want (X-rays, blood tests, etc) – **that is a beauty**. That improves the quality of care, save money and save time for admission per patient.

Interviewee	Beliefs about the Technology	PBC	Attitudes	Intentions/Usage	Other
<p>NEPHROL OGIST</p> <p>(3)</p>	<p>I think it's beneficial [Attitudes] because you can get to results, the problem is that each &amp; every admission is separate and if you're trying to find out the labs or any study that's done – there is no way to get the radiology exam for one patient in chronological order. [IQ] You have to go back to the admission record, click on it and then click on different things [Navigation] that you are interested in. So I cannot get in one page all the creatinine for the last 5 yrs.</p> <p>More beneficial than paper chart? There is no question. If you need any results - if you want the old charts [data retrieval] - you have to go down to the file system get the chart, get them 6 hrs later or the next day, the computer is fast. [RA] You go, you click and get the results there.</p> <p>It is difficult to go from admission to admission, it's time consuming to click on that, and you cannot get all data in front of you easily. You also cannot get graphs of the data, otherwise its pretty good. [EOU] [RA] Efficiency? The CS is much more efficient.</p> <p>[Patient list] When I log in I have a list of the patients, obviously the computer is as good as the person that puts the data in – most of the times is not accurate. So out of my 20 pats list I have 7 pat on the list out of which 3 of them are not mine. [IQ] I don't use the patient list. [Use] We have a pt list which is made by our secretary and I walk with it, then I go in the hospital I log in the comp, do a patient search in the hospital &amp; look at the update. If my secretary in the practice would have access to the CS in the hosp to rectify the group list with the appropriate names of the patients – it would be better. What my secretary does for us is the accurate list, the hospital list is....whatever.</p>	<p>Computers? There never gonna be enough, there could be more of them. Also, the nurses are sitting on the computer writing notes so there are very few available for the docs.</p> <p>Support? I need very few teaching tools, the systems are self-explanatory – it's like learning Windows, you click on each &amp; every function to see what it does. [Training] The idea to sit in a room and somebody explaining you this and that is not gonna work – the only thing that would work would be to have a tab with help in case you need something you're not aware of. Having smb trying to teach you the features of the system when you're on a continuous move – it's not gonna happen. When you first apply to the hospital they give you log in &amp; token, that's fine for abt 5 minutes. [Time issues]</p>	<p>The CS system is good because the data is available but it's not easily retrievable . [EOU]</p>	<p>What are you using the computer for? Labs, reports mostly.</p> <p>Log in every time? Yes, most of the data in the chart is outdated. [IQ] But... It depends what kind of data you need – when you evaluate the patient in the beginning the computer is much faster, if it's a follow up visit &amp; you have the paper chart and you know the patient that not much is going on and you have the data in front of the chart then it's easier to flip through – goes very quickly. It depends on the complexity of the case. The more complex the case, the less the chart is helpful. [complexity of the case]</p> <p>I use it the CS for so many years. We use the paper chart but most of the data is outdated. [IQ] The chart is difficult to obtain [get the paper chart] and you have to go through pages and pages to get little data that you can get in 3 clicks of a mouse. [RA]</p>	<p>[Remote Access] Probably some of the Java applets contravene most of the security measures ppl have in their PCs at home, its difficult to realize why your computer is not working, is it the firewall, is it because that one is enabled/disabled...I cannot use it well [Use] from home remotely because of Java applets and the security. I'd like to have an easier run of the program so that medium security settings of home PCs don't interfere with the program.</p> <p>Logging in from one system to another, [multiple systems] it makes you get off from your screen – you have to close it then you have to go open the EMR3 system to see the X-rays, you have to log on to that, do again the name search, you have to find again the 3-year summary for the same patient ...so the info is there but the way they [the systems] don't pull together – you have to know where to run &amp; get it. [system integration]</p> <p>I would prefer when I log in to a patient to be able to get all the data to have them somewhat linked easily....to have tabs for xrays, reports, consults, etc.</p>

Interv ie/ee	Beliefs about the Technology	Beliefs about the Profession	PBC	Attitudes	Intentions/ Usage	Other
O R T H O P E D I S T	You have to know the exact name, number, everything has to be exact – on the floor it doesn't have to be exact. [Search issues]	I never go to the Radiology dept anymore, it used to be I had to go look up the X-rays and have them pulled – so now I can look them up in the computer – it's better because I can do it on the floor, I can do it in the lounge, at the office. [RA] The computer pictures are adequate (image wise). [IQ]	The issue is having old comps that don't work, having multiple insertions of passwords and codes to get in. Does it take a long time? Yes. We constantly complain abt this to the IT ppl – trying to get them to correct that.  I prefer to access the computer in the lounge---The screens are better in the lounge.  On the floors I use the computers at the nursing stations.	I like having the system available so that we can check labs and other physicians' dictations. [data retrieval] Also you can go into their past treatment history for all their previous visits and that's all excellent.  Overall the system works pretty well.	I start every morning in the lounge & pull up my list & look at xrays & labs & then if I get a consult I look up their history & review their X-rays in EMR3 before I go see him.  At my office I ask my secretary to look up X-rays when people come in – but here there is nobody...you're it. So I have to do it myself. [Remote access] – from office – I can get my staff to pull up the X-rays – it's time efficient this way. [Efficiency] here I can't bring somebody with me so I have to do it myself. [availability of workarounds]	It's cumbersome to go through the system – for you to get to EMR3 you have to re-enter your passwords 2-3 times, so it's a struggle. [EOU]  EMR4? I was hoping they would do smh like that. It would be much easier just to point & click [EOU] rather than writing everything out. You have pull down menus & everything we write it's been written million times before. It would be so easy on the computers. I would prefer writing orders in the computer.



Interviewee	Beliefs about the Technology	Beliefs about the Profession	PBC	Attitudes	Intentions/Usage	Other
F A M I L Y  P R A C T I T I O N E R	<p>I don't think that at this point the interface is quick and easy enough for physicians [EOU] [SPEED]</p> <p>...the time it takes to go through and find something is too difficult [Efficiency] [CX]</p> <p>...the system is not EOU at this point.</p> <p>[Efficiency] [RA] The hospital it is not computerized enough to make more difference in terms of efficiency. In the office, I gain time from the system.</p>	<p>It speeds up info. For me that I am more on the cognitive side of medicine, if you can get more info to me quicker ....</p> <p>[Accessibility] [real time info] it reduces the time to make a decision [Efficiency] and reduces sometimes the tests that I have to order.</p>	<p>[Support] The staff is very helpful, they'll find something for me if I need it.</p> <p>[Computers location] The computers are not at bed side.</p> <p>There are certainly not enough computers available [number of computers]</p>	<p>[Negative about the present hospital system] [System problems]</p> <p>[Positive attitudes regarding his office system]</p> <p>I now have EMR in my office. It makes it much faster, much easier. [SPEED] [EOU]. If I can get to the level that I'm doing in my office [wireless and use of a tablet] already I would be happy. [Attitudes]</p>	<p>[Very minimal use] In the hospital I use more the paper chart at this point.</p> <p>I rarely log in, I usually ask somebody to get things for me.... [workarounds]. I go to the room, see the patient, they'll get the info for me, you don't have enough time [Efficiency] to keep doing all that [log in the computer], you go to another floor &amp; need to log in somewhere else. [multiple log ins]</p> <p>It's a matter of time [Efficiency]. ...I gotta go there, I got to log in, [log in] I got to look it up...that's taking 3-4 minutes, versus I go see the patient &amp; I'm ready to go.</p> <p>The time it takes to sign in the system, [Access] get the info, you wasted 4-5 min &amp; the time you add that up patient after patient....I've got to have quicker access, where I pick up the chart &amp; flip through pages, look at something &amp; go. If I go down the hallway log in etc that's 5-8 min and....I can't do that. [Efficiency]</p>	<p>[Access] ... right now you have to go find a computer, you got to log in, [log in] look up the results....</p> <p>...that makes it tough [CX]</p> <p>[Remote Access] I have broadband &amp; WinXP but when I am looking for info sometimes it would say "physician error" call help desk....and you go ok...I don't want to do that. [Support]</p>

Interviewee	Beliefs about the Technology	Beliefs about the Profession	PBC	Attitudes	Intentions/ Usage	Other
P H Y S I C A L	They need to make it user friendly [EOU] so that you can scroll easily and there are systems that do that. [Other systems] [Visibility] <b>Efficient?</b> No. Not with the current system. [Efficiency] [RA]	You don't have to bother the nurses so much to get info which is good and bad... the flow of information is easier. [Data retrieval] It's better to have a computer system than not have one.	You have to wait sometimes... I think they need to have both the workstations and the carts... [type of computers] the workstations need to be updated so there is more room on the table. [physical positioning] Needs to have the small computer monitors and enough room to have a chart there also.	In general positive, the system has to be more user friendly [EOU].	I use CA every day to pull up my patients. ,	[CPOE Intentions] I've heard horror stories from other people [SI] - just other places that have EMR4 [Visibility] ...I've heard there were a lot of problems from the docs that took a lot of time to work things out.
T H E R A P I S T	There is lot of holes in it. If I go to the rehabilitation unit and cover a lot of patients, I can't access a unit and do all the patients in the rehab unit [Accessing patients in the same unit] [System functionality] There needs to be physician access to a unit that you're gonna be covering. [System access directly to patients on a unit rather than all patients] I have to go get a printed census, get the pat for the docs that I cover for...it takes extra time... its ability to obtain prior studies is limited, I have to ask the nurses to get like a year ago admission, I can't pull up a lot of old reports. [CA's ability to store only 6 mo of data] [Does not use EMR I]	[Attitudes] It only helps with the charting...if things are in the computer it helps...but <b>not all info is in the computer...and not all info is in the chart...you have to use both.</b> [Accessing info] [Info spread in two places] Right now you have to look at both the chart and the computer to get all the info [Accessing info] [Info spread in two places]				...I'm sure it's gonna be a lot of glitches...it's gonna be an ordeal. [Negative attitudes abt CPOE]

Intervi ewee	Beliefs about the Technology	Beliefs about the Profession	PBC	Change	Attitudes	Intentions/ Usage	Other
P E D I A T R I C S S U R G E O N	<p>I like CA [Attitudes] because it's easy for me to find what I want... [EOU] that's basically what I'm looking for... EOU. It's gotta be friendly. CA works fine. I see a lot of people use CA [Visibility]</p> <p>It's user friendly... its not hard... you put user ID and password, get the list of the patients... click on a patient and get their labs... easy. [EOU]</p> <p>I need to have this info to take care of my patients. [Availability of info]</p> <p>The EMR3 system is a tremendous advance: [Attitudes] [Change]</p> <p>(1) because the quality of the reports [IQ] (2) it has the advantage you can scan through the films instead of looking like this on a view-box, you can look through hundreds of pictures, can make them kind of like movies... [RA] (3) you can easily access the old films, so you can do comparisons [old records] ... in the past when you requested 10 X-rays after about 2 hrs you had 4 old films on patients [Change] — now everything is there... that's <b>is absolutely spectacular.</b> [Attitudes] [Data retrieval]</p>	<p>The biggest problem we doctors have is finding things. [Data retrieval] I sometimes spend 15-20 minutes a day looking for charts, if there were no charts I wouldn't need to spend that time. [Efficiency]</p> <p>Various people utilize the charts so they're not where they are supposed to be... I was making a joke with the nurses that if I have been able to capture all the time I've been looking for charts - I've probably could take a 2 year vacation.</p>	<p>I think there are enough computers</p>	<p>I think docs are very resistant ... I am a little resistant, I just don't want anything that means more work for me, [Efficiency] [RA] that takes more time, time is very valuable to me... [Time] it's the most important commodity that I have.</p> <p>I like to try certain things and I like certain old things. I like electronics and gadgets, but I value things that I used for a long time also.</p>	<p>There is a learning curve like with any system [Learning] but it's not bad... [Attitudes].</p> <p><b>I think for a doctor you need to show him how it's gonna be better, [RA] how it's gonna make his life better, how it's gonna make his patient's life better. That for me it would be important if you were to try to get somebody to use the system.</b></p>	<p>The main thing I do is looking for lab work, test results [Use] - that's more efficient, because you have to call somebody to get it if it's not in the chart. [Efficiency] [RA]</p> <p>I think that's a big asset, that's very helpful. [RA] [Change] Before you had computers, when things were not in the chart you had to call the lab - and you had so many people calling the lab which was very inefficient for the lab also ... <b>I think it's a big advance</b> [Attitudes]</p> <p>If the info is in the chart already I don't have to do it. [Uses paper chart first]</p> <p>As far as the EMR3 system is going, I am able now to instead of going down to X-rays, finding the films, looking at the films [Change] which can take half hr for 1 film... [Efficiency] now I can look at it in the ICU, [Use in ICU where no log in required] it's right there near the patient.</p>	<p>EMR1, my problem is that if you're out of the hospital, you have to use this token, that I can't stand... [Remote Access] because I don't always have the token with me, sometimes it takes a couple of times to get it going, you want something that's fast... [Speed] it's like dial-up versus cable.</p> <p>[Visibility] [Other system] ... they had a system at ORMC which was awful... that I never liked, a system of algorithms, when you have algorithms you have to go through 10 screens to get what you want... that's ridiculous. You would come to a page and it would say list all patients, then click on a patient then click on what you want for that patient then you click on a sub-set - sub-set, and it was awful.</p>

Interviewee	Beliefs about the Technology	Beliefs about the Profession	PBC	Attitudes	Intentions/Usage	Other
NEUROLOGIST	<p>The main system we use, EMRI, is reasonably user friendly [EOU] and helpful. [RA] Once you know how to use it, you can see all the tests, dictations on a patient, all past X-ray reports and current lab studies [Data retrieval].</p> <p>You can get info faster from the computer [Real time info] rather than wait for somebody to print it and put it in the chart...the radiology reports would be in the computer almost 24 hrs before the paper report reaches the chart—it's very useful to get that info. [RA]</p> <p><b>Efficient?</b> I am more efficient...[RA] I am seeing more patients than I used to see 5 yrs ago, and without the computer system I couldn't take care of the number of patients I am taking care now... except if I ignored everything that happened in the past.[Accessing old records]</p>	<p>... It's much easier to pull a patient's old record [Accessing old records] [EOU] and see what already has been done, what the previous diagnoses were...what previous tests have been done, that tells you what doesn't need to be repeated...that's very helpful. [RA] If you have to treat each patient as a new patient, it duplicates [Duplication of work] a lot of work and it makes the patient stay in the hospital longer. [LOS]</p>	<p>Occasionally you have to run for a terminal.</p> <p>I don't think there is a lot of preventive maintenance on the laptops, they wait for something to break and then it takes a while to fix it. But in general it's not a big problem.[no of computers]</p> <p>Normally I don't need a lot of support...it's usually time consuming to try to get support...[Efficiency] [No time to get support] when I'm doing rounds I don't have time to wait to talk to a support person</p>	<p>I am comfortable using computers... some docs don't know how to type...this is the immediate barrier, [Observability] [Typing] so it can be very time consuming to put in the password, etc. [efficiency]</p> <p><b>[Specialty] Different specialties</b>—the info that's available may not be that useful, a heart surgeon operates on a patient's heart, he doesn't really care what happened 3 yrs ago. For me as a neurologist, that info is very useful, [Accessing old records] for other specialties the motivation to use it may not be as great.</p>	<p><b>What makes you use the system yourself versus asking a nurse/secretary to retrieve the data for you?</b></p> <p>It's very frustrating to ask the secretary/nurse to get something from the system, they don't have access to the same programs that we have. If you ask them to get something, it's usually time consuming and slow, they may not pull up everything you want to pull up. [Incomplete info]</p>	<p>The programs are not very smoothly integrated.[System integration] And I know they're working on that. For instance I have to go into one program to access old records, a different one to see what medications the patient received yesterday then a 3<sup>rd</sup> program if I want to look at X-ray pictures from the nursing stations. And for each program I have to sign on individually. [Log in] [Access]...that's time consuming. If I'm on call I see 15-20 patients in a day. [Efficiency]</p> <p>My patients are scattered throughout the hospital because I am a consultant so I have patients that are not all on one floor, so whenever I have to look up a patient I am in a different location and I have to sign up the computer again...[Log in] [Access on different floors] I'd like to see some kind of a proximity detector, if I approach a computer, the computer recognizes me and signs me in automatically, rather than me typing in the user name and password for authentication.</p>

Interview week	Beliefs about the Technology	Beliefs about the Profession	PBC	Change	Attitudes	Intentions/ Usage	Other
O N C O L O G I S T	Neither program is ideal...specifically time, they're both too slow. [Time] [Speed]  I got to a point where I like EMR1 better. [Attitudes] I think the way you have to get to the info is awkward...I can't just click on lab data and see it... [Navigation] I have to click here, then I have to click there...and then I can get my lab data. It's not as user friendly [EOU] as it should be. I can't change the screens, there is only one way of looking at them...their way. ...[Customization] I'd rather be able to customize the screens so that I can look at the way I want to see the data. So it's not customizable and the menu system can be better. [System display-interface]  [Benefits?] Not a lot. The data availability is a big thing that it offers to physicians, eventually if it's a purely mobile thing, you don't have to walk to a terminal and log on. [Log in] I see it being much easier than paper. .[RA] for example...a tablet PC---[type of computer] you're walking around with a tablet PC, and	It's much more efficient...[Efficiency] my access to information is much better...[Accessing old records] An example: I get a consult from somebody and I go see the patient, find out that one of my partners saw the patient 2 years ago....so I am really curious what did my partner see the patient for and why. With EMR1 you can go look it up. <b>but again you have to go through all these menus to get there...</b> [EOU] [Navigation] but then you can get to the medical records, find my partner's name click on his consult and... there...I can see exactly what my partner said. <b>That's a biiiiig change from paper-world, [Improved access to old info]</b> In the paper-world, I would have to tell the secretary I need old records on this patient, she'd call up Medical Records, Medical Records would have to dig it up on microfilm, usually it would take 1 or 2 days to	[Computers available] That's always a problem. They just don't have enough computer terminals, they're not readily accessible, [Access] that's gonna have to change. Theoretically there are enough terminals there....2000 patients and 1500 terminals, that's more than enough so that simultaneously 1500 people use the system but the reality is that there are 5-6-7 computers on the floors, half of them are gonna be in use [computers in use] at any given time so you gotta find one that's not being used. [find a computer] ...I gotta walk all over the place. [Support] I understand it's fairly good, I never had to call, I never had problems. I had computers that are broken or didn't work	I don't think it's necessarily because I am physician but everybody gets used to doing things one way...[Habit] You go to school and learn your way how to get from class A to class B so you learn one way and you tend to keep it on the same way because if you go some other way you might get lost...It's the same thing...you learn your way around the computer program, know how to go from here to there to everywhere and then somebody gives you a whole new building, a whole new computer system ..oh my God I have to re-learn everything. It's just an annoyance even though the new system or the new building may be much better, [RA] you still have to learn [Learning] it...and everybody hates doing that. Physicians do the same with new treatments...they get used to treating disease A this way and some new treatment comes along and they'll have to think about it for a while [Lag] before they'll go to the new treatment especially if the new treatment requires a lot of work [RA] from their part. If the old treatment is easier,	I don't like CA because I think the menu system is poorly designed [System issues] and CA is too slow. [Speed] EMR1 isn't fast either. The menu is a little better...there is much more info available in EMR1. [Data availability] The problem with CA is that it's got only got 6 months of data...[Ability to hold info] that's not enough...you got to be able to go back in time. EMR1 solves that problem but neither program is ideal...specific	[Use] There are times when the lab data I am interested in is already in the paper chart...so for something like that, no...I'm not gonna access the computer. [Use of paper chart first] I always check the paper chart first because if it's already there, it's faster for me to just flip a page and look at it...again going back to the computer being slow. [Speed] [Efficiency]	[Legal issues] The computer chart is not the legal chart...the paper chart is the legal chart....if after it was printed out the doctor crosses through some things and makes in some changes in the chart I wouldn't see those changes if I look at the computer data. So there are some inaccuracies in the data from this standpoint...that's inevitable when you have data in 2 different places. [CPOE] The system has to be easy, intuitive...[EOU] [Intuitive] if I want a CVC I just want to be able to click on

that's it, that's the chart.... It's easier, you just have to say I'm going to "John Jones", click on "John Jones" and here is ... "John Jones's" data. You see John, you talk to him and then stand there and dictate a note on "John Jones", boom...you dictate a note...next patient... you're done. [integration with work flow] **Thaaat's when it's really gonna be easy!!!** [Attitudes] **Technologically, this is all possible...** but we're not getting that with EMR4.

get those old records. [Time] [Medical Records] That's unacceptable. Here I am ...within 5 minutes I can have all the information that I need. [Speed] ..all the prior lab results. If I need to see this patient for anemia...did he have an anemia before...and if he'd ever been in the FH system...look him up...I can see what their hemoglobin was 5 years ago or 10 years ago as long as they've been in the system at any point....which most pat have.

the way I wanted them to....I just walk away and find another computer, I don't call support. [Time issues] ...**I'm not gonna waste any time trying to find support...I just find another terminal...**

they'll stick to it for 5 or 10 yrs before it becomes readily acceptable. The only exception is if something is a giant leap forward like chronic mitologinous leuchemia -we have this way of treating the disease and it worked for a while and... after 4-5 yrs everybody died. Then a new pill came along...it was easy... you just swallow one pill a day and the disease went away....**it was so much easier and it worked so much better....[EOU] [RA]** everybody switched over night. So if the new system [EMR4] is easier, it works so much better, it will be accepted, instantly. **But they [physicians] don't do that very often.**

ally time, they're both too slow. [Time] [Speed]

Orders, labs, CVC...done. If anything is more complicated than that---it's not gonna work [CX] because if I have to put Orders, labs, CVC - then choose a bunch of options on how I want my CVC ---that's gonna take too much time. [Time] I've seen how the Order system works, it should be easy but if they put too much stuff in there, [Info overload on the page] [Navigation] it's gonna be hard.

Interviewee	Beliefs about the Technology	Beliefs about the Profession	PBC	Attitudes	Intentions/ Usage	Other
P U L M O N A R Y  S P E C I A L I S T  (1)	<b>[Work Efficiency]</b> It's the efficiency of rounding...when you go to a patient's room and open up a chart - then I have to drop the chart, go find a computer, that computer is not working, you got to walk around the nursing station, find one, then go back to the patient's room.	<b>[No change]</b> It really hasn't changed the way I practice because we do the same things...you have to examine the patient, we have to write orders...It hasn't really changed anything. It changed the way things are recorded, instead of the paper it's recorded on the computer. It really hasn't changed much for me at all. <b>[Attitudes EMR3]</b> It's very nice I can see the X-rays in EMR3 rather than go downstairs. [Med Records] It's very nice I can pull an HMP from the computer and not have to wait for a medical record to be brought up.... So there is some details that are helpful <b>[RA]</b> but overall it hasn't changed the way I work very much.	<b>Support?</b> The people are very nice but they are not solving my problem !!! I am the one stuck here 13-14 hours a day doing my job while they go home.	<b>The only way a computer is going to help me practice is if it is easily accessible [Access] and I won't have to wait. [log in] [Time]</b>  <b>If you do something, it should be as good as or better as before. [RA] ...they've got something pathetic [Attitudes] and they want us to use it !!!!</b>  The computer systems they have right now are adequate, <b>[Attitudes]</b> they are certainly not very good but they're adequate, they have good information... <b>[IQ]</b> the problem is that the <b>access</b> to it is NOT handy---which delays our work and makes our work more difficult. <b>[Work efficiency]</b> Also, not all the information is on ONE web site, <b>[System integration]</b> you have to change from one site to the other which takes more time... <b>[Time]</b> that's cumbersome. <b>[CX]</b>	<b>[Use]</b> I don't look at other clinical information {except for X-rays} in the computer, again because of those access issues... <b>[Access].</b> The nurses are responsible to print out a medication list, and so I look at that. <b>[Nurses responsibility]</b> They provide the list and put it in the chart every day — I am not interested to go into the computer just to look at something. I can't spend time to do that on EVERY patient. <b>[Time]</b> ....it doubles my time of writing my note. <b>[Efficiency]</b>  <b>[Use of EMR3]</b> For me, being able to look at the EMR3 system on the floor is very beneficial. <b>[RA]</b> <b>[Time savings]</b> Because it saves me time to go downstairs to the radiology dept and look at X-rays there. It's time consuming...So, the fact that I can be on the floor, access EMR3 and look at my X-rays right there saves me time from going downstairs and back up. So, for me that's very important because I see X-rays all the time. The problem is <b>accessing the EMR3</b> because it is relatively slow, you go in and it takes a lot of time to load.	One of the major drawbacks of the system is that <b>ACCESS</b> is not easy. There is a delay, a problem with access. It takes a min or two to get <b>[Time to access]</b> For me to log into the computer—if the comp is right here - takes me a minute and a half. <b>[Log in time]</b> If I have 40 patients multiplied by 1.5 min you got at least one hour for that every day... <b>[work efficiency]</b> , the computer is not there always, the computer doesn't work all the times, <b>[Find a computer]</b> so it's an average of 2 to 3 minutes. If I have 40 patients, then its 2 to 3 hrs— <b>it's unacceptable for us to do that. [Attitudes]</b>  I think we're all working very hard... <b>I think that spending time trying to get data, just basic data...is... [crazy]... [Time to access info]</b> It's a lot of running around trying to find stuff from the chart to the computer to the chart again to the nurse for finding something that's not anywhere... <b>[Info being in 2 places]</b>  There are 2 problems of access: - One is the <b>physical location of the computers</b> , the computers are spread out, some of them in the nurses stations, some of them in the corridors and there is not enough for the doctors to come around, <b>[no of computers]</b> so we have to look for a computer, many times we find a computers and it's not working, and we have to go around with the chart, find a computer and put the things together...once I find a computer, there is no seat, so you have to stand (cause the seats are taken by nurses, case managers) and it makes it very difficult for me to hold the chart in one hand, trying to connect to the computer with my free hand because the computer doesn't have a desk to it, so that's very uncomfortable and cumbersome

**[Moderate use]**

The one that I use the most is EMR3, I don't use at all almost EMR1 at all, and I only use CA because most info for me that I need is already in the chart **[info in the chart]** and some that isn't I ask the nurse to get it for me ...I just don't waste my time to go into the computer and do it myself. **[Time]**

**[physical arrangement]**

- Number two, let's say I'm in the computer and I find some data---by the time I find the data that's accessible by the computer, that data is already in the chart, so it would be a **duplicate** for me to look into and so it's a waste of time **[Data is in 2 places]** for me to find that data and then...let's say I want to get a chest X-ray report, then it's easy, but if I want to look at an X-ray I have to log out and log into another system (EMR3). So, it's time consuming. **[multiple log ins]** **[System integration]**

And the other problem with the EMR3 is that if you looked at one picture for one patient on the second floor and then you go up to the 10<sup>th</sup> floor to look at another patient and try to go into the EMR3 again, if you didn't log off, it won't let you log back on. **[log out problems]** So, sometimes I don't remember where I left and where I didn't log out, then **I am stucked!!!** I can't log on again....big problem....*So what do you do then?* I don't do...I wait, or I call all the floors where I was and have them look at the computer and sometimes they log me off...but it's a big problem. **[work efficiency]** **You have to trace yourself backwards...it's pathetic" ...[Attitudes]**



Interv iewee	Beliefs about the Technology	Beliefs about the Profession	Change	Intentions/ Usage	Other
P U L M O N A R Y S P E C I A L I S T (2)	<p>EMR1 – I think it's a great advancement [Attitudes], improvement than we did before [RA], we have quick access to all kind of info about our patients [data retrieval], it's very practical for us, we can print a daily list of our pat – which sounds probably unimportant but it's very important practically cause we locate the patients very quickly and use it as a means to make sure we see everybody that needs to be seen. We also have access to lab results, records, all kinds of info on the patients, including lab data and things like that.</p> <p>The other thing is that we have quick access to the EMR3 system so that we can look at images or x-ray studies. ... wherever you happen to be which it's a great advantage. [RA EMR3]</p> <p>Efficiency? Absolutely yes for a no of reasons, (1) quick access to X-rays when I am looking at a film otherwise I would have to leave where I am, go to the x-ray dept, find the X-rays, wait for them to be pulled, I don't have to do that... that takes a long time, so definitely it improves our efficiency... [RA vs going to Med Recs] (2) quick access to the lab results (3) easy access to demographic data, info on previous admissions, a lot of the data is there, it's available so you can make an assessment very quickly and put things in prospective very quickly. [data retrieval, availability]</p>	<p>We do the same things but a lot more efficiently. [Efficiency] I still look for the same data, I still make the same diagnoses, my experience with the patient and what I do is the same. It is better, you have complete access to a lot of info... that's important. [access to info]</p> <p>I'd like the system to be easier &amp; faster in accessing old recs – I'd like it to be cross linked – [system integration] if I bring up a patient's name, I can easily &amp; immediately look at at previous reports quickly. I'd like that to be more efficient.</p>	<p>I am reasonably flexible with change... when I can value the rational for the change and the importance of it – I accept it. This is a big paradigm shift – I find myself challenged and my comfort level has not been the greatest... it takes me time, in the beginning I was uncomfortable but I knew that the benefits offset the initial difficulties.</p> <p>I don't have a problem as long as there is a benefit... I don't have a problem learning smh new [but not change for the sake of change – he says] Sometimes there is change for change and then I find myself somehow resistant to it – if you can't say that's this benefits the pat, the hospital or myself, whatever, I don't like that.</p>	<p>Are you using most of these functions personally or look at the paper chart? It's a combination of the 2. I use both. I use the paper chart – if info is there, then I don't look for it in the computer... but if it's not there, I do.</p> <p>ICU is more efficient [RA] because they have dedicated areas where films are available in EMR3... it's already logged in – [log in]</p> <p>So you like to access the films from there? Oh yeah, it's easier [EOU] and the image is better, you have a larger monitor, you have higher quality, you can manipulate the image better. [computer quality]</p> <p>Actually you can access any other hospital's X-rays as well... [access to other campuses X-rays] by pat name or MRI no – you can download them there... and it's better than the little monitors on the floors cause those are smaller screens and the resolution is better.</p>	<p><b>SI</b> - we jus don't talk abt the CS much in the lounge – In some meetings there is discussion abt that but not in our every day encounters.</p> <p>EMR4? – it sounds like there is a step in the right direction, I don't know much abt it, I know it will give us more flexibility to integrate what we do.</p> <p>I have some concerns, I am a slow typist for ex, to enter data it takes me longer – in terms of practical challenges that's one.</p> <p>Orders? I just hope the format is very user friendly. [EOU]</p>

Interv iewee	Beliefs about the Technology	Beliefs about the Profession	PBC	Change	Attitudes	Intentions/ Usage	Other
P L A S T I C S U R G E O N	<p>I don't need it - none of this pertains to me because I don't have patients in the hospital. I don't have hospitalized patients to follow, I don't have labs - I have outpatients or overnight patients, so I don't need to check X-rays or labs For me it is not helpful, I don't need it. [Need] [RA]</p> <p>What pertains to me is the use of the library---research &amp; meetings-- -I think that's helpful. [RA]</p> <p>I have enough to keep up to as far as learning in my specialty.</p> <p><b>I'd rather look at the chart because it gives me all my sides notes that you can't put in the computer. [Info organization]</b> It's never gonna help my practice. What happens if these computers crash? And lose the data....? You have to have backup disks, it's creating more &amp; more work for your office staff to try to save records that would be easily saved in a chart.</p> <p>[Initial data entry] Like with the photos...What do I do with all my photographs? I have to scan those &amp; put them on a disk, be able to locate the disk, locate that patient on the disk... give me a break. You have the chart, the prints are in the chart and the chart is right</p>	<p>The computer can't tell us that personal evaluation made by a radiologist or another specialist- it's nothing like calling up the physician and talking to him....because there is a certain feel a doc gets about a patient that can confer to you.</p> <p>Some things you put that in the chart for medical legal issues but that does not always reflect what the guy is thinking. Do you want to communicate with your boyfriend just via a computer? Without ever meeting him, talking to him...touching him? <b>The computer is a cold, inanimate object.</b></p>	<p>We don't have computer terminals everywhere in the hospital so it's so diff to access... [no of computers]</p>	<p>I like to change if it benefits: my patients, my practice and myself ! I am always trying new things for my specialty - any new advancements that come along. I involved the FDA for a brand new technology, no research done on it, put a team together, did 2yrs research got it approved within 1 yr, I use new technology for liposuction all the times. <b>Advancements, new technologies... yes if it has a track record, if I look at it, evaluate it from a surgical standpoint—this technique is worth trying, if that technique has any potential complications, why would I try it and run into more</b></p>	<p><b>Computers do not serve my patients better.</b> ...it doesn't help me at all.</p>	<p>I like email - that's a wonderful communication modality - I can communicate instantly - that is a big advantage... [RA] but to get into all these hospital records that <b>I would have to go through all this hassle [CX]</b> - because of firewalls &amp; attempts to keep it private and we still there is no guarantee they're gonna be kept private...look what happened in NY with those banks - a hacker can always go through these firewalls -that means the patient's info is gonna be available to other people ....that's the concern of a lot of docs. [Security] [UI]</p> <p>I am really not gonna use computerized systems....I access my patients by calling the front desk and have them bringing me the chart.</p>	<p>[Remote Access] I don't want to go through a cookie &amp; all this other garbage just to get access to my patient info. I want to go to a chart &amp; pick it up and find what I need. [RA]</p> <p>Also it is more work for me... [RA][EOU] it's much easier to pick up the Dictaphone and dictate to my secretary, have her type it, stamp my name &amp; mail it - it's easier than type a message to my friend via email but I do it because it's instant and I don't mind doing that - but <b>if I had to do that all day long with patient records I'd kill myself....</b></p> <p><b>Paper charts are easier to access than the computer [Accessibility] [EOU]</b></p> <p>[Previous experience/system] When I was a resident in 1965 in the 1<sup>st</sup> hospital to be computerized with IBM—they had all the drugs in there...the problem was with the pharmacy - anticancer drugs - you had to use lethal doses - the computer would reject the request to put the drugs in... they kept telling us it would kill the patient...these are the problems that we've had.</p>

there with me in the room - if the patient wants to see a picture... here it is there [Accessibility of paper chart]

Why would I want to complicate my life more than it is? [CX]

problems? I change cars, brands of cars - because it is better than what I have. [RA]

Nobody liked it then - I don't think a lot of people like it now especially people in my age group. [Attitudes]

Interviewee	Beliefs about the Technology	Beliefs about the Profession	PBC	Attitudes	Intentions/ Usage	Other
INTERTN	<p>I don't think it's a user friendly system, [EOU] ...[Visibility] [other systems] the other system I encountered was with Columbia Healthcare system at Winter Park. They had a system Meditech—was very user friendly, easy to get at info, [ease of retrieval] quickly, didn't have to get through multiple screens [navigation]</p> <p><b>What do you mean by user friendly?</b></p> <p>The interface, the data/info, is it true/accurate, [IQ] if you have to write something 3 times to get it. [navigation]</p> <p>You have to have a program that is user friendly, practical and easy for the doctor to use. [EOU]</p> <p><b>[Efficiency?]</b> At present time, no difference, maybe less efficient with the computer because it takes me time for me to go to the computer [time issues] and put a password to do something...just to look up a lab.</p>	<p>In the old days, the lab would be in front of the chart and you'd read it – a doc shouldn't have to take his time to try to get the lab work in his hand. [accessing records]</p> <p>If he has to go to the computer every time he sees another patient, re-enter his password [log in] and wait for the computer to pull out the info, [time to pull up results] he loses his precious time, [time] [efficiency] Also, the computer is not at the bed side, it is in the hallway...[physical location computers]</p>	<p>There not enough computers here maybe 2-3 on the floors that are being used...[computers in use] or the machine may be off, [computers off] and I don't have time to reboot it.</p>	<p>To me the computer system is in its infancy what we have here now, it is helpful to some degree, but its not reached what I thought it should reach.</p>	<p><b>I use it periodically</b>, when I need it. [need] I use the Internet a lot to look up info, I use email frequently to communicate, I use it to get a list of patients and where they are located, I use it to get lab tests, other procedures that have been done sometimes I use it, many times the nurse have the info or many times the info is already in the chart.</p> <p><b>How often u ask a nurse to retrieve things for you?</b></p> <p>Frequently, almost every time because when I make my rounds, first I like to talk to the nurses because they're taking care of the patients, a doc does better if he talks to the nurse who took care of the patient the last 8 hrs, get more info that he can get from anywhere else. [profession]</p> <p>I carry a <b>palm</b> I find it very helpful...I have a complete up to date lab program that allows me to look at lab tests, I have a medication formulary which helps me to look for drug interactions and side effects. [RA] I use that frequently. ...The hospital doesn't have anything like that's user friendly [EOU]</p>	<p>[Access] Also, you have to do multiple passwords, I would like to use it more from the outside but the protection system is so great that is <b>cumbersome [CX] and its not worthwhile to use it. [Benefits]</b></p> <p>Also, I find <b>the info is limited</b>, some demographics, lab tests...[limited info] [IQ]</p>

Interviewee	Beliefs about the Technology	Beliefs about the Profession	PBC	Attitudes	Intentions/ Usage
INTERVIEWEE (2)	<p>It would be nice if I can look at more info [complete info] — vital signs, it would be nice if they are all in one place. [system integration]</p> <p>[Efficiency?] I find it makes me more efficient because I have the info I need quicker &amp; easier. [better accessibility data retrieval][EOU] [RA] [Speed]</p>	<p>It makes the info more accessible</p>	<p>[Support] Few months ago they had people in the lounge showing how to log on, etc.</p> <p>[Computers] I usually use the computers down here in the lounge. Computers are available on the floors but they are already in use...[computers in use]</p>	<p>I like that I can access the system to view labs, X-rays...[data retrieval]... it's much easier to find the results in the computer than search through the chart because the results are not always where they are supposed to be in a timely fashion. [EOU] [RA]</p>	<p>Usually before I go see my patients either from here [lounge] or my computer at home I review labs, X-rays</p> <p>I don't know where to find X-ray films in the computer... I look at the reports but not the films.</p> <p><b>I don't use it too much in my daily work.</b> But what's coming would be the <b>notebooks</b> have all your patients in there, enter your orders in there, do your prescriptions in there...a more efficient way to do it. [efficiency]</p>

Interviewee	Beliefs about the Technology	PBC	Attitudes	Intentions/ Usage	Other
INTERVIEWEE (3)	<p>If we can have an easier way to get more medical info for physicians, we have an area that's a library—when you go inside to check books, magazines, it doesn't give you good info. [IQ] [library]</p> <p>[Efficiency?] Yes it made me more efficient in seeing patients, get the reports faster, and discharge patients faster.</p> <p>The computer system helps a lot...[RA] you get results faster, [speed] [data retrieval] you don't need to rely on other people — you can read it yourself. You never trust what somebody else</p>	<p>80% of the times I can find a computer, before we used to have more computers, now we have less...that may be a problem. [number of computers] We can get more units—more accessibility, it's a large hospital and when everybody uses the system, nurses, secretaries... more units would help.</p>	<p>In general it's a good system.... very easy, straight-forward, it's very simple to use. [EOU]</p> <p>I think the system is pretty good, [system quality] as a matter of fact I go to other hospitals ORMC, Health Central, Sand Lake hospital...I think it's a great system because you don't have to depend on nurses to get the reports... you can go in and check everything, X-rays, see the films, check the results on the blood work, all the</p>	<p>I use both EMR1 to print out the census, I use CA while in the hospital.</p>	<p>I'd like the software to do interactions with medications —when you order meds, write meds and the system would flag you right away there is a major interaction —you don't need to wait for the pharmacy to go to a different software and check all the meds. [would like orders][software to do more]</p> <p>[Other hospitals] At Sand Lake, you don't get the info as fast as you get it at FH. [ease of access] Same at ORMC, it's not as fast, but you can get all sorts of info. [more complete info]</p> <p>[CPOE] That depends...if we're gonna have just few stations, its gonna be a mess. [no of computers] This is the</p>

tells you...you need to see the report yourself. (to be sure). So it helps a lot in this way.

dictated reports, so it's very convenient. [RA] You can check this even from your home...[remote access] so it's very good, you get all the info through the computer... I love it.[attitudes]

biggest hospital in town, if you have only 2-3 units for so many docs, I don't think we'll use it, because everybody's in a hurry, we're very busy, if we have to wait in line just to type the orders [time] [efficiency]...if we maybe get laptops, that's the way I see it so that we move fast...

Interv iewee	Beliefs about the Technology	Beliefs about the Profession	PBC	Intentions/ Usage	Other
I N T E R N I S T  (4)	<p>You have to switch back &amp; forth... [system integration] in CA you cannot retrieve the prior HMPs &amp; dictations, so if you want to go back to a prior consult 3-6 months ago, you have to go to EMR1. [data in 2 places] So, you have to log into 2 different systems....if they provide a link between them it would be better.</p> <p>CA is EOU but the info is limited in CA [IQ]</p> <p>With dictations... I can only retrieve [data retrieval] but cannot make changes in the computer to dictated notes. [data modification] [visibility] [other systems]</p> <p>ORMC they have a box for clarifications, so you type in whatever is missing or if you want to make a correction you can correct... here at FH if you want to make a correction you have to go to Medical Records &amp; ask them for the printout then correct or re-dictate again. [CX]</p>	<p>It makes info available for a patient. [accessibility of info] all prior investigations are already there [data retrieval] - have no repeats. [quality of care] if a doctor saw the patient 2 yrs ago &amp; same problem is coming again, I can call the same doc...saves time, so that we don't have to repeat everything again &amp; again.</p>	<p><b>Computers?</b> Sometimes you have to wait but you can get a computer</p> <p><b>Support?</b> they have a good orientation for the system</p>	<p>90% of the times I go access info myself...with daily VS, I usually go with the nurses because they give more accurate track because sometimes they write on a piece of paper, they don't enter it.</p> <p>There is no tab in CA/EMR1 to keep track of VS for 3 days ...no input/output...I have to go to the chart if I want to see that. [data in 2 places]</p>	<p>Logging in is very tedious...very difficult.... I would like a tablet PC ...if I have my own screen, I don't have to log in or use the token. [Access] [CX][Remote access]</p> <p>[other systems] ORMC—very friendly, I can access it from home...no token. [EOU] [remote access]</p> <p>ORMC: Sovera system. You can access everything and don't have to double log in [log in] —there are tabs for each system). With this system you can: Log in without token Dictation you can correct Progress notes scanned Can sign docs</p>

Interviewee	Beliefs about the Technology	Beliefs about the Profession	PBC	Attitudes	Intensions/ Usage	Other
INTERT	<p>CA you are supposed to go back and look at previous hospitalizations up to 6 months but sometimes they're not there so you have to go to EMR1 to get that info. [IQ] [system integration]</p> <p>EMR1's problem is with X-rays, when you go on to X-rays, they'll have current X-rays for the current hospitalization but they won't have a list of prior X-rays from last year [IQ] so you can pull out an old X-ray and compare it with the current one you're looking at. If you need to do that, you have to find a computer outlet with EMR3. [system integration]</p>	<p>The way the system has evolved here...it's much better, much easier to use...[EOU] so it has increased my efficiency. I'd say, it hasn't really changed much cause we don't do orders or progress notes.</p> <p>As a physician I can see I'm doing more of stuff the unit secretary used to do.</p>	<p><b>Computers?</b> Usually the only time it's a problem is at change of shifts, but usually it's not a problem.</p>	<p>CA is pretty good. I can access pretty much anything. EMR1 is a little more difficult to look labs, they have the labs listed but you have to look at them one at the time. [ease of access results] [EOU][navigation]</p> <p>EMR1, if you're in the office, if you download info and print it out, you have to print out each test, with CA, I can print the whole thing, it would be 3-4 pages depending on how many tests, but it would be a lot easier to do. [EOU]</p>	<p>I use CA, from the office I use EMR1.</p>	<p>[CPOE] It depends on how easy the CPOE would be [EOU] cause I don't want to sit there for ½ hr typing something in, when before I would do it in 2 minutes. [time] [typing] [efficiency] It depends on how they set it up to do progress notes. If the system would double my time, I won't be very happy about that. It depends on how easy they make it... If it takes me 10 screens [navigation] to get to one thing, that's not exactly making me more efficient. If I have to type in a test, if depends on how the computer accepts it... if I type something in that's not recognizing, [system quality/intelligence] if I put something in like a name and it is not spelled correctly ...then have to spend time there.....so it depends a lot on how they set the system up (pull down menus, touch screens).</p>
(5)	<p>When you're looking for a patient and you don't know the exact spelling where you have a last name but you don't have a first name, the system would say there is nobody under that name but it won't give you a close spelling. [system quality] So it won't come up with anything, it would say... "there is no patient in the system with this name" ....it wouldn't say "here are your options.."</p> <p>So that's one problem, then I have to find the correct spelling of the name, then I can get the system to find the patient.</p> <p><b>[Benefits?]</b> I know what I'm looking for and I can just go directly to it, whereas I can say something to the unit secretary, she may not know what I want, she may come back to ask, is this what you need? no, I need this you know...so it's a little more efficient for me to do it myself, but it also takes more time for me... [costs]</p> <p><b>[Efficiency?]</b> It makes me more efficient cause I can follow up on things, at the same time I can look at the computer for the patients I am currently seeing...I can very easily pull up something on another patient. Plus, when I come in, in the mornings, I can pull up my patient list and see if anybody has moved cause sometimes I come in and they moved and they haven't told me ...that way I don't go to the room, see somebody different in the room and go... "where is my patient?" It's made me more efficient but because of the ease of the computer system I end up doing some stuff that I didn't have to do before. [profession]</p>					

Interviewee	Beliefs about the Technology	PBC	Intentions/Usage	Other
<p>I N T E R N I S T (6)</p>	<p>What I like about the system [Attitudes] is easy accessibility, access relevant patient info right away, [data retrieval] everything is in the computer so that I can read it easily...I don't have to read other's handwriting...it tells me all the old records in a matter of few minutes or clicks, it is faster to get X-rays/CAT scans. It is easy to look up old records, X-rays and such, [EOU]</p> <p>Sometimes it is slow, it may jammed up—you still have to log on every time...but the benefits outweigh the waiting period compared to the old charts, so in that way... it's much better. [RA compared to old charts]</p> <p>[Efficiency?] I am lot more efficient with the computer... when a patient gets admitted, if I need to look up something, I can look up old history so I am not repeating myself, old orders, redundant stuff, I can progress from that point on. [quality of work]</p> <p>I've used other computer systems in the past at other hospitals, [visibility] [other systems] the computer system here is very user friendly, [EOU] you navigate easily compared to other systems. It's much faster compared to other computer systems. You can look labs much faster... it is fast. [speed]</p> <p>It helps to look up old stuff [data retrieval old recs] that's not in the chart...so you don't have to wait 24/48 hrs to look at a test result. ...so you can make your decisions right there. [efficiency]</p> <p>Some of the lab results are in the computer before they are printed by the secretary and put in the chart, so it's much more real time....[IQ]</p>	<p><b>Computers?</b> There are 2-3 floors where there is a lack of computers...9<sup>th</sup> floor, 10<sup>th</sup> floor where you have to push the nurses out of the way.</p> <p><b>Support?</b> The hospital has support here in the lounge - but the system is user friendly, self explanatory.</p>	<p>I use the system every day...regarding other physicians' notes for example, you still have to go to the paper chart, sometimes they have printed labs in the chart, so sometimes it is much faster just to flip through the chart, but there is some staff that takes time to come to the chart...so what I do, I first look to the chart, if the labs are not there or X-rays—I go to the computer, otherwise I don't go to the computer.</p> <p>You flip through the chart anyway.... You look at chart, read see if there is any other consultant on board, what did they mention, what did they order, you look at vitals, some of the labs from the morning, then go see the patient</p> <p><b>When do you look at the computer?</b> If the labs are not there, I need to look them up, if there was something that was ordered by the clinician in the morning and I come in the afternoon and it is not in the chart. If there was an ecocardiogram or some dictated report that's not in the chart...I'll go look it up.</p>	<p>[CPOE] In my residency we had EMR4...there will be problems unless you get a very user friendly system....[EOU] at that time it was horrible, we had to enter everything (IV fluids, etc) it was not user friendly at all—the physicians had no idea which area to go to put an order, the Quantity... results/medications would disappear. ...I hope they get all the bugs out.</p> <p><b>What do you mean by user friendly?</b> Some stuff that you wanted to say was not there, sometimes you would change in the medications, it would discontinue everything. [system quality]</p> <p><b>Do you think a doctor should enter orders?</b> No, I wouldn't want that ... I've had that—it takes up time.... I feel comfortable with retrieving data and not putting data in.</p>



Interv iewee	Beliefs about the Technology	Beliefs about the Profession	PBC	Attitudes	Intentions/ Usage	Other
I N T E R N I S T (7)	<p>What I don't like is that you can't get vital signs to current patient data other than just labs. But you can get all the medications and get all the old records up to like 10 years ago. [retrieval old info]</p> <p>I don't like you can't compare labs from today, to labs yesterday side by side. You have to look at it click out, click back in. I don't like that. [ability to compare recs] But other than that I think it's very well set up. [Attitudes]</p> <p>I get more frustrated with stuff, with paper stuff not being in a chart then have to go look it up on a computer. That's what I get frustrated about.</p> <p>[Efficient?] Well it makes me more efficient because anything that's not on the paper chart I know I can look it up on the computer as far as labs, reports. [data retrieval] So... it does make it more efficient. What would be very efficient is if you had one system that had both of those. One system with all the info that you need. [system integration]</p> <p>[Visibility] [other systems] I used to do order entry in med. School... which was 8 years ago ...but we had to do like 50</p>	<p>I don't think it really changes the way you practice. Just changes the way you get information.</p>	<p><b>Computers?</b> You gotta look sometimes especially if it's like; you're getting close to changing shifts and all the nurses getting on typing up stuff. That can get a little tough. [no of computers]</p> <p>The nurses are on the floor constantly and the doctors just come in and out. So even the areas that are set aside for is to transcript, or to do our transcription or dictating or whatever you want to call it, they still use that area too. There's just not enough space.</p> <p><b>Support?</b> Yeah, those guys are great.</p>	<p>I really like EMR. I think it's very easy to use. [EOU]</p> <p>It has almost all the information you need. [IQ]</p> <p>I like stuff to be all in one. Either everything needs to be paper in the chart to everything needs to be in the computer at a bedside. [info in 2 places]</p>	<p>I use it everyday on probably at least 3 quarters of the patients.</p> <p>[used for]</p> <p>I use a computer in two specific situations (1) One is pulling up the <b>patient list</b>... So I can print out my list from here. I can print out what patients I have from here. I can check and see if they're new, if they've been seen or not....so that's a huge help for me on the weekends. [RA] I don't have to come in at 6 in the morning here and do it. I can do it Friday night.</p> <p>(2) <b>I use the computer on the floor on the rounds if information is not on the chart</b>... or sometimes I'll use it if there's a certain lab value that I want to see has been done. Say someone's been here for a month. I don't wanna flip through all that paper just looking for that one lab value. It's pretty <b>easy</b> to look it up on the computer and see if it's been done. Although I have found that people who've been in the hospital a long time the lab values actually scroll out. (3) And then I use it also on the floor for anything that's not on the chart you know. Things that didn't make it to</p>	<p>Well, I think that, probably in the system, there are different models and styles and ages of computers and so some computers take forever to get going. Some of the computers are probably from the early 90's and then you have laptops which are very quick and fast. [computer speed]</p> <p>And the one problem with this is and the other doctors have brought it up in the past is that you have to login every time and ...it sounds silly... but you know what? [log in] If you do it 20 times a day takes 5 minutes to login well that 100 minutes just logging in time. [time]</p> <p>[efficiency] That is a lot of your time. Doesn't only take 5 minutes but it can take... I mean some of the computers will take 3 minutes. So.... that's an hour of your time that you're just sitting looking at a computer. Because you know ....your patients are spread out everywhere. You can't just look 'em all up at one time. [access computer for each pat]</p> <p>→ So... I kinda prefer things to be on the paper chart for now until we have a better system and you know maybe, that's going to be, you know, we'll have a computer at every bed and you</p>

screens. **[CX]** **[navigation]** Just to put in IV fluids you had to click one screen and go the next screen and from there you'd go to the next screen... And it literally used to take 30 minutes to put in an order. **[time]** **[efficiency]**

ORMC system: compared to EMR1 it's not even close. Ancient.

the chart.... which is actually close to probably 40% of it. (4) And then the third place where I use it is the ER to look up old records. In the ER someone is new and you don't know what's happening.... all you do is look up old records.

I don't know how much more I would use the computer than I do right now...[till we go paperless].... Like I said I use the computer only to backup my, what not on the chart. What I need to know that's not already on the chart.

And... the more places you have to go to do stuff, the more likely you are to mess up or overlook something. So that's what bugs me about that.... It's all or nothing for me. **The more places you have to look the more...place for error.**

**[If mandatory?]**

As long as its easy to access a computer **[ease of access]** **[availability of computers]** and get on and its available everywhere in other words if you don't have it at each bedside or you don't have your own personal laptop which you can walk around with.

just type it in. **[computer location]** ....But for me and for efficiency it's an all or none principle either paper chart or computer chart. **[data in 2 places]**

**[CPOE]**

I think the hospital has to update the computer systems as it is now.

I don't have any problems with EMR4. I like what I see of it so far. It's more encompassing than what EMR1 is. **[system integration]** **[system quality]**

**Orders?** It's gonna be a disaster.....because with 1200 physicians on actual staff, of which I think 300 are actually on the hospital on a daily basis. So you got a huge number of people that aren't gonna get properly trained; **[training]** that may come into the hospital once a month and they're gonna be forced to do this. They're not gonna know how. Its gonna be confusing.

There are certain people that are not technologically advanced and don't know how to use computers period.... it's gonna be a disaster. A complete and total disaster. we're gonna phase it in...but that's gonna be a nightmare...

The problem is and what you can't anticipate is, you know, it's easy to say if a person has

CHF... they get CHF. You just have to order CHF. .... Well **that's not the way medicine works**.... You come in with a cough or an abnormal x-ray and it could be some weird (pneumococcal?) disease, you know? It could be Bacillitis...So there's going to be different times when you need to order different things. And that's where the disaster part is gonna be even worse. Cause then you're gonna have to go fishing around to find all these special labs....that you want to do...

I think there needs to be a **backup support system** to where there's a help support system that if the doctors stuck or can't find something there needs to be somebody that can pull orders in.

Interviewee	Beliefs about the Technology	PBC	Change	Intentions/Usage	Other
I N T E R N I S T (8)	<p>The good thing is everything is very well organized on both systems EMRI and also CA. Everything is organized in a way where you can get to it easily, ...it's intuitive. [EOU]</p> <p><b>Intuitive system?</b> I mean it's easy to learn, it doesn't take a long time to figure out what's going on, you know everything's organized and commonsensical arrangement. It's not difficult to pick up and learn...</p> <p>One of the things I don't like about CA in particular is Microbiology...it takes a very long time to click on every symbol microbiology to find out the results. [navigation] [organization of info] ...you have to click on each day where the cultures were done to find out the results. So we would have patients in the ICU who are very sick and who have been in the hospital for a week, 2 weeks, 3 weeks and they have like 20, 30 cultures from blood cultures, urine cultures you name it. It just takes a very long time to go through each one of them to find out the results. [CX]</p> <p>For me one of the biggest drawbacks with the system that we have is the Microbiology...and we have a patient here, who's been here for along time. They have this many, you know, microbiology cultures and so on and so forth and you have to click on every one just to get the results...takes a very long time... [navigation] that's the thing that</p>	<p><b>Computers?</b> It's not too bad. There are certain floors where you kind of have to walk around to get to a computer and sometimes the computers aren't turned on; but these are all logistic problems. It would be nice to have more computers [no of computers] and when you get there have the computers turned on and all you have to do is click on it and you get going. And it would also be nice if all the computers were functioning at the same speed.</p> <p><b>Support?</b> There are people who introduce you to the system when you start working, but like I said, it's not</p>	<p>If it's something that's gonna help, [RA] then sure I'll look into new things. So... if it's something that's gonna make things easier, [EOU] [RA] make life easier, then sure, why not? Even if it takes some getting used to, takes some work.</p>	<p>The reason I use the computers... I like to check out the labs for today and also go back to previous labs... and a lot of times what's on the paper is incomplete. [incomplete paper chart] A lot of times they'll print out labs early in the morning when all the labs aren't there. So... on the paper printout everything may not be there. So... when I go see a patient I always log onto the computer and like I said I always like to go back to previous labs for previous days and previous weeks and it's all there. And it's not always there on the chart.</p> <p>I do just hospital work so for me it's easy. I use the computer all the time.</p> <p><b>Do you actually go in and log in for each patient when you do your rounds?</b></p> <p>Yeah... I mean it depends on the patient. If it's a simple patient who doesn't have a lot of lab work or radiology or whatever, No. But if it's a patient who has a lot of stuff, a lot of lab work, a lot of CTs whatever... yes. Patients who're sick you need to be up to date on about what's going on with their labs...so it depends on the patient.</p> <p><b>What makes you go into the computer rather than asking a nurse to get the results for you?</b></p> <p>If you're just interested in this or that then it's easier to ask someone to pull it up for you. But you know I'm the internist, so I have to know everything that's going on. So that's why when I get on the computer I make sure that I look at everything. I mean everything's not always on the chart,</p>	<p>[EMR4] it would be nice... I mean it would cut down on time running around, looking for the charts. Also, you wouldn't be fighting over charts with other physicians. Sometimes you go and see a patient and the physician would say come back later. And that's a waste of time. [efficiency] Sometimes you get very busy. So you know you're not looking for a chart, you're not fighting over charts. You could actually see a patient, go somewhere else and write the note somewhere else. You don't have to come back to the unit or the room just to write the note because that's where the chart is. So that helps a lot. [RA] Plus the other thing is, you know, that physicians have different writing. So if everyone's typing the progress notes it's easier to read, so... <b>Benefits? The patients aren't always there, the charts not always there, the information's not always there.</b> So you</p>

frustrates me the most about this system. There's really no way to just get what's positive and have it all on one screen. **[search] [sorting]** Like for example, say someone has 10 blood cultures and 3 of them are positive. You're not going to know it till you click on every one of them. If there was way you could just click and it shows you, you know day 1, day 5 or day 7 are positive and these were the results, that would be great, instead of having to click on all of them. And some of these patients have 20 or more cultures because they've been here a longtime when they're very sick ...**so...it takes a long time [efficiency] [time]**

**[Efficiency?]** Oh it's more efficient. Yeah. It's definitely more efficient. **Why?** ...The paper charts usually don't have everything I need and I kinda like to look at everything so I guess that's really the only option I have. You know it'd be kinda impossible to put everything that you're looking for in the paper chart, it'd just be too much.

difficult to use, you pick up how to use the system pretty easily. It hasn't really been a problem.... for me or for anyone I know.

so that's why you kind of have to do that. At least I have to do that.

know if everything was there, **[IQ] [complete info]** things would move very smoothly. If things aren't there you have to run around looking for charts, you have to run around looking for labs. **[looking for info]** That slows you down and kinda puts a kink in the day.

Interv iewee	Beliefs about the Technology	Beliefs about the Profession	PBC	Attitudes	Intentions/ Usage	Other
GI	<p>When I started at FH, if u had to order a CVC--there would be a piece of paper 2.5 inches high and maybe 7 inches long and that would get pasted into the chart &amp; that would come back the next day after you ordered it maybe mid morning...if you wanted the report before that you called up the lab &amp; stayed on hold for a long time until a lady that has had so many calls like that during the day with the attitude that she had so many calls that day &amp; she gave u the result. And if you needed a report of an xray before the printed report came to the chart probably the next day &amp; you had to call down to radiology &amp; have one of the radiologists take the film &amp; look at it &amp; read your report because there was no way to access that dictated report. So if you look at the system as we have it today compared with the system that we had 15-20 yrs ago, its dramatically better. <b>If you look at it in that perspective I see what we have now as a dramatic improvement. [RA]</b></p> <p>EMR1 can be a little cumbersome...[Navigation] you've been in the hosp, you're in my office today, your blood count is low, so I want to know what your blood count was in the past, so I pull up under 1<sup>st</sup> yr your MRI no, you're in the hosp in June for 10 days, outpatient in June, in May you were in the hosp for 17 days ... in order to find what your blood count was this yr I have to open up each one of those, then go into the labs find that CBC...I cant just say CBC date [Search] – but 10 yrs ago if I wanted all that I had to go to Med Recs, ask them to bring me all those charts. Compared to what it was its fantastic. [RA from past]</p>	<p>It is tremendously more efficient then it used to be. [Efficiency] The process is still the same, see the patient, talk to them, examine them, order tests, get the results back, act upon those test results, order more tests &amp; meds. That is basically the same. [same process] The obtaining the lab results &amp; acting upon it – when I started Med School there was one CT scanner in Miami, later on there was one in each hosp, now I can get to the comp – I can not only get the report in the computer, I can not only get the report of the CT scan, I can see the films → more efficient ... 10 yrs ago to get the report, I had to wait for the report to come back in the chart, go down look at the film with the radiologist, then I could actually hear the report (hear the doc dictation) as soon as it was typed I could see it in the comp, now I can actually see the films themselves – so we've gone from this progression of one CT scanner in Miami to I can actually see the films myself. [RA] But it's basically a matter of technology changed the efficiency but I still order an Xray- getting the results &amp; acting on it. That really hasn't changed with the system.</p>	<p>It's not great....but it's not bad....there can certainly be more comps</p>	<p>The system we have now is reasonable. For what it is, it's good. Clearly I made a commitment [UI] to the computer system at FH because I believe in it. [Attitudes] I think there are a no of things the future comp system can &amp; should do for us.</p>	<p>Why did you start using EMRI? Timely access to info...think abt what it was like in the past...</p>	<p>I think that are unfortunately a lot of non-clinical people that have their fingers in the pie, developing it. [Non-clinical developers] For ex, the fact that a doc could not write orders in the ER till the pat is moved on the floor – that simply shows a total ignorance on how does practice medicine. How can you possibly be creating an EMR without simply understanding that simple a concept? This is simply understanding what physicians workflow is like. This concerns me greatly. If they can't agree a solution is necessary for such an obvious problem, what abt more complicated probs? Cause this is as simple as it gets!</p> <p><b>LOG IN for each patient]</b> You know what I had to do while I was rounding? If I am in room 8201 next person I see is in 9209 according to my list, while I am logged in in 8201, I try to look up their labs, then I try to remember it till I get to 8209. ....90% of the times what would happen is I would get there &amp; I would realize that there was smh I haven't looked at &amp; I'd have to log in again. Every once in a while it worked, but most of the times it didn't...cause what happens, you get to some chart &amp; it would be some progress note that would say smh like "I'm sure that Dr S. has</p>

Sometimes the Xray report doesn't get to the paper chart (that doc who first saw the pat didn't admit the pat) – the piece of paper maybe it gets in the chart or maybe gets put in the wrong folder, in the very back under respiratory therapy – doc never sees it, pat goes home, 6 mo later the pat is coughing blood, has lung cancer he could have been operated on. OR for some other reason a test gets order and the physician is unaware of or he just forgets abt it...and it comes back in the chart as a piece of paper & misfiled or the piece of paper gets lost – essentially if a test gets done, is there in EMR1 and its not gonna go away - you can find it there, can look it up...that's why its good. [data storage]

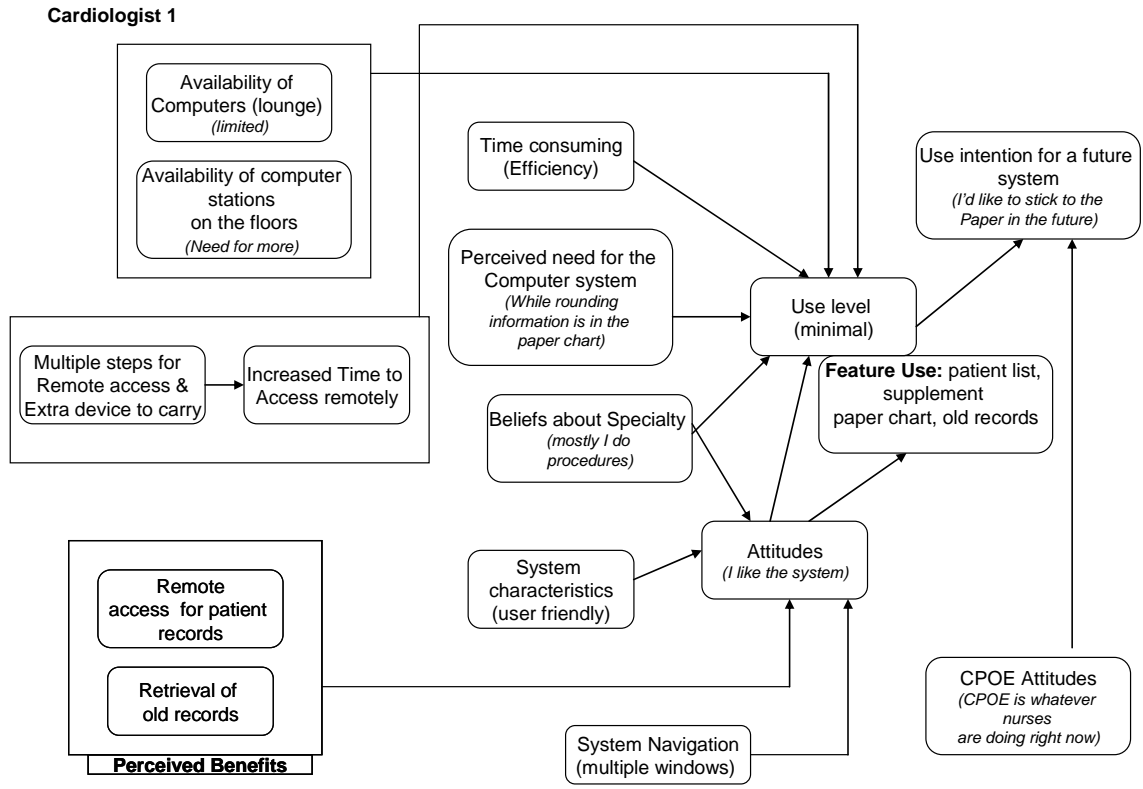
Pat list – it's a big problem [IQ]– use our own list – the comp can only sort the info that's put in by smb. – can't DEL just Hide. One of the routines in the morning was to clean my list – it's a pain. [time consuming] If a patient gets left off the list by accident – he's not gonna get seen – it's as simple as that. That list has to be accurate & the girls in the office understand that.

.....15 yrs ago you had to walk down the hall, walk in the elevator, go down to the 1<sup>st</sup> floor, go to the radiology, take the films out, look at the CT of the brain.....go find a radiologist, have him look at it, have him tell you its ok, go back to the elevator, go upstairs, now smb has moved the chart, you cant find the chart, you find it, some case manager is looking at it, u ask if u could have the chart, she gives you a look, ---yeah I can complain but **compared with what we used to have to do, it's much better. [RA]**

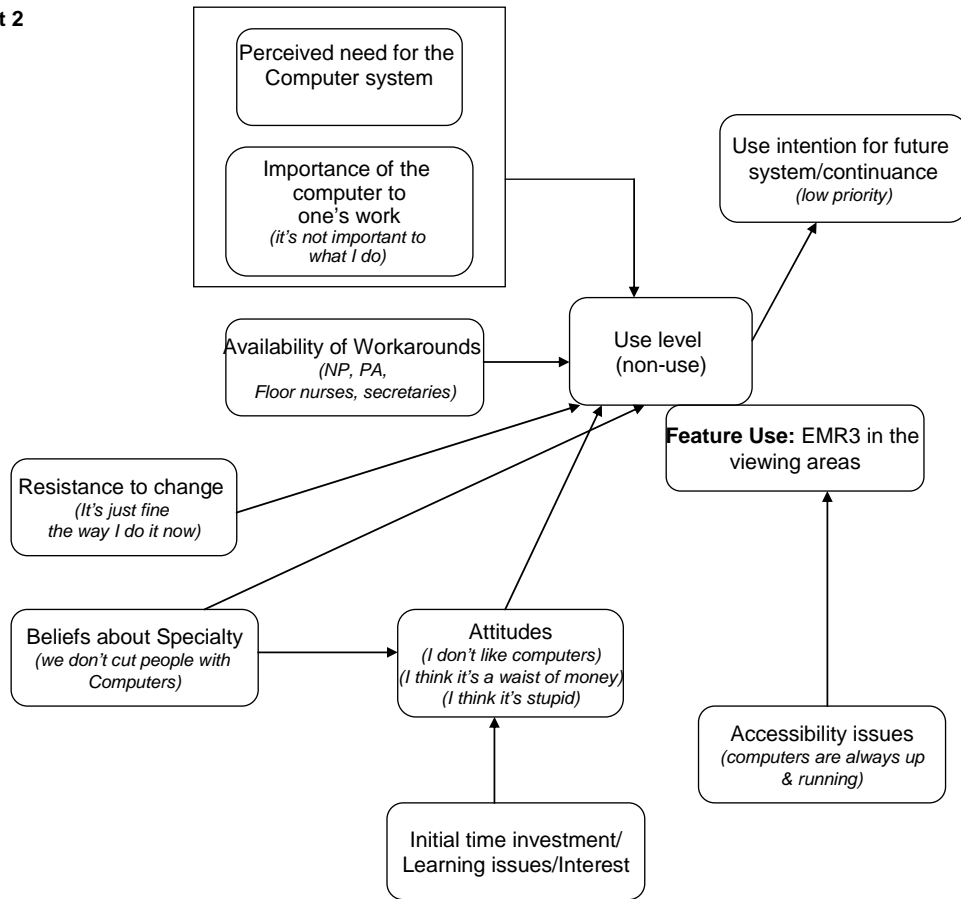
seen the CT scan from march of 04” and you're going “the CT scan from march of 04...???” what the hell are you talking abt?” so you have to sign in, go back to the hospitalization from march of 04, bring it up...every time I would try to do that, it never worked. There is only one thing I can possibly want to know abt this lady is her hemoglobin...you get the chart & find out that last night she fell out of bed & had a brain CT – have to log in & look at brain CT. that plan of anticipating never worked.

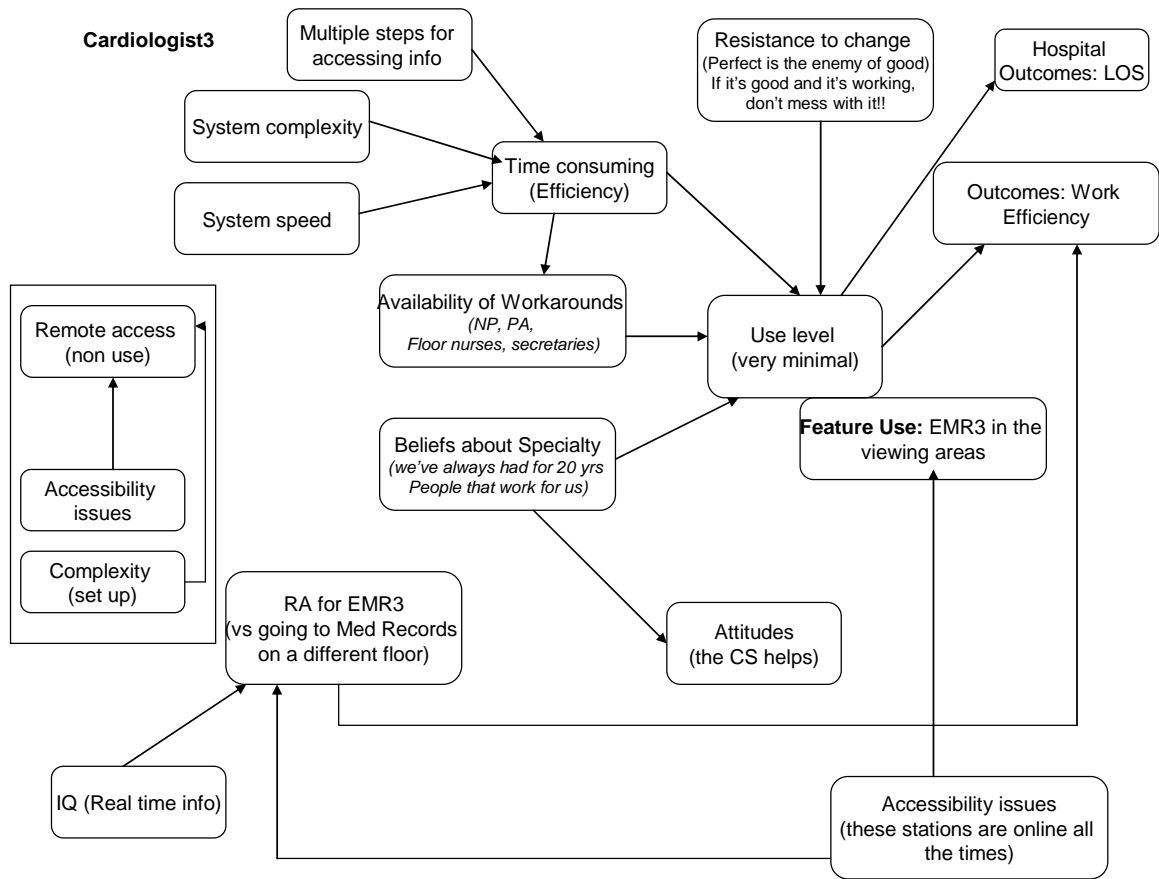
## **APPENDIX C: PHYSICIANS' INDIVIDUAL COGNITIVE MAPS**



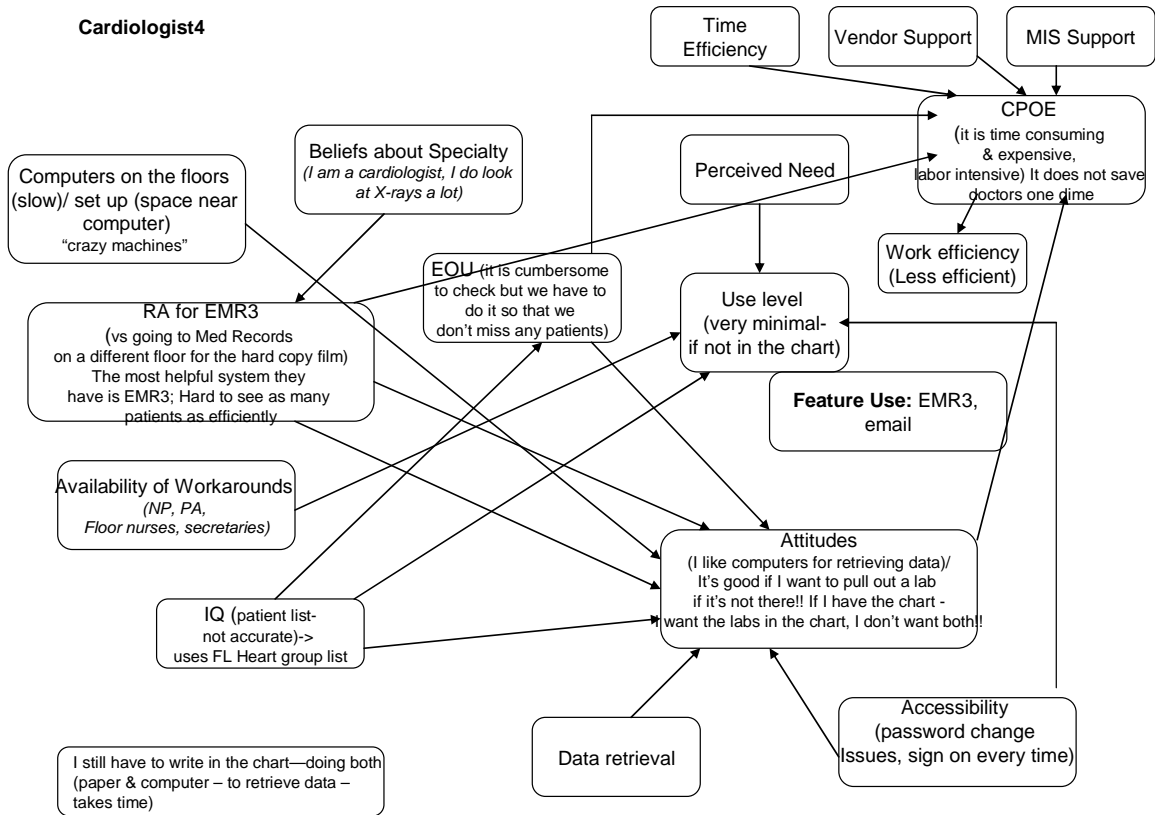


Cardiologist 2

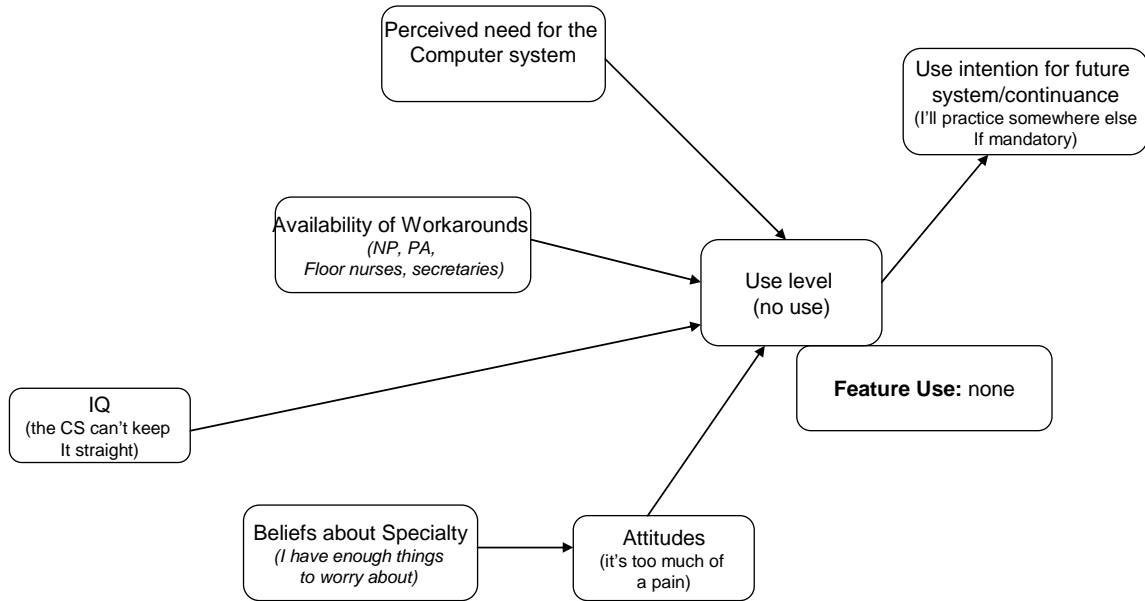




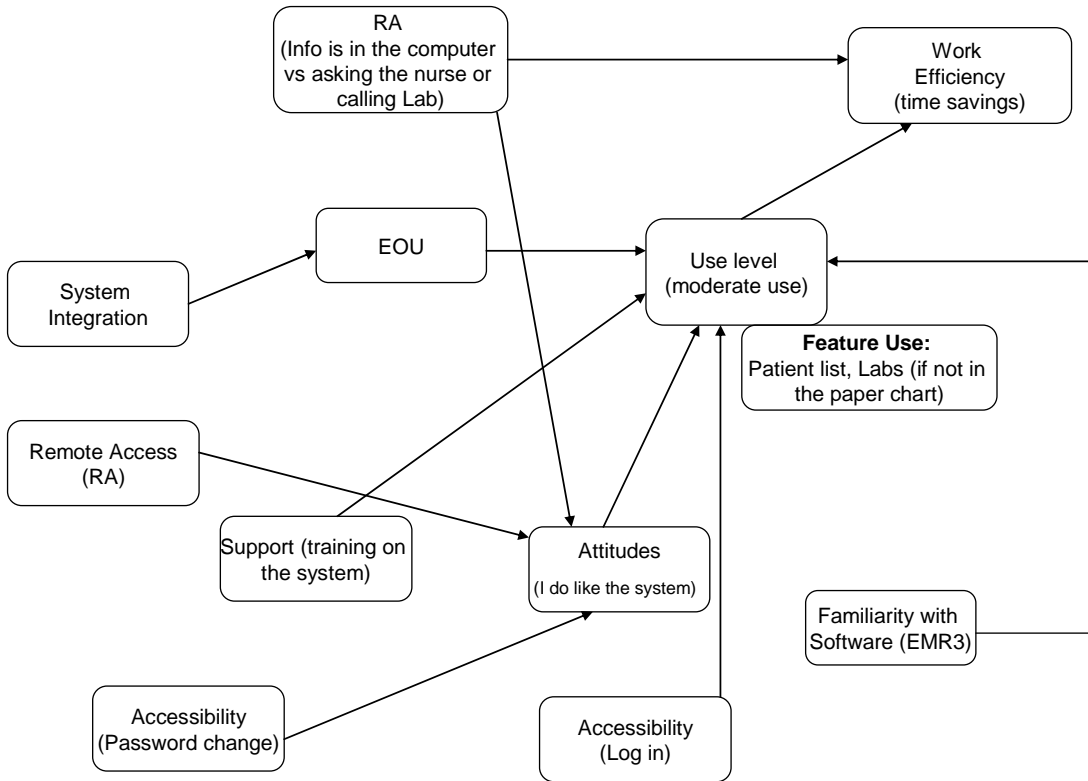
### Cardiologist4



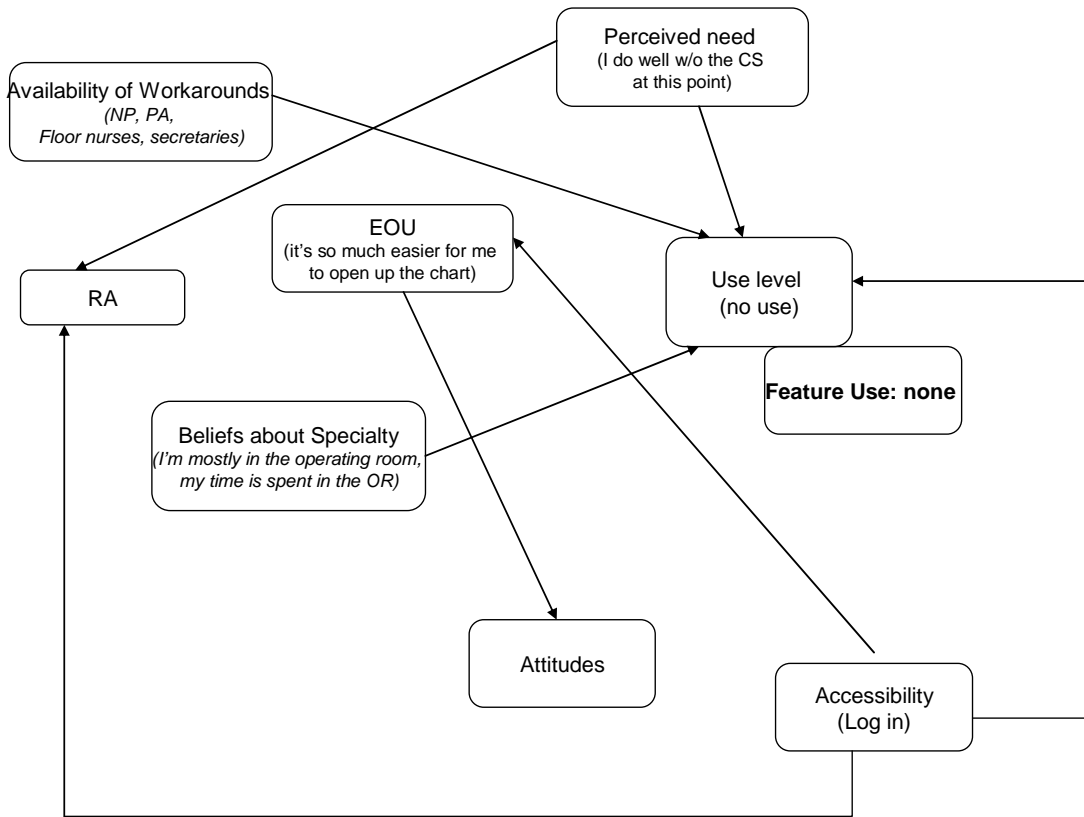
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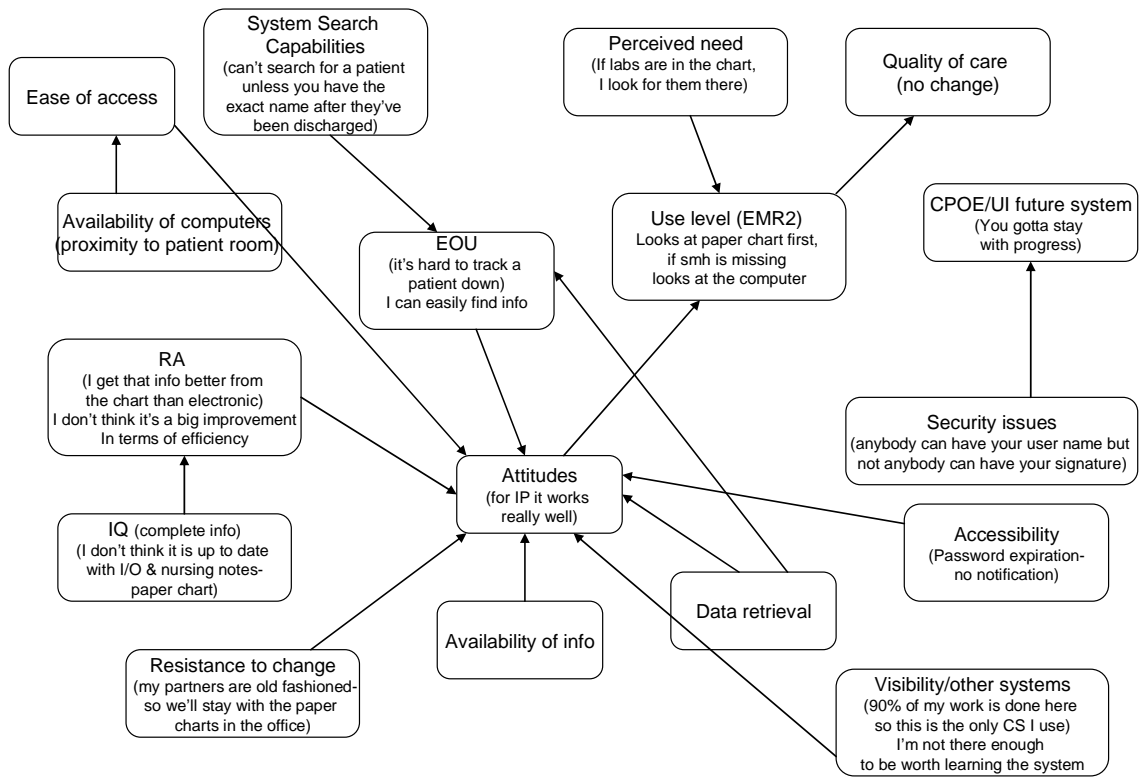
General Surgeon2



**General Surgeon3**

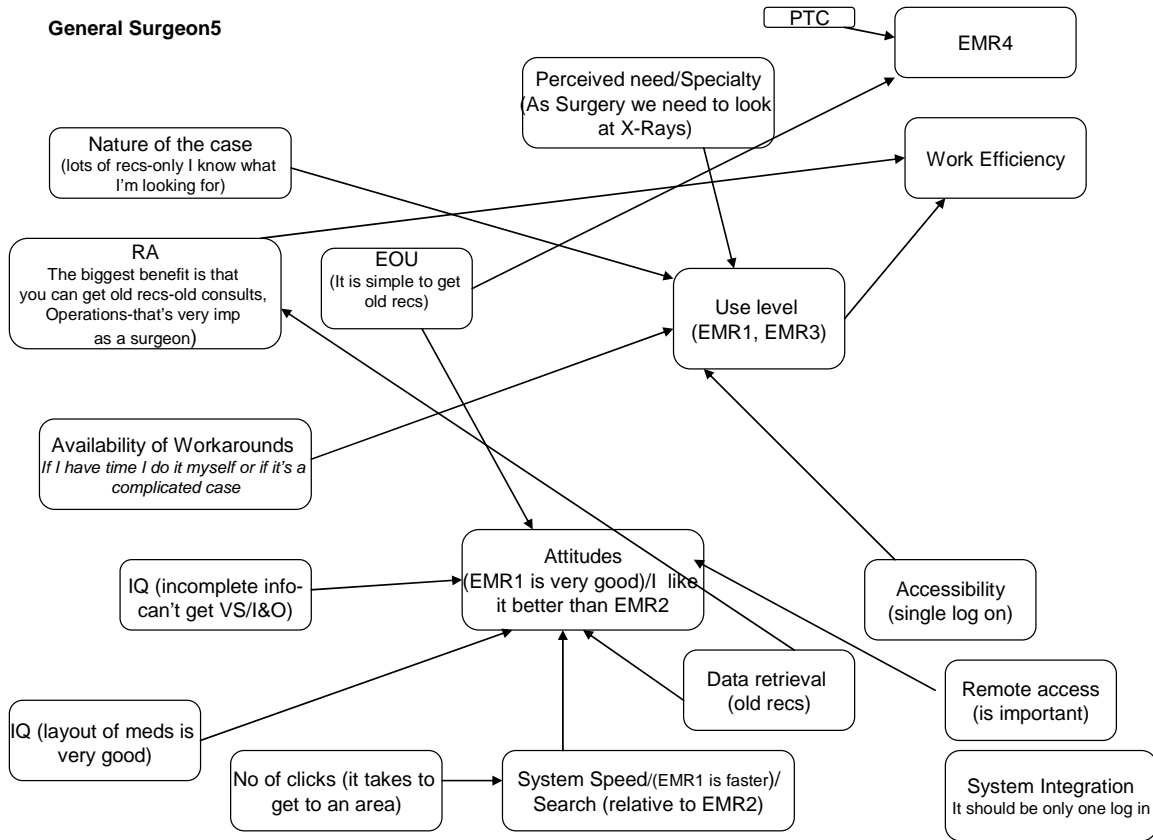


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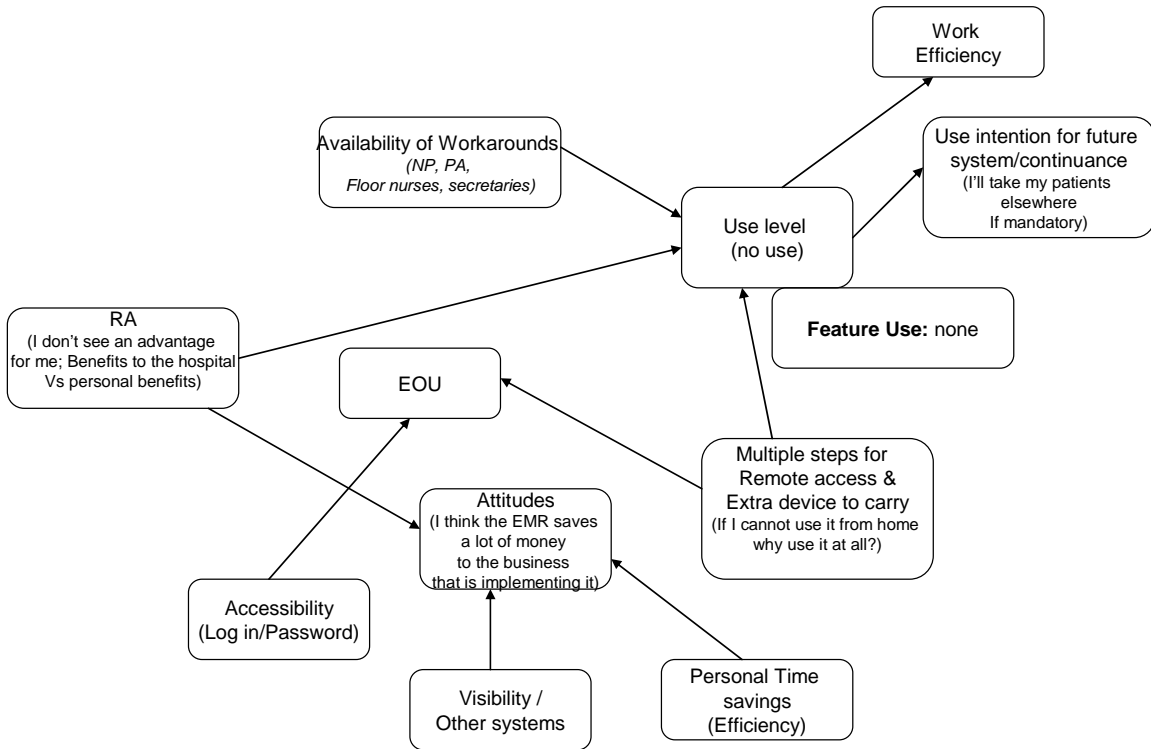


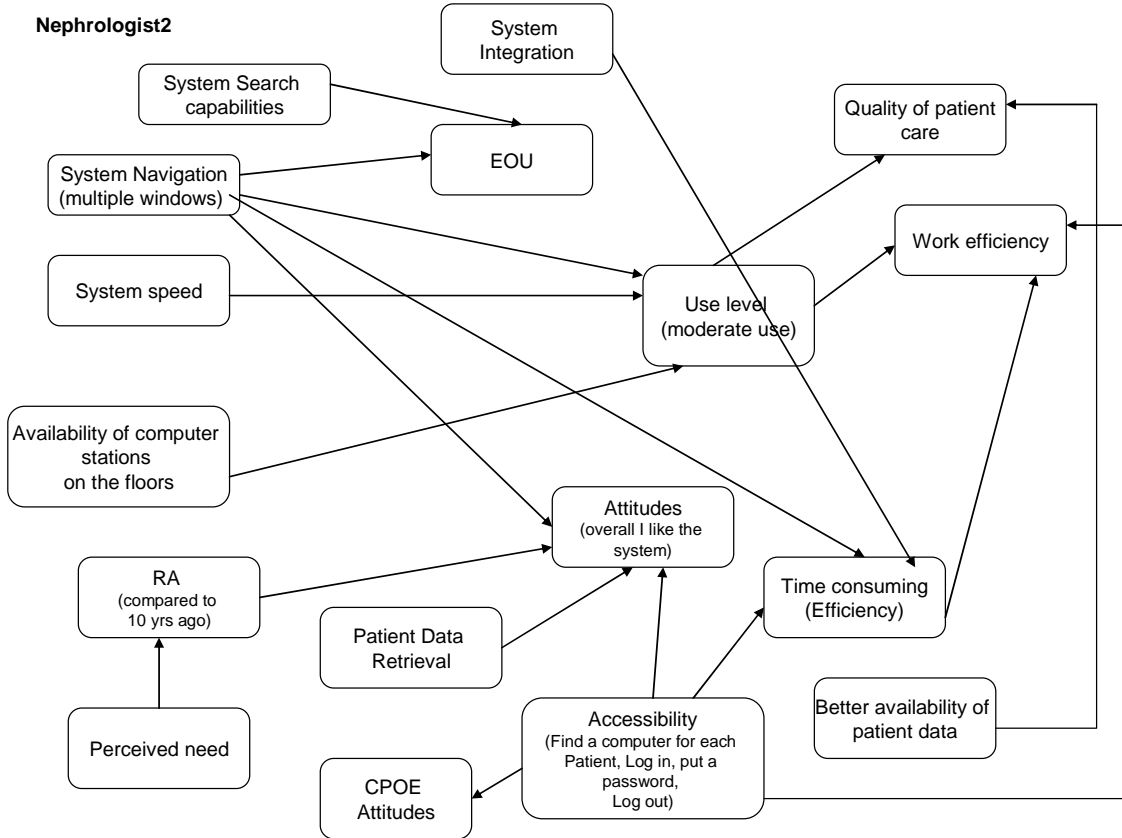


**General Surgeon5**



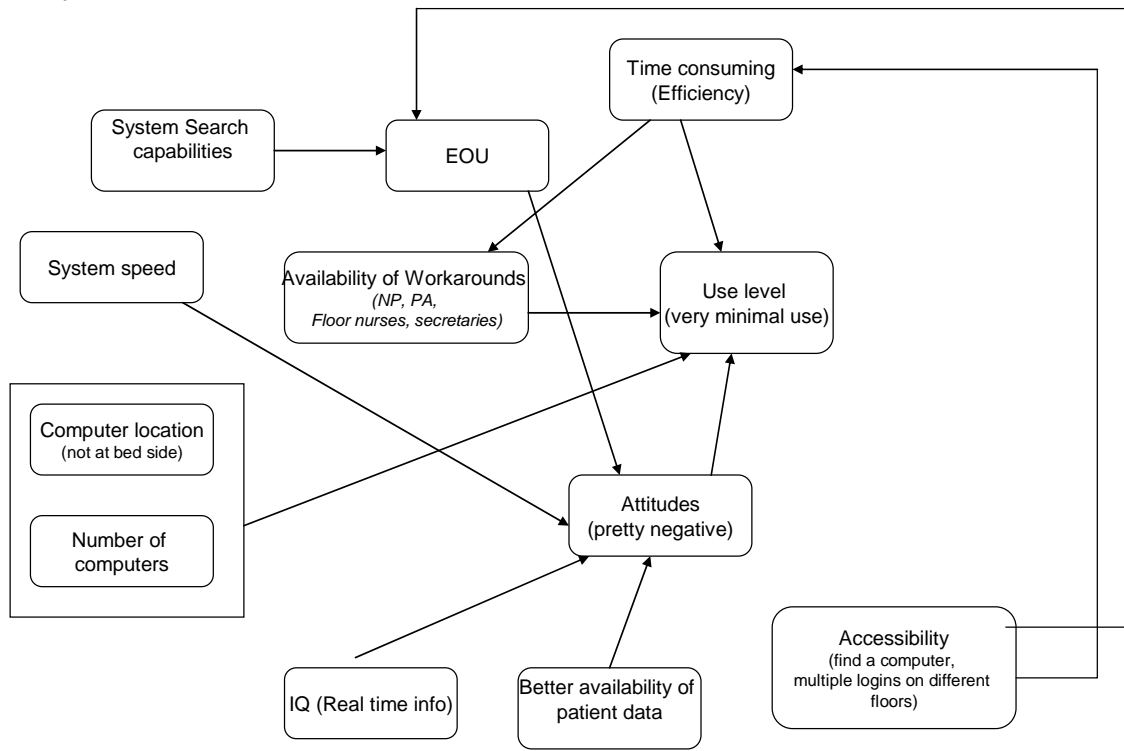
Nephrologist1

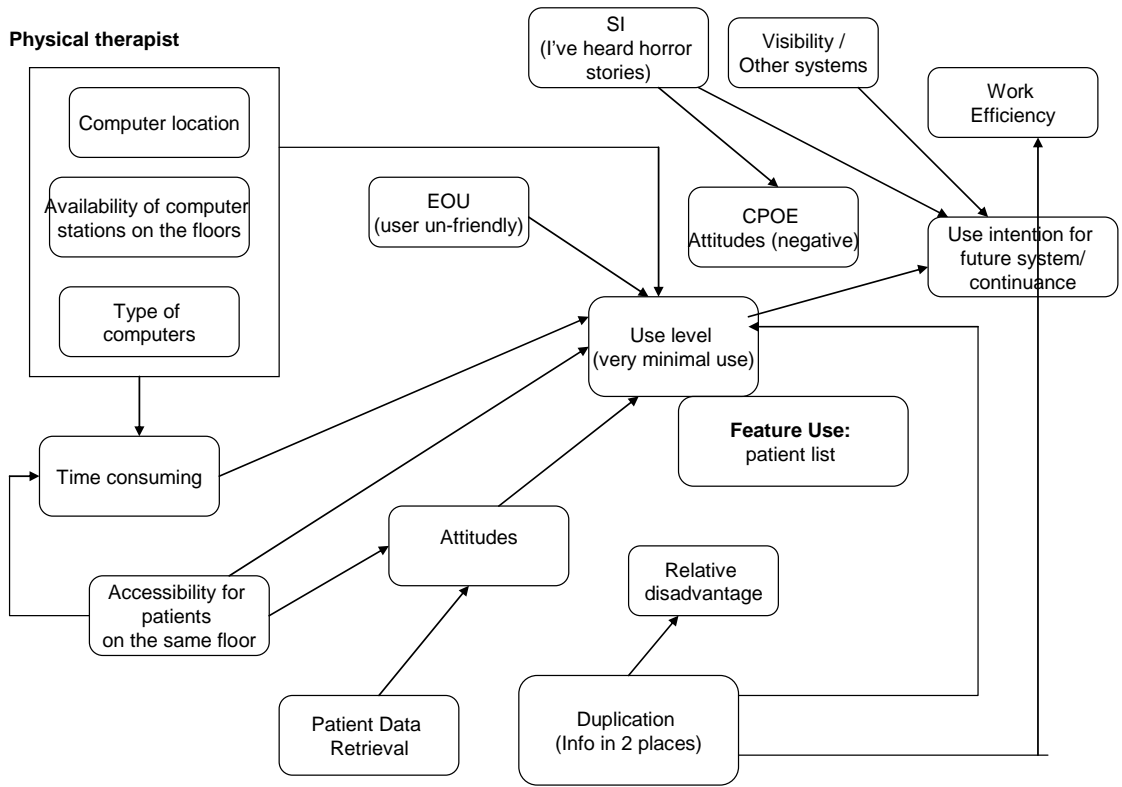




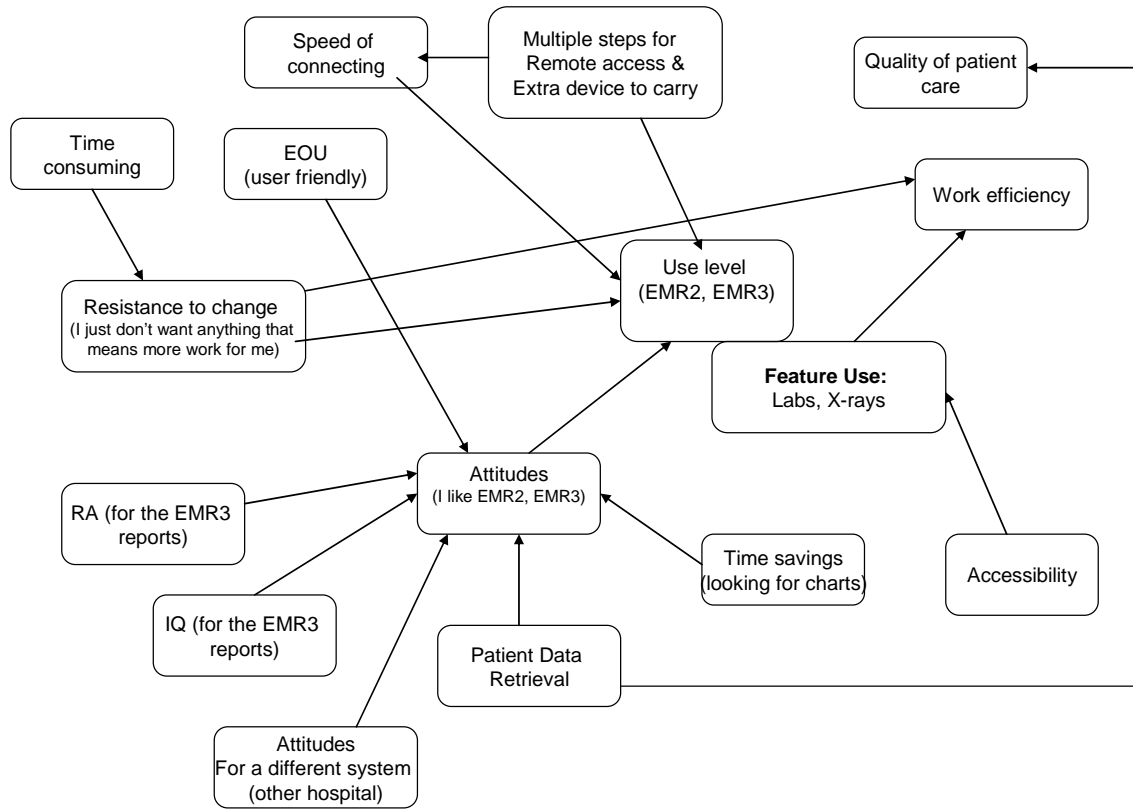


**Family Practitioner1**

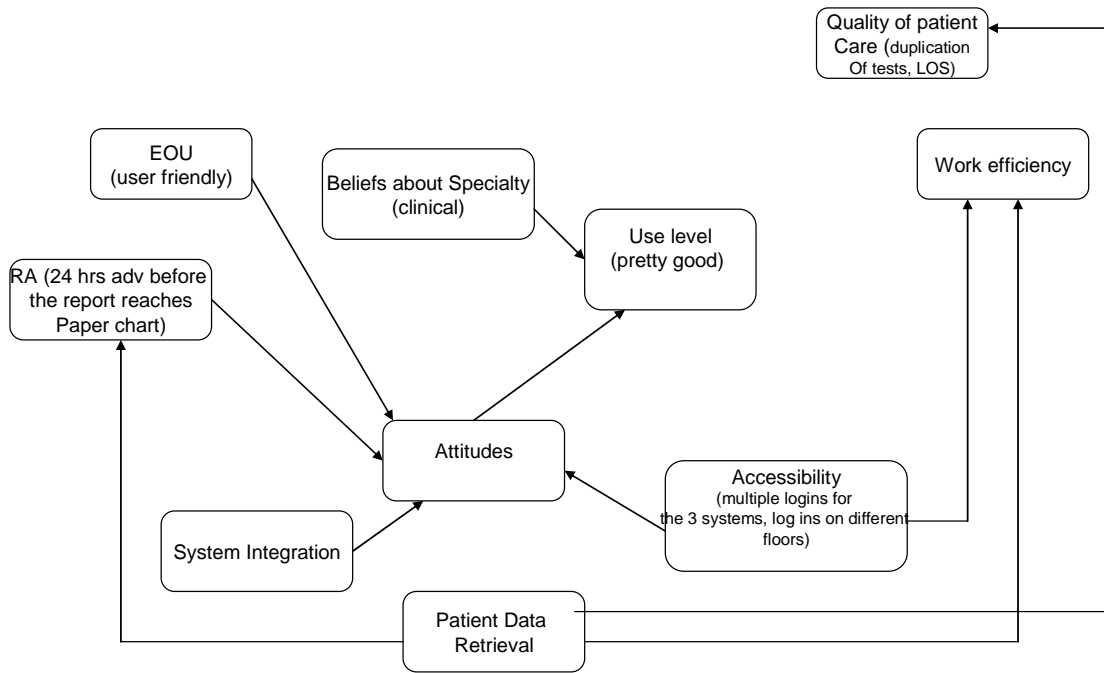




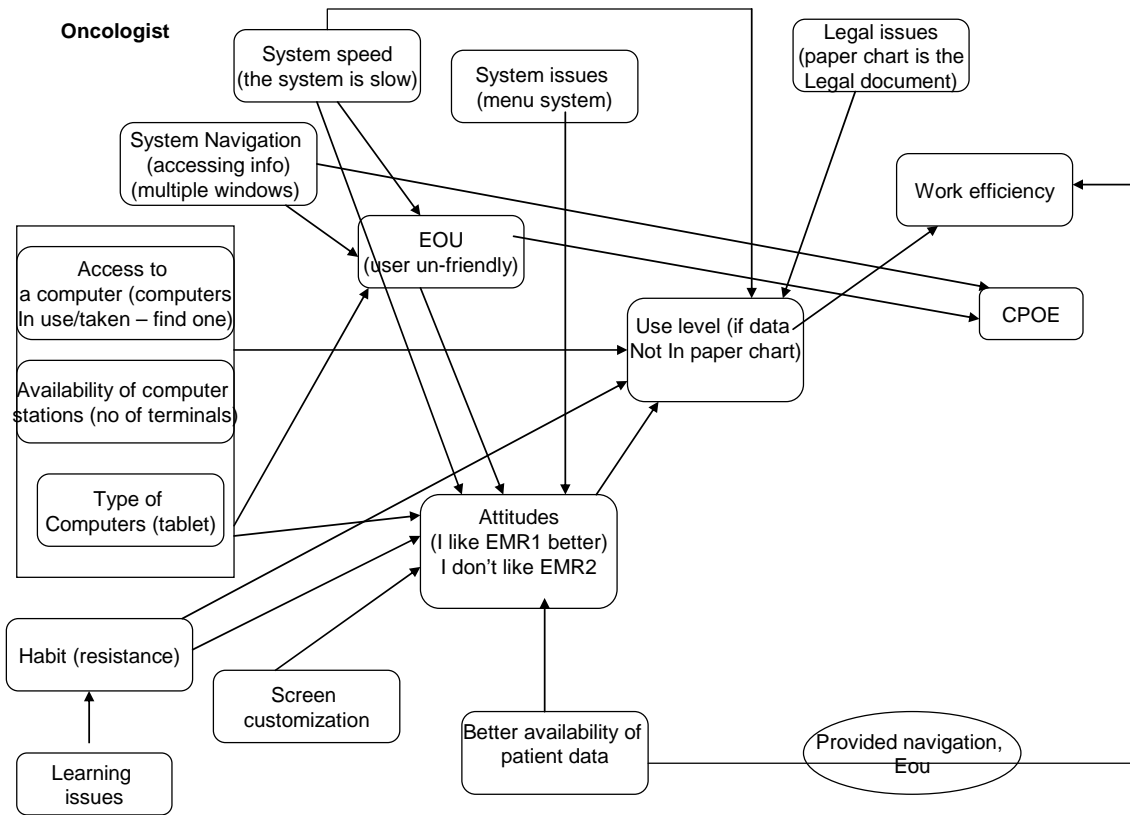
**Pediatrics Surgeon**



Neurologist

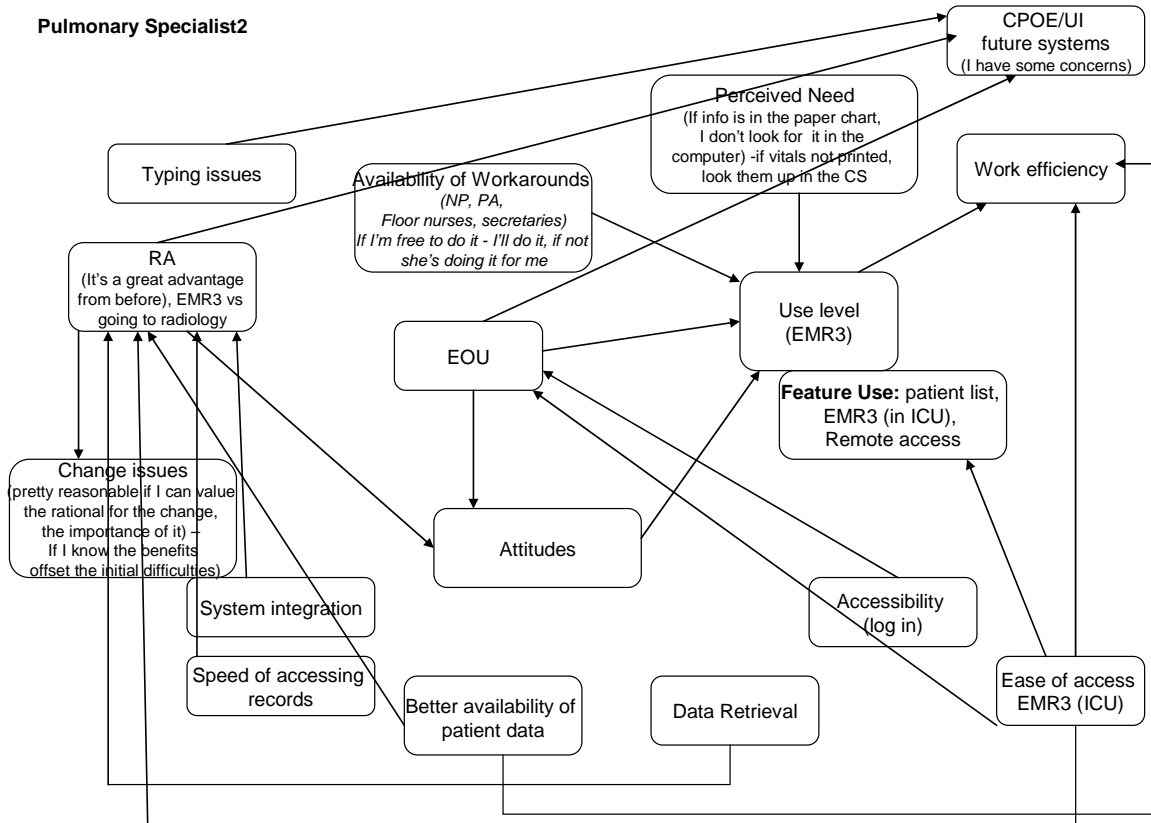




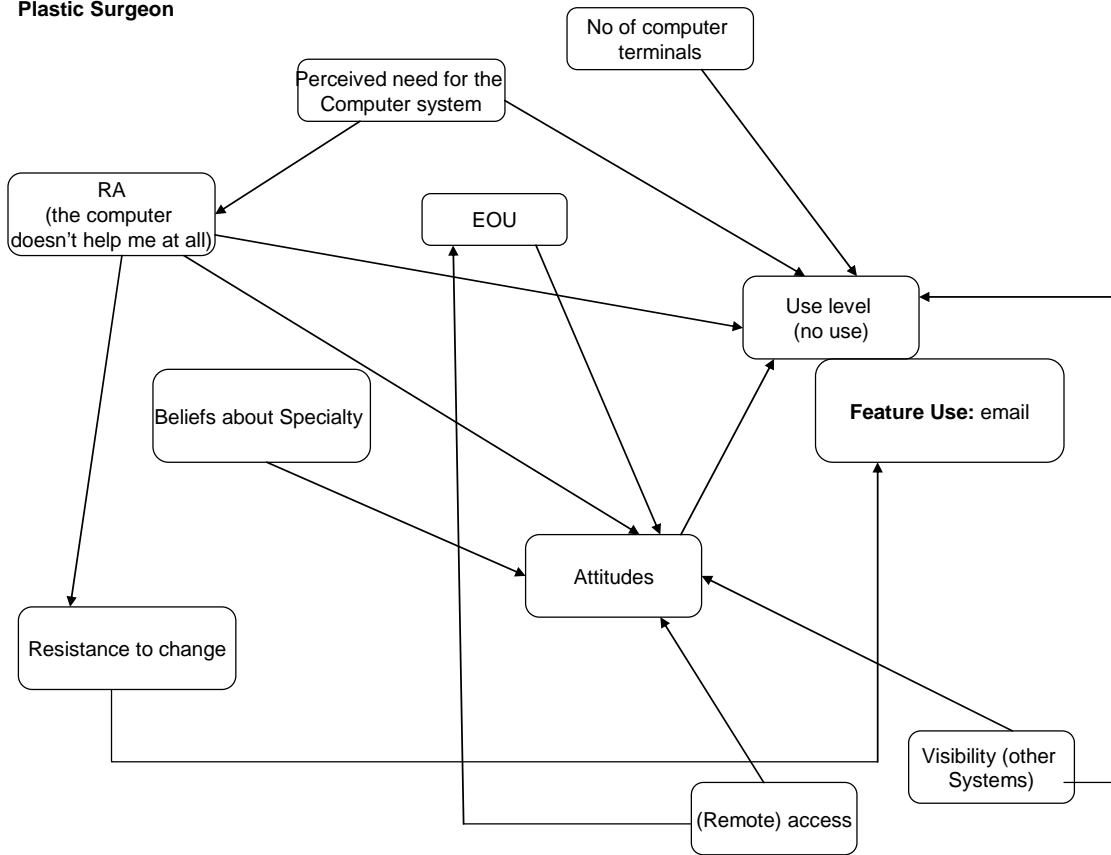




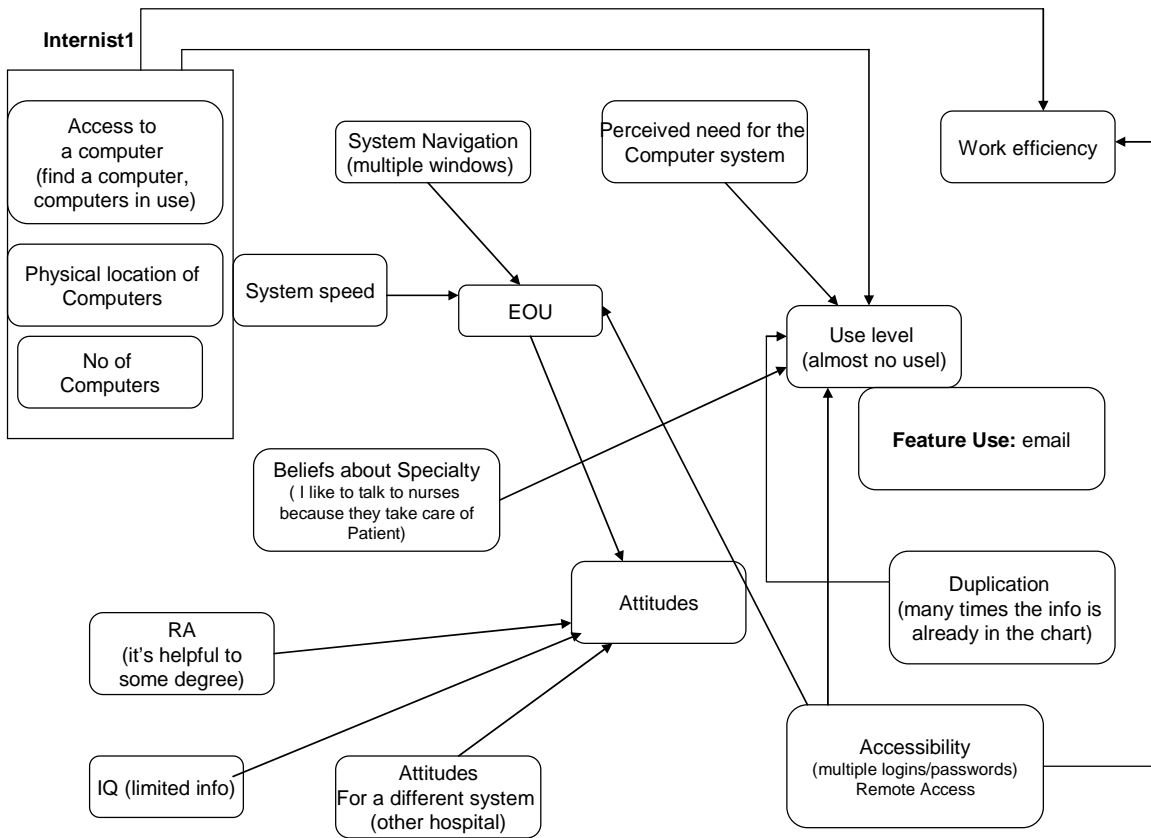
**Pulmonary Specialist2**



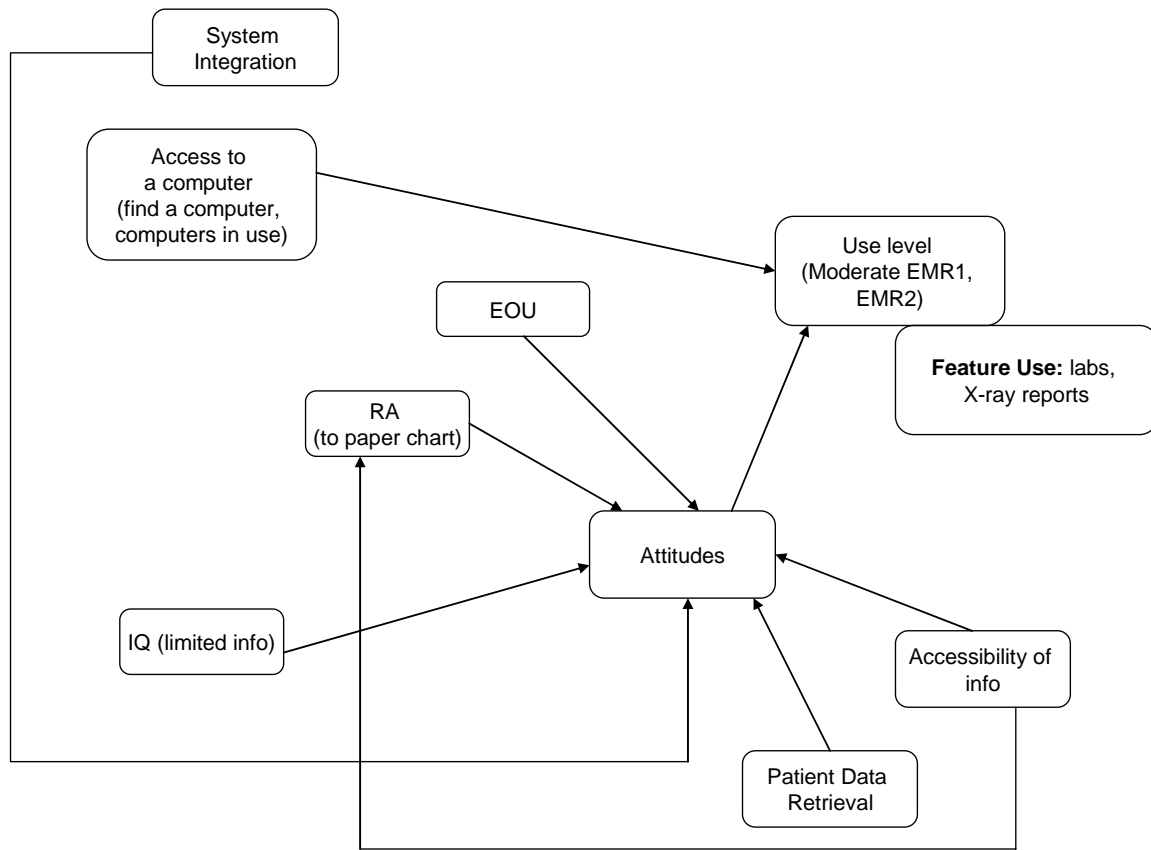
Plastic Surgeon



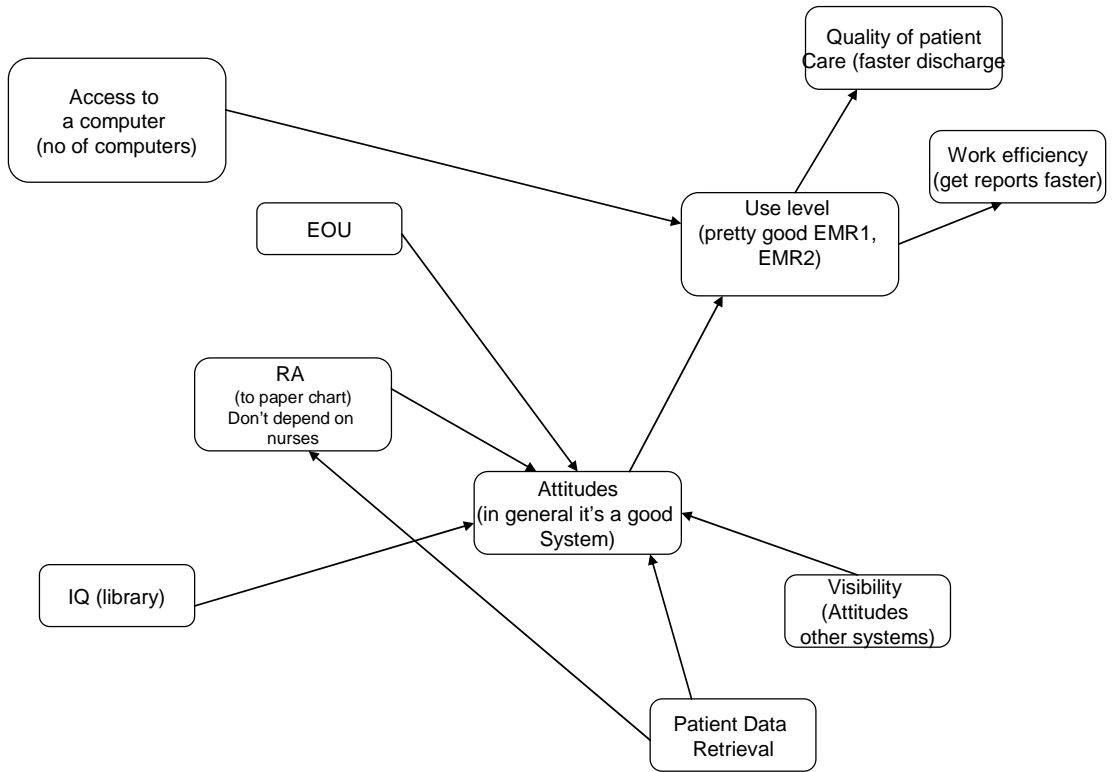




**Internist2**

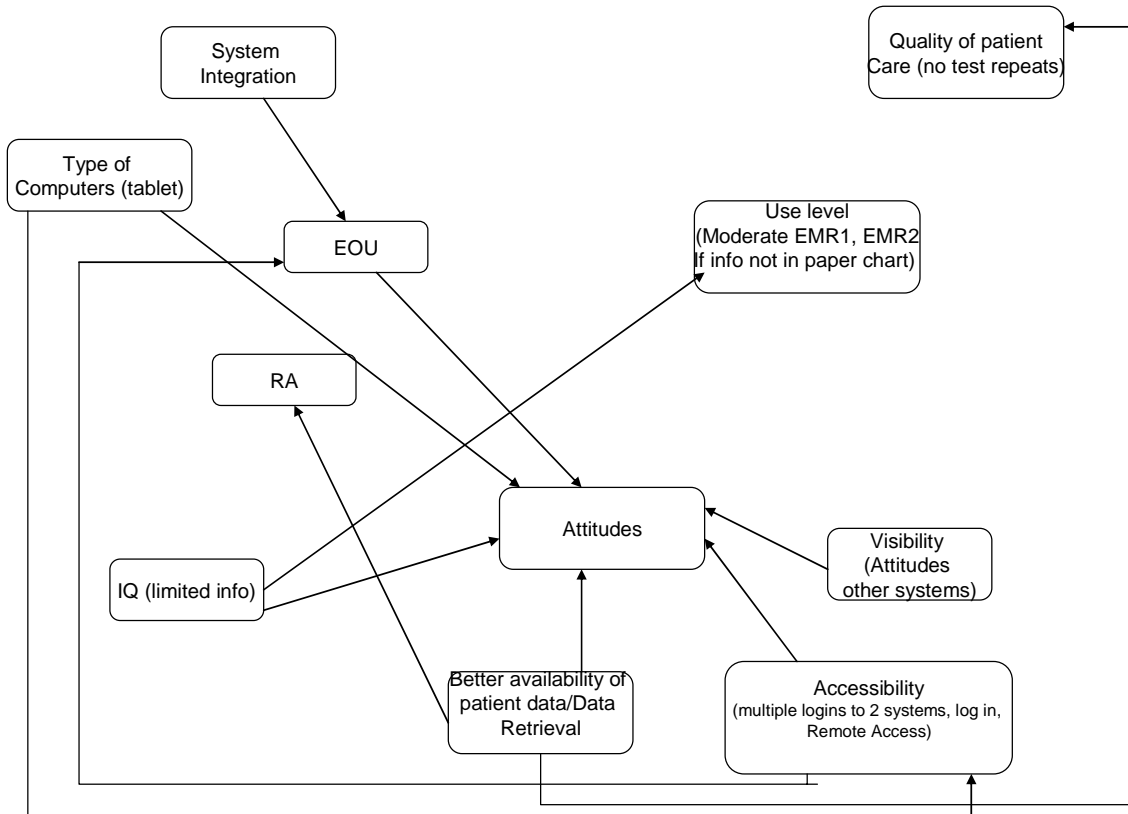


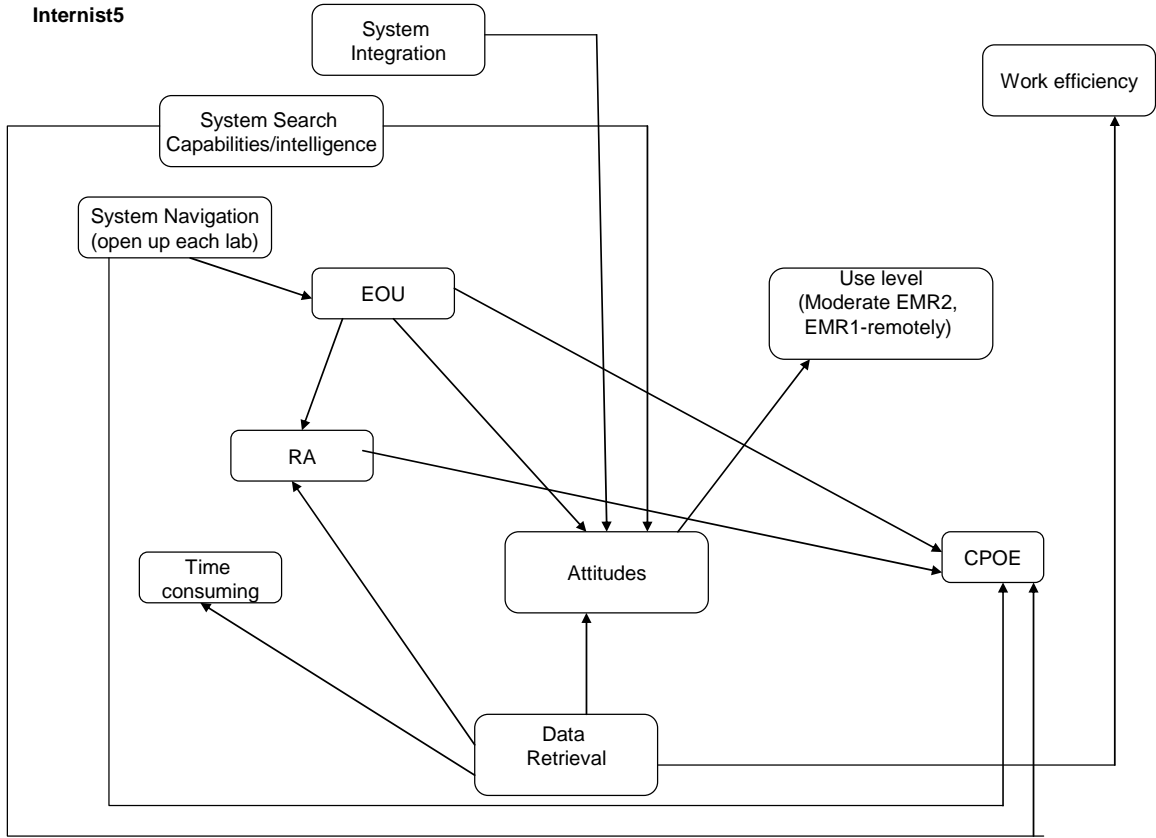
Internist3



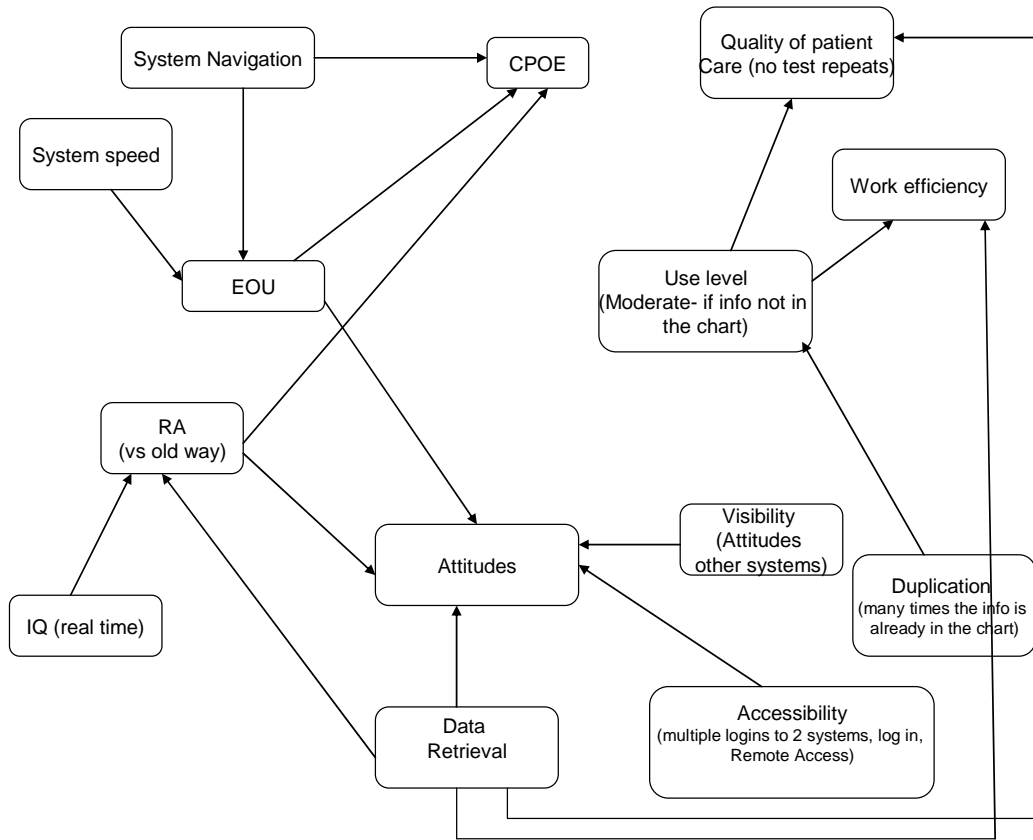


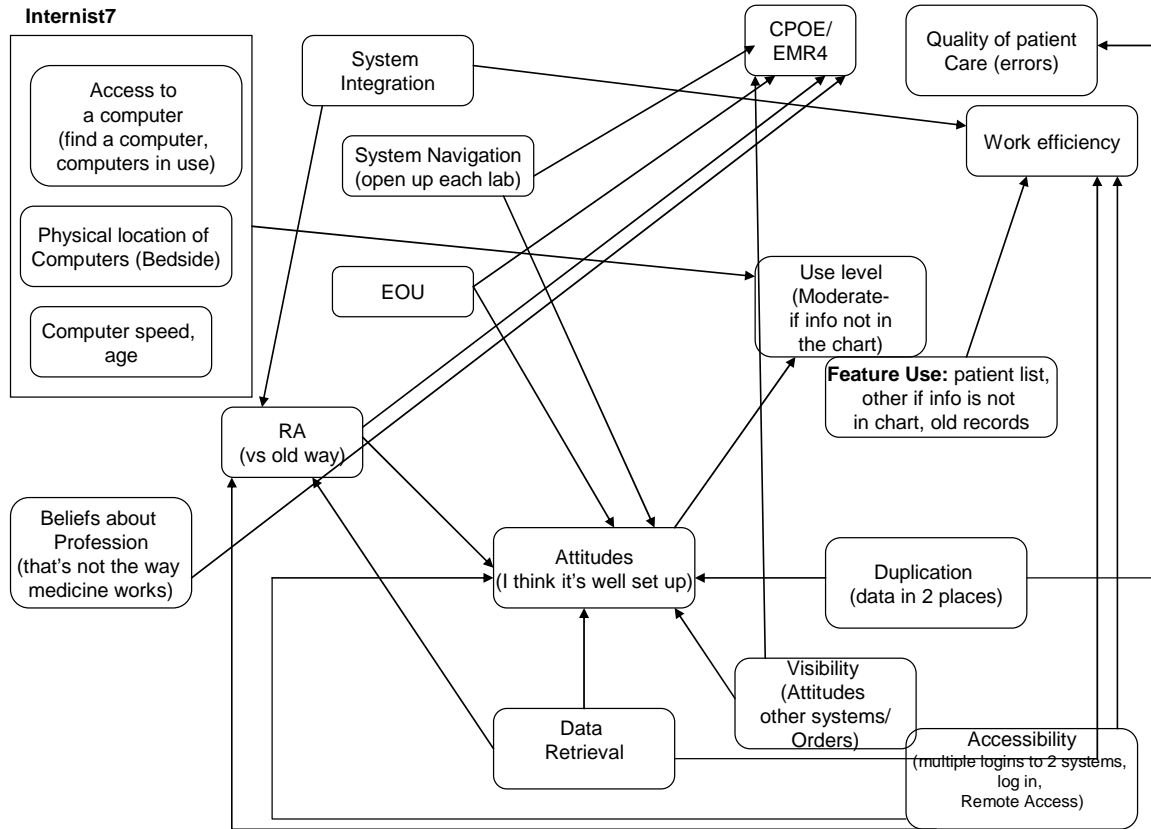
**Internist4**



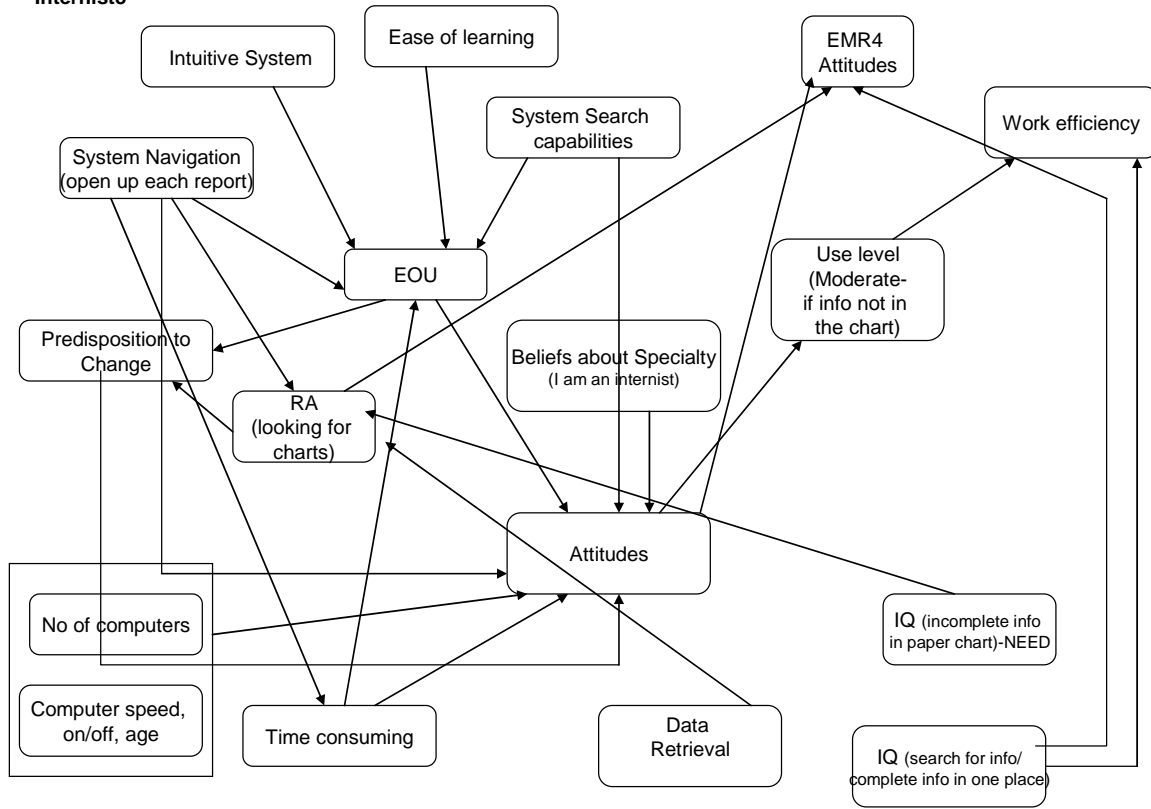


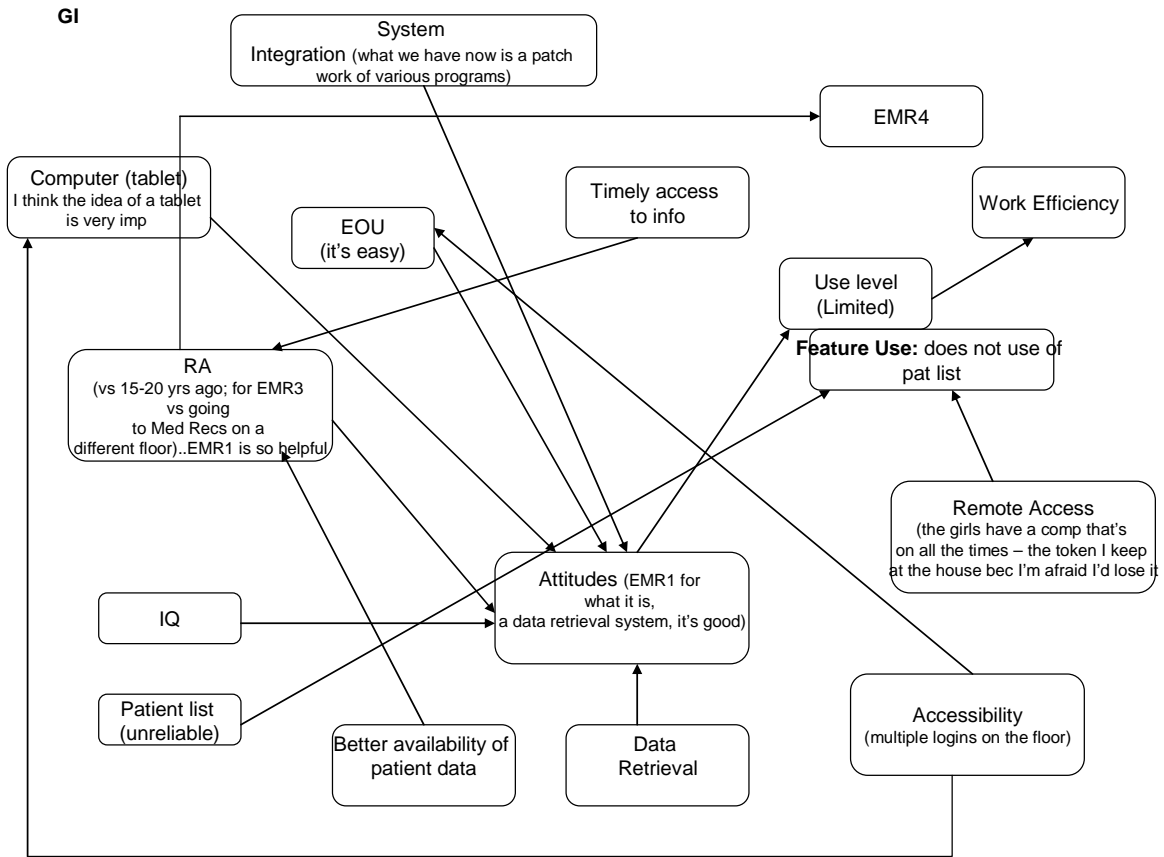
Internist6





Internist8





## **APPENDIX D: IRB DOCUMENT**



Office of Research & Commercialization

April 22, 2005

Virginia Ilie  
Doctoral Student  
College of Business Administration  
Department of MIS  
BA1, Room 357  
University of Central Florida  
4000 Central Florida Boulevard  
Orlando, Florida 32816-1400

Dear Ms. Ilie:

With reference to your protocol #05-2563 entitled, "Information Technology Acceptance and Usage by Healthcare Professionals" I am enclosing for your records the approved, expedited document of the UCFIRB Form you had submitted to our office. **The expiration date for this study will be 4/19/06.** Should there be a need to extend this study, a Continuing Review form must be submitted to the IRB Office for review by the Chairman or full IRB at least one month prior to the expiration date. This is the responsibility of the investigator. **Please notify the IRB office when you have completed this research study.**

Please be advised that this approval is given for one year. Should there be any addendums or administrative changes to the already approved protocol, they must also be submitted to the Board through use of the Addendum/Modification Request form. Changes should not be initiated until written IRB approval is received. Adverse events should be reported to the IRB as they occur.

Should you have any questions, please do not hesitate to call me at 407-823-2901.

Please accept our best wishes for the success of your endeavors.

Cordially,

*Barbara Ward*

Barbara Ward, CIM  
IRB Coordinator

12443 Research Parkway • Suite 302 • Orlando, FL 32826-3252 • 407-823-3778 • Fax 407-823-3299

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THE UNIVERSITY OF CENTRAL FLORIDA  
INSTITUTIONAL REVIEW BOARD (IRB)

*IRB Committee Approval Form*

PRINCIPAL INVESTIGATOR(S): Virginia Ilie

IRB #: 05-2563

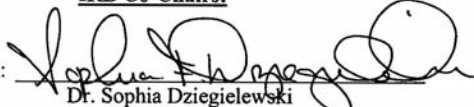
**PROJECT TITLE: Information Technology Acceptance and Usage by Healthcare Professionals.**

- New project submission
- Continuing review of lapsed project # \_\_\_\_\_
- Study expires \_\_\_\_\_
- Initial submission was approved by full board review but continuing review can be expedited
- Suspension of enrollment email sent to PI, entered on spreadsheet, administration notified \_\_\_\_\_
- Resubmission of lapsed project # \_\_\_\_\_
- Continuing review of # \_\_\_\_\_
- Initial submission was approved by expedited review

**Chair**

Expedited Approval  
 Dated: 22 April 2005  
 Cite how qualifies for expedited review:  
 minimal risk and # 7

**IRB Co-Chairs:**

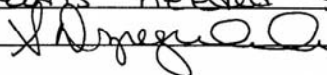
Signed:   
 Dr. Sophia Dziegielewska

Exempt  
 Dated: \_\_\_\_\_  
 Cite how qualifies for exempt status:  
 minimal risk and \_\_\_\_\_

Signed: \_\_\_\_\_  
 Dr. Jacqueline Byers

Expiration  
 Date: 21 April 2006

Waiver of documentation of consent approved  
 Waiver of consent approved

NOTES FROM IRB CHAIR (IF APPLICABLE): see attached comments.  
Needs IRB approval from \_\_\_\_\_ Hospital. Other  
minor clarifications needed see attached.  
 12 APRIL 2005

April 6, 2005

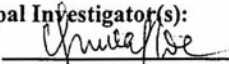
### C. UCFIRB Form

05-2563

The complete IRB packet must be submitted by the 1<sup>st</sup> business day of the month for consideration at that monthly IRB meeting. Please see page 6 of this manual for detailed instructions on completing this form.

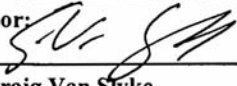
**Title of Project:** Information Technology Acceptance and Usage by Healthcare Professionals

**2. Principal Investigator(s):**

Signature:   
 Name: Virginia Ilie  
 Mr./Ms./Mrs./Dr. (circle one)  
 Degree: MBA  
 Title: PhD Candidate  
 Department: MIS  
 College: CBA  
 E-Mail: vilie@bus.ucf.edu  
 Telephone: 407-823-1712  
 Facsimile: 407-823-2389  
 Home Telephone: \_\_\_\_\_

Signature: \_\_\_\_\_  
 Name: \_\_\_\_\_  
 Mr./Ms./Mrs./Dr. (circle one)  
 Degree: \_\_\_\_\_  
 Title: \_\_\_\_\_  
 Department: \_\_\_\_\_  
 College: \_\_\_\_\_  
 E-Mail: \_\_\_\_\_  
 Telephone: \_\_\_\_\_  
 Facsimile: \_\_\_\_\_  
 Home Telephone: \_\_\_\_\_

**3. Supervisor:**

Signature:   
 Name: Craig Van Slyke  
 Mr./Ms./Mrs./Dr. (circle one)  
 Department: MIS  
 College: Business

Degree: \_\_\_\_\_  
 Title: \_\_\_\_\_  
 Telephone: \_\_\_\_\_  
 Facsimile: \_\_\_\_\_  
 E-Mail: \_\_\_\_\_

4. Dates of Proposed Project (cannot be retroactive): From: April 15, 2005 To: May 31, 2005.  
 Source of Funding for the Project: (project title, agency, and account number) Personal and departmental funds.

6. Scientific Purpose of the Investigation: See attached proposal.

7. Describe the Research Methodology in Non-Technical Language: (the UCFIRB needs to know what will be done with or to the research participants): Interviews with physicians in order to investigate their perceptions related to their use of electronic medical records.

8. Potential Benefits and Anticipated Risks. (Risks include physical, psychological, or economic harm). Describe the steps taken to protect participant. There are no anticipated benefits or risks associated from participation.

9. Describe how participants will be recruited, the number and age of the participants, and proposed compensation (if any): Participants will be recruited through the MIS department at \_\_\_\_\_ Hospital. All participants will be adults.

10. Describe the informed consent process: (include a copy of the informed consent document)

Copy of the informed consent included

I approve this protocol for submission to the UCFIRB.

 14-05-05  
 Department Chair/Director Date



Virginia Ilie, MBA,  
 Craig Van Slyke, Ph.D.  
 Management Information Systems  
[vilie@bus.ucf.edu](mailto:vilie@bus.ucf.edu)  
[cvanslyke@bus.ucf.edu](mailto:cvanslyke@bus.ucf.edu)  
<http://www.bus.ucf.edu/vilie>,  
<http://www.bus.ucf.edu/cvanslyke>  
 407-823-1712, 407-823-4149

### *Informed Consent*

Please read this document carefully before you decide to participate in this study.

**Project title:** "Information Technology Acceptance and Usage by Healthcare Professionals."

**Purpose of the research study:** This research investigates individual responses to introduction of information systems in healthcare organizations. Specifically, we are looking at how healthcare professionals decide to adopt and use electronic medical records (EMR).

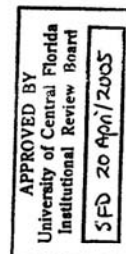
**What you will be asked to do in the study:** You will be asked to participate in an interview in which we will explore physicians' attitudes about EMR. To facilitate discussion, we will ask a number of questions about your perceptions and use of computers. We will also ask you to complete a short, anonymous questionnaire designed to capture the depth to which you use an EMR (in terms of features that you use). At your discretion, you may answer or not answer any of these questions. No personally identifiable information about you will be shared with anyone outside the research team. No identities will be included in any reports or articles resulting from this research.

**Time required:** 30 minutes to one hour.

**Risks:** There are no anticipated risks from participation.

**Benefits/Compensation:** There is no compensation or other direct benefit for participation.

**Confidentiality:** Full confidentiality will be guaranteed to all participants. No-one other than the interviewer will be aware of your identity. Each interviewee will be assigned a number by the primary researcher such that the contact information is kept separate from the transcribed data. Only the assigned number will appear on the transcribed documents. All identifiable information will be thus kept separate from any interview transcripts and other notes. A copy of this informed consent may be used by participants if they wish to contact the researcher with additional information, questions or



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 **REVISED**  
4(20105 BW)

concerns. The interviews will be audio taped using a digital recorder and transcribed (but not video taped) for researchers to review content of discussion. Anonymous demographic information and informed consent will primarily be stored in a lockable office and unavailable to parties outside the research team. Subsequently, audio files, transcripts and other documents will be stored on a password protected computer. The audio files, transcriptions, and demographic questionnaires will be destroyed when the study is completed, or no later than December 31, 2005. Your name will not be used in any report. Reports may be shared with your organization, published in academic journals and provided to software and/or hardware designers to improve design.

**Your permission to audio-tape the interviews:** Your permission to audio-tape the interview is required. Please indicate your agreement below:

- Yes, I agree to be audio-taped                       No, I do not agree

**Voluntary participation:** Your participation in this study is voluntary. There is no penalty for not participating.

**Right to withdraw from the study:** You have the right to withdraw from the study at any time without consequence.

**Whom to contact if you have questions about the study:** Virginia Ilie, MBA, Ph.D. Candidate or Craig Van Slyke, Assistant Professor, Management Information Systems Department.

**Whom to contact about your rights in the study:** Barbara Ward, UCFIRB Office, University of Central Florida Office of Research, Orlando Tech Center, 12443 Research Parkway, Suite 302, Orlando, FL 32826. The phone number is (407) 823-2901.

**I have read the above and voluntarily agree to participate in the study.**

\_\_\_\_\_  
Participant

\_\_\_\_\_  
Date

APPROVED BY  
University of Central Florida  
Institutional Review Board  
SFD 20 April 2005  
CHAIRMAN



THE UNIVERSITY OF CENTRAL FLORIDA  
INSTITUTIONAL REVIEW BOARD (IRB)

*IRB Addendum/Modification Request*

**INSTRUCTIONS:** Please complete the upper portion of this form and attach all revised/new consent forms, altered data collection instruments, and/or any other documents that have been updated. The proposed changes on the revised documents must be clearly indicated by using bold print, highlighting, or any other method of visible indication. The Addendum/Modification must be sent the IRB Office: ATIN: IRB Coordinator, 12443 Research Parkway, Suite 301, Orlando, FL 32826, Email: [IRB@mail.ucf.edu](mailto:IRB@mail.ucf.edu), Phone: 407-823-2901, Fax: 407-823-3299.

- **DATE OF ADDENDUM:** 5/31/05 #2656 to IRB# 2563
- **PROJECT TITLE:** Information Technology Acceptance and Usage by Healthcare Professionals
- **PRINCIPAL INVESTIGATOR:** Ms. Virginia Ilie (Supervisor: Craig VanSlyke, Ph.D.)
- **MAILING ADDRESS:** UCF College of Business Administration, Dept of MIS, BA1, Room 357
- **PHONE NUMBER & EMAIL ADDRESS:** 407-823-1712 vilie@bus.ucf.edu
- **REASON FOR ADDENDUM/MODIFICATION:** Hospital request to modify consent
- **DESCRIPTION OF WHAT YOU WANT TO ADD OR MODIFY:**

Switch consent to one approved by – removes headings, decreases size of font, puts all on one page instead of two pages, deletes the audio-taping opt in/out statement, adds the IRB contact information, adds "Signature/Printed Name of Person Explaining the Study" and basically rearranges already-approved information.

**This addendum form does NOT extend the IRB approval period or replace the Continuing Review form for renewal of the study.**

Approved     Disapproved    *Virginia Ilie*    5/31/2005  
 Full Board     Chair Expedited    IRB Chair Signature    Date



Virginia Ilie, MBA,  
 Craig Van Slyke, Ph.D.  
 Management Information Systems  
 vilie@bus.ucf.edu  
 cvanslyke@bus.ucf.edu  
 http://www.bus.ucf.edu/vilie  
 http://www.bus.ucf.edu/cvanslyke  
 407-823-1712, 407-823-4149

**Consent to Participate**

**Project title: "Information Technology Acceptance and Usage by Healthcare Professionals."**

You are being asked to participate in a research study to investigate individual responses to how healthcare professionals decide to adopt and use electronic medical records (EMR).

This study is voluntary, and you may or may not agree to participate, or you may withdraw from the project without consequence to you. If you agree to participate, the research team will interview you to explore physicians' attitudes about EMR. To facilitate discussion, we will ask you (1) questions about your perceptions and use of computers, and (2) to complete a short, anonymous questionnaire designed to capture the depth to which you use an EMR (in terms of features that you use). At your discretion, you may answer or not answer any of these questions.

Your part should take less than an hour to complete and there are no anticipated risks from your participation. There is no compensation or other direct benefit to you for your participation.

Only the interviewer will be aware of your identity. You will be assigned a number so that the contact information is kept separate from the transcribed data. Only the assigned number will appear on the transcribed documents, therefore, all identifiable information will be kept separate from interview transcripts and notes.

Interviews will be audio taped using a digital recorder and transcribed so the research team can review the discussions. Anonymous demographic information will be stored in a secured location and unavailable to anyone outside the research team. Audio files, transcripts and other documents will be stored on a password protected computer and will be destroyed when the study is completed (no later than December 31, 2005). The final report of the study may be shared with your organization, published in academic journals and provided to software and/or hardware designers, however, your name will not be revealed.

If you have questions about the study, you may contact Virginia Ilie, MBA, Ph.D. Candidate or Craig Van Slyke, Assistant Professor, Management Information Systems Department at the numbers at the top of this letter.

This study was reviewed by the Hospital IRB and the UCF IRB. For questions regarding your rights as a participant at Hospital, you may call the IRB Administrative Offices at (407) 303-1965. For questions regarding your rights and UCF, you may contact Barbara Ward at UCF IRB Office, University of Central Florida Office of Research, Orlando Tech Center, 12443 Research Parkway, Suite 302, Orlando, FL 32826. The phone number is (407) 823-2901.

By signing this letter, you are stating you understand this research study and that you agree to be audio-taped during the interview. You will be given a copy of this letter (consent) for your records.

I agree to participate and be audio-taped for this study. The study has been explained to me to my satisfaction.

\_\_\_\_\_  
 Signature/Printed Name of Participant Date

\_\_\_\_\_  
 Signature/Printed Name of Person Explaining the Study Date

APPROVED BY University of Central Florida Institutional Review Board  SFD May 31, 2005 CHAIRMAN
--

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## LIST OF REFERENCES

- Abernathy, W., and Clark, K. (1985). "Innovation: Mapping the Winds of Creative Destruction," *Research Policy* 14(1), 3-22.
- Agarwal, R. (2000). "*Individual Acceptance of Information Technologies*," in Framing the Domains of IT Management, Robert Zmud Eds.
- Agarwal, R. and Prasad, J. (1997). "The Role of Innovation Characteristics and Perceived Voluntariness in the Acceptance of Information Technologies," *Decision Sciences* 28 (3) 557-582.
- Agarwal, R. and Karahanna, E. (1998). "On the Multi-dimensional Nature of Compatibility Beliefs in Technology Acceptance," DIGIT Manuscript.
- Ajzen, I. (1985). "*From Intentions to Actions: A Theory of Planned Behavior*," in Action Control: From Cognitions to Behavior, J. Kuhl and J. Beckmann Eds., Springer Verlag, New York, 11-39.
- Ajzen, I. (1991). "The Theory of Planned Behavior," *Organizational Behavior and Human Decision Processes* 50 (2), 179-211.
- Ajzen, I. and Fishbein, M. (1980). "*Understanding Attitudes and Predicting Social Behavior*," Prentice-Hall, Englewood Cliffs, NJ.
- Anderson, J.G. (1997). "Clearing the Way for Physicians" Use of Clinical Information Systems," *Communications of the ACM* 40 (8), 83-90.
- Anderson, R.A. and McDaniel, Jr., R.R. (2000). "Managing Healthcare Organizations: Where Professionalism Meets Complexity Science," *Healthcare Management Review* 25(1), 83-92.
- Ayres, C. (1944, reprinted in 1962, 1978 and 1996), "*The Theory of Economic Progress*," Chapel Hill, University of North Carolina Press, 4th edition.
- Bandura, A. (1977). "Self-efficacy: Toward an Unifying Theory of Behavioral Change," *Psychological Review* 84(2), 191-215.
- Barley, S.R. (1986). "Technology as an Occasion for Structuring: Evidence from Observations of CT Scanners and the Social Order of Radiology Departments," *Administrative Science Quarterly* 31(1), 78-108.
- Barki, H., and Hartwick, J. (1989). "Rethinking the Concept of User Involvement," *MIS Quarterly* 13(1), 53-64.

- Benbasat, I., Goldstein, D.K. and Mead, M. (1987). "The Case Research Strategy in Studies of Information Systems," *MIS Quarterly*, September issue, 369-386.
- Berg, B.L. (2004) "*Qualitative Research Methods for the Social Sciences*," Allyn & Bacon 5<sup>th</sup>. Eds.
- Bhattacharjee, A. (2001). "Understanding Information Systems Continuance: an Expectation-Confirmation Model," *MIS Quarterly* 25(3), 351-370.
- Bijker, W. (1987). "The Social Construction of Bakelite: Toward a Theory of Invention" in *The Social Construction of Technological Systems*, W. Bijker, T. Hughes, and T. Pinch Eds., MIT Press, Cambridge MA, 159-190.
- Blumenthal, D. (2002). "Doctors in a Wired World: Can Professionalism Survive Connectivity?" *The Milbank Quarterly* 80(3), 525-546.
- Brown, S. A., Montoya-Weiss, M. M. and Burkman, J. R. (2002). "Do I Really Have To? User Acceptance of Mandated Technology," *European Journal of Information Systems* 11, 283-295.
- Bujak, J.S. (2002). "Service and Collaboration Keys to Physician Control," *The Physician Executive*, May-June.
- Burke, D.E. and Menachemi, N. (2004). "Opening the Black Box: Measuring Hospital Information Technology Capability," *Healthcare Management Review* 29(3), 207-217.
- Bush, P. D. (1986). "On the Concept of Ceremonial Encapsulation," *Review of Institutional Thought* 3, 25-45.
- Bush, P. D. (1987), "The Theory of Institutional Change," *Journal of Economic Issues*, 21(3), 510-581.
- Bush, P. D. (1989). "The Concept of Progressive Institutional Change and its Implications for Economic Policy Formation," *Journal of Economic Issues*, 23 (2), 455-463.
- Bush, P. D. (1991). "The Contemporary American Institutional Contribution to the Theory of Social Change," a paper presented at the *Fourth Colloquium of the Charles Gide Association for the Study of Economic Thought*, University of Aix-Marseille, Marseille, France.
- Bush, P. D. (1994). "The Pragmatic Instrumentalist Perspective on the Theory of Institutional Change," *Journal of Economic Issues* 28(2), 647-657.
- Camic, C. (1986). "The Matter of Habit," *American Journal of Sociology* 91(5), 1039-87.



- Chau, P.Y.K. and Hu, P. J. H. (2001). "Information Technology Acceptance by Individual Professionals: A Model Comparison Approach," *Decision Sciences*, 32 (4), 699-719.
- Chiasson, M.W. and Davidson, E. (2004). "Pushing the Contextual Envelope: Developing and Diffusing IS Theory for Health Information Systems Research," *Information and Organization* 14, 155-188.
- Chiasson, M.W. and Davidson, E. (2005). "Taking Industry Seriously in IS Research," forthcoming in *MIS Quarterly* (29)
- Chilingerian, J.A. and Sherman, H.D. (1990). "Managing Physician Efficiency and Effectiveness in Providing Hospital Services," *Health Services Management Research* 3(1), 3-15.
- Chismar, W.G. and Wiley-Patton, S. (2003). "Does the Extended Technology Acceptance Model Apply to Physicians?" *Proceedings of the 36<sup>th</sup> Hawaii International Conference on Information System Sciences (HICSS)*.
- Commons, J. (1931). "Institutional Economics," *American Economic Review*, 21, 648-657.
- Connolly, C. (2005). "Cedars-Sinai Doctors Cling to Pen and Paper," *The Washington Post*, March 21. <http://www.msnbc.com/id/7251945>
- Cooper, R.B. and Zmud, R.W. (1990). "Information Technology Implementation Research: A Technological Diffusion Approach," *Management Science* 36(2), 123-139.
- Creswell, J.W. (1994). *Research Design Qualitative and Quantitative Approaches*, Thousand Oaks, Calif.: Sage Publications.
- Creswell, J.W. and Miller, D.L. (2000). "Determining Validity in Qualitative Inquiry," *Theory Into Practice* 39 (3), 124-130.
- Davis, F. (1989). "Perceived Usefulness, Perceived Ease of Use and User Acceptance of Information Technology," *MIS Quarterly* 13(3), 319-339.
- Davis, F., Bagozzi, R.P. & Warshaw, P.R. (1989). "User Acceptance of Computer Technology: A Comparison of Two Theoretical Models," *Management Science*, 35(8), 982-1003.
- Denzin, N.K. (1978). *The Research Act: A Theoretical Introduction to Sociological Methods*, New York: McGraw-Hill.
- Devaraj, S. and Kohli, R. (2003). "Performance Impacts of Information Technology: Is Actual Usage the Missing Link?" *Management Science* 49(3), 273-289.

- DiMaggio, P. and Powell, W. (1983). "The Iron Cage Revisited: Institutional Isomorphism and Collective Rationality in Organizational Fields," *American Journal of Sociology* 48(2), 147-160.
- DiMaggio, P. and Powell W. (1991). "*The New Institutionalism in Organizational Analysis*," Introduction in W. Powell and P. DiMaggio Eds., Chicago, University of Chicago Press (1-38).
- Dunham, R.B., Grube, J.A., Gardner, G.B., Cummings, L.L. and Pierce, J.L. (1989). "The Development of an Attitude Towards Change Instrument," *Academy of Management Proceedings*.
- Eisenhardt, K.M. (1989). "Building Theories from Case Study Research," *Academy of Management Review* 14(4), 532-550.
- Fiol, C.M. and O'Connor, E.J. (2004). "*Stuff Matters: Artifacts, Identity and Legitimacy in the US Medical Profession*," a submission to Rafaeli, A. & Pratt, M. (Eds). *Artifacts in Organizations*: Lawrence Erlbaum Associates Inc. Mahwah, New Jersey.
- Fishbein, M. and Ajzen, I. (1975). *Belief, Attitude, Intention and Behavior: An Introduction to Theory and Research*, Addison-Wesley, Reading, MA.
- FitzHenry, F., Salmon, J.W. and Reichelt, P.A. (2000). "Adopting Knowledge Technology to Manage Care: Issues and Status of Physician Use," *Journal of Managed Care Pharmacy* 6(1), 35-41.
- Fontana, A. and Frey, J. H. (1994). "*Interviewing: The Art of Science*," in Norman K. Denzin and Yvonna S. Lincoln Eds., *Handbook of Qualitative Research*. Thousand Oaks: Sage.
- Foster, J.F. (1981). "The Papers of J. Fagg Foster," *Journal of Economic Issues* 15 (Dec), 857-1012.
- Fottler, M.D., Schermerhorn, J.R., Wong, J. and Money, W.H. (1982). "Multi-institutional Arrangements in Healthcare: Review, Analysis and a Proposal for Future Research," *Academy of Management Review* 7(1), 67-79.
- Fulk, J., Steinfield, C. W., Schmitz, J. and Power J. G. (1987). "A Social Information Processing Model of Media Use in Organizations," *Communication Research*, 14, 529-552.
- Hamilton, W. (1932). "*Institution*" in Geoff Hodgson (Eds), *Economics of Institutions*, 3-8.
- Henderson, R. and Clark, K. (1990). "Architectural Innovation: The Reconfiguration of Existing Product Technologies and the Failure of Established Firms," *Administrative Science Quarterly* 35(1), 9-30.

- Hickerson, S.R. (1987). "Instrumental Valuation: The Normative Compass of Institutional Economics," *Journal of Economic Issues* 21.
- Hodgson, G. (1993). "Institutional Economics: Surveying the 'Old' and the 'New'," *Metroeconomica* 44 (February), 1-28.
- Hu, P. J-H., Chau, P.Y.K. and Sheng, O.R.L. (1999). "Adoption of Telemedicine Technology by Healthcare Organizations: An Exploratory Study," *Journal of Organizational Computing and Electronic Commerce* 12(3), 197-221.
- Iivari, J. (1986). "An Innovation Research Perspective on Information System Implementation," *International Journal of Information Management* 6(3), 123-144.
- Institute of Medicine's CPR Report (1991). "*The Computer-based Patient Record: An Essential Technology for HealthCare*," National Academy Press.
- Jasperson, J., Carter, P.E. and Zmud, R.W. (2005). "A Comprehensive Conceptualization of the Post-Adoptive Behaviors Associated with IT-Enabled Work Systems," *MIS Quarterly*, forthcoming.
- Johnson, R.D. and Marakas, G.M. (2000). "The Role of Behavioral Modeling in Computer Skills Acquisition: Toward Refinement of the Model," *Information Systems Research*, 11(4).
- Joshi, P.L. (2001). "The International Diffusion of New Management Accounting Practices: The Case of India," *Journal of International Accounting, Auditing and Taxation* 10, 85-109.
- Junker, L.J. (1982). "The Ceremonial Instrumental Dichotomy in Institutional Analysis: The Nature, Scope and Radical Implications of Conflicting Systems," *American Journal of Economics and Sociology* 41 (April), 141-150.
- Karahanna, E., Straub, D.W. and Chervany, N.L. (1999). "Information Technology Adoption Across Time: A Cross-Sectional Comparison of Pre-Adoption and Post-Adoption Beliefs," *MIS Quarterly*, 23(2), 183-213.
- Kelly, D. and Amburgey, T. L. (1991). "Organizational Inertia and Momentum: A Dynamic Model of Strategic Change," *Academy of Management Journal*, 34, 591-612
- Kelman, H. C. (1958). "Compliance, Identification and Internalization: Three Processes of Attitude Change," *Conflict Resolution*, 2(1), 51-60.
- Kim, K.K. and Michelman, J.E. (1990). "An Examination of Factors for the Strategic Use of Information Systems in the Healthcare Industry," *MIS Quarterly* June issue, 201-215.
- Klein, K.J. and Sorra, J.S. (1996). "The Challenge of Innovation Implementation," *Academy of Management Review* 21(4), 1055-1080.

- Kohli, R. and Kettinger, W.J. (2004). "Informing the Clan: Controlling Physicians' Costs and Outcomes," *MIS Quarterly* 28(3), 363-394.
- Kostova, T. (1999). "Transnational Transfer of Strategic Organizational Practices: A Contextual Perspective," *Academy of Management Review* 24(2), 308-324.
- Kostova, T. and Roth, K. (2002). "Adoption of an Organizational Practice by Subsidiaries of Multinational Corporations: Institutional and Relational Effects," *Academy of Management Journal* 45(1), 215-233.
- Leonard, K.J. (2004). "Critical Success Factors Relating to Healthcare's Adoption of New Technology: A Guide to Increasing the Likelihood of Successful Implementation," *Electronic Healthcare* 2 (4), 72-81.
- LeTourneau, B. (2004). "Managing Physicians' Resistance to Change," *Journal of Healthcare Management* 49(5), 286-294.
- Lincoln, Y.S. and Guba, E.G. (1985). "*Naturalistic Inquiry*," Newbury Park, CA: Sage.
- Lyytinen, K. and Rose, G.M. (2003). "The Disruptive Nature of Information Technology Innovations: The Case of Internet Computing in Systems Development Organizations," *MIS Quarterly* 27(4), 557-595.
- Mathieson, K. (1991). "Predicting User Intentions: Comparing the Technology Acceptance Model with the Theory of Planned Behavior," *Information Systems Research* 2(3), 173-191.
- March, J. G. (1991). "Exploration and Exploitation in Organizational Learning," *Organization Science* 2(1), 71-87.
- Meyer, J. and Rowan, B. (1977), "Institutionalized Organizations: Formal Structure as Myth and Ceremony," *American Journal of Sociology*, 83(2), 340-363.
- Miles, M.B. and Huberman, A.M. (1994). "*An Expanded Sourcebook: Qualitative Data Analysis*" (2<sup>nd</sup> Edition), Sage Publications, Thousand Oaks, CA.
- Moore, G.C. and Benbasat, I. (1991). "Development of an Instrument to Measure the Perceptions of Adopting an Information Technology Innovation," *Information Systems Research* 2(3), 192-222.
- Myers, M.D. (1997). "Qualitative Research in Information Systems," *MIS Quarterly*, 21(2), 241-242.

- O'Reilly, C. and Chatman, J. (1986). "Organizational Commitment and Psychological Attachment: The Effects of Compliance, Identification and Internalization on Prosocial Behavior," *Journal of Applied Psychology* 71(3).
- Patton, M. Q. (1990). *Qualitative Evaluation and Research Methods*, Sage Publications, Newbury Park, CA.
- Prescott, M.B. and Conger, S.A. (1995). "Information Technology Innovations: A Classification by IT Locus of Impact and Research Approach," *Database for Advances in Information Systems*, 26 (2-3), 20-41.
- Redmond, W.H. (2003). "Innovation, Diffusion and Institutional Change," *Journal of Economic Issues* 37(3), 665-679.
- Rogers, E.M., (1995). *Diffusion of Innovations*, The Free Press, New York,
- Ruef, M. and Scott, W.R. (1998). "A Multidimensional Model of Organizational Legitimacy: Hospital Survival in Changing Institutional Environments," *Administrative Science Quarterly* 43, 877-904.
- Saka, A. (2002). "Multiple Paths to Adoption: The Role of Actors in the Appropriation of Japanese Work Systems," *Asian Business & Management*, 1, 353-372.
- Sangster, A. (1994). "The Adoption of IT Management in Accounting: The Expert Systems Experience," *Journal of Information Technology* 9, 159-169.
- Scott, W.R. (1987). "The Adolescence of Institutional Theory," *Administrative Science Quarterly* 32, 493-511.
- Starr, P. (1982). *The Social Transformation of American Medicine*, New York: Basic Books.
- Taylor S. & Todd, P. A. (1995). "Understanding Information Technology Usage: A Test of Competing Models," *Information Systems Research* 6(2), 144-176.
- Thompson, T. (2004). "News Release from the Department of Health and Human Services" on July 21, 2004, accessed December 5, 2004.  
<http://www.hhs.gov/news/press/2004pres/20040721a.html>
- Tornatzky, L.G. and Klein, K.J. (1982). "Innovation Characteristics and Innovation Adoption-Implementation: A Meta Analysis of Findings," *IEEE Transactions on Engineering Management* 29(1), 28-45.
- Treister, N.W. (1998). "Physicians Acceptance of New Medical Information Systems: The Field of Dreams," *Physician Executive* 24(3), 20-24.

- U.S. Department of Health and Human Services (2004). "The Decade of Health Information Technology: Delivering Consumer-Centric and Information-Rich Health Care. A Framework for Strategic Action," available from: <http://www.hhs.gov>. Accessed January 23, 2005.
- Van Slyke, Belanger C.F. and Comunale C. (2004). "Factors Influencing the Adoption of Web-Based Shopping: The Impact of Trust," *Database for Advances in Information Systems* 35(2), 32-49.
- Veblen, T. (1899, reprinted 1912 and 1953), "*The Theory of Leisure Class*" Mentor Books, MacMillan Company.
- Venkatesh, V. (2000). "Determinants of Perceived Ease of Use: Integrating Control, Intrinsic Motivation and Emotion into the Technology Acceptance Model," *Information Systems Research* 11(4), 342-365.
- Venkatesh, V. and Brown, S.A. (2001). "A Longitudinal Investigation of Personal Computers in Homes: Adoption Determinants and Emerging Challenges," *MIS Quarterly* 25(1), 71-102.
- Venkatesh, V., Morris, M.G., Davis, G.B. and Davis, F.D. (2003). "User Acceptance of Information Technology: Toward a Unified View," *MIS Quarterly* 27(3), 425-478.
- Waller, W.T. (1988). "The Concept of Habit in Economic Analysis," *Journal of Economic Issues* 22(1), 113-126.
- Weiner, B.J., Savitz, L.A., Schulamit, B. and Pucci, L.G. (2004). "How Do Integrated Delivery Systems Adopt and Implement Clinical Information Systems?," *Healthcare Management Review* 29(1), 51-77.
- Wholey, D.R. (2000). "The Diffusion of Information Technology Among Health Maintenance Organizations," *Healthcare Management Review* 25(2), 24-33.
- Wood, Jr. T. and Caldas, M. P. (2002). "Adopting Imported Managerial Expertise in Developing Countries: The Brazilian Experience," *Academy of Management Executive* 16(2), 18-32.
- Yin, R.K. (1994). "*Case Study Research: Design and Methods*" (2<sup>nd</sup> Edition), Sage Publications, Thousand Oaks, CA.
- Zaltman, G., Duncan, R., and Holbek, J. (1977). "*Innovations and Organizations*," John Wiley & Sons, New York.
- Zucker, L. G. (1987). "Institutional Theories of Organization," *Annual Review of Sociology* 13, 443-464.