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INVESTIGATING HETEROGENEITY IN PHYSICIAN USE OF ELECTRONIC MEDICAL RECORDS:
THE ROLE OF PROFESSIONAL VALUES AND PERSPECTIVES OF UNCERTAINTY

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INVESTIGATING HETEROGENEITY IN PHYSICIAN USE OF ELECTRONIC MEDICAL RECORDS: THE ROLE OF PROFESSIONAL VALUES AND PERSPECTIVES OF UNCERTAINTY

by

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Dissertation

Presented to the Faculty of the Graduate School of

The University of Texas at Austin

in Partial Fulfillment

of the Requirements

for the Degree of

Doctor of Philosophy

The University of Texas at Austin

May 2010

Dedication

To those who believed, challenged, listened and shared. To each of you who placed

your unique fingerprints on this work.

You know who you are, and

this work is dedicated to you.

Acknowledgements

I am fortunate to have had the help and support of many people in this endeavor. Thank you to the information technology department employees, physicians, nurses, managers, staff members, and executives of MetroClinic for the time and energy they donated to this academic pursuit. Your contribution to this research and the lessons you taught me are invaluable. I particularly want to thank the Chief Executive Officer and the Physician Leadership for allowing me to explore my questions in their organization.

Thank you to Mei Lin, Michelle Chen and Tayfun Keskin, my information management PhD cohort, for your encouragement and support during the last six years (especially in first-semester Microeconomics!). It's been a pleasure working with each of you during our time in the program together, and I look forward to learning with you in the future as we move through our careers.

Thank you to the too many to name friends, faculty, advisors and colleagues who valued my work, guided my efforts, and challenged me without end. I have been blessed to have worked with many top scholars from across North America over the last six years. Thank you to my colleagues in San Antonio for teaching me and so warmly welcoming me into your research world. A bit farther away, sincere thanks to my friends in Toronto and Cambridge for your willingness to share your work and help light my path. From Somerset to Denver to Durham, I thank you all for allowing me to join your esteemed company over the past few years and for introducing me to interdisciplinary, collaborative research. To the faculty and staff

INVESTIGATING HETEROGENEITY IN PHYSICIAN USE OF ELECTRONIC MEDICAL RECORDS: THE ROLE OF PROFESSIONAL VALUES AND PERSPECTIVES OF UNCERTAINTY

Publication No._____

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The University of Texas at Austin, 2010

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While information systems researchers have argued well from socio-technical and organizational culture perspectives that information technology (IT) and organizational structures are interdependent and continually reshape each other, few studies have sought fine-grained, micro-level explanations for the heterogeneity in IT use often observed across seemingly similar end users and seemingly similar work contexts. Using a nested comparative case study design, I explore electronic medical record (EMR) use by physicians in an integrated multi-specialty health care organization. I use multiple methods to observe and develop micro-level understandings of factors associated with EMR use. The study was conducted in eight practices operating within the same organization. Data collection methods included semi-structured interviews, non-participant observations, and questionnaires. A constant comparative approach guided data analysis. Differences

in physician values were noted, as were differences in physician perspectives of uncertainty. I categorized physicians as high, medium and low EMR users depending on a variety of factors including degree to which the EMR was integrated into work practices, degree of feature use, and degree of EMR-enabled communication. Drawing on theories of professionalism, I explain between-physician heterogeneity in EMR use as partly a function of differences in dimensionality of professional values. Three dimensions of professional values were identified 1) profession-oriented, 2) patient-oriented and 3) organization-oriented. Drawing on complexity theory, I argue that differences in physician perspectives of uncertainty influence their EMR use. I found that physicians who viewed uncertainty primarily as reducible through information tended to be higher users of the EMR. Physicians who viewed uncertainty as fundamental, or inherent, in care delivery processes tended to be lower users of the EMR. This study contributes to information systems research by extending current understandings of IT use. The professional values held by physicians and their perspectives of uncertainty may be more important in shaping EMR use than previously thought. These findings indicate the need to more aggressively pursue EMR designs, implementation strategies and policies that accommodate these two additional factors. Additionally, findings from this research indicate a need for IT managers in professional settings to consider end-user professional values and perspectives of uncertainty in decisions involving IT assets.

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Chapter 1: Introduction

Understanding information technology (IT) use in health care contexts is becoming increasingly important. Nations around the world are confronting head-on the challenges of managing health information in effective and meaningful ways. For the past decade, government and health policy leaders in the United States have promoted IT as a strategy for improving access and quality of health care and for reducing the costs associated with health care delivery (Institute of Medicine, 2001; United States Congress, 2009). Electronic medical records (EMR) systems are a particularly prominent part of this discussion and are receiving significant attention in the national health IT (HIT) policy debate. Research reveals that efforts to introduce EMRs into health care delivery contexts are, in general, failing to meet expectations in terms of both improving quality (Linder, Ma, Bates, Middleton, & Stafford, 2007) and reducing costs (Sidorov, 2006). A recent report reveals that only 13% of US physicians working in out-patient settings report using a basic EMR and only 4% report using a fully functional EMR (DesRoches et al., 2008). Additionally, reports estimate that 33% of EMR implementations fail within a year (Chin, 2006). For the implementations that succeed, differences in between-physician EMR use often occur and can be problematic. Few studies, however, examine these differences. Research investigating the differences in how physicians use EMRs is needed to better understand factors influencing EMR use and to generate insights for managing IT in this important domain.

At the same time, IT use research in the information systems field is experiencing a shift in focus. After decades of research focused on understanding

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behavioral intention to use IT (Davis, 1989; Venkatesh, Morris, Davis & Davis, 2003), studies of actual IT use – or IT use after adoption – are on the rise (Jasperson, Carter & Zmud, 2005; Zhu & Kramer, 2005). Because theories of IT use after adoption are relatively immature, in-depth studies exploring factors that influence IT use in a variety of contexts are needed. For many reasons, it is likely true that IT use in professional settings will be fundamentally different from IT use non-professional settings. For example, work in non-professional settings is in general more routine than work in professional settings. Professional organizations are frequently thought of as knowledge-intensive work environments and this is less the case for non-professional settings. Following this logic, studies of IT use in professional settings should be conducted independently from studies of IT use in non-professional settings. Examining IT use in a health care context can inform theory development of IT use in professional settings.

This research is motivated by the following question: Why do physicians working in the same organization use the same EMR differently from each other? Using multiple methods, I examine physician use of an EMR system in an integrated multi-specialty out-patient health care organization. Twenty-eight physicians working in eight different medical practices participated in the study. I used an ethnographic approach to data collection (Agar, 1996). Data collection methods included semi-structured interviews, non-participant observations, and questionnaires. Instruments were developed using relevant literatures and/or by adapting existing instruments. A constant comparison approach guided data analysis (Strauss & Corbin, 1998). Data analysis efforts focused on uncovering new

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and relevant variables for understanding IT use by professionals and relating patterns in these new variables to patterns in IT use. Analysis revealed that patterns in physician EMR use were associated with patterns of professional values and perspectives of uncertainty. Based on these findings, I develop a theory of IT use that integrates theories of professionalism and complexity theory and that includes fine-grained, micro-level explanations for IT use in professional settings. This study contributes to information system research by extending current understandings of individual-level IT use to include professional values and perceptions of uncertainty.

<center>**********</center>

Throughout the course of this study, physician statements such as the ones provided below were percolating…

> *"…if someone over 80 calls and needs anything, we'll do it. I mean we'll have them come in. If they're here they've earned it. So they get a little bit more attention I think than someone who can probably wait a day or two. So I think I value the older generations a lot. I kind of like history too. I know they grew up in the great depression. I think they tend to; it's just different. They go to their doctor appointments with their coats and all dressed up and looking nice. They're always on time. They're super early as a matter of fact. They don't miss their appointments. If they do you know something has happened, something is wrong. So, I really value that generation a lot."*
>
> – Cecil

> *"I grew up in a mission environment and my aim in being a doctor was very idealistic - that I care for people who need a physician in underprivileged areas. And I did my training in India - worked in mission hospitals and it was very fulfilling to be able to be a general practitioner*

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to about 150 villagers. It was very fulfilling in a sense you know. They need you. It doesn't pay anything I was just probably getting $50 dollars a month. But, in a way it was very fulfilling. You kind of felt like a hero and every; I think every doctor wants to be hm like a little; you know (short pause) a bit of that. Hm so. Yeah. I, I like being in a place where I'm needed. I dream to go back and work there again, so. I think this is not the ideal thing for me. I'm here to explore how things are here. I feel I'm kind of I've betraying my medical school coming here."

– Mirelle

"I'm not sure what the purpose of having a medication list in there if we pretty much don't know if it's correct or not. For example, any medication list in the system assumes that every doctor the patient sees is within the clinic which is not true, most of the time; and it also assumes that somebody updated the list every time that medication has changed, which is not true most of the time. But still the fact is that you don't know what someone's taking unless you ask them that day; because that could have changed the day before; you wouldn't know. We never actually have all the medications that someone is taking. We never have a complete list."

– Charlie

"I'm just maybe a little more compulsive than other people and it satisfies that need in me to know exactly what medicines my patients are on; know exactly what interactions they may have; you know and so for someone with those needs this is a great system."

– John

These statements and others like them impressed upon me the complex nature of understanding IT use by professionals. Reflecting on these statements, and other statements like them, helped me recognize the need to move beyond current understandings of IT use. Variables such as perceived usefulness, perceived

ease-of-use, age, gender, IT experience, and voluntariness are important; yet in professional settings it appears that additional explanations are needed to more fully explain patterns of IT use. As I observed 28 physicians use an EMR and as they each spoke with me about this IT, I noted that seemingly similar physicians can have very different ideas about what is important in the practice of medicine and about the role of information in managing uncertainty. These differences seemed to be important in explaining between-physician differences in EMR use.

In this study, I explore differences in EMR system use by physicians working in the same organization. I describe the variety of ways in which physicians incorporate this IT in their work practices. I uncover a diversity of perspectives held by physicians about the practice of medicine and about EMR systems. I argue that statements such as the interview excerpts above represent the often hard to see, difficult to ascribe professional values and perspectives of uncertainty that come into play when professionals incorporate new information technologies into work practices. Traditionally, researchers have argued that variables such as age, gender, previous experience with IT, perceived usefulness and perceived ease of use influence individual-level IT use. I argue, on the other hand, that views held by professionals about how they define what is important in their work and about how they perceive uncertainty are important in explaining their IT use. Not all of these findings are novel and some of them may overlap conceptually with existing IT use constructs. This research does, however, contribute new insights into studies of IT use in professional settings. This research shows that in addition to considering the specific orientation of the values held by professionals, studies of IT use should also

consider the total number of values contained in a professional's value set. Additionally, the findings from this study indicate the possibility that professionals who acknowledge fundamental uncertainty (uncertainty that is not reducible with more information) may see less of a role for IT in accomplishing work tasks than professionals who hold more traditional views on uncertainty.

This research is guided by a two sets of theoretical frames. I use theories of professionalism and professional organizations to better understand the role of physician values in EMR use. I use complexity theory to better understand how differences in perceptions of uncertainty shape EMR use. I integrate ideas from these theoretical frameworks and draw on the results of this study to build a new theory of IT use in professional settings. This theory articulates a positive relationship between the dimensionality of professional values and IT use, a positive relationship between traditional views on uncertainty and IT use, and suggests that heterogeneity in IT use can be an important source of learning, sensemaking and problem solving in professional organizations.

In this chapter, I define heterogeneous IT use. I place heterogeneous IT use in the broader context of IT use research. I discuss heterogeneous use in the context of EMR systems. I then argue why heterogeneous IT use is an important area of study.

HETEROGENEOUS IT USE

I define heterogeneous IT use as any observable difference in how individuals working within the same work role use the same IT. Software designers

who use collaborative work systems differently from each other, lawyers who use electronic search tools differently from each other, university professors who use classroom management systems differently from each other, and physicians who use EMR systems differently from each other are all examples of heterogeneous IT use. Heterogeneity in IT use can be observed through:

1) differences in the degree to which an IT is incorporated into work practices/work routines (ex. degree of IT integration into work flow, degree of IT feature use, frequency that IT use changes, etc.) and/or

2) differences in specific, highly-nuanced IT use behaviors that are often idiosyncratic to the user (ex. work-arounds, user generated labeling schemes, reminder systems, etc).

Research from information systems and organizational theory informs this conceptualization. (Barley, 1986; DeSanctis & Poole, 1994; Edmondson, 1999, 2003; Fiol & O'Connor, 2004; Orlikowski, 1993, 1996) have researched topics helpful in thinking about heterogeneous IT use in professional contexts. Barley (1986) and Edmondson (1999, 2003) examined the relationships between interdependent work tasks in teams and IT implementation. From this research, we know that seemingly similar radiology units implementing the same IT artifact can go through the same stages of implementation in the same order, but can end up using the same IT very differently from each other (Barley, 1986). We know that cardiac surgery teams implementing new surgical techniques differ in their success rates and that psychological safety is an important condition for surgical teams learning new surgical techniques (Edmondson, 1999, 2003). Orlikowski (1996)

studied IT implementation as a process of situated change in which IT use unfolds through a process of ongoing interaction between an IT user and an IT artifact. This perspective implies that local conditions shape the interactions that take place and the structures that develop. Heterogeneity in IT use can occur across organizational or work group boundaries. Barley (1986) and Orlikowski (1996) explain differences in IT use as arising from contextual differences in how technology structures and organizational or work role structures iteratively influence each other over time. An example of this phenomenon is two physicians working in separate organizations using the same EMR system differently from each other. This study, however, studies heterogeneous IT use occurring between individuals working within the same professional organization.

In this study, I conceptualize heterogeneity in EMR use as any difference in how professionals working in the same health care delivery organization use the same EMR system. Heterogeneous EMR use can occur between nurses, medical assistants, and physicians. The focus of this research is on explaining the differences in how physicians working in the same health care delivery organization use the same EMR system. Heterogeneity in EMR use can be observed in a variety of ways. For example, physicians can differ from each other in how they use the EMR to manage their patient panel. Physicians can differ in how much they allow the EMR to influence their work flow. They can differ in terms of where they choose to locate EMR work stations (e.g. offices, exam rooms, nurses' stations). Physicians can differ from each other in how they use the EMR to involve patients in the medical encounter. Physicians can differ in terms of how and when they document the

clinical visit. Physicians can differ in how they use information from the EMR in medical decision making. Physicians can differ in terms of which EMR features they commonly use. The list continues. These differences fit into the categories described above: 1) differences in the degree to which an IT is incorporated into work practices/work routines and/or 2) differences in specific, highly-nuanced IT use behaviors that are often idiosyncratic to the user. It is important to note that the differences studied here are between individuals in the same profession (physicians) using the same IT artifact (EMR system).

Heterogeneity in IT use is an important area of study. Understanding why professionals use IT differently from each other can shed light on a number of important issues at the intersection of IT and organizations. Better data-driven explanations of why professionals use IT differently from each other can inform the design of IT for professional organizations and create better strategies for implementing and managing IT in professional organizations.

Understandings of heterogeneous EMR use could impact health care management and policy. This research can inform the design, implementation and management of health IT so that IT can make a positive impact on health care quality, cost and access. This research also informs health policy making, giving government and policy leaders much needed knowledge about IT use in health care delivery contexts. The problems in health care are 21st century problems and, in addition to what we already know about the solutions to these challenges, they require knowledge from 21st century inquiries.

My research question is: Why do seemingly similar physicians working in the same organization use the same EMR system differently from each other? The goals of this research are to discover new variables that are relevant to understanding IT use by professionals, build theory based on these findings, and articulate consequences for this new theory on research and practice.

The remainder of this paper is organized as follows. Chapter 2 provides a literature review for this research focusing specifically on the IT use, health IT - focusing specifically on EMR systems, professionalism, and complexity science. In Chapter 3, I describe the research design including methods for data collection, data analysis and an introduction to the research setting. The study results are shown in Chapter 4. Chapter 5 discusses these results and includes a discussion of the implications for research and practice and the study limitations. In Chapter 6, I introduce a conceptual model of IT use in professional organizations and provide conclusions. Supporting materials such as data collection instruments and physician profiles as used in data analysis are provided in the appendices.

Chapter 2: Literature Review

In this chapter, I review the areas of research most relevant to my research topic: IT use, health IT (HIT) focusing specifically on EMR systems, professionalism, and complexity science. I begin by stating key assumptions.

Starting Assumptions

Health care organizations are professional organizations. Health care delivery organizations are an appropriate setting to investigate IT use in professional organizations. Professional organizations are organizations that coordinate the use of knowledge and expertise embedded in individuals and organizations to accomplish its goals (Benveniste, 1987). Examples of professional organizations are law firms, accounting firms, professional services firms, architecture agencies, universities and health care organizations. Work performed in professional organizations is often thought of as being less routine that work performed in non-professional organizations and professional work environments are often characterized by high ambiguity and uncertainty (Faraj & Xiao, 2006). Professional organizations are in the midst of transitioning into the information age and are investing heavily in IT to help with this transition. In doing so, they encounter unique challenges such as low user acceptance by autonomous and often high power individuals; difficulty codifying, abstracting, and diffusing tacit knowledge and expertise; and difficulty managing the dynamic nature of knowledge held by professionals.

Health care delivery organizations are professional organizations (Anderson & McDaniel, 2000); however, they exist in an industry with some unique qualities. Perhaps the most important to mention is the fact that, at least from the patient's perspective, the product and the customer are the same entity. The patient is both the product being transformed and the customer seeking a service. This is, of course, only one view of health care delivery and one could easily argue that insurance companies and other payers or even physicians are the customer in health care organizations. This argument is not within the scope of this paper, but the point is an important one to consider. Another important distinction is that health care organizations work on humans, as opposed to financial statements, building designs, or legal briefs. Health care delivery takes place at the intersection of commercial and humanitarian endeavors. One researcher describes health care markets in the following way, "There seems to be no convergence to superior technologies over time in medical care markets ... a distinguishing feature of medical care markets from other markets" (Phelps, 1996, p. 38). Phelps goes on to say that "activities of medical practice are too complex and numerous to pre-specify, thus gains from standardization do not exist" (Phelps, 1996, p. 38). Arrow (1963, p. 958) adds to this argument, "the fact that physicians are working on patients that present similar conditions differently from each other and who respond differently from each other after the same treatment adds to the difficulty of standardizing medical care." These unique qualities are important to consider when drawing conclusions from research conducted in health care organizations, but research in health care delivery settings can produce tremendous insights for many research

areas including research examining the effects of work roles and power structures on group performance, the effects of various organizational structures and strategic alliances on organizational dynamics, and factors affecting behavioral decision making. Many organizational and information systems scholars have successfully demonstrated important insights that can be developed through studies in health care organizations (Barley, 1986; Dukerich, Golden & Shortell, 2002; Edmondson, 1996; Fiol & O'Connor, 2004; McDaniel, 1997; Meyer, 1982; Weick, 2003).

Health care organizations are complex adaptive systems. I start this research with the assumption that health care organizations are complex adaptive systems (CAS). CAS theory is a subset of complexity science and is particularly useful in understanding systems that are made up of agents that are diverse and that interact over time. While no formal consensus exists on the set of characteristics that define CAS, the following five characteristics capture the major concepts from the CAS literature (Anderson, 1999; Cilliers, 1998; Gell-Mann, 1994; Holland, 1995; Maguire, McKelvey, Mirabeau & Oztas, 2006; McDaniel, 2004; McDaniel & Driebe, 2001; Waldrop, 1992): (1) diverse agents that learn (2) nonlinear interdependencies (3) self-organization (4) emergence and (5) co-evolution.

Diverse agents that learn. CAS are composed of diverse agents that learn over time (Cilliers, 1998). In studying social systems within a CAS framework, diversity is viewed as differences in worldviews, or cognitive diversity (McDaniel & Walls, 1997).   As agents that are diverse interact with each other and with their environments over time they learn by processing new information. Learning is in CAS is not always easily detected and what is learned is not necessarily intentional.

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Nonlinear interdependencies. Relationships between agents in CAS are both linear and nonlinear (Capra, 2002; Kauffman, 1995). Linear relationships are fairly straightforward and easy to understand; for every *x* change in A there is a *y* change in B. In nonlinear relationships, small inputs can produce disproportionately large outcomes, and large inputs can produce disproportionately small outcomes. Furthermore, nonlinear relationships imply that future system behaviors are sensitive to small changes in initial conditions, and these small changes make future system outcomes unpredictable past the immediate or short-term (Basingthwaighte, Liebovitch & West, 1994).

Self-organization. Agents in CAS exhibit self-organization (Camazine, Deneuborg, Franks, Sneyd, Theraulaz & Bonabeau, 2001). Self-organization is the development of stable patterns of organizing through local interactions among agents. Self-organization is inherent in CAS and can come from both formal and informal structures. Because of this, one must recognize the limits of imposed structures, such as formal organizational hierarchies and management control mechanisms. No one agent can control the self-organization that takes place in CAS, but all agents have influence in shaping how a CAS self-organizes. An example of self-organization is how students during a college semester settle into seating arrangements in classrooms without assigned seats by their professor.

Emergent properties. CAS display emergent properties, which are properties of a system that arise from local interactions of agents (Epstein & Axtell, 1996). Emergent properties cannot be explained by analyzing and understanding the parts of a system (Agar, 2004; Holland, 1998). Examples of emergent properties are

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patterns of communication between employees and customers, attitudes toward management driven policies, levels of trust between people in an organization, and knowledge sharing behaviors.

Co-evolution. CAS co-evolve with their environments (Allen, 2005; Capra, 1996; Holland, 1995). Co-evolution is a process whereby agents and their environments iteratively interact and adapt. Often, a system's reaction to an environmental stimulus alters the environment; thus, making the original action taken by the system no longer optimal – or even correct -- requiring the system to adapt yet again. A key point here is that co-evolution is a continuous and dynamic process; thus organizations never "get it right."

CAS theory has been successfully applied in both organizational theory (Anderson, 1999; Axelrod & Cohen, 1999; Bettis & Prahalad, 1995; Boisot & Child, 1999; McDaniel & Driebe, 2001) and research at the intersection of IT and organizations (Allen & Varga 2006; Benbya & McKelvey 2006; Curseu, 2006; Merali, 2006; Vidgen & Wang, 2009). A primary strength of this theoretical frame lies in its ability to help researchers think differently about problems. For instance, instead of approaching the study of agile software development as a problem of project management, scholars using CAS theory approached this problem as a process of co-evolution whereby agile software development is conceptualized as *planning*-driven as opposed to *plan*-driven (Vidgen & Wang, 2009). Ideas from CAS theory were instrumental in developing a reconceptualization of firm dominant logic as an emergent property as opposed to a problem simply of learning and unlearning (Bettis & Prahalad, 1995). This revised conceptualization of dominant logic turned

researcher attention toward understanding the role of non-equilibrium dynamics in facilitating or blocking shifts in dominant logic. CAS theory has also led to new insights on topics of diversity (McDaniel & Walls, 1997), decision making (Ashmos, Duchon, McDaniel & Huonker, 2002), and work relationships (Lanham, McDaniel, Crabtree, Miller, Stange & Nutting, 2009) in organizations.

INFORMATION TECHNOLOGY USE

Information technology use research encompasses a wide range of topics but can be effectively divided into two major sub-areas. One sub-area focuses on understanding antecedents predicting IT use and behavioral intention to use IT (Agarwal & Karahanna 2000; Davis, 1989; Lewis, Agarwal & Sambamurthy, 2003; Taylor & Todd, 1995; Venkatesh et al., 2003). Another sub-area focuses on understanding various IT use behaviors that take place post-adoption (Ahuja & Thatcher, 2005; Beaudry & Pinsonneault, 2005; Jasperson et al., 2005; Kim & Malhotra, 2005; Parthasarathy & Bhattacherjee, 1998; Zhu & Kraemer 2005). Studies investigating IT use in the context of work practices are particularly relevant in this discussion (Levina, 2005; Orlikowski, 2000; Schultz & Orlikowski, 2004). Both of these research streams are important for understanding the larger phenomenon of IT use. However, in contexts where organizations have already made the adoption decision and have already purchased and implemented the IT, the more relevant research questions are those aimed at understanding how people incorporate IT into their work. Professional organizations tend to fall into the latter

category where IT use by individuals and groups of individuals, as opposed to IT adoption, is perhaps a more important topic of study.

At its core, IT use research is aimed at understanding the factors contributing to how people think about IT and about how they integrate IT artifacts into work practices/processes. Early theories of IT use focus on understanding antecedents of IT adoption by individuals. Davis' early work on technology acceptance by individuals is the most highly recognized work in this stream of research (Davis, 1989; Venkatesh et al., 2003). Numerous studies have been conducted that extend the understandings generated by the original technology acceptance model (TAM) work. IT use theories focusing on antecedents to IT adoption and behavioral intentions to use IT provide key information about variables such as age, gender, IT experience, voluntariness of IT, perceived ease-of-use and perceived usefulness of an IT and these theories are relatively mature.

More recent studies of IT use have focused on understanding post-adoption IT use, or IT use that occurs after adoption (Ahuja & Thatcher 2005; Beaudry & Pinsonneault, 2005; Jasperson et al., 2005; Kim & Malhotra, 2005; Parthasarathy & Bhattacherjee, 1998; Zhu & Kraemer, 2005). These studies have examined the role of IT values and/or beliefs about IT in shaping end-user behavior. They have also examined how user behavior changes or remains stable over time during IT implementation (Jasperson et al., 2005). The theories developed in this research stream are relatively immature and more research is needed to develop better understandings of IT use in post adoption contexts.

Researchers have worked toward understanding issues related to IT use in groups and organizations with a practice lens (Brown & Duguid, 1991; Edmondson, Bohmer & Pisano, 2001; Faraj & Xiao, 2006; Levina, 2005; Orlikowski, 2000), in which work tasks are viewed as non-routine and situated within unique contexts. These studies tend to focus less on the antecedents of IT use and more on the IT use processes or behaviors that occur during adoption and implementation and/or the consequences of IT use behaviors. Barley's (1986) work on the structuring of IT and organizational roles in two radiology departments implementing identical computerized tomography scanners, DeSanctis and Poole's (1994) work on adaptive structuring of IT and organizational change and Faraj and Xiao's (2006) work on coordination in fast-response teams are good examples of research carried out using a practice lens.

Structuration theory has played a significant role in efforts to understand IT use in organizations (Barley 1986; Orlikowski & Robey, 1991; Poole & DeSanctis, 2004). Research grounded in structuration theory has influenced current thinking on a wide range of information systems topics including IT use (DeSanctis & Poole, 1994) IT implementation (Barley, 1986), IS development (Newman & Robey, 1992), and virtual teams (Majchrzak, Rice, Malhotra, King & Ba, 2000). Viewing technology as a social entity whose meaning is derived through the interactions of agents as they use the technology enables new understandings of the role of IT in reshaping work roles and patterns of interaction among workers (Barley, 1986). Recognizing a "duality of technology" (Orlikowski, 1992) offers new understandings of the role of IT in organizations.

While information systems researchers have argued well from an organizational culture perspective that IT and other organizational structures are interdependent and continually reshaping each other through ongoing interaction, fewer studies have sought more fine-grained, micro-level explanations for heterogeneity in IT use often observed across seemingly similar end users and seemingly similar work contexts. Heterogeneity in IT use has been studied by comparing different populations (e.g., voluntary versus mandatory settings, male versus female subjects or older versus younger subjects), but little attention has been paid to heterogeneous IT use among similar users. Despite similarities in both the IT artifact and the environment in which work groups operate, people often use IT differently from each other (Barley, 1986; Edmondson et al., 2001; Orlikowski, 2000). In this study, I focus on investigating heterogeneity in IT use among physicians using the same EMR systems in an effort to better understand why such differences exist.

HEALTH INFORMATION TECHNOLOGY

Information systems have the potential to play a fundamental role in addressing current challenges faced by the health care industry. Health IT generally includes the following technologies: electronic medical records[1] (EMR), computerized physician order entry (CPOE), electronic prescribing tools, and clinical decision support tools. EMRs are essentially a digital version of paper

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[1] Electronic medical records are also known as electronic health records (EHR) and electronic patient records (EPR). Some distinctions have been made between these systems, yet no consistency exists on terminology.

medical records, and depending on the level of sophistication (which is highly variable) can allow for significant advancements in data and information storage, manipulation and retrieval. CPOE systems allow physicians and other health care professionals to electronically enter medical instructions for the treatment of patients (typically used in hospital, or other inpatient settings). Electronic prescribing is the electronic transfer of prescription information from the prescriber's computer to the pharmacist's computer. Clinical decision support systems are interactive expert systems designed to assist physicians and other health care professionals with decision making. These systems are generally thought of as methods to improve patient safety and the efficiency of health care delivery. There are a number of other technologies that are relevant to the health care sector such as wireless monitoring devices, radio frequency identification devices, and camera pills but these technologies and others like them are beyond the scope of this research. These technologies are in some ways better conceptualized as biomedical devices as they are used more directly in the patient care process. Studies of how health care professionals use these technologies are needed, and some of the findings from this research may apply in their use. This research, however, focuses on enterprise-wide IT and within this category, specifically on EMR systems.

Electronic medical records are one highly promoted mechanism for dealing with the challenges facing the health care sector (Institute of Medicine, 2001). Government and health policy leaders have been promoting this IT for the past two decades, yet relatively few health care providers are using it. A recent report from

the medical industry reveals that an overwhelming majority of US physicians have not adopted EMR systems (DesRoches et al. 2008). Other reports estimate that approximately 20 to 33% of EMR implementations fail (Chin, 2006). While government and policy leaders are calling for more widespread use of this IT, evidence from the HIT literature is mixed at best. A systematic review conducted for the Agency for Healthcare Research and Quality found that HIT systems, including EMRs, can increase the delivery of guideline-adherent care, improve quality of care through clinical monitoring, and reduce rates of medical errors (Chaudry et al, 2006). This review also revealed that the majority of the research supporting these findings in the United States comes from four benchmark academic institutions with largely internally developed and supported EMR systems. This is important to note because a small proportion of US citizens receive health care from institutions like these; approximately 80% of US citizens receive care from small, independent community-based providers. The concern is whether findings from these exemplar settings accurately represent the larger health care delivery system which is highly fragmented as opposed to highly integrated. In fact, evidence exists that supports this argument. A retrospective, cross-sectional analysis of visits in the 2003 and 2004 National Ambulatory Medical Care Survey found that EMRs are not associated with better health care delivery in outpatient settings (Linder et al, 2007). In other research, an analysis of panel data from Medicare shows that EMRs have small positive effect on patient safety outcomes (Parente & McCullough, 2009).

The relationship between EMRs and costs are also not clear. A study at Kaiser Permanente found that using an EMR system in a large integrated

ambulatory care system significantly decreased traditional office visit rates for primary care and specialty care and significantly increased scheduled telephone visits and secure email messaging, resulting in cost savings (Chen et al., 2009). At the same time, a recent systematic study of EMR use revealed that EMR use is not associated with reductions in the cost of health care delivery (Sidorov, 2006). Other research indicates that EMRs fail to provide an adequate return on investment (Menachemi & Brooks, 2006). Messages from the US Congressional Budget Office suggest that the mere adoption of EMRs is not sufficient to produce significant cost savings in the absence of incentive structures that reward efficiencies (Orzag, 2008). In many ways, this debate resembles the debate in the information systems community about the return on investment and the strategic advantage of IT in firms – a.k.a. the IT paradox (Brynjolfsson & Hitt, 1998). Whether the health care sector is facing a problem analogous to the IT paradox of firms is not clear. What is clear is the inconsistent evidence about how HIT is affecting the cost of health care delivery.

Research has sought to address the resistance shown by physicians for EMR systems. Physicians have been shown to resist EMR technologies because of the perceived threat to professional autonomy (Sidorov, 2006; Walter & Lopez, 2008; Loomis, Ries, Saywell, & Thakker, 2002). Other scholars have studied EMRs as artifacts that signal a decrease in the level of distinctiveness for physicians with respect to other health care professionals (Fiol & O'Connor, 2004). This research indicates that EMRs may be artifacts that are linked to social identity (Ashforth & Mael, 1989). More investigations into factors contributing to physician resistance to

EMR technologies are needed, and studies examining between-physician differences in EMR use may be helpful in developing insights into this issue.

Health care organizations are struggling to unravel the role of EMRs in their organizations (Hillestad, Bigelow & Bower, 2005). Understanding why EMR systems are poorly accepted and why high EMR implementation failure rates exist is clearly a multifaceted, complex challenge. In-depth accounts of the differences in how physicians use EMR systems are particularly salient in the current health IT environment.

PROFESSIONALISM

Professional organizations are organizational arrangements created for dealing with high levels of complexity and uncertainty in the workplace (Scott, 1987). Professional organizations have also been conceptualized as "organizations that embody the transformation process in people rather than in machines and represent a strategy to deal with uncertainty in the workplace" (Weick & McDaniel, 1989). Professional organizations are made up of "exclusive occupational groups applying somewhat abstract knowledge to particular cases" (Abbott, 1988, p. 8).

Health care organizations have been studied as professional organizations (Anderson & McDaniel, 2000; Ashmos et al., 2002). Work tasks in health care organizations are often uncertain, ambiguous and non-routine, and the work performed in these organizations generally requires social interaction (i.e. physician, nurses and clerical employees often work together to care for patients). The values and expertise held by professionals are key mechanism for resolving the

difficult and ambiguous problems faced in these organizations (Anderson & McDaniel, 2000).

Values are the criteria employed in selecting the goals of behavior (Scott, 1981). Values are conceptions of the preferred or the desirable together with the construction of standards to which existing structures or behavior can be compared and addressed (Scott, 1995). Values have also been defined as "an enduring belief that a specific mode of conduct or end-state of existence is personally or socially preferable to an opposite or converse mode of conduct or end-state of existence" (Rokeach, 1973, p. 5). Rokeach's conceptualization (1973) is particularly useful in this study because he argues that values represent individual beliefs that form the rationale for action. Using this logic, values held by professionals form the rational for IT use.

Professional values are a particular type of value (Weick & McDaniel, 1989). Professional values are not ones that people grew up with – they are owned by and supportive of the larger society and are expressed through professionals who apply them (Weick & McDaniel, 1989). Professional values vary by profession. For instance, educational professionals often share the following values: students should be helped to grow, students should be treated with respect, and students should learn how society works. Accounting professionals often share the following values: accountants should remain independently objective, accountants should carry the burden of answering to a higher authority (the public), and accountants should hold a special regard for truth, fairness and accuracy. Health care professionals often share the following values: first do no harm, all patients should

receive equitable treatment, and the patient should be first priority. Whereas professional expertise address questions of what *can* be done, professional values address questions of what *should* be done.

Institutional values (ex. accounting, marketing, publishing, etc.) can interfere with organizational values (Greenwood & Hinings, 1996). Organizations are made up of people belonging to different professional institutions and differences in the values espoused by an organization (ex. mission statement) and the values held by professional groups within the organization (ex. departments) can be a source of tension. Fiol and O'Connor (2004) discuss how artifacts signal various things – such as legitimacy, and distinction – in the medical profession. Their research suggests that EMRs are artifacts that signal less distinction for physicians. Better understandings of professional values held by physicians in health care delivery organizations may be helpful in explaining differences in between-physician IT use behaviors.

Research in information systems literature has discussed values primarily in the context of values about IT artifacts. Much of the technology acceptance and technology usage research in the information systems literature deals with beliefs and attitudes of users – but beliefs and attitudes in this research are typically about IT artifacts, as opposed to beliefs, attitudes or values about a profession (for example, Davis, 1989; Venkatesh et al., 2003; Agarwal & Karahanna 2000; Taylor & Todd, 1995; Lewis et al., 2003, Bhattacherjee & Premkumar, 2004).

Information systems research examining values in a broader sense exists but is limited. Reluctance to use IT can be rooted in user views on how the technology

supports or opposes the values held by the users (Markus, 1983; Linder, 1991).

Hedstrom (2007) emphasizes the role of values in developing, implementing and

using IT in elderly care. Jenson and Kjaerdgaard (2008) discuss the role of

sensemaking in IT implementation and talk about the role of user values in guiding

users in their sensemaking of IT. They argue that values are integral to the

sensemaking process, that sensemaking is important in electronic patient record

implementation, and identify the following values in a grounded theory study:

values related to status, values related to the core mission, values related to work

practices, values related to personal issues (Jenson and Kjaerdgaard, 2008).

Research shows that professional group differences in values may be related

to differences in acceptance attitudes toward HIT (Aydin & Rice, 1991) and

perceived characteristics of HIT (Prasad, 1993). Physicians and nurses may be

reluctant to use HIT if they perceive that it will negatively impact their status,

autonomy, or traditional work relationships (Counte, Kjerulff, Salloway, & Campbell,

1984). Physicians have been found to express disappointment with a computer

based quality control system because of perceived negative impacts on their

professional autonomy and quality of health care delivery (Linder, 1991). Kaplan

(1987) identified several values including establishing and maintaining

relationships with patients, maintaining dignity of patients, and recognizing the art

of medicine (as opposed to the science of medicine) as values important in

influencing use of computer applications in health care settings. Better

understandings of how professional values held by physicians are associated with

EMR use may be helpful in explaining differences in between-physician IT use behaviors.

COMPLEXITY SCIENCE

Complexity science has been applied to problems of interest to organizational researchers (Anderson, 1999; Boisot & Child 1999; Brown & Eisenhardt, 1997; Cohen, 1999; McDaniel, 1997) and information systems researchers (Allen & Varga 2006; Benbya & McKelvey 2006; Curseu 2006; Merali 2006) for more than two decades. This literature is diverse and distinctions have been made, for instance, contrasting European approaches with North American approaches and contrasting objectivist perspectives with interpretivist perspectives (Maguire et al., 2006). One of the earliest applications of complexity science in organizational literature appears in Morgan's (1986) *Images of Organizations*, in which organizations are discussed as learning, self-organizing systems operating far from equilibrium (Morgan, 1986). In 1999, the first scholarly journal dedicated to complexity science and organizational research appeared (*Emergence, now Emergence: Complexity and Organizations*). Numerous books (Axelrod & Cohen, 1999; Brown & Eisenhardt, 1998; Wheatley, 1992; Zimmerman, 1998) and special issues of scholarly journals have been dedicated to the study of complexity science and organizations (ex. *Organization Science,* 2001) and of complexity science and information systems (*Information Technology and People*, 2006 and *Journal of Information Technology*, 2006).

Until the introduction of complexity science, organizational and information theorists traditionally conceptualized and studied organizations as mechanistic systems characterized by predictability and affinities for equilibrium (Allen & Varga, 2006; Sornette, 2006). Traditional views of organizations led to a focus on command and control strategies for managing organizations. Taking a complexity science view organizations are complex adaptive systems (CAS) (Capra, 1996) that are made up of diverse agents and that are characterized by nonlinear dynamics (Anderson, 1999; Cilliers, 1998). As agents in CAS interact locally over time they self-organize, forming stable patterns of organizing (Kaufmann, 1995); they express emergent properties, properties at one level of a system that cannot be understood by analyzing the same property at another level of the system (Epstein & Axtell 1996; Holland, 1998); and they co-evolve with their environments (Allen, 2005; Chu, 2003; Vidgen & Wang, 2009).

An important notion that complexity science contributes to organization and information theory is that of fundamental uncertainty. Organizational uncertainty has traditionally been conceptualized as reducible with more information or better information processing. Traditional efforts to manage uncertainty in organizations focus on information gathering activities and information processing capacity (Daft, 1989; Galbraith, 1973; Shannon, 1948; Tushman & Nadler, 1978). Complexity science recognizes the role of traditional uncertainty, but it also recognizes fundamental uncertainty. Fundamental uncertainty is a type of uncertainty that cannot be reduced with more information. The difficulty in managing fundamental uncertainty is that it arises from the nonlinear dynamics in CAS. A well-known

illustration of this notion is the Lorenz attractor, whereby the variables and the relationships among the variables are known, but predicting system behavior precisely over time turns out to be impossible (Liebovitch, 1988). Even sophisticated experimentation and simulation techniques cannot reduce fundamental uncertainty because it is dictated by the nonlinear dynamics present in a system. Outcomes in CAS are typically discussed in terms of probabilities and ranges of possibilities as opposed to precise predictions (Sornette, 2006). Thus, dealing with fundamental uncertainty requires strategies for uncertainty absorption (Ashmos, Duchon, Hauge & McDaniel, 1996; Boisot & Child, 1999; March & Simon, 1958).

The research assumptions and literatures discussed above provide the motivation and background for this study of between-physician difference in EMR use. Chapter 3 describes the research design and provides information about the field site, study participants, data collection methods, and data analysis techniques used in this research.

Chapter 3: Research Design

Early efforts to understand IT use have typically focused on understanding behavioral intention to use IT (ex. Davis, 1989). Recent studies have begun shifting attention toward actual IT use – or IT use after adoption (ex. Jasperson et al., 2005). Theories of IT use after adoption are relatively immature, and in-depth studies exploring factors that influence IT use in a variety of contexts are needed. Health care delivery organizations are a context where relatively little is understood about how and why IT is used by the professionals providing services. For these reasons, in-depth multi-method investigations of IT use in health care delivery contexts are appropriate.

This research was conducted in an integrated multi-specialty outpatient clinic located in a major metropolitan area of one of the largest states in the US. MetroClinic, a pseudonym, serves a variety of patients, providing family care as well as highly specialized medical care. Using primarily qualitative methods, I studied EMR use by 28 physicians working in eight medical practices operating within MetroClinic. I conducted my study during academic year 2008-2009. At the time of the study, seven years had passed since the organization implemented an EMR system. Three family medicine practices and five specialty practices were selected for study. Selection criteria sought to optimize the potential for studying a wide range of EMR use behaviors. By studying the same IT in the same organization, the study design allows examination of differences in EMR use that might be explained by factors relating to physician differences, as opposed to technological or organizational factors.

Using multiple methods, I collected data about EMR use and about physician perspectives on topics at the intersection of medical practice and EMR systems. Data collection methods included semi-structured interviews, non-participant observations and questionnaires. The interview guide was developed based on relevant information systems (Davis, 1989; Taylor & Todd, 1995), HIT (Ash, Berg & Coiera, 2004; Reddy, McDonald, Pratt & Shabot, 2005; Kaplan, 1987), and organizational behavior literature (Langer, 1995; Daft & Lengel, 1984; Edmondson, 2003; Weick, 1993; Weick & Roberts, 1993). Interviews lasted approximately 30-45 minutes and were audio recorded and transcribed. The observation template was developed using an observation guide previously used for research in health care organizations (Stroebel, McDaniel, Crabtree, Miller, Nutting & Stange, 2005). Included in the observation template were items such as clinic physical layout, work flow description, and patient flow description. The questionnaire was developed using validated items/constructs from information systems literature (Davis, 1989; Taylor & Todd, 1995). Items were modified for use in this research setting by replacing IT with EMR and by replacing intention to use language with actual use language. For instance, the original statement, "Learning to operate the IT would be easy for me" was adapted to, "Learning to use the EMR was easy for me."

I spent approximately one month collecting data in each practice. I met each week during the data collection period with my advisor to debrief about the fieldwork. These debriefing sessions were a fundamental part of the research design. They were used to (1) facilitate critical reflection on observation processes and data collection methods, (2) discuss any preliminary findings or patterns in the

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data, (3) refocus/reshape observation methods if needed, and (4) address any study-related issues that developed during the clinic observation.

Analysis of qualitative and quantitative data was performed iteratively. Analysis of each data type informed analyses of the other data types. Priority was not given to one particular data type, and each data type was viewed as distinct in what it could contribute to the understandings of EMR use in this setting. I used a constant comparative approach to analyzing the interview and observation data (Strauss & Corbin, 1998). Interview data and observation field notes were analyzed in three steps: 1) theme formation, 2) theme matching along dimensions of EMR use behaviors and perceptions of the EMR and 3) theme comparison. Open, selective and axial coding procedures were performed on these data. Analysis of the questionnaire included examining patterns in physician EMR use that could be explained by age, gender, generalist/specialist, previous experience with the EMR, professional training, others. All three data sources were used to create narratives describing physician EMR use and factors influencing EMR use. Additionally, all three data sources were used to create physician profiles of EMR use, professional values and perspectives of uncertainty. Analysis of physician narratives and physician profiles informed explanations of between-physician heterogeneity in EMR use and development of new theory of IT use in professional settings.

INTRODUCTION TO METROCLINIC

MetroClinic is a 120+ physician, for-profit integrated multi-specialty health care organization.[2] MetroClinic is made up of 24 medical specialties operating in 6 locations. Over the years, MetroClinic has aggressively pursued forward-looking technologies throughout the clinic. This clinic has been perceived as a leader in health care as noted by the fact that many of its physicians have received local and national recognition for clinical accomplishments. In 2001, MetroClinic purchased an EMR system and began the implementation process. By the time of the data collection, all practices except the pediatrics practices were using the EMR system. In all cases, the practices had been using the EMR for over 5 years. MetroClinic's reasons for purchasing the EMR system were to: 1) improve information timeliness and availability to geographically dispersed users, 2) improve capacity to compile patient data and medical delivery data over time in order to learn about the population of patients being cared for by this organization, and 3) provide physicians with alternative tools for clinical documentation. Use of the EMR system purchased by MetroClinic was originally voluntary; however, over the seven years leading up to this study pressure from both administration and peers grew as more physicians became EMR users. According to conversations with people at MetroClinic, EMR use behaviors evolved over time as familiarity with the system grew and work practices adapted.

At the time of the study, executives at MetroClinic were struggling to get physicians to use the EMR in ways that improved the information management

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[2] Information for this introduction came from conversations with MetroClinic's Chief Information Officer and senior employees of the EMR group within the IT department.

capacity of the organization as a whole – striving, in particular, for improved information and knowledge transfer, coordination of patient care efforts and patient population information management. Seven years after implementing the EMR, MetroClinic was dissatisfied because of the difficulty they faced in explaining persistent and wide-ranging differences in how physicians were using the EMR. Differences in EMR use were expected when work tasks differed. However, differences in EMR use occurred even when tasks and/or work processes seemed to be the same. Despite upfront and ongoing physician involvement in decision making with respect to the EMR, tailored training for physicians, good EMR vendor support, open-minded leadership and management, and the application of financial penalties to guide user behavior, MetroClinic continued to see puzzling differences in EMR use.

DESCRIPTION OF IT ARTIFACT

In a general sense, an EMR is a digitized version of a paper medical record. EMRs represent qualitative technological advancement in the way medical information can be organized and manipulated both within and across health care organizations. The EMR system purchased by MetroClinic was among the most widely used EMR systems at the time of the study and was designed to allow medical professionals to document clinical visits, streamline workflow, and securely exchange clinical data with other medical professionals. In order to work in a clinical/medical capacity at MetroClinic, one must use the EMR at least at a minimal level. Minimal use in this study is defined as performing the following tasks via the

EMR: documenting phone notes, updating patient medication lists, ordering labs, and ordering x-rays or other medical imaging services. Heavy use of the EMR is defined here as performing all or most clinical documentation and inter-organizational patient information exchanges via the EMR – i.e. all of the tasks included minimal use items plus developing tailored templates for documenting clinical visits, documenting clinical visits in the EMR, generating patient panel reports, inputting labs from external systems, inputting prescriptions, using flow sheets to track patient data over time, updating medication lists, viewing imaging, labs and reports from all providers, communicating with others within MetroClinic, communicating with patients, and communicating with pharmacies.

FIELD SITES

I worked with a research colleague, MetroClinic's Chief Information Officer in the site selection process. Practices were purposefully selected based on their capacity to inform the research question. Selection criteria and practice enrollment decisions were based on the following: 1) likelihood of observing a range of between-physician differences in EMR use and 2) practice size – minimum of 2 physicians, no maximum because most practices at MetroClinic were between 3-5 physicians. The goal of this study was not to identify a complete or exhaustive list of factors that explain between-physician differences in EMR use. Rather, the goal of this study was to identify the kinds of between-physician EMR use that were occurring in this setting and to develop new understandings of between-physician differences in EMR use. Likewise, the goal of this research was not to test

hypotheses explaining or predicting between-physician differences in EMR use. Rather, the goal of this research was to discover new variables associated with between-physician EMR use, and based on these findings develop a new model of IT use in professional organizations. I selected eight practices for study. Three of these practices were family medicine practices (generalists), and five of these practices were specialty practices (specialists). These practices are typical practices operating within a larger health care delivery organization context. They are representative of health care delivery practices operating in a larger, multispecialty outpatient health care delivery setting. They are also representative of small professional organizations made up of people performing interdependent, collaborative work tasks. In the next section of this chapter, I describe these eight practices and the 28 physicians who participated in the study. I then describe the methods used for data collection data analysis.

Family Practice 1

Family Medicine 1 is a family practice with 16 practice members including three physicians. Clinical support roles consist of a clinical manager, a licensed vocational nurse (LVN), three medical assistants (MA), a phlebotomist, and an x-ray technologist. The non-clinical support roles include a business manager, three business associates (BA), a medical records clerk and a referral coordinator. This practice was co-located with a pediatric practice also affiliated with MetroClinic and was not located on the main MetroClinic campus.

Family Practice 2

Family Medicine 2 was a family practice with 14 total members including three physicians. Clinical support roles include a clinical manager, three LVNs, and three MAs. Non-clinical support roles include a business manager and three BAs. This practice was co-located with family practice 3, but these two practices operated out of different physical spaces (that were adjacent) and maintained independent work environments, cultures, and norms. This practice was located on the main MetroClinic campus.

Family Practice 3

Family Medicine 3 was a family practice with 13 total members including three physicians. Clinical support roles include a clinical manager, two LVNs, and three MAs. Non-clinical support roles include a business manager and three BAs. This practice was co-located with family practice 2 (please see the note above describing this practice relationship). This practice was located on the main MetroClinic campus.

Specialty Practice 1

Specialty Practice 1 was made up of two physicians, two LVNs, two MAs and one BA, for a total of 7 clinic members. Specialty Practice 1 was the first practice at MetroClinic to implement the EMR system and has in some ways been viewed within the organization as a model practice for EMR use, particularly in terms of piloting and rolling out new EMR features. This practice was located on the main MetroClinic campus.

Specialty Practice 2

Specialty Practice 2 had a total of 15 practice members including four physicians. The clinical support staff include a clinical manager, three LNVs, three MAs, and one patient referral coordinator. The non-clinical support staff included a business manager and two BAs. This practice was located on the main MetroClinic campus.

Specialty Practice 3

Specialty Practice 3 was made up of six physicians, making this the largest practice in the study. Also in this practice was a nurse practitioner, six LVNs, a clinical manager, a business manager, a technical assistant, and three BAs for a total of 19 practice members. This practice was located on the main MetroClinic campus.

Specialty Practice 4

Specialty Practice 4 was made up of four physicians, three LVNs, three MAs, a clinical manager, business manager, one technical assistant, and three BAs for a total of 16 practice members. This medical specialty routinely performed a high number of procedures relative to the other practices (except Specialty Practice 5, which also routinely performed a high volume of clinical procedures). This practice was located on the main MetroClinic campus.

Specialty Practice 5

Specialty Practice 5 included three physicians, one LVN, three technical assistants, a clinical manager, business manager, and two BAs for a total of 11 practice members. This medical specialty routinely performed a high number of procedures relative to the other practices (except Specialty Practice 4, which also

routinely performed a high volume of clinical procedures). This practice was located on the main MetroClinic campus. Table 1 below provides a summary at a glance of the eight practices.

Table 1: Overview of Eight Practices

Practice	Physicians	Clinical Staff	Non-clinical staff	Total Practice Members
Family Practice 1	3	7	6	16
Family Practice 2	3	7	4	14
Family Practice 3	3	6	4	13
Specialty Practice 1	2	4	1	7
Specialty Practice 2	4	7	4	15
Specialty Practice 3	6	9	4	19
Specialty Practice 4	4	8	4	16
Specialty Practice 5	3	5	3	11

In these eight practices, I studied 28 physicians. Among the physicians, 57% were male (n=16) and 43% were female (n=12). A wide range of ages (32-76 years) and medical specialties were represented. Table 2 provides a summary of the physicians who participated in this study.

Table 2: Overview of 28 Physician Subjects

	Gender	Age			Gender	Age
John	Male	40-49		Craig	Male	60-69
Charlie	Male	40-49		Norman	Male	30-39
Tula	Female	30-39		Tate	Male	50-59
Brian	Male	50-59		Wendy	Female	30-39
Patrick	Male	50-59		Mirelle	Female	30-39
Nell	Female	30-39		Henry	Male	70-79
Morgan	Female	50-59		Renee	Female	30-39
Abby	Female	50-59		Nathan	Male	60-69
Taylor	Male	30-39		Frances	Female	50-59
Madeleine	Female	50-59		Liam	Male	60-69
Stella	Female	50-59		Sherman	Male	30-39
Paul	Male	40-49		Helen	Female	30-39
Cecil	Male	30-39		Urielle	Female	40-49
Ted	Male	30-39		Percy	Male	30-39

DATA COLLECTION

I collected data on physicians' perspectives about the practice of medicine, perspectives about the EMR system purchased by MetroClinic and about how physicians were using the EMR system. Data collection methods included semi-structured interviews, non-participant observation, and questionnaires.

To obtain in-depth, rich accounts of EMR use I used an ethnographic interview approach (Agar, 1996). The interview guide (see Appendix A) was developed based on relevant information systems (post-adoption IT use literature in particular) and organizational behavior (organizational learning, work relationships) literature. I co-developed and piloted the non-IT questions of this interview guide in a study of relationships and learning in primary care practices (Leykum, Parchman et al., 2008). The interview guide focused on observing physicians' perspectives on the practice of medicine, the role of the EMR in the practice of medicine and patterns of EMR use as articulated by each physician. All but two physician interviews[3] were audio recorded. Interviews lasted approximately 30-45 minutes. For the two interviews that were not audio recorded, field notes were taken and subsequently transcribed.

I developed the observation template (see Appendix B) by adapting an observation guide previously used for research in health care organizations (Stroebel et al., 2005). The original observation templates were designed to study the relationship between organizational factors (ex. work relationships, work flow and practice structures) and practice outcomes. Adaptations for this study focused

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[3] Two physicians requested the interview not be recorded.

on tailoring the observation template for collecting data pertinent to EMR use by physicians. I co-developed and piloted the non-EMR use aspects of this instrument in a study of relationships and learning in primary care practices (Leykum, Parchman et al., 2008). I used the observation template to collect data on work environment, clinic physical layout, work flow description, and patient flow description. Researcher field notes were written from jottings taken while in the field. In addition to observations made in the clinics at nursing stations, patient reception areas, and employee break rooms, I shadowed several workers in each role as they worked with the EMR. I did not observe patient-physician encounters as part of this study. Many studies in health care informatics focus on EMR use during the patient-physician encounter. These studies tend to be descriptive in nature and highly focused on identifying similarities in how physicians use EMRs. I designed this study to develop additional understandings of differences in EMR use among physicians and, thus, focused data collection efforts on obtaining physicians' perspectives about the EMR which were then used to develop new insights and build theory.

To capture physician perceptions of the EMR system and about their EMR use, I administered a 22-item questionnaire (see Appendix C) to each physician. Questionnaire items were adapted from previously validated scales in information systems literature (Davis, 1989; Taylor & Todd, 1995) and focused on physician perceptions of ease of use, perceived usefulness, and attitude. The questionnaire was used to collect demographic data on the physicians and to supplement findings from interviews and observations.

Supplementing these observations, I interviewed MetroClinic's Chief Information Officer, Chief Medical Director, Associate Director of the Board, family practice administrator, and several members of MetroClinic's internal IT staff to gain a more in-depth understanding of the history surrounding the use of the EMR in this organization and of existing user behaviors, perceptions and attitudes about this IT. These interviews were unstructured and were not audio recorded. Additionally, I received clinical support staff EMR training from MetroClinic's EMR training staff to better understand observations made during the study.

I spent approximately one month collecting data in each field site, a total of approximately 750-800 hours in the field. The first week at each clinic was dedicated to non-participant observation. This allowed me to develop a general sense of the practice and develop rapport with participants prior to conducting the interviews. Observations made in the first week often informed the interviews in subsequent weeks in that practice. For example, I often developed specific questions for physicians by talking with nurses as they worked or by observing physicians as they used the EMR in their offices or at nurse stations. I conducted semi-structured interviews in the second and third weeks. Questionnaires were administered in the fourth week. Non-participant observations were ongoing throughout the entire data collection effort.

I met with my advisor on the fourth day of each week during the data collection period to debrief and critically reflect on observations from the field. These debriefing sessions were used to (1) facilitate critical reflection on the observation process and the methods, (2) discuss any preliminary findings or

patterns in the data, (3) refocus/reshape observation methods if needed, and (4) address any study-related issues that developed during the clinic observation. In the debriefing session, I discussed the current state of the study and made adjustments as appropriate. Debriefing sessions were viewed as an essential part of the research effort.

Data collection was designed to obtain multiple and different views of EMR use by physicians. As such, data collected via interviews were used to inform the story of EMR use for each physician, as were data from observations and questionnaires. I viewed each data collection method as having the capacity to provide a distinct yet complementary perspective on EMR use and the factors associated with EMR use.

DATA ANALYSIS

Data analysis occurred in three phases and was guided by qualitative data analysis methods described by Crabtree and Miller (1999) and Strauss and Corbin (1998). The *first phase* occurred while I was in the field collecting data. As I made observations and interviewed physicians, I developed preliminary interpretations of factors associated with EMR use. In this phase, I developed tentative theories linking EMR use to individual-level variables. These preliminary interpretations and tentative theories served as the basis of many of the debriefing session discussions. It was in this first phase of data analysis that I noted the possibility that differences in values and/or beliefs expressed by physicians were associated with differences in physician EMR use. In this phase of data analysis I had not begun

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systematic coding of the data. The majority of the analysis in this phase took place in the form of reflections on the observations made while in the practices.

Data that were particularly important were surprising observations and contradictory observations. An example of a surprising observation happened in family practice 1 where a 40-year-old technologically-savvy physician, who was on the decision making committee for the EMR purchase, did not use the EMR and was one of the few physicians at MetroClinic that maintained the use of paper medical records. This observation was surprising for several reasons: the physician was young-ish (~40 years old), IT savvy, and part of MetroClinic's leadership team, yet he did not use the EMR. This was my first observation of physicians working in the same medical specialty with distinctly different patterns of EMR use. I made this observation early in the field work and often used this surprising observation to formulate tentative theories about EMR use. A contradictory observation is when, for example, data from direct observation and data from an interview about the same phenomenon are conflicting. This kind of observation happened when I was investigating why one physician in a practice of four used the EMR at the nurses' station while the other physicians used the EMR in their offices. When I asked people in the practice about this they replied that "it's all about efficiency" or that physician was "old school" and couldn't use the EMR very well on his own because he was older. When I asked the physician about it directly, he said that it "was all about efficiency" and that it was "too many steps" to go to his office and that his "partners had exam rooms that were much closer to their offices" than his were making it more efficient for them to use the EMR in their offices. This explanation

sounded reasonable until I measured the distances between his exam rooms and his office and compare those measurements with the measurements between his partners' exam rooms and offices and found that the distances were the same. In this case when I followed up with the physician on this issue, he said, *"I mean, it sounds a little; maybe over the top but hm you can walk right out there and it's easier to do and sometimes I need to communicate with my nurses. If I'm doing things and I can just talk to her right here..."* When I asked another physician in this practice, he said, "*He has a kind of closer, communication with his nurse. He uses his nurse differently than we do."* This is one example of how I found contradictions in the data about potentially important aspect of EMR use helpful in generating tentative theories during this first phase of data analysis.

While the first phase of data analysis took place while I was still in the field, the **second phase** took place after the data collection was complete. I used systematic methods for generating insights from the data in the second and third phases of data analysis. I used a constant comparative approach to guide this data analysis (Strauss & Corbin, 1998). Interview transcripts and observation fieldnotes were analyzed in three distinct steps: 1) theme formation, 2) theme matching and condensing and 3) theme comparison between physicians. I read through the interview transcripts and fieldnotes, making methodological and theoretical memos and preliminary interpretations. I supplemented preliminary interpretations with discussions with my advisor whereby themes were further refined and new themes were added. The second phase of data analysis began with open coding of the interview and observation data. In addition to allowing preliminary interpretations

to influence coding, I developed codes in real time for data that seemed to have potential to provide insights into the research question but that I had not identified prior to the start of coding. A selection of codes from this open coding process is provided in Exhibit 1.

Later in the second phase of data analysis, themes were developed by identifying a unifying idea that represented interpretations from multiple ideas in the interview and observation data. At each step of analysis, themes were refined whereby similarly labeled ideas were combined and given more general labels. Iterations of this process produced the findings described in the following results section (Chapter 4) and provided a platform for comparing EMR use between physicians. During the second phase of data analysis, I identified EMR use, professional values, and perspectives of uncertainty as key themes for further analysis. I used these conceptual labels to organize relevant coded data into themes according to a common thread of ideas. For example, the theme *professional values*, included data coded as values/beliefs, beliefs about job, beliefs about EMR, perceptions of practice style, and job philosophy. Similarly, any codes pertaining to *EMR use* were grouped together and any codes that pertained to *perspectives of uncertainty* were grouped together. Selections of these codes are provided in the results.

Exhibit 1: Selection of Codes from Data Analysis.

I started with codes in several broad categories: ex. work flow, values/beliefs, uncertainty, attitude/belief about EMR, job philosophy. During the coding process, I created new codes to capture and organize other aspects of the data that seemed relevant to the research or that could potentially provide counterarguments to the main paths of analysis. The codes added during analysis are categorized as "Added." A selection of codes, their definitions and example text are provided below.

Code	Category	Definition	Example
Feature use	Work flow	Direct observations made or statements made during interviews or informal conversations describing the EMR features used in accomplishing clinical and non-clinical work.	"I'm able to generate flags to myself in the future about follow-up needs that I know would be a challenge to remember otherwise. I'm able to track drug interactions for new medications. There are some other features that having a computer in every exam room also give me, the main one is that from my desktop I'm able to open up a web-based information service, and I use that to answer live clinical questions that I have at the time of the interaction with my patients."
Values - patient-oriented	Values/beliefs	Statements pertaining to physician values, beliefs, attitudes about the world or about health care delivery that focus on the patient.	"I think I'm pretty patient oriented. In terms of listening to the patient and bird-dogging all the problems they have and try to be; cover the water front in terms of their problems. I would say I guess; that's a perception I have."
Values - disease-oriented	Values/beliefs	Statements pertaining to physician values, beliefs, attitudes about the world or about health care delivery that focus on the disease.	"The way I see it we dealt with; immune system abnormalities. So that's where things like rheumatoid arthritis comes from. Rheum, there's that word again "rheum" so it deals with immune system problems. And then because immune system problems so frequently involve joints; bones, and soft tissues; I mean actually arthritis and muscular skeleton system stuff…"

Exhibit 1 continued.

Code	Category	Definition	Example
EMR use - information accuracy	Uncertainty	Statements of EMR use pertaining to the correctness, exactness or accuracy of medical information.	"I find it is more complete and that I can remember better because you know once I've seen ten of fifteen patients it really starts blurring together who had this complaint, and who had that complaint what doctors they've seen and the I mean we're just I'm just taking in so much information all day long I mean in 15 to 45 minutes segments you know I may be spending half of the visit just listening to information, and then sometimes I forget why I'm doing something or what I wanted to do so I want to; I want to write down I wanna have the information accurate. Accurate and complete. Also it's just more efficient."
Managing uncertainty - reduction	Uncertainty	Direct observations or statements associated with/indicating strategies for managing uncertainty by decreasing it with more information or better information processing; to lessen or diminish knowable risk, move toward certainty.	"I take pride in the fact that if a patient gets dumped in our hospital for an admission, I want them to go to my note first; rather than the internal medicine doctor's history and physical because they get better and more information out because I did write down that they had an append- appendectomy. That they had three pregnancies but only two kids, and one spontaneous abortion. That kind of information. That's a personal note of pride that actually drives me more to be an excellent record keeper in that way, that's; my information that can be used."
Managing uncertainty - absorption	Uncertainty	Direct observations or statements associated with/indicating strategies for managing uncertainty assimilating it or incorporating it; to take in, or engage wholly. May include high use of relationships or interdependencies	"There's the constant worry of have I missed something. Has something slipped through the cracks? Am I not interpreting something correctly or I'm, am I not thinking; hm. So it's a it's kind of an obsessive thought I think. I'm just trying to be very thorough. Hm I think that probably for me, relationship with the patient is really important. Hm a patient, saying you know; saying something to the effect that they feel comfortable here or, they feel like they've received good care, makes my day. So, I think relationship with the patients is really important."

Exhibit 1 continued.

Code	Category	Definition	Example
Attitude/belief about EMR	Attitude/belief about EMR	Statements made about the EMR artifact. Statements may contain physician views on the ideal EMR system or about EMRs in general. These statements focus on perceptions, attitudes or beliefs about the EMR, particularly as it relates to the practice of medicine.	"I think in terms of drug interactions it's a very powerful tool. In terms of deciding whether or not a patient symptom is just from anxiety or some other pathology, I'm not sure the EMR really helps with that. I'm not I guess it would it would depend on what type of problem people might be referring to. Yeah; I'm not I'm not sure if it helps me with decision making."
Perceptions of practice style	Job philosophy	Statements pertaining to how a physician describes themselves as a physician and their approach to practicing medicine; includes comments about practice style, philosophy of practicing medicine, approach to job, etc.	"Well I think that I; because of the way I set up my practice, I do spend more time, talking with my patients, so I do feel like I probably pick up more psychiatric disorders and in terms of women's health I think I have again have a niche in that as well. But that's just because of my gender I think whether I chose it or not it happened."
Humor	Added	Statements referring to the role of humor in health care, or the use of humor in the delivery of health care.	"I think being a doctor is yes, you do what you're taught in medical school, how to play the doctor part; but besides that, how to; diagnose and help them, but besides them I think that you really, I like to focus on the person behind it; because I think a lot of it is there's the strictly medical part of it but it's attached to the person that you got to get into their personality and see what's gonna work with them and what's not going to work. And I think a lot of times you know folks come in here because they are not feeling well. So I think that we can throw in a little TLC or a little nice word or a little humor. A little spark of personality I think goes a long way in a sterile environment

Exhibit 1 continued.

Code	Category	Definition	Example
Emotions about EMR	Added	Statements about the EMR or about EMR use that are particularly vivid, descriptive, colorful, particularly in terms of expressing emotion.	"I usually make fun of when our EMR is down, for a period of time, like when either one the power is out or let's say there is an entire half day or day when the EMR is actually down because something's got corrupted, he's actually frozen in his tracts, he has no idea, who somebody is, what medication they're on and there's he has no information because he has no paper backup; I'm just usually I'm still working usually because I work with paper and, I know who the person I I'm not looking at somebody and saying "Okay. Who are you and what medi- I don't look like an idiot you know, because the more dependent you are on this, the more you are completely paralyzed I mean as far as I'm concerned if this EMR is down he might as well not even be at his office because he can't do anything he doesn't know anything."
Habit	Added	Statements referring to EMR use behavior in terms of what a person is used to/comfortable doing, or in terms of using the EMR in certain ways because that's the way they've always done it.	"I've gotten used to the way things are, that I don't mind even though it takes a long time to do some things 'cause I've gotten so fast at doing it."
Nurse involvement	Added	Direct observations made or statements referring to what, how, where, why a physician uses his/her nurse or medical assistant in practicing medicine.	"I just saw a patient that needs everything done somewhere else; and so I just sent a flag to my nurse that said she's gonna need to have everything done in an outside clinic; so that gives that information but anyway we go over there and you know I might use, talking to my nurse in front of the patient, I might use it as kind of a way to reiterate things we've already said, like 'remember we're gonna do a pelvic ultrasound and she's gonna help to set that up and it's for the irregular bleeding…' and then she grabs the prescriptions or I'll get them myself they're already been printed out so all I have to do is sign them."

While the second phase of data analysis identified themes in the interview and observation data linking EMR use with professional values and EMR use with physician perspectives of uncertainty, the ***third phase*** of data analysis focused on comparing EMR use, professional values and perspectives of uncertainty across the 28 physicians. For this analysis, I developed profiles for each physician containing data-driven themes on these three variables of interest. Interview, observation and questionnaire[4] data were used to build the 28 physician profiles. Developing the physician profiles allowed me to organize the data in a way that enabled between-physician comparisons along EMR use, professional values and perspectives of uncertainty. Table 3 provides an example physician profile.

Table 3: Example Physician Profile

DEMOGRAPHIC INFORMATION[5]	PROFESSIONAL VALUES
Gender	Integrating clinical information for patients is important
Age	I'm part of a medical group
Generalist/Specialist	I make complex decisions in my head all day long
Organizational Tenure	I help patients
Years of EMR Experience	I am responsible to my patients
Year Graduated from Medical School	Information availability is critical to my work
Any additional roles	
EMR USE	**PERSPECTIVES OF UNCERTAINTY**
High integration of EMR and practice of medicine	Believes explicit/codified information is accurate
High feature use	Seeks certainty through explicit/codified information
High use of reports/trending features	Invests in making data/information explicit
High use of EMR to provide literature to patients	High nurse involvement in accomplishing work
High EMR-enabled communication with nursing	Invests in finding codified data/information
Documents in exam room	
Maintains and refers to paper medical records	
Primary work space: office and exam room	

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[4] Questionnaire data were used as available; 8 of 28 physicians did not fill out questionnaires.

[5] Demographic information was removed from physician profiles for this report of research to keep participants' identities protected.

I used the physician profiles to perform independent analyses of EMR use, professional values and perspectives of uncertainty. I analyzed these variables independently in an effort to avoid biases that might have resulted from analyzing them together. The order in which I performed these analyses was 1) EMR use, 2) professional values, 3) perspectives of uncertainty. For the analysis of each of these three variables, I used only the contents of the specific variable of interest. For example, when I analyzed EMR use I only had available the EMR use contents of the 28 profiles. The analysis of each subsequent variable (professional values and perspectives of uncertainty) was done in this same way and in the same physician order. See Appendices D-F for the final categorization of physicians by EMR use, professional values and perspectives of uncertainty. The results of these analyses can be found in Chapter 4.

I used the questionnaire data in the development of the physician profiles. These data were used to supplement the findings from observation and interview data. Considering the small size of the dataset (n = 28) and the number of variables being considered, I limited analysis of the questionnaire data to descriptive analysis only. These analyses efforts focused on developing understanding of between-physician differences in EMR use. Future analysis of these data might include non-parametric testing methods, log-linear techniques in particular, to examine underlying patterns in these data and generate additional insights/questions for future research.

To further analyze the relationships between EMR use, professional values and perspectives of uncertainty, I developed six cases. I selected three high EMR

users and three low EMR users. The low EMR users were selected based on the fact that there were only three in this category. I selected the three high EMR users that exemplified all three of the key constructs. This type of theoretical sampling is often used when theory is being generated from small samples, and is based in the idea that studying extremes can be useful in theory building. The case development focused on re-integrating the key constructs that were developed and analyzed independently from each other in the analysis using the physician profiles.

The research design, data collection methods, and data analysis techniques described in this chapter enabled between-physician comparisons of EMR use and relevant factors associated with EMR use. The major findings from this study are provided in Chapter 4.

Chapter 4: Results

In this chapter, I discuss the results and interpretive process through which the results emerged. Data from each method were analyzed and informed the results. No one data source was given priority over the others. Interview data were particularly important in understanding physicians' thoughts about their professional values and their perspectives of uncertainty. For this reason, I rely heavily on excerpts from interview data throughout this chapter. I start by describing the findings related to differences in between-physician EMR use. I then describe the findings related to professional values and EMR use and the findings related to perspectives of uncertainty and EMR use. In doing so, I discuss early indications in the data linking professional values with EMR use and linking perspectives of uncertainty with EMR use. I then present results from additional analysis further illustrating patterns in the data supporting these linkages.

EMR Use

Given that the focus of this research was on trying to understand differences in between-physician EMR use, it makes logical sense to describe the findings of EMR use first. I began this research with an open mind about how to conceptualize differences in EMR use. This openness was reflected in the research design, instrument development, data collection and data analysis processes of this study. As such, the data obtained through this study could be reused in the future to develop a variety of different categorization schemes for EMR use. For the purposes of this research, I categorized the EMR use of the 28 physicians into three

categories: high, medium and low. This categorization scheme seemed effective for developing better understandings of differences in between-physician EMR use in settings where the IT had been in use for an extended period of time, as opposed to settings where users were in the early adoption and implementation stages. High, medium and low EMR use seemed to be a relatively stable characteristic of EMR use in this setting. In reflecting on the data, it was also the most obvious way to categorize EMR use. The EMR use data were easily organized as high, medium and low. Exhibit 2 describes these categories in detail.

Exhibit 2: Summary of EMR Use Categories

I categorized EMR use into high, medium and low. This categorization scheme emerged during data analysis and was selected because it seemed to best capture the nature of the heterogeneity in between-physician EMR use. These categories organized the EMR use data by physician which enabled analysis of the linkages between EMR use and professional values and perspectives of uncertainty. The categories and descriptions of the observed EMR use behaviors in each category are provided below.

EMR Use Category	Definition

High	Users in this category display high integration of EMR with work practices. Individuals in this category exhibit the following items:
	• High feature use (including *at least two* of the following features)
	   o Reports, flow sheets and/or other tracking & trending features
	   o EMR-generated patient literature
	   o Macros/quick text feature
	• High EMR-enabled communication with others inside practice
	• High EMR-enabled communication with others outside practice
	• High EMR-enabled communication with pharmacies
	• High modification/tailoring of clinical documentation templates
	• Frequently changes EMR use as new features rolled out or learned

Medium	Users in this category display moderate integration of EMR with work practices. Individuals in this category can be divided into two types:
	  1) Users that exhibit high use of *some but not all* of the items in the high user category.
	  2) Users that exhibit moderate use of **all or most** of the items listed. This user type is articulated below:
	• Moderate feature use (including *at least one* of the following features)
	   o Reports, flow sheets and/or other tracking & trending features
	   o EMR-generated patient literature
	   o Macros/quick text feature
	• Moderate EMR-enabled communication with others inside practice
	• Moderate or sporadic EMR-enabled communication with others outside practice
	• Moderate EMR-enabled communication with pharmacies
	• Moderate modification/tailoring of clinical documentation templates
	• Rarely or sometimes changes EMR use as new features rolled out or learned

Low	Users in this category have low integration of EMR with work practices. Individuals in this category exhibit the following items: • Low/minimal feature use (ex. minimal documentation) • Low/minimal EMR-enabled communication with others inside practice • Low/minimal EMR-enabled communication with others outside practice • Low/no EMR-enabled communication with pharmacies • Low/minimal modification/tailoring of clinical documentation templates • Rarely changes EMR use as new features rolled out or learned • May have high reliance on clinical staff to accomplish EMR related work tasks • May use paper records as primary documentation source

This categorization scheme for EMR use emerged from the data analysis. Fifteen of the 28 physicians were categorized as high EMR users, ten were categorized as medium EMR users and three were categorized as low EMR users. Of the high EMR users, six (40%) were female and nine (60%) were male; two (13%) were generalists and thirteen (87%) were specialists. Of the medium EMR users, six (60%) were female and four (40%) were male; six (60%) were generalists and four (40%) were specialists. Of the low EMR users, all three (100%) were male; one (33%) was a generalist and two (66%) were specialists. I report these values not as a basis for making generalizability claims, but rather as an attempt to provide general information about the participants included in these categories. These results may hint at some interesting patterns for future research, specifically in terms of differences in how generalists and specialists use EMRs. For the purpose of this research, however, this categorization scheme for EMR use is used to further investigate the relationships between EMR use, professional values, and perspectives of uncertainty.

PROFESSIONAL VALUES

I noted the association of physician values and/or beliefs with EMR use early in the data analysis process. As I worked on describing between physician differences in EMR use and explaining these differences across the set of 28 physicians, values and beliefs continually entered the scene. One of the earliest examples of this occurred in the family practice 1 when I was trying to explain the differences in EMR use between John and Charlie. John was a high user of the EMR.

He used the EMR before, during and after patient exams, he had high feature use, high EMR-enable communication with his nurse and medical assistant, and he tried to use new features as they were rolled out by the IT department. On the other hand, Charlie was a low user of the EMR. In fact, he still used paper charts as his main source of clinical information. Before each patient visit, his nurse printed out any relevant material from the EMR for Charlie's review. He used dictation services to document his clinical visits and these were transcribed, printed and scanned into the EMR. Data comparing these two physicians reveals marked differences in how they described their values and beliefs about the practice of medicine. Conversations with John provided insights into his values as they related to his profession. He made statements about being a physician, "being able to integrate clinical information for my patients is important to how I practice medicine" and "information availability is critical to my job as a physician." He made statement about his patients, "my workday has not really become any easier with the EMR; it's just sort of me being able to offer my patients more" and my patients tend to be older and have more chronic conditions" and "I need to make absolutely sure that I give the patient the feeling during the visit that even as I'm entering this information that I'm still listening to them." John also made statements about the organization acknowledging the fact that he is part of a larger organization. Charlie, on the other hand, made value statements that were more narrowly focused on the medical profession. He did not make anti-statements about patients or about the organization, but Charlie did not mention his patients or MetroClinic in his value statements. An example of his profession-oriented value statements is, "...so this is

not a factory, where we're all doing the same process, we're all doing different processes." Charlie also made value statements that included ideas about the EMR and about his profession such as, "A template, you know, there are all sorts of situations where you know in any situation somebody that hands you a checklist is not as useful as the narrative, the information in there is not as good because it hasn't been condensed; it's been broken down into multiple choice questions, and it hasn't been summarized in any way."

The differences in EMR use and values and/or beliefs between John and Charlie provided the basis for my early investigations into this aspect of the research. As I carried the investigation forward, I noted many other instances where between-physician values and/or beliefs differed in interesting ways. For instance in specialty practice 2, one physician described his role as a physician as "taking care of patients." His responses to questions about his work, his use of the EMR, his values were primarily focused on his patients. Another physician in this practice described his role as "treating diseases." His responses to the same interview questions were primarily focused on the diseases that his medical specialty is responsible for treating. Another physician in this practice described his role as "a consultant." His responses were highly focused on how his work relates with referring physicians. These differences in how these three seemingly similar physicians viewed their role as a physician may not be clearly values or beliefs, but they seemed important enough to continue thinking about.

The level of differences in physician values and/or beliefs was higher than I had anticipated. Below are examples that illustrate some of these differences:

"I do still believe that people can heal themselves and can take better care of themselves and I haven't been in practice so long that I've given that up. Even though I see it all the time that people are self destructive. So I think I still have, the belief that maybe naively; that people will take care of themselves and will do what I've asked."

– Nell

"I am not an information processor, I'm a doctor."

– Charlie

"...if someone over 80 calls and needs anything, we'll do it. I mean we'll have them come in. If they're here they've earned it. So they get a little bit more attention I think than someone who can probably wait a day or two. So I think I value the older generations a lot. I kind of like history too. I know they grew up in the great depression. I think they tend to; it's just different. They go to their doctor appointments with their coats and all dressed up and looking nice. They're always on time. They're super early as a matter of fact. They don't miss their appointments. If they do you know something has happened, something is wrong. So, I really value that generation a lot."

– Cecil

"I have a mission to each patient to help them; help them maintain their health. And give them; guidance so that they can be healthier. And to help them to get through medical crisis."

– Brian

"I was talking about my son, because my son asked me about this when he trying to talk to physicians about the discomfort that they feel with change. The metaphor that has come to help me with that and this is, again during this transition going to the electronic medical record, is that, doctors can only do what they do, you know, if they have a very stable platform. It's kind of like we are always working among the high tension wires. So we have to, we are the little cherry picker. We've got to have a stable platform otherwise when it begins to shake too much, we'll bump into the high wires and; kill ourselves or others and in this case kill our patients. And so at this particular point; when a doctor thinks he's in danger for himself he destabilizes the platform. Because of these external forces that have shaken, it causes great I mean it begins it gets into their anxiety levels and fear and your gonna find incredible extensive explosive reactions. Over what appears to be trivial things, but it's because you're messing with the secure platform they need. So when you go to move to change them you have to essentially; show them that the platform it's going to be secure. It's just going to be a better platform or whatever. And then you have to put something out in that platform to make them desire to be on that platform. Hm but if you just shake them up too much; hm you can, you better

be careful because they'll be terrorists. Doctors are very good at being terrorists, if you if you threaten them too much. So that's what I've learned.

– Tate

"I grew up in a strong Christian mission environment and my aim in being a doctor was hm very (short pause) idealistic -- that I care for you know people who need a physician and underprivileged areas. And I did my stuff in India. Worked in mission hospitals and it was very fulfilling to be able to be a general practitioner to about 150 villagers, and not just myself, to my colleagues it was very fulfilling in a sense you know. They need you. It doesn't pay anything I was just probably getting $50 dollars a month? (short pause) Yeah. Fifty, sixty dollars a month. But in a way it was very fulfilling. You kind of felt like a hero and every; I think every doctor wants to be hm like a little; you know a bit of that so. Yeah. I, I like being in a place where I'm needed. Work and; you know (short pause) the patients appreciated it... ...I like being more in a, I mean; medical school I grew up in is best. And being in the country where you've been brought up and working with tribal areas and, places where I'm needed. So quite a few of my people are doing that; in really, remote places and they- you know, I feel I'm (short pause) kind of I've betraying my medical school coming here (slightly laughs). And there is a kind of attitude also from the rest of them. You know, you are not the way you should be and I feel like I shouldn't be here."

– Mirelle

"I think I'm pretty patient oriented. In terms of listening to the patient and bird-dogging all the problems they have and try to be; cover the water front in terms of their problems. I would say I guess; that's a perception I have... ... My job is to provide the patient; the best quality, of care is I guess that's the best way to put it."

– Craig

"I think a physician is responsible for practicing good medicine irrespective of his tools. Okay? I do think that we rely on the electronic medical record hm blindly; could lead you into practicing poor medicine."

– Tate

"so I think one of the things that makes it hard for me to understand is our clinic would be more profitable if doctors would all do this and do their part so that's frustrating, and I have a hard time understanding why doctors aren't willing to do that, I feel they are not as committed to the clinic as they should be and that's frustrating."

– Madeleine

The quotes above demonstrate the variety of responses I received from the interview questions asking about values. The statements that Tate, Mirelle, and Charlie made were physician-oriented; they were focused on what it means to be a physician. The statements that Brian, Nell, Craig, and Cecil made were patient-

oriented; they were focused on their patients and/or the care of patients. The statement made by Madeleine is organization-oriented; it demonstrated her identification with MetroClinic. These kinds of quotes occurred throughout the data and demonstrate the differences in how physicians think about their values and beliefs. It also demonstrates that while many of the values and/or beliefs may be widely different from each other, they in large part seem to be oriented in one of three ways: patient, profession, and organization.

As I continued to examine the role of values and/or beliefs in EMR use, I noted many instances where differences in EMR use seemed to be directly associated with differences in values and/or beliefs. I would like to be able to say that the values and/or beliefs influenced physician EMR use (or vice versa), but this study at this stage of analysis cannot support causal arguments. These values/beliefs were focused on a number of factors including the patients, the practice of medicine, information accuracy and availability, MetroClinic, the EMR, etc. Table 4 provides other instances across the data set where EMR use was associated with values and/or beliefs held by the physicians.

Table 4: Selection of observations associating EMR use with physician values/beliefs.

Physician	Physician values/beliefs	Observed EMR use behaviors
Wendy	Each patient is a unique case	• ↓ use of template modification • ↓ use of quick text feature
Stella	Knowing patients on a personal level is important	Documents social/personal info about patients in the EMR as a reminder to ask patient about in future visits
Percy	EMR makes me more efficient	• ↑ EMR-enabled communication with nurses and other physicians • ↓ face-to-face communication
Charlie	The most accurate information about a patient's current medications is in the patient	• ↓ feature use • ↑ reliance on medication list stored in patient
John	The most accurate information about a patient's current medications in the EMR	• ↑ feature use • ↑ reliance on medication list stored in EMR
Paul	I am a consultant	Documents in the EMR as if having a conversation with referring physician
Ted	I treat diseases	Tailors EMR templates around diseases; high use of checkboxes and quick text
Craig	I treat patients	• Uses EMR as a tool to care for patients • Charts at nurses station

These examples from the data indicated evidence of a possible connection between professional values and EMR use but did not demonstrate clear patterns in the overall data set linking professional values with EMR use. Based on the early insight discussed above, I pursued additional paths of analysis investigating the link between professional values and EMR use. This next step took a closer look at the definition of values and professional values and moved forward in the data analysis using these definitions.

I derived a definition of professional values from Rokeach (1973) and Weick and McDaniel (1989). Rokeach (1973) provides the following definition of values:

"A value is an enduring belief that a specific mode of conduct or end-state of existence is personally or socially preferable to an opposite or converse mode of conduct or end-state of existence." (Rokeach, 1973, p. 5)

Rokeach argued that values represent individual beliefs that form the rationale for action. Using this definition and this logic connecting values with action, I conceptualized values held by physicians as a basis for action pertaining to EMR use. To distinguish the values of physicians further, I drew on Weick and McDaniel's (1989) definition of professional values:

"Professional values are not ones that people grew up with -- they are owned by and supportive of the larger society and are expressed through professionals who apply them," and, "Professional values address questions of what should *be done."* (Weick & McDaniel, 1989, p. 334)

I approached subsequent data analysis efforts that were focused on understanding professional values and their relationship with EMR use using these definitions. Coding and interpreting the data using this definition of professional values helped me to reorganize the data around professional values (as opposed to values and beliefs). By reorganizing the data, I mean that I placed all codes conceptually related to professional values together in one set under a label "professional values." Codes such as job philosophy, beliefs about job, perceptions of practice style, etc. were placed in this set of codes themed professional values. In this stage of the analysis, I opted to analyze professional values independently from EMR use and perspectives of uncertainty. I did this in an effort to better understand

the professional values construct apart from the other key constructs. I subsequently analyzed the perspectives of uncertainty construct in this same manner, so as to develop a good understanding of this construct independent from the other constructs. After developing an understanding of these three constructs separately from each other, I worked to understand them as a set of interconnected constructs.

I analyzed the professional values codes by creating and using the 28 physician profiles. I synthesized all of the data related to professional values and placed this information (usually in the form of short summary phrases) in the appropriate space in the profiles. Data analysis revealed between-physician differences in their professional values. These differences fell into two main categories: 1) differences in the number of dimensions observed in professional value space and 2) the orientation of these dimensions.

Physicians differed in what I call the dimensionality of their values. Dimensionality is a mathematical notion typically used to describe a space or an object. The dimension of a space or object is typically defined as the minimum number of coordinates needed to specify each point on it. For example, a line only has a dimension of one because all points can be specified by one coordinate. A square has two dimensions, and so on. Each dimension is distinct from the others, yet they combine to create the dimensionality of the space or object. Applying the notion of dimensionality to describe the space of professional values held by physicians was useful in understanding my data. In this study, I did not quantify the strength or magnitude of the various dimensions. I believe, however, this could be

done in future research. I identified three dimensions of professional values: profession-oriented, patient-oriented, and organization-oriented. Exhibit 3 provides a selection of codes resulting from the data analysis of the professional values construct.

Exhibit 3: Selection of Codes on Professional Values

Below are example codes for the following dimensions of professional values that emerged during data analysis. During data analysis, I created the codes noted below to capture and organize aspects of the data that seemed particularly salient in understanding the linkages between professional values and EMR use and perspectives of uncertainty and EMR use. A selection of codes, their definitions and example text are provided below.

Dimension	Category	Definition	Example
Identification with profession	Professional values	Statements pertaining to physician values, beliefs, attitudes about their fundamental work task or profession.[6]	"I do believe in cutting the cost of medicine so I do discourage my patients who want to get an MRI just because they feel nervous, but I also based that on you know I base that on how much I can convince them. Do they really need that MRI and how much do I how much can I reassure them by just exam and history. So I think I spend, the, my uniqueness I think is spending more time with patients talking, and examining them. | So I always keep an eye on cost on the back of my head. And not because; you know; that was even before the insurance companies wondered how much doctors spend. 'Cause I think a lot of things are excessive and I think if patients paid for them, they wouldn't be asking for all those things."
Identification with patients	Professional values	Statements pertaining to physician values, beliefs, attitudes, about their individual patients or about their patient panel.	"I have a mission to each patient to help them; help them maintain their health. And give them; guidance so that they can be healthier. And to help them to get through medical crisis."
Identification with organization	Professional values	Statements pertaining to physician values, beliefs, attitudes about the organization, their role in the organization, or consideration for the organization.	"I think one of the things that makes it hard for me to understand is our clinic would be more profitable if doctors would all do this and do their part so that's frustrating and I have a hard time understanding why doctors aren't willing to do that, I feel they are not as committed to the clinic as they should be and that's frustrating."

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[6] Definition of professional values derived from Rokeach (1973) and Weick and McDaniel (1989).

Analysis of the professional values data revealed an interesting relationship between dimensionality of professional values and EMR use. Physicians with a higher number of dimensions included in their professional value space tended to be higher users of the EMR. Physicians with a lower number of dimensions included in their professional value space tended to be lower users of the EMR. Table 5 reports these results.

Table 5: Results organized by number of dimensions in professional values.

Physician	Values #	EMR Use
Charlie	1	Low
Tula	1	Med
Tate	1	Low
Mirelle	1	Med
Henry	1	Low
Brian	2	Med
Patrick	2	Med
Wendy	2	Med
Morgan	2	Med
Abby	2	Med
Taylor	2	Med
Paul	2	High
Craig	2	High
Nathan	2	High
Frances	2	Med
Liam	2	High
Sherman	2	Med
Percy	2	High
Nell	2	High

Physician	Values #	EMR Use
John	3	High
Madeleine	3	High
Stella	3	High
Cecil	3	High
Ted	3	High
Norman	3	High
Renee	3	High
Helen	3	High
Urielle	3	High

Figure 1 below involves the same data as in Table 5 but provides another perspective on these results. This figure further illustrates the trend in the data suggesting that the number of dimensions in professional values is associated with EMR use.

Figure 1: Results – number of dimensions and EMR use.
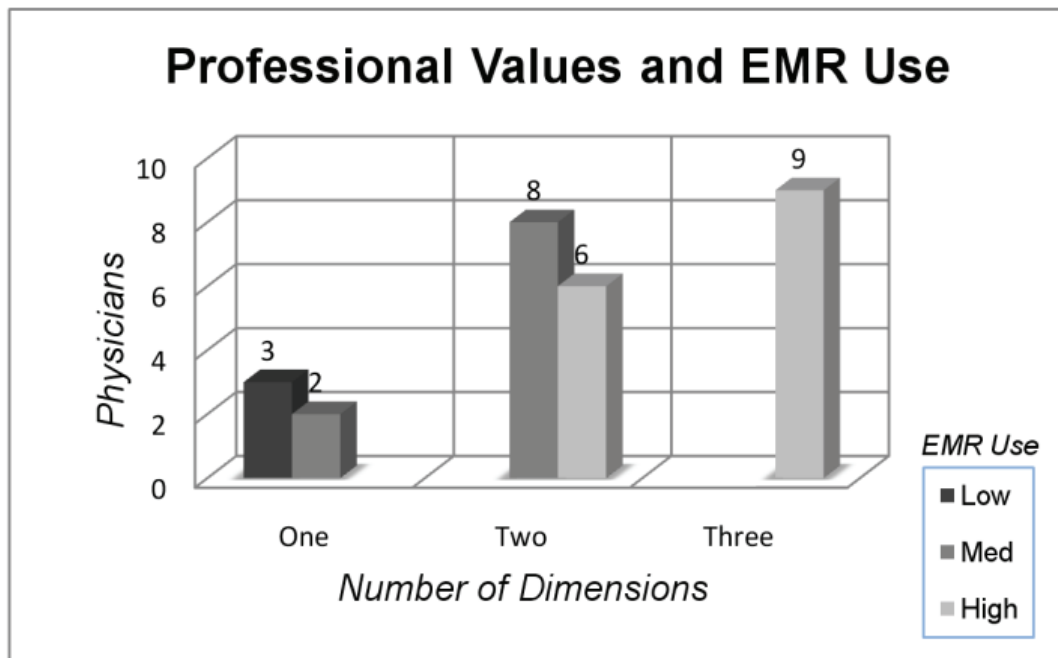
Further examination of the professional values data revealed additional insights into the linkage between professional values and EMR use. Of the 28 physicians, eleven had organization-orientation as a dimension in their professional value space, and 100% of these physicians were high users of the EMR. Nine of these eleven had three dimensions in their professional value space and two had only two dimensions. There were no medium or low users of the EMR that had an organization-oriented dimension in their professional value space. Physicians with

patient-orientation as a dimension in their professional value space tended to be higher users of the EMR. Of the 15 physicians who were categorized as high EMR users, 100% had patient-oriented as one of the dimensions in their professional value space. Eight of the ten physicians who were categorized as medium EMR users had patient-oriented as one of the dimensions in their professional value space. None of the physicians who were low EMR users had patient-oriented as one of the dimensions in their professional value space. I found an interesting pattern with regard to the profession-oriented dimension in professional values space. Of the 28 physicians in this study, 100% had a profession-oriented dimension in their professional value space. Five physicians were identified as having a professional value space that was dominated by one dimension. All five of these physicians shared the same narrowly defined professional value space with a profession-oriented dimension. Of the three physicians who were low EMR users, 100% had this highly profession-oriented singular dimensionality to their professional value space. The other two physicians with this type of professional value space were medium users of the EMR.

These results reveal interesting trends in this data that indicate potential relationships between the dimensionality of professional values (both in terms of number and orientation) and EMR use. These results are discussed in Chapter 5. Table 6 provides these results.

Table 6: Relationship between EMR use and professional values.

Physician	EMR Use	Values #	Professional Values (in rank order of relative strength)
John	**High**	3	Patients, Profession, Organization
Madeleine	**High**	3	Profession, Organization, Patients
Stella	**High**	3	Profession, Patients, Organization
Nell	**High**	2	Patients, Profession
Paul	**High**	2	Organization, Profession
Cecil	**High**	3	Patients, Profession, Organization
Ted	**High**	3	Organization, Profession, Patients
Craig	**High**	2	Patients, Organization
Norman	**High**	3	Profession, Patients, Organization
Renee	**High**	3	Profession, Patients, Organization
Nathan	**High**	2	Patients, Profession
Liam	**High**	2	Profession, Patients
Helen	**High**	3	Profession, Patients, Organization
Urielle	**High**	3	Patients, Profession, Organization
Percy	**High**	2	Profession, Patients
Tula	**Med**	1	Profession
Brian	**Med**	2	Profession, Patients
Patrick	**Med**	2	Profession, Patients
Morgan	**Med**	2	Patient, Profession
Abby	**Med**	2	Profession, Patients
Taylor	**Med**	2	Patients, Profession
Wendy	**Med**	2	Profession, Patients
Mirelle	**Med**	1	Profession
Frances	**Med**	2	Profession, Patients
Sherman	**Med**	2	Patients, Profession
Charlie	**Low**	1	Profession
Tate	**Low**	1	Profession
Henry	**Low**	1	Profession

PERSPECTIVES OF UNCERTAINTY

I noted an association between physician perspectives of uncertainty and EMR use later in the data analysis process. As I worked to refine the professional values construct, I began to see that physicians differed in how they viewed the role

of information in the practice of medicine. As I refined the definition of values/beliefs to professional values, the data pertaining to physician views on data and information in large part fell out of the refined definition of professional values. These data still seemed important in understanding differences in EMR use. The first time I noted the possibility that between-physician differences in views on information were related to between-physician differences in EMR use was during data collection in Specialty Practice 3. I was trying to explain a puzzling difference in EMR use between Norman and Tate, two specialty physicians working in the same practice. Norman was a high user of the EMR. He used the EMR for all clinical documentation and was extremely thorough in his documentation, he had highly modified his templates and had created macros/quick text for routine types of clinical documentation, he had high feature use, high EMR-enable communication with his medical assistant, he tried to use new features as they were rolled out, and was an overall champion of the EMR. On the other hand, Tate was a low user of the EMR. Tate struggled to document his clinical visits in the EMR. He spoke irreverently about the information in the EMR system – even the information he added. When asked about his typical day, his response was full of mentions of his nurse – not in terms of clerical assistance, but rather in terms of an integral part of his practice. Tate spent $800-$1000 per month out of his own personal salary to use a transcription service for his clinical documentation in lieu of using the voice recognition software (used by most other physicians at MetroClinic) attached to the EMR. Data comparing these two physicians reveals marked differences in how they viewed the role of information in the practice of medicine. Reflecting on Norman's

interview provided insights into his views on this issue. He made following statement in response to a question about how he used the EMR:

> *"I take pride in the fact that if a patient gets dumped in our hospital for an admission, I want them to go to my note first; rather than the internal medicine doctor's history and physical because they get better and more information out because I did write down that they had an append- appendectomy. That they had three pregnancies but only two kids, and one spontaneous abortion. That kind of information. That's a personal note of pride that actually drives me more to be an excellent record keeper in that way, that's; my information that can be used."*

Norman also made the following statement during his interview in response to a question about the pros and cons of EMRs:

> *"I force myself into a linear- a linearity when discover; when taking care of these issues because, otherwise it doesn't suit the structure for the long term care of the patient 'cause I won't remember what the heck I'm doing, or I won't get all my issues covered. I might have taken care of them for their headache, but they might have a tiny little pituitary system issue that I have to take another picture of in two or three years. And if I don't put that in the right spot in the note, to go find that, when I see them in a year or two, I might forget that. I'm gonna miss a brain tumor then I'm gonna have my butt chewed off. So, in general it's a good, place keeping. Again these are all things for place keeping, to establish the best care in the long term for the person."*

He went on to make the following comments, also focused on the role of information in medical practice:

"So in that way the electronic medical record is a sound investment, for the long term care. I expect that whatever I yapped out in 2004 would be available for time in memoriam just like every other little paper trail we ever make in the Internet or in the medical computer system. So I know that when we go in the public medical records that stuff's gonna be all over the world and someday somebody will say "Oh, let's see how many patients Norman saw in 2004 on September 10." Click. Boom. And someday it's all on a single depository that's gonna be pretty good. Pretty available. And they will chart my patterns. Some PhD grad student in 100 years will be able to chart exactly what Norman did today. Because all those records possible will be still there. So I'm scratching on the big, I'm scratching on cave wall now expecting that's gonna be there in a thousand years. And I don't wanna screw it up in that way. I feel that while I'm yapping in the computer it is something that's gonna be indelible."

"I'm a consultant, so a huge component of my job is going into the hospital and another physician asks me to do something, to evaluate; and half or a third of the information that I use to access that information is what that doctor has written into the chart. The verbal handoff or information they give me is usually quite inadequate. So I'm limited to the patient's history which is a tremendous component but a secondary follow-up component is what the physician's actual reasoning is for what's going on."

Norman spoke frequently about the role of codified, explicated information in medical decision making. He seemed to place priority on information that can be stored in a medical record (seemingly regardless of digital or paper system). He seemed to view historical information as critical for future decision making.

Tate, on the other hand, made following statement in response to a question about how he used the EMR:

"...I think that when I read peoples' notes I don't get much. I mean, what the government has ordained that we document does not help me a lot. So the bottom line, I'm more interested in the practitioner's assessment of putting it all together. That's what really counts to me. And if that's done in a way that I, know it's original, and fresh."

"I think that [medical specialty], in my opinion, does not lend itself well to a template form based on diseases, like in some manage care chronic diseases you have a template. You fill in the boxes, and this and that. I don't think that in [medical specialty], what we do in [medical specialty] lends itself well to that."

"I think that once someone's got a chronic illness in neurology I think what becomes more important long term is how the patient is coping psycho-socially as well as the family, and that's not, you can't record that in a template. That's something you have to use your judgment, to put in there. So those are the things that I focus on: diagnosis and then plan of action. You know. I see that as the most important."

"The second major thing that drives me in health care is that I have had the firm belief that if you spend extra time in educating the patient to what they have or how the system works or whatever it is they need to know; that they can bring internal resources that they don't know they have in finding solutions for their problem. And so I really try to spend a lot of time in trying to educate them. And even when I don't know the answers. I'm not particularly worried about showing them that I don't know the answer. But the reality I think is that, they can find the answers sometimes if I can put it in context for them with what they're dealing with."

When observing Tate one day, he pointed out his doctor's bag. He spoke proudly of this artifact and said it was the same bag that he'd used during medical residency and that his wife made some of the items inside that he still used in doing neurological assessments.

Tate spoke frequently about the kind of information that is not easily, or that cannot be captured in an EMR. He seemed to place priority on information that unfolds during the patient encounter, as opposed to information that can be stored or that is already stored in a medical record. He seemed to view real-time and tacit information as critical for decision making and focused on real-time decision making as opposed to future decision making.

The differences in EMR use and views on the role of information in the practice of medicine between Norman and Tate provided the start for my investigations into this aspect of the research. As I carried the investigation

forward, I noted many other instances where between-physician differences in views on information seemed to be associated with differences in EMR use. In fact, there seemed to be a correlation between what I now call *perspectives of uncertainty* and EMR use.

Upon reflection on the differences between Norman's views on information and Tate's views on information, I categorized these views as traditional or fundamental. Norman's views were consistent with information as a strategy for reducing uncertainty (traditional). Tate's views were consistent with strategies for absorbing uncertainty (fundamental). In this study, I define *traditional uncertainty* as uncertainty that can be reduced with more information or better information processing. Some concepts of information theory (Galbraith, 1973; Shannon, 1948) and organizational theory (Daft, 1989; Tushman & Nadler, 1978) are based in this view of uncertainty. I define *fundamental uncertainty* as uncertainty that cannot be reduced with more information or better information processing. Fundamental uncertainty is not a result of ignorance or the partiality of human knowledge but is a characteristic of the world itself (West, 2006). This type of uncertainty is a product of the nonlinear interdependencies in complex systems (Liebovitch, 1988).

I approached subsequent data analysis efforts with these definitions of uncertainty. The following quotes are examples of statements that are consistent with perspectives of uncertainty that are traditional (reducible with information/information processing):

"And you know you wanna have the information you need, when you need it. I guess at some point we put all the information into electronic medical records and we do away with the charts and if we get records somewhere else, we'll maybe they can just download all in that information in there you know."

– Brian

"I'm just maybe a little more compulsive than other people and it satisfies that need in me to know exactly what medicines my patients are on; know exactly what interactions they may have; you know and so for someone with those needs this is a great system."

– John

"I take pride in the fact that if a patient gets dumped in our hospital for an admission, I want them to go to my note first; rather than the internal medicine doctor's history and physical because they get better and more information out because I did write down that they had an append- appendectomy. That they had three pregnancies but only two kids, and one spontaneous abortion. That kind of information. That's a personal note of pride that actually drives me more to be an excellent record keeper in that way, that's; my information that can be used.

– Norman

"I think it's; it made things a lot safer in many respects. And as doctors we need that. You know we need we need the, immediate availability of information.

– Ted

The following quotes are examples of statements made by physicians that are consistent with perspectives of uncertainty that acknowledge fundamental uncertainty: (non-reducible, inherent in complex systems):

"I'm not sure what the purpose of having a medication list in there if we pretty much don't know if it's correct or not. For example, any medication list in the system assumes that every doctor the patient sees is within the clinic which is not true, most of the time; and it also assumes that somebody updated the list every time that medication has changed, which is not true most of the time. But still the fact is that you don't know what someone's taking unless you ask them that day; because that could have changed the day before; you wouldn't know. We never actually have all the medications that someone is taking. We never have a complete list."

– Charlie

"And, I mean the notes are important, but I really don't know if they're going to help anyone."

– Mirelle

"I don't know if the information I need is really in there [EMR].

– Morgan

"Information has no value unless it is quickly retrievable and in the right/useable form. When I read other people's notes I don't get very much information; I'm interested in practitioner's assessment of putting it all together."

– Tate

"Life is like a box of chocolates… you never know what you're gonna get when you open that door."

– Urielle

The quotes above demonstrate the between-physician differences in perspectives of uncertainty. I did not ask questions about uncertainty or about the role of information in the practice of medicine. This insight emerged from the data during the data analysis. This is an important distinction to make in that it serves to strengthen the plausibility of the connection between EMR use and perspectives of uncertainty. These kind of quotes occurred throughout the data and they demonstrate the differences in how physicians think about the role of information in practicing medicine and possible differences in how physicians think about and manage uncertainty.

As I continued to examine the between-physician differences in perspectives of uncertainty, I noted many instances where differences in EMR use seemed to be directly associated with differences in perspectives of uncertainty. Again, I cannot make claims about the causal linkages with this data. These findings, however,

indicate the need for further investigation into the role of perspectives of uncertainty on IT use.

These examples from the data indicated between-physician differences in perspectives of uncertainty, but they did not demonstrate clear patterns in the overall data set linking perspectives of uncertainty with EMR use. Based on the insight discussed above, I pursued additional paths of analysis investigating the link between perspectives of uncertainty and EMR use. In doing so, I used the definitions provided above to analyze the interview and observational data. Coding the data and interpreting aspects of the data using these definitions resulted in a reorganization of the data pertaining to perspectives of uncertainty (and included data coded for information use, manipulation, etc.). As with professional values, I analyzed perspectives of uncertainty independently from the other key variables. This was done in an effort better understand and develop the perspectives of uncertainty construct apart from the other key constructs. After completing analysis of the variables independently, I conducted analysis focused on understanding them as a set of interconnected constructs.

I analyzed the perspectives of uncertainty codes using the 28 physician profiles. I synthesized all of the data related to perspectives of uncertainty and placed this information (again, usually in the form of short summary phrases) in the appropriate space in the profiles. Data analysis revealed three categories of perspectives of uncertainty 1) traditional, 2) fundamental and 3) hybrid (combination of traditional and fundamental). Physicians categorized as traditional made no mention of ideas consistent with fundamental uncertainty in their

interviews. Physicians categorized as fundamental spoke frequently of ideas consistent with fundamental uncertainty. Exhibit 4 provides a selection of codes resulting from the data analysis of the perspectives of uncertainty construct.

Exhibit 4: Selection of Codes on Perspectives of Uncertainty

Below are example codes for the following categories of perspectives of uncertainty that emerged during data analysis. During data analysis, I created the codes noted below to capture and organize aspects of the data that seemed particularly salient in understanding the linkages between professional values and EMR use and perspectives of uncertainty and EMR use. A selection of codes, their definitions and example text are provided below.

Code	Category	Definition	Example
Traditional	Perspectives on uncertainty	Statements demonstrating the view that uncertainty is reducible with more information or better information processing, with no acknowledgement of uncertainty that is not reducible via | information. [7]	"I'm just maybe a little more compulsive than other people and it satisfies that need in me to know exactly what medicines my patients are on; know exactly what interactions they may have; you know and so for someone | with those needs this is a great system."
Fundamental	Perspectives on uncertainty	Statements demonstrating the view that uncertainty is not always a result of ignorance or the partiality of human knowledge but is a characteristics of the world itself. [8]	"I'm not sure what the purpose of having a medication list in there if we pretty much don't know if it's correct or not. For example, any medication list in the system assumes that every doctor the patient sees is within the clinic which is not true, most of the time; and it also assumes that somebody updated the list every time that medication has changed, which is not true most of the time. But still the fact is that you don't know what someone's taking unless you ask them that day; because that could have changed the day before; you wouldn't know. We never actually have all the medications that someone is taking. We never have a complete list."

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[7] Definition of traditional uncertainty derived from a review of the work by contributors to information theory (ex. Shannon, 1948; Daft, 1989; Galbraith, 1973).

[8] Definition of fundamental uncertainty derived from a review of the work by contributors to complexity science as applied to organizations (ex. Anderson, 1999; Cohen, 1990; McDaniel, 1997).

Analysis of the perspectives of uncertainty data in relation to EMR use revealed an interesting pattern. Physicians who acknowledge fundamental uncertainty tended to be lower users of the EMR. Physicians with traditional views of uncertainty tended to be higher users of the EMR. Physicians with a hybrid view of uncertainty (made statements indicating the presence of both views of uncertainty somewhat evenly), tended to be medium users of the EMR.

Of the 28 physicians, five (18%) were categorized as having a perception of uncertainty consistent with the notion of fundamental uncertainty. Of these five physicians, three were categorized as low EMR users, one as a medium EMR user and one as a high EMR user (this outlier is discussed further in Chapter 5). Nine of the 28 (32%) physicians were categorized as having a hybrid view of uncertainty. Of these nine physicians, seven were categorized as medium EMR users and two were categorized as high EMR users. Thirteen of the 28 (46%) physicians were categorized as having traditional views on uncertainty. Twelve of these thirteen were categorized as high EMR users and one was categorized as a medium EMR user. One physician (4%) did not have enough data on this variable to clearly categorize. This physician was categorized as a medium EMR user. Table 7 summarizes these results.

Table 7: Results organized by perspectives of uncertainty.

Physician	Uncertainty	EMR Use		Physician	Uncertainty	EMR Use
Henry	**Fundamental**	Low		John	**Traditional**	High
Charlie	**Fundamental**	Low		Madeleine	**Traditional**	High
Cecil	**Fundamental**	High		Stella	**Traditional**	High
Tate	**Fundamental**	Low		Nell	**Traditional**	High
Mirelle	**Fundamental**	Med		Taylor	**Traditional**	Med
				Paul	**Traditional**	High
Morgan	**Hybrid**	Med		Ted	**Traditional**	High
Tula	**Hybrid**	Med		Norman	**Traditional**	High
Brian	**Hybrid**	Med		Renee	**Traditional**	High
Abby	**Hybrid**	Med		Nathan	**Traditional**	High
Craig	**Hybrid**	High		Liam	**Traditional**	High
Wendy	**Hybrid**	Med		Helen	**Traditional**	High
Frances	**Hybrid**	Med		Percy	**Traditional**	High
Urielle	**Hybrid**	High				
Sherman	**Hybrid**	Med		Patrick	**Not sure**[9]	Med

Figure 2 involves the same data as is used in Table 7 but provides another perspective on these results. This figure further illustrates the trend in the data suggesting that perspectives of uncertainty are associated with EMR use.

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[9] There was insufficient data to categorize Patrick's perspective of uncertainty.

Figure 2: Results - perspectives of uncertainty and EMR use.
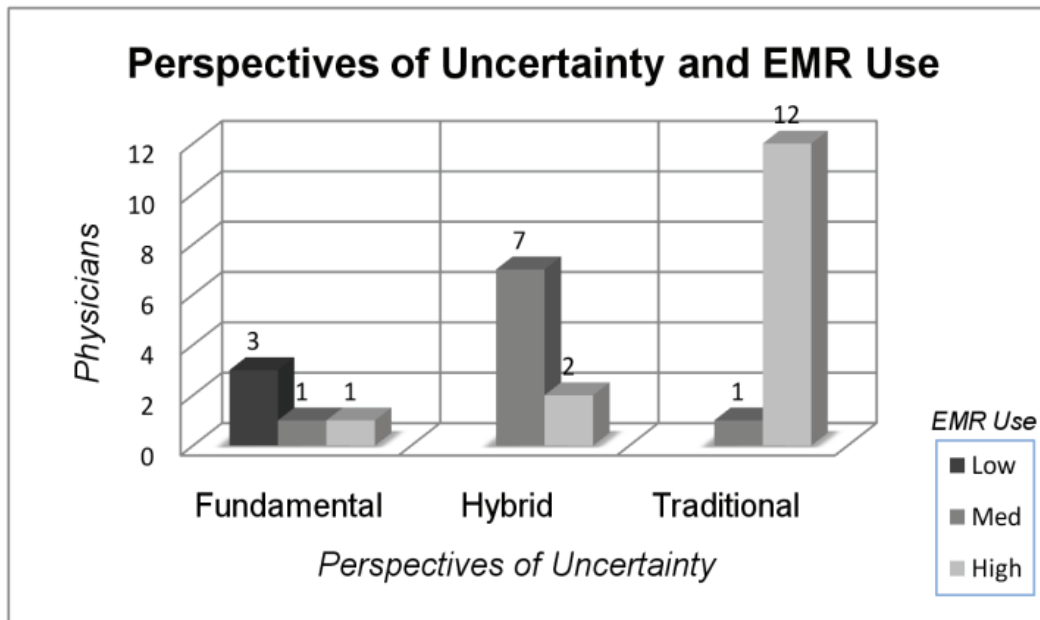
These results reveal interesting trends in this data that indicate a possible relationship between individual perspectives of uncertainty and EMR use. These results are discussed further in Chapter 5.

The final stage of data analysis focused on understanding the relationships between all three variables: EMR use, professional values and perspectives of uncertainty. To do this, I purposefully selected three physicians that were low EMR users and three physicians that were high EMR users and developed narrative cases based on the data from each of these six physicians. I selected physicians who were most representative of the findings described in this chapter. This analysis was done in an effort to develop richer, more contextual insights about the linkages among the main variables of interest in this research. Exhibit 5 provides a summary of the data from these six cases.

Exhibit 5: Synthesis of data from six exemplar cases.

Physician	Professional Values	Professional Values	Perspectives of Uncertainty
High EMR Use			
John *Generalist*	Three; Patients, Profession, Organization	Integrating clinical information for my patients is an important part of my work ▪ I'm part of a medical group ▪ I make complex decisions in my head all day long ▪ I help patients ▪ I am responsible to my patients ▪ Information availability is critical to my work	*Traditional Uncertainty* Believes explicit and/or codified information is accurate ▪ Seeks certainty through explicit/codified information ▪ Invests in making data and information explicit ▪ Invests in finding explicit/codified information
Madeleine *Specialist*	Three; Profession, Organization, Patients	I am (and we in this practice are) responsible to the patient ▪ Nursing staff are critical to my work ▪ I am part of medical group ▪ Practice improvement is an important part of my work ▪ The patient experience is important	*Traditional Uncertainty* Seeks certainty through explicit information ▪ Invests in making information explicit ▪ Invests in finding explicit/codified information ▪ High reliance on nursing to accomplish work ▪ Organizes work to increase routine
Norman *Specialist*	Three; Profession, Patients, Organization	Neurology is a linear specialty ▪ I'm a consultant ▪ I'm part of a medical group ▪ Organization, accuracy, completeness of clinical documentation are important in my work ▪ I am the patient's advocate first, regardless of cost to others	*Traditional Uncertainty* Almost obsesses over clinical documentation ▪ Seeks/values accuracy in medical information ▪ Focuses on better and more information ▪ Generates extensive records ▪ It's comforting to be able to explicate care ▪ Seeks certainty through explicit/codified information ▪ Invests in making information explicit

Exhibit 5 continued.

	Physician	Professional Values	Professional Values	Perspectives of Uncertainty
Low EMR Use	Charlie *Generalist*	One; Profession	My job is to be a physician ▪ I am not an information processor ▪ I run my own small practice ▪ The IT department doesn't understand my job as a physician ▪ We're not working in a factory - physicians are all doing different processes	*Fundamental Uncertainty* Information in the patient is accurate ▪ High reliance on tacit information ▪ High use of information that emerges during patient encounter ▪ Narrative is key in understanding what's going on with my patients ▪ Invests in tacit information, creating narratives in patient records ▪ Invests in interpreting others' narratives ▪ One never knows if the explicated medication list in the EMR is correct or not; you never have a complete list ▪ Knows the limits of technology
	Henry *Specialist*	One; Profession	Being forward-thinking is important in how I practice medicine ▪ Developing and maintaining medical expertise is important ▪ I run my own small practice	*Fundamental Uncertainty* Determining change in patient condition is critical ▪ It is difficult to discern change that has occurred when using information in EMR ▪ Sometimes when data is explicated, it's hard to figure out what information is real ▪ High reliance on nurse

90

Exhibit 5 continued.

	Physician	Professional Values	Professional Values	Perspectives of Uncertainty
Low EMR Use	Tate *Specialist*	One; Profession	Physicians need a stable platform on which to work ▪ Physicians can be terrorists ▪ Physicians need a sense of nobility (good) ▪ Actions and artifacts are symbols and they have meaning ▪ Billing phenomena are separate from science and art of medicine ▪ Humor is important in dealing with medical tragedy ▪ I became a physician to help all people ▪ I work at a free clinic to "nourish my soul"	*Fundamental Uncertainty* When I read other people's notes I don't get very much information; I need to get a sense of the practitioner's assessment of putting it all together ▪ The most important part of my job is detecting change ▪ Neurology can't be done using templates ▪ Psychosocial and family issues are important and can't be captured in templates ▪ Educating patients inevitably leads to increasing their ability to bring unforeseen knowledge and skill to solving their own problems better ▪ I'm not worried about showing them I don't know the answer – they can find the answer sometimes if I can put it in a context for them ▪ High reliance on nurse

The synthesis of the data from the six cases provided in Exhibit 5 (above) provides additional texture to the main findings from this study. An important insight gained from this additional step in data analysis is the discovery of patient-oriented data in the perspectives of uncertainty column for two of the three low EMR users. Charlie and Tate's statements that were consistent with the notion of fundamental uncertainty were often patient-oriented. If one were to analyze Charlie and Tate's professional values data only, one might conclude that both of these physicians express little to no patient-orientation. Analysis of their perspectives of uncertainty, however, suggests both of these physicians are patient-oriented. This insight demonstrates the need to practice caution in drawing conclusions based on analysis of professional values and perspectives of uncertainty independently from each other. Additionally, this analysis illustrates the extent to which physicians working in the same practice can differ from each other in terms of their professional values and perspectives of uncertainty. John and Charlie were from the same practice as were and Norman and Tate, and these pairs differed dramatically from each other on each of the major variables.

Table 8 provides a summary of the key findings from this study. This table provided the basis for much of the results and discussion chapters. In this report of research, I focus on the relationships between EMR use, professional values, and perspectives of uncertainty and leave the findings related to age, gender, medical specialty, and practice (work group) for future studies. I include the findings related to all of these variables in an effort to more fully describe the data and results obtained in this research.
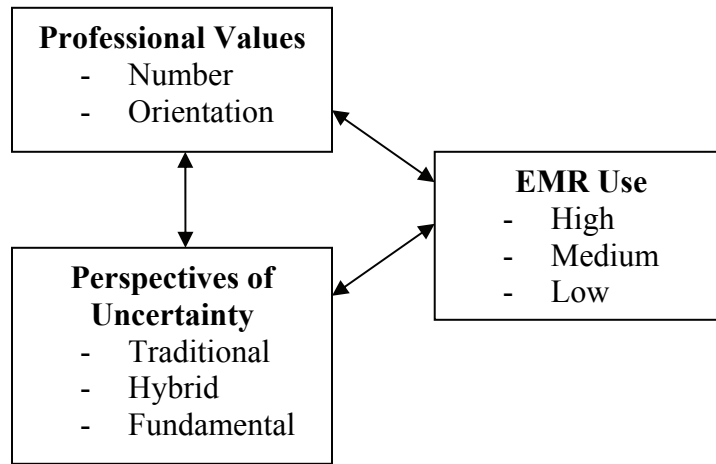
Table 8: Results organized by EMR use.

Physician	EMR Use	Values #	Uncertainty	Top Value	Information	Specialist/ Generalist	Practice #
John	**High**	3	Traditional	Patient	Explicit	Gen	1
Madeleine	**High**	3	Traditional	Profession	Explicit	Spec	2
Stella	**High**	3	Traditional	Profession	Explicit	Spec	2
Nell	**High**	2	Traditional	Patient	Explicit	Gen	5
Paul	**High**	2	Traditional	Organization	Explicit	Spec	7
Cecil	**High**	3	Fundamental	Patient	Both	Spec	7
Ted	**High**	3	Traditional	Organization	Explicit	Spec	7
Craig	**High**	2	Hybrid	Patient	Both	Spec	7
Norman	**High**	3	Traditional	Profession	Explicit	Spec	8
Renee	**High**	3	Traditional	Profession	Both	Spec	8
Nathan	**High**	2	Traditional	Patient	Explicit	Spec	9
Liam	**High**	2	Traditional	Profession	Explicit	Spec	9
Helen	**High**	3	Traditional	Profession	Explicit	Spec	10
Urielle	**High**	3	Hybrid	Patient	Tacit	Spec	10
Percy	**High**	2	Traditional	Profession	Explicit	Spec	10
Tula	**Med**	1	Hybrid	Profession	Both	Gen	1
Brian	**Med**	2	Hybrid	Profession	Both	Gen	5
Patrick	**Med**	2	Not sure	Profession	Tacit	Gen	5
Morgan	**Med**	2	Hybrid	Patient	Both	Gen	6
Abby	**Med**	2	Hybrid	Profession	Both	Gen	6
Taylor	**Med**	2	Traditional	Patient	Explicit	Gen	6
Wendy	**Med**	2	Hybrid	Profession	Both	Spec	8
Mirelle	**Med**	1	Fundamental	Profession	Tacit	Spec	8
Frances	**Med**	2	Hybrid	Profession	Tacit	Spec	9
Sherman	**Med**	2	Hybrid	Patient	Tacit	Spec	9
Charlie	**Low**	1	Fundamental	Profession	Tacit	Gen	1
Tate	**Low**	1	Fundamental	Profession	Tacit	Spec	8
Henry	**Low**	1	Fundamental	Profession	Tacit	Spec	8

Table 8 (above) contains the same data already reported on professional values and perspectives of uncertainty. It also provides results from additional data including the most prominent value in each physician's professional value space (top value), the extent to which a physician gives priority to tacit knowledge and/or information, explicit knowledge and/or information or both (information), type of

medical practice (generalist/specialist), and practice affiliation (practice #). This table illustrates additional inquiries related to those under discussion in this report of research that could be pursued with this data set in the future.

I used the findings from this study to develop the model depicted in Figure 3. This model summarizes the results from this study and will be discussed in detail in Chapter 5. The results of this research focus on the relationship between EMR use and professional values and between EMR use and perspectives of uncertainty because these two factors were most prominently associated with EMR use in the data. The most surprising finding that emerged from this study was the association between the number of dimensions in a physician's professional value space and EMR use. The second most surprising finding was the association between differences in a physician's perspectives of uncertainty and EMR use. For these reasons, the discussion in Chapter 5 focuses on explaining these two findings. The relationship between professional values and perspectives of uncertainty will also be explored in the discussion of results.

Figure 3: Data-driven model of EMR use.

```
┌─────────────────────────┐
│  Professional Values    │
│    -  Number            │◄──┐
│    -  Orientation       │   │          ┌──────────────────┐
└──────────┬──────────────┘   └─────────►│    EMR Use       │
           ▲                             │   -  High        │
           │                             │   -  Medium      │
           ▼                             │   -  Low         │
┌─────────────────────────┐   ┌─────────►└──────────────────┘
│  Perspectives of        │◄──┘
│     Uncertainty         │
│    -  Traditional       │
│    -  Hybrid            │
│    -  Fundamental       │
└─────────────────────────┘
```

This model provides the basis for the discussion in the following section. I use theories of professionalism and complexity science to explain the main findings from this research. These diverse theories are beneficial to understanding these results and in generating additional theory about IT use in professional settings.

Chapter 5: Discussion

In this chapter I interpret and discuss the study results. I begin by discussing each of the linkages in the data-driven model located at the end of Chapter 4 (Figure 3). First, I discuss the linkage between professional values and EMR use. I use a number of theories to better understand the association between the number of dimensions in professional values and EMR use and to better understand the association between the orientation of these dimensions and EMR use. Next, I use complexity science to better understand how differences in perceptions of uncertainty shape EMR use. Then I discuss the linkage between professional values and perspectives of uncertainty. After discussing the model, I discuss the outliers and suggest plausible explanations for these data points. I conclude this chapter by discussion implications for research and practice and study limitations.

PROFESSIONAL VALUES AND EMR USE

The results of this study suggest a relationship between professional values and EMR use. For the purposes of streamlining the discussion, I divide the findings on professional values into two aspects: *number of dimensions* of professional values and *orientation of dimensions* of professional values. Both of these aspects were associated with EMR use.

Number of Dimensions

As noted in the previous chapter, I define dimensionality of professional values as the minimum number of coordinates needed to specify each point in a physician's professional value space. At this stage in the research process, the

following three dimensions of professional values have been identified: profession-oriented, patient-oriented, and organization-oriented. I recognize that these three dimensions are not likely to capture 100% of the professional values in this data set or in the population of physicians. These three dimensions, however, were the most prominent in this data set and are consistent with physician professional values identified in other research (Jensen & Kjaergaard, 2008; Kaplan, 1987). As previously noted, dimensionality is a mathematical notion typically used to describe a space or an object and the dimension of a space or object is typically defined as the minimum number of coordinates needed to specify each point on it. As with the formal mathematical notion, each dimension was distinct from the others, and the set of dimensions could be combined to create the dimensionality of the professional value space. Although I did not attempt to quantify the strength or magnitude of the dimensions, application of this idea was useful in understanding my data.

The finding regarding the number of dimensions in professional values was that EMR use trended in the same direction as the number of dimensions included in a physician's professional value space. If a physician had three dimensions in their professional value space, they tended to be a high user of the EMR. If a physician had two dimensions, they tended to be a medium user of the EMR. If a physician had only one dimension, they tended to be a low user of the EMR.

These results indicate a possible connection between the narrowness/broadness of professional values and IT use by professionals. Perhaps this is simply a numbers game -- professionals who see themselves and/or define

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their professional work in more than one way are more likely to be able to conceptualize ways to benefit from IT. Holding individual perspectives of IT (or IT values) constant for the sake of argument, perhaps professionals with a high number of dimensions in their professional value space are more likely to be high users of IT because they are more likely to have a dimension of their professional value space that triggers an openness to IT. Making this argument from the other direction, perhaps professionals who have a narrowly, singularly, tightly focused professional value space are less likely to be high users of IT because the tightly focused views on who they are as a professional and/or how they define their work as a professional block their capacity to incorporate new artifacts or new methods for accomplishing professional tasks. If how I conceptualize myself as a scholar resides solely on research (as opposed to for example research, teaching and service), then will I be less likely to be a high user of education information systems such as Blackboard? If I include aspects of research, teaching and service in how I view myself as a scholar, am I more likely to be a high user of these systems? The answer to this question is unclear, but the results of this research suggest the answer could be yes to both of these questions.

Research on the role of insight in creative scientific thinking may be helpful in this discussion. In addition to discussing hypothesis generation as originating from empirical and non-empirical sources, Clement (1989) finds evidence supporting the argument that a well-defined mental model essentially predetermines the relevant solution space for a problem (Clement, 1989). This notion could be applied in interpreting the findings in this study regarding

dimensionality of professional values. Physicians with only one dimension in their professional value space could be described as having a well-defined mental model of themselves as physicians and/or of their professional work. Data from Charlie, Tate, Henry and Mirelle indicate the presence of well-defined mental models of themselves as physicians. They were each found to have only one dimension in their professional value space. Three of these physicians (Charlie, Tate and Henry) were low users of the EMR and one (Mirelle) was a medium user. Perhaps these four physicians had such well-defined mental models of who they were and what they did that they could not see a role for IT in the relevant solution space for the problem of practicing medicine. This is one possible explanation for the results indicating a relationship between dimensionality of professional values and EMR use.

Ashby's Law of Requisite Variety may also be helpful in interpreting these findings. Ashby's law states that adaptive order creation occurs if internal complexity exceeds external complexity and that variety absorbs variety, meaning that for a controller to control a system it must have more variety (distinct system states) than the system being controlled (Ashby, 1956). Ashby's work is generally used to think about topics in the fields of cybernetics and complex systems, but it could also be used to think about this issue. If one thinks about dimensions of professional values as variety (distinct system states), then it could logically follow that professionals with more dimensions in their professional value space will be better able to incorporate new methods/tools for accomplishing work (not to exceed the number of dimensions in the professional value space) than

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professionals with fewer dimensions in their professional value space. Carrying this argument forward, if a professional has a variety of ways to conceptualize their professional values, then s/he will also be better able to conceptualize a variety of methods for carrying out professional work. In the case of incorporating new IT into work practices, perhaps professionals with two or more dimensions in their professional value space will more readily adopt and more fully use IT because the interdependency between their professional values and methods for accomplishing professional work is not tested/strained as it would be if they had one dimension in their professional value space. Professionals with only one dimension in their professional value space would have a harder time adopting and using new IT because the interdependency between their professional values and methods for accomplishing work are already matched, leaving little to no room for additional variety in the methods used to accomplish work.

The linkage between dimensionality of professional values and IT use needs further examination. Future investigations into this topic should make an effort to operationalize and measure the dimensions of professional values. One way to think about this problem is by using the three dimensions identified in this research: profession-oriented (PROF), patient-oriented (PT) and organization-oriented (ORG). One could develop a way to measure the presence of each of these dimensions for physicians. For illustrative purposes lets assume each of these dimensions had a minimum value of zero maximum value of five (scale = 0-5). One could consider using a three-dimensional space (cube) to graph each physician according to these three dimensions of professional values. PROF could be graphed along the y-axis,

PT graphed along the x-axis and ORG graphed along the z-axis. So for hypothetical

physician, Holly, with PROF = 4, PT = 2, and ORG = 0, her professional values space

would be graphed as shown in Figure 4 (below). The letter H, M, L could be used to

indicate Holly's data point, which would include Holly's data about her IT use in this

graph. For the sake of illustration, let's also consider a physician with coordinates

PROF = 5, PT = 5, and ORG = 2 and another physician with coordinates PROF = 5, PT

= 0, and ORG = 0. Coordinates for physicians (or other professionals) could be used

to detect and study patterns in the relationship between professional values and IT

use. This is an example of one path for additional study of this topic.

Figure 4: Example analysis examining dimensionality of professional values and IT use.
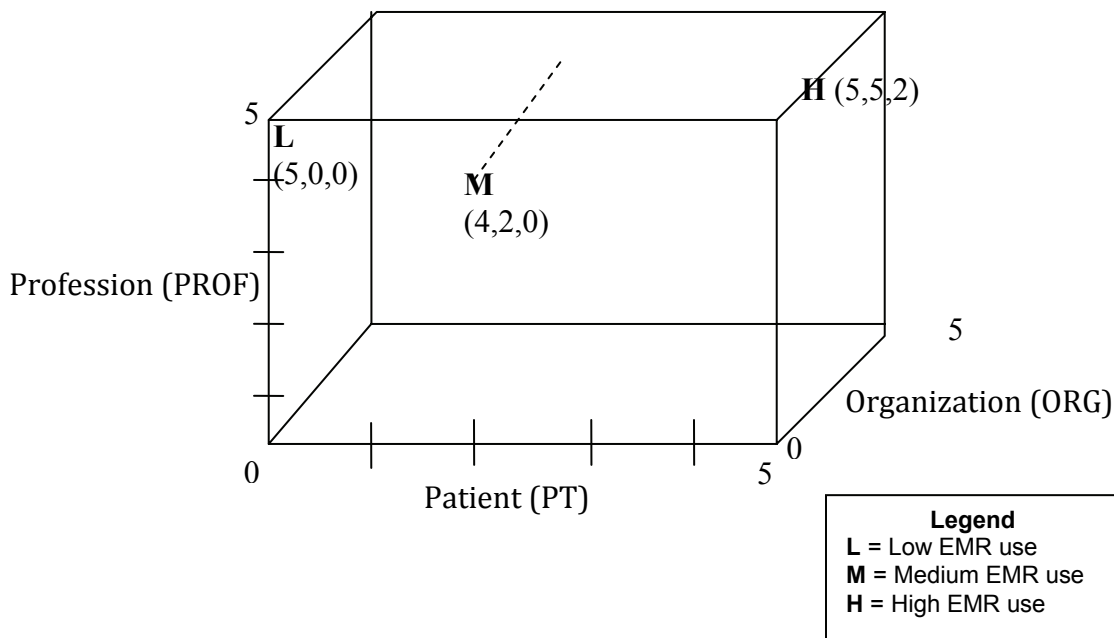
Orientation of Dimensions

In this study, I examined the differences in values of individuals within a single profession: medicine. All of the professionals studied were physicians. All of the physicians expressed some combination of the following dimensions of professional values: 1) profession-oriented, 2) patient-oriented, and 3) organization-oriented. Physicians varied in the orientation of their professional values.

The results of this research indicate that physicians with patient-oriented values are more likely to be high EMR users than physicians without patient-oriented values. This finding could have important implications for the patient-centered movement. Patient-centered health care delivery is an important topic in modern health services research. Many researchers in this field are investigating ways to design and effective deliver health care while appropriately involving patients in their care. The patient-centered care model (Stewart, Brown, Weston, McWhinney, McWilliam, & Freeman, 2003) and the patient-centered medical home (Nutting, Miller, Crabtree, Jaen, Stewart, & Stange, 2009) are examples of how the health care industry is working to include patients in the care delivery process. A subsidiary of the American Academy of Family Physicians, TransforMED, developed a model of patient-centered care calling for the following components: the patient at center stage; open access by patients; care that is both responsive and prospective; use of electronic health records; a defined set of services offered; redesigned offices; integrated care that has a whole-person orientation; use of e-mail, Web and voice-mail communication; use of a multidisciplinary team as the source of care; evidence-

based care with a focus on quality; and purposeful, organized chronic disease management (Nutting et al., 2009). Other patient-centered medical home models include the following principles: personal physician, physician directed medical practice, whole person orientation, coordinated or integrated care, and quality and safety. IT has a potential role to play in many of these areas. A clear role for IT exists in the principles focused on coordination/integration of care, organized chronic care disease management, quality and safety.

Government and policy leaders in health care have been arguing this for years (Institute of Medicine, 2001; United States Congress, 2009). While this study did not examine the relationship between EMR use and quality of care or other performance outcomes, the findings indicate a positive relationship between patient-oriented professional values and EMR use. This finding could be informative to those working on understanding the role of IT in the various patient-centered care movements.

The results of this research indicate that physicians with organization-oriented values are more likely to be high EMR users than physicians without organization-oriented values. This finding was most commonly manifest in the data by physicians stating they routinely sacrifice individual efficiency when using the EMR for the organizational benefits most often expressed in terms of immediate availability of patient information across the organization or cost savings by reducing the number of redundant test and procedures. This finding may of course only be relevant to settings where a medium or large organization is present. That is, it may not apply as well in small, 1-2 physician practices that are independently

owned and operated. It may, however, apply just as well. This is an empirical question that needs further examination.

All of the 28 physicians in this study expressed professional values that included profession-orientation. One way to interpret this is that profession-oriented professional values are not associated with EMR use or cannot be used to explain between-physician differences in EMR use. Another way to interpret this is that of these 28 physicians, all of them regardless of gender, age, medical specialty, EMR use, organizational tenure, had profession-oriented professional values indicating the ubiquity of this dimension of professional values. This would not be surprising, though, as one would likely expect professionals to hold values pertaining to their profession. Perhaps the interesting finding this study reveals regarding this dimension of professional values is that all three of the low EMR users had a single profession-oriented dimension in their professional value space. The number of physicians in this category is small (n=3), but this finding may indicate a relationship between highly profession-oriented professional values and low IT use.

Previous research on IT in medical contexts is relevant to this discussion. Fiol and O'Connor (2004) studied the EMR as an artifact important in how physician view themselves as professionals. Their research asserts that just as black bags and white coats are artifacts of medicine that have meaning, so are EMRs. In their theory building research, they point out that while black bags and white coats signal more distinction for physicians, EMRs signal less distinction for physicians. When physicians use an EMR they look more like everyone else in the medical setting.

This is one of the main arguments made in this work and it speaks to examinations of IT as a threat to professional autonomy. While some physicians at MetroClinic made statements consistent with this theory (IT as a threat to professional autonomy), most did not. This could be because the EMR had been purchased and implemented six years prior to the data collection as opposed to being under consideration for adoption or in early states of implementation giving physicians time to resolve the majority of their threat to professional autonomy concerns. Nonetheless, the work by Fiol and O'Connor could be helpful in thinking about physicians with a narrowly focused professional value space oriented around profession. Perhaps physicians who focus highly on what it means to be a physician are more likely to be low EMR users and this low EMR use could be explained by a perceived threat to their most highly regarded professional value (profession).

The findings on the orientation of professional values could be interpreted by using a framework for examining diversity in organizations (Harrison & Klein, 2007). This framework was developed in an effort to more systematically study diversity and its implications for organizations. While my study focuses on IT use at an individual level of analysis, this framework may be useful in thinking about how a group of individuals working in the same professional organization are similar/different in terms professional values and in thinking about how to manage professional organizations made up of individuals with widely different professional values. The framework categorizes diversity into three types: separation, variety and disparity. They define separation as differences in position or opinion among unit members. "Such differences reflect disagreement or opposition – horizontal

distance along a single continuum representing dissimilarity in a particular attitude or value, especially regarding team goals and processes" (Harrison & Klein, 2007, p.2). Variety is defined as "differences in kind or category, primarily of information, knowledge, or experience among unit members." This type of diversity is captured by thinking about the differences in the physicians at MetroClinic explained by medical specialty or training. The third type of diversity in this frame is disparity, defined as "differences in concentration of valued social assets or resources such as pay and status among unit members – vertical differences that, at their extreme, privilege a few over many" (Harrison & Klein, 2007, p. 2).

Examining my findings on the orientation of professional values with this frame enables a focus on Harrison and Klein's notion of *separation* to interpret and develop implications for differences in orientation of professional values. Harrison and Klein (2007) depict scenarios of minimum, moderate and maximum separation in a figure similar to Figure 5 (below).

Figure 5: Separation: adapted from Harrison and Klein (2007).
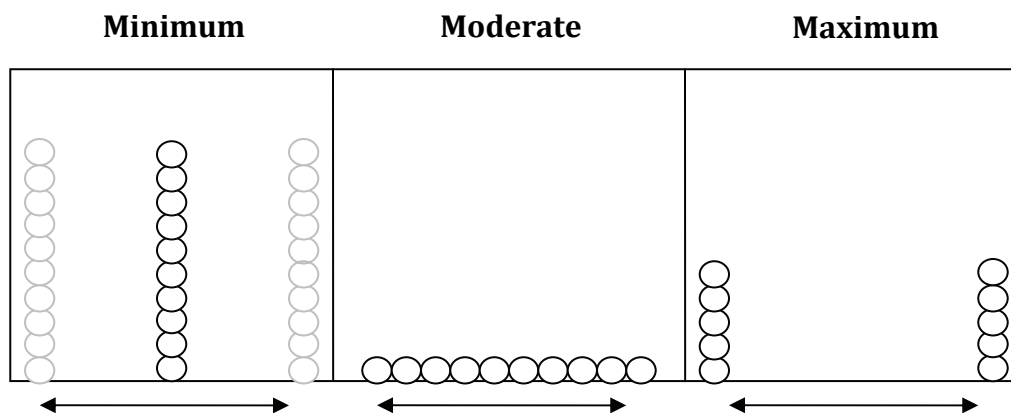
In the minimum separation scenario, there is no variation on the variable of interest. Minimum separation on orientation of professional values would mean that all 28 physicians would share the same professional value space. In the moderate separation scenario, each individual has a different point on the continuum for the variable of interest. In my study, this would mean that each of the 28 physicians would have a unique professional value space. In the maximum separation scenario, individuals cluster around two points on opposite ends of the continuum of the variable of interest. This scenario (maximum separation) seems to map most closely onto the results for professional values of the 28 physicians studied at MetroClinic.

The findings on professional values reveal a possible separation in values among the 28 physicians in this study. There appears to be two clusters of physicians: physicians that include patient and/or organization in their professional values and physicians that do not. The physicians that do not include patient and organization in their professional values form a small group of physicians with profession-oriented professional values. Separation among the physicians on these three dimensions (profession-, patient- and organization-orientation) was associated with differences in EMR use. Viewing this issue as a separation in professional values among the physicians at MetroClinic may help in understanding the linkage between professional values and EMR use, and may help in developing implications for this observation.

Diversity is often studied in an effort to understand its effects on performance. Harrison and Klein (2007) developed this framework to help

researchers more rigorously study diversity and better understand the boundaries for drawing conclusions depending on the type of diversity being examined. Separation diversity tends to be associated with reduced cohesiveness, more interpersonal conflict, distrust and decreased task performance. While my study did not examine these specific variables, they may have nonetheless been present at MetroClinic and may be important in helping MetroClinic understand some of the differences in between-physician EMR use. I discuss this topic further in the implications section of this chapter.

Figure 6 (below) illustrates the separation of professional values along the patient-oriented and organization-oriented values, and makes it easy to visualize the patterns of between-physician differences along these two dimensions. Each circle in the two boxes on the right and left side of the figure represents a physician. The circles on the left side of the boxes are physicians included that dimension in their professional values. The circles on the right side of the boxes are physicians that did not include the dimension. For the patient-oriented dimension, 23 physicians had this value and five physicians did not. For the organization-oriented dimension, 11 physicians had this value and 17 physicians did not. As stated earlier, there was no separation among the 28 physicians on the profession-orientation dimension. Assuming the professional values held by physicians are relatively stable over time, one could argue that the differences in these dimensions could have created conditions within MetroClinic that contributed to the associated patterns of EMR use. As stated in the results chapter, patient- and organization-oriented professional values were associated with higher EMR use than profession-

oriented professional values alone. Regardless of profession-orientation, patient-oriented professional values were associated with higher EMR use than the lack of patient-oriented professional values. Also regardless of profession orientation, organization-oriented professional values were associated with higher EMR use than the lack of organization-oriented professional values. It's possible that the separation in the professional values among the physicians at MetroClinic played a role in how physicians incorporated this IT into their work.

Figure 6: Separation of professional values at MetroClinic.
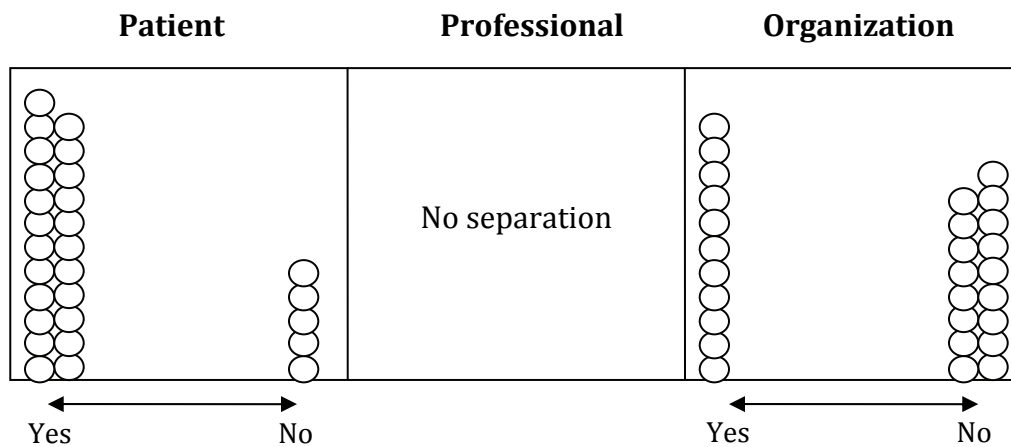
While the relationship between the number and orientation of the dimensions in professional values is not clear, it appears that both of these aspects of professional values are related to physician EMR use. The extent to which a physician uses an EMR may depend in part on the number or composition of his/her professional values. Professional values may be sticky and financial incentives may only go so far, as Tate reminded us in his willingness to pay up to $1000 per month to not use the EMR as MetroClinic intended. If the goal of EMR implementation is to

have all physicians using EMRs highly, then this IT must be made relevant for physicians regardless of what constitutes their professional values. If the goal is for EMRs to help physicians deliver effective and efficient care, then the designs of these systems should recognize and allow space for between-physician differences in professional values. The results of this study suggest the need to further consider the relationship between the dimensionality and orientation of professional values and IT use.

PERSPECTIVES OF UNCERTAINTY

The finding that physician perspectives of uncertainty are associated with EMR use is a potentially important contribution to information systems and organizational behavior research. Previous IT use research has not yet examined this relationship, and this could be an additional source of understandings of how professionals incorporate IT into their work. From a socio-technical perspective, we know that IT structures and organizational structures shape each other as people, technology and processes interact during IT implementation and use (Barley, 1986). From a technology acceptance perspective we know that individual perceived usefulness and perceived ease of use predict intention to use IT (Davis, 1989; Venkatesh et al., 2003). From an organizational learning perspective, we know that a groups' ability to learn to use a new technologically advanced procedure is associated with the nature of the interdependencies among the team leader and the rest of the team (Edmondson, 2003). From a virtual collaboration perspective, we know that physicians must trust each other before they will collaborate through

telemedicine technologies (Paul & McDaniel, 2004). The finding that between-physician differences in EMR use are associated with between-physician differences in perspectives of uncertainty adds an additional set of understandings to the problem of IT use.

Research on uncertainty can be categorized into two major streams: 1) research that examines uncertainty from a traditional perspective and 2) research that examines uncertainty from an alternative perspective – one that considers some uncertainty as fundamental. In summary, traditional uncertainty is uncertainty that can be reduced or managed with information (i.e. by obtaining more/better information or by improving information processing capacity). This view is the typical view of uncertainty in information theory and organizational theory and the majority of research on uncertainty in these fields takes this perspective (Clemen & Reilly, 2001; Daft, 1989; Galbraith, 1973; Knight, 1921; Schrader, Riggs, Smith, 1993; Stinchcombe, 1990; Tushman & Nadler, 1978). Fundamental uncertainty, on the other hand, is uncertainty that is irreducible (Cilliers, 1998). Fundamental uncertainty is uncertainty that is not a result of ignorance (lack of information) or the partiality of human knowledge but is a characteristic of the world itself (Sornette, 2006). Uncertainty of this kind is often described as probabilistic as opposed to predictable (although it can be deterministic) (Liebovitch, 1988). The presence of nonlinearity in complex systems contributes to fundamental uncertainty. This research stream originates in chaos theory and complexity theory and is moving into the organization theory and information systems literatures (Anderson, 1999; Brown & Eisenhardt, 1997; Capra,

1996; Cilliers, 1998; Gell-Mann, 1994; Liebovitch, 1988; Maguire et al., 2006; McDaniel, 1997; McKelvey, 2006; Merali, 2006; West, 2006).

Traditional Uncertainty

Organizational researchers and information theorist have been studying uncertainty for decades. Most researchers focus on uncertainty reduction, and summarize uncertainty as the lack of information and define uncertainty reduction as the process of gathering information relevant to the variables defined within one's model of the problem at hand (Schrader et al., 1993). Schrader et al. (1993) examine the notion of unforeseeable uncertainty, which they define as the inability to recognize and articulate some of the relevant variables and their functional relationships. Tushman and Nadler (1978) argue that organizational performance is a function of the match between information processing needs and the organization's information processing capacity (Tushman & Nadler, 1978). This definition is consistent with the mathematical theory of communication (Shannon & Weaver, 1949). These perspectives all point to information for managing uncertainty.

One could argue that it makes logical sense that individuals with a traditional perspective on uncertainty would be higher users of IT. IT is generally implemented to help people and/or organizations store, organize, analyze, transfer, etc. information, and IT often does these things better and more efficiently than humans. It makes intuitive sense then that physicians focused on improving the availability, storage, organization and transfer of clinical information would be high users of an

EMR. In this study, high EMR users made an effort to use the EMR fully, even if it decreased their individual work efficiency (as it often did). Sometimes physicians categorized as high EMR users treated EMR use as a hobby – spending high volumes of time to tailor and revise templates, develop quick text/macros, talk with the IT department staff about new features, etc.

Physicians with a traditional perspective of uncertainty might be prone to making some problematic oversights. For instance, physicians who overemphasize the role of information in managing uncertainty could fall into a trap of "cluttering up the medical record." Several physicians spoke about physician peers who put too much information in the medical record, making it difficult to see the information they needed to see or making it difficult to recognize a meaningful change in the patient condition. An overreliance on information may result in circumstances where information blocks, as opposed to facilitates, effective decision making. Another problem that can occur with physicians taking a traditional perspective of uncertainty is their making an erroneous assumption that information in the EMR is correct/accurate. This issue arose many times in the data. Physicians with a traditional perspective of uncertainty tended to view information in the EMR as accurate. They seemed to rarely question the accuracy of the information in the EMR. Even though EMRs are generally thought of as strategies for reducing errors, a lack of appropriate questioning the information in an EMR could increase errors or introduce new errors (Ash et al., 2004).

Fundamental Uncertainty

An important contribution complexity science makes to information systems research is the inclusion of fundamental uncertainty in the discussion of uncertainty management. Fundamental uncertainty is uncertainty that cannot be reduced by collecting more information or by manipulating existing information (Anderson, 1999; Capra, 2002; McDaniel, 1997; McDaniel & Driebe, 2001; West, 2006). Fundamental uncertainty is inherent in CAS; it is a result of underlying principles and the dynamism of CAS. In systems where fundamental uncertainty exists, uncertainty reduction strategies alone are unlikely to lead to maximum system performance (McDaniel, Lanham & Anderson, 2009). Dealing effectively with fundamental uncertainty requires a different kind of approach (non-reductionist). One such approach is uncertainty absorption (March & Simon, 1958; Boisot & Child, 1999). Rather than prioritizing one strategy over another, the most effective strategies for managing uncertainty in CAS may come from appropriately using both uncertainty reduction strategies and uncertainty absorption strategies.

Previous work in information systems literature relates to the notion of fundamental uncertainty. The notions of ambiguity, equivocality and wicked problems are similar to but not the same as the notion of fundamental uncertainty. Ambiguity and equivocality both suggest a lack of clarity about meaning; the possibility exists that something can be interpreted in more than one way. A key difference between the notions of ambiguity and equivocality and the notion of fundamental uncertainty is that ambiguity and equivocality can usually be resolved through conversation whereas fundamental uncertainty cannot. Wicked problems

are problems that are impossible to solve because of incomplete, contradictory and changing requirements. The idea of wicked problems is more closely related to fundamental uncertainty than ambiguity and equivocality because this idea acknowledges a role for complex interdependencies in problem solving. Wicked problems are in many ways a predecessor to what one might now term problems involving fundamental uncertainty.

It might be helpful to think about this problem in light of work suggesting the need for semi-confusing designs of information systems in organizations operating in dynamic environments (Hedberg & Jonsson, 1978). It is also consistent with work by Weick (1985) which suggests the need for caution as organizations become increasingly reliant on IT, particularly in terms of situations where IT can lead to misinterpretations of data and information, where IT drives out attention to non-routine work and where IT blocks sensemaking (Weick, 1985).

Physicians with a fundamental perspective of uncertainty might be prone to some problematic pitfalls. For instance, physicians who do not adequately reference information available in an EMR can make decisions resulting in life-threatening implications. In talking with Ted, a specialty physician, he spoke of a time when finding some obscure information in his patient's medical history resulted in him not ordering a procedure (which up until that moment he was seriously considering ordering for the patient) that would have caused her to "bleed out." Overreliance on decision making heuristics that give priority to physician intuition, local experience or the "art of medicine" can lead to redundancies in care which are highly inefficient,

costly and can lead to serious medical errors (Groopman, 2007). Paul, a specialty

physician, expressed it this way, "The way I see it, an EMR saves blood and time."

Professional Values and Perspectives of Uncertainty

The analysis of the data from the six cases provided insights, particularly in

terms of the linkage between professional values and perspectives of uncertainty. I

found that a physician who is a high EMR user is likely to have high dimensionality

in his/her professional value space and is likely to have a traditional perspective of

uncertainty. On one hand, high dimensionality in professional values indicates

openness to considering multiple aspects of professional values important, or an

ability to focus on multiple important items in tandem. On the other hand, one

could argue that a traditional perspective of uncertainty indicates a restricted, less-

than-open attitude on managing uncertainty. Looking at the results from the other

extreme, we see that a physician who is a low EMR user is likely to have low

dimensionality in his/her professional value space and is likely to recognize

fundamental uncertainty. The same issue exists in this scenario – a mismatch in the

nature of these two variables associated with EMR use. This observation is difficult

to explain, particularly because there seems to be within-subject inconsistency in

the degree of openness exhibited by physicians.

Another insight that emerged from the analysis of the six cases was the

discovery of patient-oriented data in the perspectives of uncertainty for physicians

that had expressed little to no patient-orientation in their professional values.

Because between-physician differences in professional values and between-

physician differences in perspectives of uncertainty emerged as key variables early in the data analysis, I organized the data first by professional values and perspectives of uncertainty. I then analyzed both of these key variables separately from each other and developed categories within each key variable that seemed to capture and organize the majority of the content within each key variable. In this analysis, patient-orientation emerged as an important category in professional values but did not emerge as an important category in perspectives of uncertainty. Both Charlie and Tate had multiple patient-oriented statements in their data coded for perspectives of uncertainty. If one were to analyze these physicians' professional values without also analyzing their perspectives of uncertainty, one would likely conclude that Charlie and Tate express little to no patient-orientation. Close examination of both of these variables together produces a different story of these physicians and their EMR use than analysis of either one of these variables alone. For instance, patient-oriented statements contained within text coded as perspectives of uncertainty could be interpreted as signaling greater overall patient-orientation than patient-oriented statements contained within text coded as professional values. This suggests a need to be cautious when drawing conclusions based on analysis of professional values and perspectives of uncertainty independently from each other. It also suggests a need to refrain from using the categorization results from the analysis of one key variable (ex. professional values) to characterize the whole physician.

One interpretation of this observation may stem from taking a closer look at how these six physicians use tacit and explicit knowledge (see Table 8 at the end of

Chapter 4). Information and knowledge that can be articulated, codified or stored in an EMR is explicit (Polanyi, 1958; Nonaka, 1994). Information and knowledge that is difficult to articulate, codify and store in an EMR is tacit (Polanyi, 1966). In general, the physicians with traditional perspectives of uncertainty gave priority to information and/or knowledge that could be explicated or codified in an EMR. These physicians often invested time and energy inputting, manipulating and retrieving patient information from the EMR. They did not ignore their patients, but they seemed to place priority on the information that was stored in the EMR as opposed to in the patient. Physicians who recognized fundamental uncertainty tended to give priority to information and/or knowledge that was not easily explicated or codified (i.e. tacit information and/or knowledge). These physicians often invested time and energy in the exchange of knowledge during a patient encounter. They did not ignore the information in the EMR, but seemed to place priority on the information contained in their patients as opposed to the information in the EMR. These physicians often spoke about patient encounters as unfolding as opposed to planned and emphasized the intricacies associated with the exchange of information and knowledge between physicians and patients. Assuming that information and knowledge are critical to a physician's work, it is logical to assert that physicians will choose to spend time with information and knowledge resources they see as valuable and accurate. Perhaps physicians that perceive tacit information and knowledge as valuable and accurate will spend more time and energy in the patient encounter and will be more patient-oriented in their perspectives of uncertainty. At the same time, perhaps physicians that perceive

explicit information and knowledge as valuable and accurate will spend more time and energy with an EMR and will be more information-oriented in their perspectives of uncertainty. Reviewing Table 8, one can see that the three physicians who were exemplar high EMR users tended to speak about explicit information in their perspectives of uncertainty column while the three physicians who were exemplar low EMR users tended to speak about tacit information contained in physicians and patients in their perspectives of uncertainty column. These findings suggest a relationship between physician preferences for tacit/explicit knowledge and their perspectives of uncertainty.

Another important insight that stems from this analysis is the extent to which physicians working in the same practice can differ from each other in terms of their professional values and perspectives of uncertainty. John and Charlie were from the same practice as were and Norman and Tate. These cases were helpful in illustrating the extent to which seemingly similar physicians can differ from each other in terms of EMR use, but also in terms of professional values and perspectives of uncertainty. This observation points out the fact that heterogeneity in EMR use may be more difficult to understand than previously believed. Professional values and perceptions of uncertainty are difficult to observe, yet if these two variables are to be considered important in understanding physician EMR use then reliable observation strategies will need to be developed.

A Twist on Perspectives of Uncertainty and EMR Use

The following section provides a slightly different perspective on how physician perspectives of uncertainty might relate with EMR use. One must make assumptions about the world when operating under uncertainty, regardless of whether the uncertainty is traditional or fundamental, and expected results of action are sensitive to assumptions made. This idea of assumption making under conditions of uncertainty is relevant in this discussion. Physicians work under conditions of uncertainty (Anderson & McDaniel, 2000). In doing so, they must make assumptions about probabilities of various outcomes on a regular basis (ex. probability of correct diagnosis; likelihood that patients will understand plan of care; probability that prescribed medication will be effective, etc.). Conceptualizing the work of physicians this way enables the following idea about physician EMR use and perspectives of uncertainty. Perhaps the physicians that are high users of the EMR do so because they find it useful to explicate/codify their assumptions and resultant decisions. Maybe they like the fact that they can visualize and incorporate the results of their assumptions and decisions into future decision making activities. Following this logic, perhaps physicians that are low users of the EMR do not find explicating assumptions and decisions useful. In some ways, using an EMR calls attention to the fact that physicians are operating under conditions of high uncertainty and that physicians don't know all the answers. One could imagine how this could be distressing and/or could make some physicians uncomfortable and thus reluctant to use an EMR.

Therefore, instead of thinking about low EMR users as physicians who recognize the presence of fundamental uncertainty, it may be useful to think about low EMR users as physicians who are uncomfortable codifying the information they use and the decisions they make. Discomfort felt in codifying information and decisions could be related to the belief that physicians operate under conditions of uncertainty that are irreducible with information. This discomfort could stem from the recognition that one operates under conditions of uncertainty in general as opposed to conditions of fundamental or traditional uncertainty. Perhaps all physicians recognize fundamental uncertainty, but physicians who are high EMR users have less anxiety about codifying information and decisions while physicians who are low EMR users have more anxiety about these activities.

Uncertainty may be a consequence of a lack of information or it may be a consequence of inability to know the nonlinearities in the interdependencies of the variables of a system. The extent to which a physician uses an EMR may depend in part on how s/he perceives uncertainty. Individual perspectives of uncertainty may not be very malleable (Kruglanski, 1989). If the goal of EMR implementation is to have all physicians using EMRs highly, then steps improving the relevance of this IT for physicians who acknowledge fundamental uncertainty in their work need to be taken. If the goal is for EMRs to help physicians practice better, safer, more efficient medicine, then the designs of this IT should adequately accommodate between-physician differences in perspectives of uncertainty. The results of this study suggest the need to further consider the relationship between individual perspectives of uncertainty and IT use.

There were three outliers in the results outlined in Table 8 at the end of Chapter 4 (Cecil, Craig and Mirelle). This section discusses plausible explanations for these outliers. Cecil and Craig were physicians from the same specialty practice. This particular practice had a strong practice-level EMR use. All four physicians in this clinic used the same template(s) to record clinical documentation. These physicians decided as a group what items to include/exclude on their EMR templates. They met regularly to discuss the EMR template and made modifications to the templates only if everyone was in agreement on what needed to be modified. One physician from this practice spoke about this in an interview by saying:

> *"And sometimes I'll modify [the templates] for my whole section. And when I do that, I'll strike some stuff off that I think it's not important. One of my partners go, "Wow!" "Back up" "I need that." And I go, "Wow" you know "I can't believe you need that." You know "I didn't think anybody was doing that." And so sometimes we will preserve something for one guy. But a lot of times you know manipulation will apply in a positive way to all of us."*

I use this quote to show the possibility that in some circumstances practice-level factors of EMR use may override individual-level factors of EMR use. While my study did not focus on work group or team level IT use, this observation may hint at the possibility that collective IT use by groups may supersede factors shaping individual level IT use. In the cases of Cecil and Craig, their practice made an effort to use the EMR as a group. The four physicians differed from each other, however,

along many of the individual-level variables. All four physicians were categorized as high EMR users. In terms of professional values, Paul and Craig had two dimensions and Cecil and Ted had three. Paul and Ted expressed organization-orientation as their top professional value and Cecil and Craig expressed patient-orientation as their top professional value. In terms of perspectives of uncertainty, Paul and Ted were categorized as having a traditional perspective of uncertainty, Cecil as fundamental uncertainty and Craig as having a hybrid of the two perspectives of uncertainty. In terms of information, Paul and Ted gave priority to explicit information and knowledge whereas Cecil and Craig used both explicit and tacit information and knowledge relatively evenly. Table 9 provides the data on the four physicians from this practice.

Table 9: Individual differences and practice similarities.

Physician	EMR Use	Values #	Uncertainty	Top Value	Information	Specialist/ Generalist	Practice #
Paul	**High**	2	Traditional	Organization	Explicit	Spec	7
Cecil	**High**	3	Fundamental	Patient	Both	Spec	7
Ted	**High**	3	Traditional	Organization	Explicit	Spec	7
Craig	**High**	2	Hybrid	Patient	Both	Spec	7

The outliers Cecil and Craig provide evidence supporting the notion that practice-level EMR use can in some cases take precedence over individual-level EMR use. Looking at the individual data for Cecil and Craig, one might predict them to be medium or perhaps even low users of the EMR. Considering the fact that all four physicians in this practice were high users of the EMR along with the data on this practice in terms of how they made EMR use decisions as a group, it seems plausible that practice-level forces were playing a role in Cecil and Craig's EMR use.

Another outlier is Mirelle, specialty physician from Specialty Practice 3. Mirelle's results (provided below in Table 10) on each of these variables are most consistent with the physicians who were categorized as low EMR users. She expressed only one dimension in her professional value space, this value was profession-oriented, she gave priority to tacit information and knowledge and had a fundamental perspective of uncertainty. Considering all of this data in light of the study findings, one would predict Mirelle to be a low EMR user. As turns out, Mirelle was a medium EMR user.

Table10: Results from outlier, Mirelle.

Physician	EMR Use	Values #	Uncertainty	Top Value	Information	Specialist/ Generalist	Practice #
Mirelle	**Med**	1	Fundamental	Profession	Tacit	Spec	8

It is not clear what factors led to Mirelle's being an outlier, but the following ideas could be considered plausible explanations. The fact that Mirelle was a female may have played a role in her higher than expected EMR use. In this data, there were no females categorized as low EMR users. Another possible explanation for Mirelle's medium EMR use is her age. Mirelle is aged 30-39 and some studies have indicated a linkage between age an IT acceptance/use (Venkatesh et al., 2003). Another possible explanation is her short organizational tenure. Mirelle joined MetroClinic approximately three months prior to the data collection in her practice. She may have put forth extra effort learning and using the EMR because she did not feel that she could oppose the EMR given the fact that she was so new to the clinic. These are a few ideas for interpreting the results on these three outlier physicians.

LIMITATIONS

This kind of study has inherent limitations, particularly in terms of its qualitative nature, interpretive approach, and considerations for generalizability. The explanations for heterogeneity of IT use in health care organizations are based on insights gained from 28 physicians working in eight clinics operating within one health care organization. My primary objective was to conduct an in-depth investigation of why individuals and operating in similar contexts used the same IT differently from each other. In doing so, I traded off breadth of generalization in favor of depth of the analysis.

Qualitative studies require caution when generalizing to other populations or settings. Thus, the value in this research is not in its predictive capacity. Rather, the value of this type of study is in the new understandings of or insights about a particular phenomenon that has yet to be closely examined. While it may be tempting to make generalizing statements from the findings of this research, this should be avoided as what I have observed and asserted is context dependent and derived from a small, non-random sample.

This study reflects a dynamic, evolving research design. I started the study with certain assumptions about the world and about the research and worked to be honest with myself and explicit with others about these assumptions. I entered the field with a diversity of models from previous research to help me address my research question. In an effort to uncover new variables of interest for understanding differences in IT use, I iteratively redefined my constructs and refined my interpretations as I learned more about the problem and the research

context. Consequently, I have little understandings of the relative importance of each dimension of professional values or each perspective of uncertainty on IT use.

The IT studied was sophisticated but limited in scope which likely affected the number and nature of explanatory variables encountered. A study involving a different IT artifact may lead to different usage patterns and its use may be influenced by variables not detected in this study.

Additionally, as is generally true of case research, some sources of heterogeneity could not be assessed. The eight practices studied were relatively small which likely influenced the types of variables uncovered as important in understanding between-physician differences in IT use. Future research should consider larger work groups to see how work group size affects the variables of interest or the heterogeneity in IT use.

The interdependencies between the eight practices and other practices were minimal. Future research should consider systems with greater interdependencies to see how degree of interdependence affects the amount of heterogeneity in IT use.

This study has limitations that must be acknowledged. This study had high reliance on single researcher and did not make use of inter-rater reliability as it is frequently used in this type of research. To mitigate issues arising from this limitation, I used debriefing sessions with co-investigators to check assumptions, guide data analysis efforts, refine interpretations and develop theory.

Professional values and perspectives of uncertainty are difficult to observe and measure. Thus, operationalization and testing of these findings may be difficult.

Additional research will be required to develop methods for observing these variables and testing their proposed linkages with IT use.

IMPLICATIONS FOR RESEARCH

Future efforts to understand heterogeneous IT use in professional organizations should consider the role of professional values and perceptions of uncertainty in IT use.

The professional values identified in this study were profession-, patient-, and organization-oriented. These three dimensions capture the majority of value statements expressed by physicians during the study. While consistent with physicians' values identified in other research (Kaplan, 1987), these three dimensions may not encompass the full range of possible values held by professionals. Nonetheless, the findings from this study remain relevant for future investigations of IT use. Future IT use research should consider both the number and the orientation of professional values as important in understanding IT use by professionals. The results of this study suggest that professionals with more dimensions in their professional values are higher users of IT than professionals with fewer dimensions in their professional values. Additionally, these results suggest that professionals with organization-oriented professional values may be higher users of IT than professionals without organization-oriented professional values. The patient-oriented values are more difficult to generalize to other professional settings. For instance, patients in health care organizations are analogous to both customers and products in other professional settings. Thus, the

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findings from this study suggest that professionals with customer and/or product oriented professional values may be higher users of IT than professionals without these dimensions in their professional values. The relationships between 1) the number of professional values and IT use and 2) the orientation of professional values and IT use need additional examination. Moreover, the causality of these relationships need further examination as this study suggests an association between these variables but does not address the problem of causality.

The results of this study also generate relevant implications for future research examining the role of perspectives of uncertainty in IT use. The findings discussed in this chapter suggest a need for further examinations of the relationship between perspectives of uncertainty and IT use. This study identified three perspectives of uncertainty held by physicians: 1) traditional, 2) fundamental and 3) a hybrid perspective that combined aspects of both traditional and fundamental perspectives of uncertainty. I found that physicians who held traditional perspectives of uncertainty tended to be higher users of IT than physicians who held fundamental perspectives of uncertainty. This finding is particularly interesting as it has not been identified by previous research as relevant to understanding IT use. Additional studies of the relationship between how professionals perceive uncertainty and manage uncertainty and how they use IT are needed.

In addition to individual-level IT use, group-level IT use may be important in understanding heterogeneous IT use in professional settings. For this reason, multilevel studies investigating individual and collective IT use should be considered in future research (Burton-Jones & Gallivan, 2007). The findings from

specialty clinic 2 indicate that collective IT use by work groups may be an emergent property arising from the local interactions of agents operating within a group. Research following this logic should investigate not only the properties of the individuals in the system, but also the rules by which the individuals interact with each other over time (Epstein & Axtell, 1996). Given the importance of agent interactions in emergent properties, work relationships (Lanham et al., 2009) may be an important consideration in explaining IT use as an emergent property. Additional understandings of heterogeneity of IT use in professional organizations are likely to come from longitudinal studies as well as from comparative studies. Longitudinal studies designed to observe the dynamics of individual-level and/or group-level IT use are needed to develop better understanding of the dynamics of IT use in professional organizations.

IMPLICATIONS FOR PRACTICE

This study revealed that heterogeneity in IT use can be associated with heterogeneity in professional values and heterogeneity in perspectives of uncertainty. These findings have the potential to have implications on how IT is designed, implemented and managed. The insight provided by a framework for studying diversity (Harrison & Klein, 2007) has implications for IT management in settings where individuals are separated along professional values. Whereas variety in expertise or differences in knowledge can lead to increased creativity, better problem solving and innovation, separation across an organization in the professional values held by individuals can lead to reduced cohesiveness, increased

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conflict, decreased trust, and reduced performance. Understanding IT use in professional organizations could, therefore, be used as a strategy for managing diversity. This insight suggests that professionals and managers should find ways to acknowledge and productively deal with differences in professional values. Because separation types of diversity tend to be associated with negative organizational consequences, the goal of managing separation of professional values should perhaps focus on making differences in professional values benign as opposed to beneficial. Regardless, if left unmanaged differences in professional values may erode work relationships and organizational performance over time, or may prevent an organization from achieving its goals.

Executives often believe they want employees to be homogenous in their use of IT. Idiosyncratic differences in IT use tend to be viewed as behavior that will prevent organizations from realizing the full benefits of IT investments. This view of heterogeneity of IT use would likely lead an executive or IT manager to pursue paths of standardizing IT use (i.e. minimizing variability in IT use behavior will always lead to better organizational performance). Standardization may not be the only, or the best, path in IT management pursuits. The results of this study suggest that heterogeneous IT use in professional organizations may be inherent. Professional values and perspectives of uncertainty are characteristics of individuals that may be difficult to change. Moreover, physicians in this study seemed to guard their professional values (i.e. they did not speak very easily or openly about their values). Finally, physicians' perspectives of uncertainty were somewhat subtle in the data and physicians did not seem overtly conscious about

their perspectives of uncertainty. Thus, it may be difficult to change IT use behavior when individuals are highly autonomous in their work, when values are protected and when perspectives of uncertainty are less than obvious.

It may also be true that in professional organizations, efforts to standardize IT use may be seen as efforts to de-professionalize work. Efforts to standardize how professionals use IT might be better spent developing strategies for leveraging the differences in IT use. IT managers should work to assess the consequences of heterogeneous IT use before attempting to eliminate it. Possible strategies for managing heterogeneous IT use include developing relationships among professionals that encourage knowledge transfer about IT use as opposed to focusing only on developing relationships between the IT department and each professional (i.e. enable decentralized conversations that focus on IT and IT use). Alternatively, managers could evaluate IT use in terms of overall patterns of IT use as opposed to evaluating one element at a time. An example of this is to ask the question, "For what kinds of tasks does Dr. Jones typically use the EMR?" vs. "Is Dr. Jones using the prescription fax feature of the EMR?" Evaluating patterns of IT use could help the organization learn about current IT use and future IT use capabilities. IT designs and implementations should involve users in ways that frame user input in terms of professional values and perspectives of uncertainty. Doing so would allow organizations to improve IT use by working within professional values and within perspectives of uncertainty as opposed to focusing only on optimizing work tasks.

These insights are relevant for health IT (HIT) managers. This study suggests that HIT managers should actively look for and try to better understand differences in EMR use among physicians, particularly differences in physicians' professional values and differences in how physicians view uncertainty. IT managers should consider heterogeneous IT use as a source of learning in organizations. In all of my time in the field, I noted very few conversations where physicians, nurses, etc. asked about or shared with each other their rationale for using the EMR as they did. Differences in EMR use at MetroClinic seemed in one sense taboo. One can envision scenarios where conversations about differences in EMR use could be beneficial to organizations such as MetroClinic. In professional organizations where work is ambiguous, complex and non-routine, heterogeneous IT use may be an important source of learning about both the IT and the task at hand.

HIT managers should encourage task-oriented interaction among physicians that would enable physicians to explore their differences and learn from each other as they seek ways to improve the practice of medicine. The clinical encounter is the source for evidence-creating medicine (Bohmer, 2009) and learning while doing. Differences in EMR use, when treated as a source of understanding rather than behavior that needs to be corrected, offer a potentially rich source of new IT management insights. For example, physicians who tend to use the EMR minimally should be encouraged to interact with physicians who are high users of the EMR. Physicians with subtle differences in EMR use should be encouraged to talk with each other about why they use the IT as they do. Physicians that hold different values and/or different perspectives of uncertainty should be encouraged to

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interact with each other. The objective should not be to merge the differences, but rather to learn from the differences. It is the IT use that can provide a bridge between differences. It is the IT use that can create a space for learning – learning about the practice of medicine, the organization and about the IT artifact itself. Being able to recognize the presence of this bridge and the possibility of IT use as a space for learning is difficult. It will require a mindset that is comfortable with differences and a willingness to learn from differences.

Chapter 6: Conclusions

Through this research, I developed additional theory of IT use. My goal was to understand why seemingly similar professionals working in the same organization use the same IT differently from each other. Findings from this study suggest that IT use can be a function of professional values and perspectives of uncertainty.

In addition to identifying two additional variables relevant to understanding IT use, this research generates questions for future research. Beyond the inclusion of professional values and perceptions of uncertainty in studies of IT use, levels of heterogeneity in IT use and organizational perspectives of heterogeneous IT use and their linkages with organizational learning should be examined.

Data from this research suggests that individuals using IT in significantly different ways from their peers developed the same socially acceptable explanation for these differences. Without variation, when I asked about unconventional EMR use behaviors physicians responded, "It's all about efficiency." Upon analyzing the data, the efficiency argument explained less and less of what I observed. When probed further, physicians spoke about additional rationales for why they used the EMR differently from their peers. For example, I heard the following explanations. One family physician said that he used the dictation process as a way to think about the patient's case in real time and as a way to reflect on previous medical decision making. This physician stated that the narrative, or the story, of the medical case is what drives his thought processes and decision making activities. Another physician explained his unconventional use of the EMR as a way to maintain the role

of his nurse as an integral part of his practice. This physician used his nurse heavily in making decisions and in managing his extensive and established patient panel. Another physician eventually explained his unconventional use of the EMR as a way to best care for his patients. She believed that working at the nurses' station, as opposed to her office, in the presence of not only her nurse and MA but also the entire nurse support staff helped in delivering high quality care to patients. The efficiency explanation for heterogeneous EMR use behaviors may have maintained separation among physicians at MetroClinic and blocked learning about the EMR, the practice of medicine, and the organization.

Efficiency was believed to be a widely-held value in MetroClinic. Physicians learned that they could respond to inquiries about unconventional EMR use by saying the adapted behavior made them more efficient. This response to heterogeneous EMR use may have created conditions where physicians were not able to learn from the differences in EMR use behaviors. Figure 7 is a conceptual model of IT use developed during the course of this study. The linkages between professional values and IT use and between perspectives of uncertainty and IT use are the data-driven portion of this model. The remainder of this conceptual model is speculation, but is nonetheless based on observations made during this study.

In this model, I integrate ideas from information systems, organizational theory and complexity science. In doing so, I seek to build new theory of IT use focused particularly on IT use in professional organizations. This theory articulates a positive relationship between the dimensionality of professional values and IT use, a positive relationship between traditional views on uncertainty and IT use, and

suggests that heterogeneity in IT use can be an important source of organizational learning.

Figure 7: Conceptual model of IT use in professional organizations.
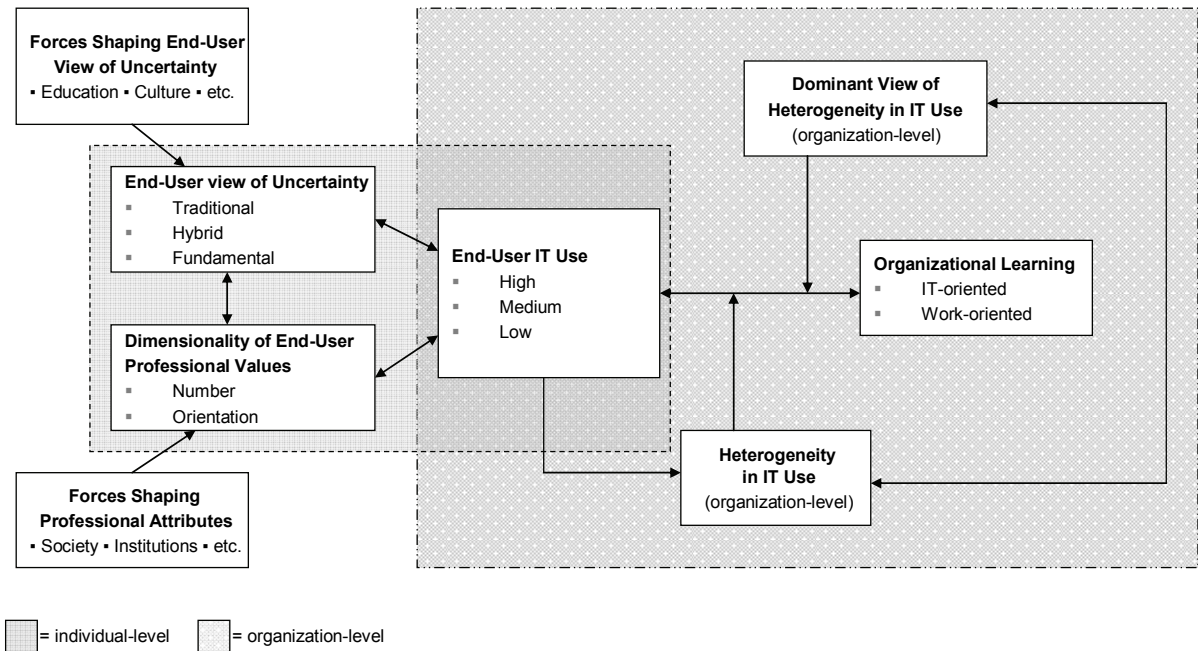
Heterogeneous IT use is not inherently positive or negative. Heterogeneous IT use may be a source of learning. This study suggests that professional values and perspectives of uncertainty should be considered when researching or managing IT in professional organizations. In addition to considering the role of professional values and perspectives of uncertainty in IT use, IT researchers and managers should find ways to help professionals recognize and use IT as an artifact for learning. IT has the potential to generate conversations between professionals.

Professionals who have difficulty talking with each other about differences in how they approach their work may find it easier to ask tough questions about how they use IT.

The idea that professionals differ in how they use IT is not controversial. Organizational and information systems scholars have acknowledged this in previous research. What is novel about this research is the focus on understanding the heterogeneity in IT use. Additionally, rather than approaching heterogeneous IT use as a problem that needs to be resolved (i.e. reduced, standardized), this study approaches heterogeneous IT use as a phenomenon from which one can learn about both IT users and the organizations in which IT is used. This research contributes two new variables to the study of IT use in professional contexts.

First, the dimensionality of the values professionals bring with them to the organizations in which they work may be important in explaining IT use. I found that physicians with a higher number of dimensions in their professional value space exhibited higher EMR use than physicians with fewer dimensions. I also found that the orientation of professional values were associated with IT use. Physicians with patient- and/or organization-oriented values tended to be higher EMR users than physicians that did not express those professional values. These findings have implications for many areas including IT design, IT implementation, and management of IT in professional organizations. In managing IT, we often think that professionals share the same values, or that there is little heterogeneity in values held by professionals, particularly among seemingly similar professionals such as physicians. This perception can be seen when IT design and/or

implementation efforts seek end-user input. Often, efforts to involve end-users do so with the goal of defining end-user requirements for a homogeneous set of end-users. This research suggests a need to revisit IT management strategies such as those seeking end-user involvement in developing requirements specifications.

Second, perceptions of uncertainty may be important in explaining IT use in professional settings. I found that physicians who perceived uncertainty primarily as reducible with information exhibited higher EMR use than physicians who indicated a recognition of fundamental uncertainty. This finding has implications for IT design, IT implementation and management of IT in professional organizations. For example, IT policy makers and managers often assume that professionals want the same kinds of information and that professionals think similarly about how to create, codify and transfer knowledge. This study suggests that professionals differ in how the think about and assign priority to information and knowledge. Previous studies have examined the relationship between differences in work practices and IT use, but few if any have studied the relationships between differences in perceptions of uncertainty and IT use. How professionals perceive uncertainty has implications for how they view and use information and knowledge. The relationship between information and behavior is not yet well understood and requires additional inquiry.

Based on the findings from an in-depth mixed methods study of EMR use in an integrated outpatient multispecialty health care delivery organization, I develop additional explanations of IT use focusing specifically on IT use in professional settings. Understandings of IT use in these setting are important because

professional organizations are becoming increasingly reliant on IT and limited knowledge exists about the fine-grained, micro-level factors associated with how professionals use IT in accomplishing their work. Additional research on this topic is needed, but the results of this study indicate the potential for this model to inform the way IT use is studied in the information systems and organizational theory literatures and the way IT is managed in professional organizations.

Appendices

[The EMR has been both overestimated and underestimated in terms of its usefulness and its potential for improving clinical practice. In this study, we are not working under any assumptions of the EMR in terms of whether it is good or bad for health care. In a sense, we are working with a mindset seeking to de-myth EMR technologies. This conversation is an effort to learn from you and from this clinic. Specifically, we want to learn about how you use information about the patient and information about the patient encounter, how you operate without an EMR within a larger organization that has an EMR, and what you think about the EMR. This interview is guided by a set of pre-determined questions, but the exact course of this interview will emerge from the interview process itself. Thus, each interview will be unique at some level. We believe this semi-structured approach will improve the potential for this study to provide rich insights about the use of information about the patient and about the patient encounter.]

Exploration of the clinic and its current use of information about the patient and the encounter

[Throughout this process, the interviewer will listen and watch carefully; continually probing for more information based on what the physician tells the interviewer. Treat the interview as a conversation from which new meaning is created, not as a script]

What is special or interesting about this practice?

Describe a typical day at this practice

[Interviewer will probe to help interviewee report sufficient detail]

Describe how you collected, recorded and organized information about the patient and the patient encounter yesterday from the time you arrived at work until the time you left.

> When is the first time you look at patient/clinical information?
>
> *[Explore what the physician is doing and how patient/clinical information is being used to do it]*
>
> Describe the different locations from which you use patient/clinical information?

What are the other times when you use patient/clinical information?

What other kinds of patient/clinical information do you routinely use? Why and when do you use them?

Imagine you are preparing for a visit with a patient who has a chronic condition. Describe your work process showing how you would use information, what kinds of information would you look for?

In doing your job, what kinds of things do you hope to accomplish through using patient/clinical information?

Describe how you address or integrate the recommended clinical guidelines into patient care processes

What is this clinic's process for updating and maintaining patient/clinical information?

Has this process changed over time? If so, how has it changed?

Do you believe the quality of this medical information will change after implementing an EMR? If so, describe how you think it will change.

Do you believe that your ability to access patient information will change after implementing an EMR? If so, describe how you think it will change.

Sensemaking and perceptions of an EMR

It is often difficult for physicians to make sense of what's going on with their patients, and different physicians have different methods to help them make sense of what's going on with their patients.

Describe how you make sense of what's going on with your patients.

Can you give an example of what resources you use to help you make sense of what's going on with your patients?

Can you give an example of how these resources might obstruct your ability to make sense of what's going?

Do you think an EMR will help you make sense of, or better understand, your patients' clinical situations? If so, how do you think it will help? If not, why not?

It is often difficult for patients to make sense of what's going on with their health, and different physicians have different methods to help patients make sense of what's going on with their health.

Describe how you help your patients make sense of what's going on with their health.

Can you describe a situation when you were particularly successful in getting a patient to understand their clinical situation? What resources did you use to help you do this?

Can you describe a situation when you were unsuccessful in getting a patient to understand their clinical situation? If so, what resources did   you use? What do you   think were some of the barriers to your helping your patient make sense of their health? Do you think an EMR would have helped you in this situation?

Do you think an EMR will help your patients make sense of, or better understand,   their clinical situation? If so, how do you think it will help? If not, why not?

History around decision to adopt an EMR

Talk with me about the time when this organization first considered purchasing an EMR.

What was this practice like then?

How was this technology perceived among the pediatrician groups?

What were the main concerns that people had about this technology?

Was there a lot of disagreement about the EMR among the pediatricians or not much at all?

What were the topics of disagreement/concern?

What made you first consider using an EMR?

Describe how the pediatricians have gone about making the decision to use an EMR (who did you talk to? What did you read? What EMR systems did you look at?)

How did you decide on this EMR?

What was the role of the other practice staff in this decision making process?

How is this clinic preparing to implement the EMR?

Who in the practice is going to be involved in this process? Probe specifically for the role each person played in the planning process?

Have you already received training in using the EMR? If so, would you describe this training process for me?

Worker Relationships

How would you describe the relationships among physicians in this practice?

Among clinical support staff?

Among non-clinical support staff?

How do you relate with other physicians in this clinic?

Clinical support staff?

Non-clinical support staff?

Do you think the presence of an EMR will change how you relate with other physicians in this practice?

In the organization?

With clinical support staff?

With non-clinical support staff?

What's your perception of how the EMR changes the way people in practices relate with each other? How did you arrive at this perception?

When there are non-medical decisions to be made in this clinic, how are they usually made?

When there are disagreements in this clinic of a non-medical nature, how are they usually resolved?

There are some medical decisions that are not patient specific that clinics sometimes make. For example, how to manage patients with diabetes. How are these decisions usually made?

Can you recall a particularly high stress or confusing situation that occurred in this practice? Describe the situation. What happened? How did the practice go about resolving the situation?

Final Questions

Imagine that I am the person who is developing the EMR you are about to use. What would you like to tell me about the EMR that I am developing for you and for this clinic?

Professional Values

One thing that distinguishes professionals from non-professionals is that they define their task, not the organization. Physicians often define their task differently from each other, even when their medical specialty is the same. One of the things I am having difficulty doing is getting people to talk with me about how they define their work task. Do you have any advice for me about how I might go about getting people to tell me how they define their task?

How do you define your task?

Are there any particular beliefs or values that you have about the practice of medicine that you think drives your approach to practicing medicine? If so, what are they?

All of us are better at some things than others. Are there any particular areas of expertise that you have that enable you to do your job particularly well? If so, what are they?

What have I not asked you that you think is important I know in order to better understand this clinic?

Thank you so much!

1. Physical location/Environment
    a. Location of the practice (building, setting, surrounding community)
    b. Setting - describe the layout and general appearance of the facility
        i. Adequacy of space
        ii. People flow
        iii. Location of computers/EMR
2. Describe the workflow in this practice
    a. What are the different functional areas of the practice (clinician group, clinical support staff, reception, billing, etc.)?
    b. Describe the number and types of people in each function area
    c. What is the training and background of each person (including office staff, nurses, and others)?
        i. What type of activities are done in each area?
        ii. How is the EMR used or not used to accomplish these tasks?
        iii. How is the EMR used different across these functional groups?
        iv. Observe and describe how the EMR is used different within these group (what different approaches do clinicians, clinical support staff, non-clinical staff, etc.) have for using the EMR
        v. Describe work flow in each of these areas and how the EMR is integrated into those processes
        vi. Describe patient flow through each of these areas and how the EMR is used to accomplish patient care tasks (including billing)
3. How well do people in this practice cooperate with each other?
    a. Describe any sources of tension or conflict that you observe
    b. Describe how conflicts are resolved?
    c. Describe or characterize the communication among practice members
4. Describe the system for patient flow through the practice. Pay particular attention to how the EMR is integrated into or used to accomplish these activities.
    a. What happens when the patient first enters the practice?
    b. What happens when the patient is called back?
    c. What happens both in and outside of the examination room?
        i. With office staff?
        ii. With clinical staff?
        iii. With clinicians?
    d. Where does the patient go after the examination is complete?
    e. What do practice members and patients do prior to the patient leaving the practice?
5. Overall, how well do people in this practice like using the EMR?
    a. Do people find the EMR easy to use?
    b. Do people feel the EMR make their work easier?
    c. Do people feel that using the EMR improves the quality of care they can provide to patients?
    d. What stories to practice members tell about the EMR?

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The purpose of this survey is to get a better idea of your work environment and your feelings about the patient information that you use. Individual respondents will not be identified by name in any analysis or report. Responses will be aggregated and reported as summary statistics only. For questions pertaining to this survey, please call Holly Lanham at (512) 970-9971 or Reuben McDaniel at (512) 471-9451.

Date: Month____ Day____ Year ____

Please indicate how much you agree or disagree with the following statements about this clinic. We ask that you answer these questions based on your perceptions about <u>the specific clinic you work in</u>, not the larger organization of which your clinic is a part.

Please select the box that best describes how much you <u>agree or disagree</u> wi following statements about this clinic.

	Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
1. This clinic encourages nursing staff (i.e. RN, LVN, MA and CMA) input for making changes.	☐	☐	☐	☐	☐	☐
2. Most people in this clinic are willing to change how they do things in response to feedback from others.	☐	☐	☐	☐	☐	☐
3. Most people in this clinic actively seek new ways to improve how we do things.	☐	☐	☐	☐	☐	☐
4. Most people in this clinic are comfortable voicing their opinion even though it may be unpopular.	☐	☐	☐	☐	☐	☐
5. Most people in this clinic pay attention to how their actions affect others in the clinic.	☐	☐	☐	☐	☐	☐
6. After making a change, we usually discuss what worked and what didn't.	☐	☐	☐	☐	☐	☐
7. Most people in this clinic get together to talk about their work.	☐	☐	☐	☐	☐	☐
8. On most days, information is communicated in this clinic through memos, post-it notes, or e-mails.	☐	☐	☐	☐	☐	☐
9. This clinic values people who have different points of view.	☐	☐	☐	☐	☐	☐
10. Difficult problems in this clinic are usually solved through face-to-face discussion.	☐	☐	☐	☐	☐	☐
11. We regularly take time to consider ways to improve how we do things.	☐	☐	☐	☐	☐	☐
12. In this clinic, someone usually makes sure that we stop to reflect on work processes.	☐	☐	☐	☐	☐	☐

Please continue onto the next page.

Please select the box that best describes how much you <u>agree or disagree</u> with the following statements about this clinic.

	Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
13. Most people in this clinic tend to think differently about important issues.	□	□	□	□	□	□
14. When there is a conflict in this clinic, the people involved are encouraged to talk about it.	□	□	□	□	□	□
15. Most people in this clinic regularly talk about their personal lives with coworkers.	□	□	□	□	□	□
16. Most people in this clinic do not feel they need to check all information they receive before acting on it.	□	□	□	□	□	□
17. Most people in this clinic understand how their job fits into the rest of the clinic.	□	□	□	□	□	□
18. This clinic usually encourages everybody's input for making changes.	□	□	□	□	□	□
19. My opinion is valued by others in this clinic.	□	□	□	□	□	□
20. The leadership in this clinic usually makes sure that we have the time and space necessary to discuss changes to improve care.	□	□	□	□	□	□

Please continue onto the next page.

Listed below are a number of statements that could describe your clinic. Please indicate the extent
to which each statement is an <u>accurate or inaccurate</u> description of the clinic in which you work.

How <u>accurate</u> is this statement for describing your clinic?	Very Inaccurate	Inaccurate	Slightly Inaccurate	Slightly Accurate	Accurate	Very Accurate
21. In this clinic, people often experiment with new ways of doing things.	☐	☐	☐	☐	☐	☐
22. Most people in this clinic look for feedback from people in the clinic as well as from patients and family members to understand how well we're performing our work.	☐	☐	☐	☐	☐	☐
23. Most people in this clinic look for feedback from people outside of the clinic to understand how well we are performing our work.	☐	☐	☐	☐	☐	☐
24. If you make a mistake in this clinic, it is often held against you.	☐	☐	☐	☐	☐	☐
25. People in this clinic usually share their special skills and expertise with each other.	☐	☐	☐	☐	☐	☐
26. It is often difficult to ask members of this clinic for help.	☐	☐	☐	☐	☐	☐
27. People in this clinic often speak up about issues under discussion.	☐	☐	☐	☐	☐	☐
28. This clinic frequently seeks new information that leads us to make important changes in our work.	☐	☐	☐	☐	☐	☐
29. We invite people from outside the clinic to present information or have discussions with us.	☐	☐	☐	☐	☐	☐
30. Problems or mistakes in this clinic are usually communicated to the appropriate people (whether clinic members or others) so that action can be taken.	☐	☐	☐	☐	☐	☐
31. Critical quality errors occur frequently in this clinic.	☐	☐	☐	☐	☐	☐
32. In this clinic, people talk about mistakes.	☐	☐	☐	☐	☐	☐
33. In this clinic, people talk about ways to learn from our mistakes.	☐	☐	☐	☐	☐	☐
34. People in this clinic often ask others for help.	☐	☐	☐	☐	☐	☐
35. In this clinic, we regularly take time to figure out ways to improve our work processes.	☐	☐	☐	☐	☐	☐
36. In this clinic, someone usually makes sure that we stop to reflect on and think about work Processes.	☐	☐	☐	☐	☐	☐

Please continue onto the next page.

Clinic Member Questionnaire

Listed below are a number of statements that could describe your clinic. Please select the box that best describes how much you <u>agree or disagree</u> with the following statements about this clinic.

	Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
37. Learning in this clinic tends to focus on specific problems.	☐	☐	☐	☐	☐	☐
38. We often learn how to do things in this clinic by sharing knowledge with each other.	☐	☐	☐	☐	☐	☐
39. In this clinic we have many resources that we can use to increase our knowledge about how we do our jobs.	☐	☐	☐	☐	☐	☐
40. Most people in this clinic learn a lot about how to do their job by talking with other people in the clinic.	☐	☐	☐	☐	☐	☐
41. When we have a problem in this clinic, we tend to examine it carefully so that we can come to an understanding of the problem.	☐	☐	☐	☐	☐	☐
42. People in this clinic are frequently taught new things by other people in this clinic.	☐	☐	☐	☐	☐	☐
43. In this clinic, people usually have time to think about how they are doing at their jobs.	☐	☐	☐	☐	☐	☐
44. In this clinic, physicians are encouraged to use practice guidelines as a way to deliver patient care.	☐	☐	☐	☐	☐	☐
45. Most people in this clinic go outside of the clinic to learn new things to help them with their job.	☐	☐	☐	☐	☐	☐
46. Even when things are going well in this clinic, we think about changing the way things are done around here.	☐	☐	☐	☐	☐	☐
47. In this clinic, we frequently learn about new things together as a group.	☐	☐	☐	☐	☐	☐
48. I would be more effective in my work if people in this clinic would leave me alone and let me do my job.	☐	☐	☐	☐	☐	☐
49. In this clinic, we tend to look for several good ways to do things.	☐	☐	☐	☐	☐	☐
50. People in this clinic often consider changing the way they work because of things they have learned.	☐	☐	☐	☐	☐	☐
51. Learning in this clinic is often focused on matters that lead me to question what we already know.	☐	☐	☐	☐	☐	☐
52. Most people in this clinic ask other people here how they do things.	☐	☐	☐	☐	☐	☐
53. People in this clinic frequently teach other people in this clinic new things.	☐	☐	☐	☐	☐	☐
54. We are encouraged to experiment with new ways of doing things in this clinic.	☐	☐	☐	☐	☐	☐
55. Most people in this clinic need to learn all the time in order to be successful at their job.	☐	☐	☐	☐	☐	☐
56. In this clinic we usually have a lot of flexibility in how we do our work.	☐	☐	☐	☐	☐	☐
57. In this clinic we usually try to tailor treatments to fit the specific needs of each patient.	☐	☐	☐	☐	☐	☐

Please continue onto the next page.

Clinic Member Questionnaire

**Listed below are a number of statements that could describe how you make sense of confusing
situations at work. Please indicate the extent to which each statement is an <u>accurate or
inaccurate</u> description of how you respond to confusing situations at work.**

*How <u>accurate</u> is this statement for describing how you make sense
of confusing situations at work?*

	Very Inaccurate	Inaccurate	Slightly Inaccurate	Slightly Accurate	Accurate	Very Accurate
58. I often find myself talking with others in this clinic in order to make sense of confusing situations.	☐	☐	☐	☐	☐	☐
59. I often find myself using the EMR to make sense of confusing situations.	☐	☐	☐	☐	☐	☐
60. I often find myself relying on my intuition to make sense of confusing situations.	☐	☐	☐	☐	☐	☐
61. I often find myself relying on my past experiences to make sense of confusing situations.	☐	☐	☐	☐	☐	☐
62. When a confusing situation arises at work, I often avoid addressing it.	☐	☐	☐	☐	☐	☐
63. When a confusing situation arises at work, I often don't have the time to address it.	☐	☐	☐	☐	☐	☐

Please continue onto the next page.

Now we would like you to think about the Electronic Medical Record (EMR) system that your clinic uses.

64. **Do you use the EMR for documenting clinical information?**
   □ Yes
   □ No (please skip to question #90)
   □ Don't know

65. **Approximately, how long have you been using the EMR?**
   □ Less than 1 year   □ 6 – 8 years
   □ 1 – 2 years   □ More than 8 years
   □ 3 – 5 years

Listed below are a number of statements that could describe your experience using your clinic's EMR. Please indicate the extent to which you <u>agree or disagree</u> with each statement.

	Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
66. Using the EMR enables me to accomplish my work tasks more quickly.	□	□	□	□	□	□
67. Using the EMR improves the quality of my work.	□	□	□	□	□	□
68. Using the EMR makes my work easier.	□	□	□	□	□	□
69. Using the EMR give me great control over my work.	□	□	□	□	□	□
70. Using the EMR is clear and easy to understand.	□	□	□	□	□	□
71. When I use the EMR, it is easy to get the software to do what I want it to do.	□	□	□	□	□	□
72. Overall, I believe that it is easy to use the EMR to do my work.	□	□	□	□	□	□
73. Learning to use the EMR to accomplish my work tasks was easy for me.	□	□	□	□	□	□
74. Those in charge in this clinic are committed to using an EMR.	□	□	□	□	□	□
75. My co-workers think that using an EMR in this clinic is valuable.	□	□	□	□	□	□
76. People in my profession think that using an EMR is valuable.	□	□	□	□	□	□
77. The opinions of people in my profession are important to me.	□	□	□	□	□	□
78. If I heard about a new information technology, I would look for ways to experiment with it.	□	□	□	□	□	□
79. Among my peers, I am usually the first to try out new information technologies.	□	□	□	□	□	□
80. In general, I am hesitant to try out new information technologies.	□	□	□	□	□	□
81. I like to experiment with new information technologies.	□	□	□	□	□	□
82. I use the EMR each day and I hardly even notice that I am using it.	□	□	□	□	□	□
83. When we first purchased the EMR, we made many modifications to the templates in order to have the EMR fit our work practices. (Leave blank, if don't know or are unsure)	□	□	□	□	□	□
84. I use most of the features or tools in the EMR.	□	□	□	□	□	□
85. I sometimes turn off features of the EMR.	□	□	□	□	□	□
86. I use the EMR beyond how I was trained to use it.	□	□	□	□	□	□
87. I have used the EMR in ways that goes beyond what this tool was designed to do.	□	□	□	□	□	□

Please continue thinking about how <u>you</u> use the Electronic Medical Record (EMR) in your clinic.

88. The EMR system in our clinic helps me when I have to make decisions: (Please check all that apply)

I use the EMR to:

□ Identify problems
□ Understand problems
□ Raise issues
□ Clarify problems

□ Generate alternatives
□ Evaluate alternatives
□ Choose alternatives
□ Other (Please specify) _____

89. Please read the list below, and check all of the features of the EMR that you use. (Check all that apply)

I use the EMR for:

□ Ordering prescriptions
□ Ordering lab test
□ Writing patient notes
□ Billing/financial tasks
□ Sharing patient records

□ Scheduling patient appointments
    □ Making patient care decisions
□ Identifying groups of patients in the clinic
        in need of a service (e.g. patient registries)
□ Making referrals
□ Other (Please specify) _____

If you answered 'NO' to question number 64, and indicated that you do <u>not</u> use the EMR for documenting clinical information please answer the next question. If you <u>do</u> use the EMR, please skip to question 91.

90. Please read the list below, and check all the answer that most accurately describes your experience with the EMR: (Choose <u>one</u> response only)
        □ I tried the EMR and decided not to use it
        □ I did not try the EMR and I decided not to use it

Please continue onto the next page.

Please fill in the following information about yourself. Responses will be kept confidential. Responses will be aggregated and reported as summary statistics only.

91. Age _____ (years)

92. Gender: □ Male   □ Female

93. Do you consider yourself Hispanic or Latino?
     □ Yes   □ No   □ Don't know

     If yes, please indicate country of origin: _____

94. What race(s) do you consider yourself to be? (Check all that apply)
     □ White, Non-Hispanic
     □ Black/African American, Non-Hispanic
     □ Native American, American Indian, or Alaska Native
     □ Asian or Pacific Islander
     □ Hispanic

95. What is the highest level of education you have attained? (Choose only one)
     □ Elementary school
     □ Some high school
     □ High school graduate or GED
     □ Technical school graduate (e.g. LPN, CMA, CNA, RN)
     □ Some college
     □ College graduate (e.g. BA, BS, BSN)
     □ Graduate school or medical school (PhD, MD)

96. What year did you complete your education?   _____ (for example, 1975)

97. How many years have you worked in this clinic? (if less than 1, enter 0) _____

98. How many hours per week do you work in this clinic? _____

99. What is your role in this clinic? _____

100. Please choose the category that best fits your role in this clinic: (Choose only one)
     □ Lead Physician/Medical Director
     □ Physician
     □ NP/PA
     □ Nursing/clinical staff (take vital signs, give injections, patient education, etc.)
     □ Front office staff
     □ Office Manager
     □ Billing staff
     □ Other (please specify) _____
                    Thank you for completing this survey.

High EMR Users

John

Demographic Information	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	Integrating clinical information for patients is important
	I'm part of a medical group
	I make complex decisions in my head all day long
	I help patients
	I am responsible to my patients
	Information availability is critical to my work
EMR Use	**Uncertainty**
High integration of EMR and practice of medicine	Believes explicit/codified information is accurate
High feature use	Seeks certainty through E/C information
High use of reports/trending features	Invests in making data/information E/C
High use of EMR to provide literature to patients	High nurse involvement in accomplishing work
High EMR-enabled communication with nursing	Invests in finding E/C data/information
Documents in exam room	
Maintains and refers to paper medical records	
Primary work space: office and exam room	

Nell

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	People can heal themselves
	Timely access to accurate information critical
	I run my own small practice
	Patients can come to me with 3 or 4 problems
	Patients are responsible for their care
EMR Use	**Uncertainty**
High integration of EMR and practice of medicine	Focuses on instant access to patient information
High feature use	I order my own labs, etc. so there's no mistakes
High use of reports/trending features	Spends time at nurse station to give verbal orders and clarify instructions, field nurse questions
High use of nurse in work tasks	High reliance on nurse
High EMR-enabled communication with nurse	Seeks certainty through E/C information
Documents very little in exam room	Invests in making data/information E/C
Prefers electronic over paper records	Invests in finding E/C data/information
Primary work space: office and exam room	Spends more time with patients than partners
Types when brief; Dragon when extensive	

Madeleine

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	Responsibility to the patient (MD and practice)
	Nursing staff are critical to my work
	I am part of a medical group
	Practice improvement is important
	Patient experience is important
EMR Use	**Uncertainty**
High integration of EMR and practice of medicine	Seeks certainty through E/C data/information
High feature use	High reliance on nursing to accomplish work
High use of letter feature	Nursing staff anticipate – high heedful interaction
High use of quick text feature	Invests in making data/information E/C
High modification/tailoring of templates	Invests in finding E/C data/information
High EMR-enabled communication with nursing	Organizes work (nursing) to increase routine
Documents in exam room when possible	
Primary work space: office and exam room	
Communicates frequently with MIS re EMR	
Frequently changes EMR use, learns features	

Stella

Demographics	Professional Values/Beliefs	
	I value efficiency	
	I am part of a medical group	
Demographic data removed to maintain subject confidentiality	I analyze complex problems all day	
	Knowing patients on personal level is important	
	I practice defensive medicine	
EMR Use	**Uncertainty**	
High integration of EMR and practice of medicine	Seeks certainty via E/C data/information	
High feature use	High reliance on nursing to accomplish work	
High use of letter feature	Nursing staff anticipate – high heedful interaction	
High use of quick text feature	Invests in making data/information E/C	
High modification/tailoring of templates	Invests in finding E/C data/information	
High EMR-enabled communication with nursing	Seeks information accuracy and completeness	
Primary work space: office and exam room		
Communicates frequently with MIS re EMR		
Frequently changes EMR use, learns features		
High documentation in exam room		

Paul

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	I am a consultant
	I am part of a medical group
	My team (practice) is important
	Information accessibility/availability is important
	Coordination of care is important
	Efficiency is important
	Hard to define my medical specialty

EMR Use	Uncertainty
High EMR use, but appears to be a separate task – not seamless with practice of medicine	Seeks certainty via E/C data/information
High feature use	Invests in making data/information E/C
High use of flowchart feature	Invests in finding E/C data/information
High use of quick text feature	Removes self from extraneous conversations at nurses' station ("chit-chat")
High modification/tailoring of templates – group	Uses nurse to give soft touch to patients
High EMR-enabled communication with nursing	Compartmentalizes work task/functions
Primary work space: office and exam room	Computers good at organizing/manipulating data
Documents some in exam room	↑ complex the patient = ↑ data needed
Changes EMR use/learns features as rolled out	↑ organs involved = ↑ specialists required
Uses flags to communicate with nurse and MDs	

Cecil

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	Values older generation
	Values time with patient more than money
	Narrative important in medical investigations
	Tries to live healthy lifestyle as model for patients
	Family is important (no 80 hour work weeks)
	Hard to define my medical specialty
	Patient is priority
	I'm part of a medical group

EMR Use	Uncertainty
High integration of EMR into work practices	Making data/information E/C improves accuracy & clarity of medical info
High feature use	E/C data/information can generate clutter/noise that he has to filter
High use of flags to communicate with nurse	Prefers paper chart for medical investigation
High modification/tailoring of templates – group	Discusses info/plan of care with patients to clarify
Primary work space: office and exam room	Reads E/C data/information to prepare for patient visit/anticipation
Changes EMR use/learns features as rolled out	
Starts clinical documentation before exam	
Uses EMR to improve chargeability	
Some patient involvement in EMR use	

Ted

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	Efficiency in providing care important
	Reducing costs and increasing quality important
	I'm part of a medical group
	Improving safety of medical care is important
	"Lack of sloth"
	Combination of patient and disease focus
	Referral network of young-ish physicians

EMR Use	Uncertainty
High integration of EMR into work practices	Very little face-to-face with nurse
High feature use – prefers phone notes over flags to communicate with nurse	Everyone having the same information at the same time is important
Very high EMR-enabled communication - nurse	Seeks/values accuracy in medical information
High modification/tailoring of templates – group	Invests in making medical information E/C
Primary work space: office and exam room	Invests in retrieving E/C information
Changes EMR use/learns features as rolled out	Uses analytical language (ex. Venn Diagram)
Template modification	Seeks second opinions from partners (formally)
	Information symmetry emphasized

Craig

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	I take care of patients
	I'm part of a medical group
	Face-to-face discussions are important
	Patient must be the focus of the visit

EMR Use	Uncertainty
High integration of EMR into work practices	EMR helps organize the details/↑ accuracy by keeping track of dialogue with nurse
High feature use	Invests in finding E/C data/information
Changes EMR use as new features are rolled out	Uses nurses' station as primary work space
High use of flow sheets/tracking and trending	"Uses his nurse differently than the rest of us"
Heavy use for information gathering purposes	Uses face-to-face conversations often – with nurses and other MDs (will walk to another clinic)
Low use of EMR in exam room with patient	Seeks exchanges with others while doing work

Norman

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	Neurology is a linear specialty
	I'm part of a medical group
	I'm a consultant
	Organization, accuracy, completeness important
	Patient advocate first, regardless of cost

EMR Use	Uncertainty
High integration of EMR into work practices	Almost obsesses over clinical documentation
High focus on thorough clinical documentation	Seeks/values accuracy in medical information
High use of macros/quick text feature	Invests in making medical information E/C
Uses EMR to reset mind about patients	Invests in retrieving E/C data/information
High tailoring of templates based on condition	Focus on "better and more information"
Jumps around in EMR to help build story	Generates extensive records
Dictates sometimes days after visit (weekends)	It's comforting to be able to explicate care
Time with patient more important than time with EMR (dictating/documenting)	

Liam

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	I am a gentle soul – try to listen to patients
	First do no harm, then try to help
	Focus on disease and patient

EMR Use	Uncertainty
High integration into work	Seeks information via (investigation)
High feature use	Doesn't believe that all patient information should be explicated (ex. no BM, use a laxative)
Learns new features as rolled out and by experience with EMR	Finds it difficult to remember one patient from another so documents immediately after each one
High use of flags – prefers over phone notes	"Armed with information"
High disdain for voice recognition tool	Focus on information availability
Documents immediately after each patient	
Does a little as possible computer work in visit	

Renee

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	Works efficiently, no chatting over long lunches
	Values patient story as critical to investigation
	I'm part of a medical group
	Needs to be in control; know what's going on with patients (could not use MD extender like PA/NP)
	Focuses on patient and problem at hand

EMR Use	Uncertainty
High integration of EMR into work	Uses E/C data/information to anticipate, but in a "knowing" sense
High feature use	Sees most complex patients in the practice
High use of flag to MDs and nurse	Requires nurse document every pt interaction
High EMR-enabled communication with nurse	Co-signs every nurse document to be "up-to-date"
High documentation requirements – co-signs everything; high use of templates, macros/quick text feature and copy & paste features	Limits verbal conversations with nurse because it creates double work since every conversation needs to be documented
Reads nurse intake prior to visit	High nurse involvement (tailored to work style)
May dictate first part of note before visit	Makes high use of patient story/asks many Qs
Dictates each note immediately after visit	High investment in making data E/C ("meticulous, obsessive, compulsive")
Nurse prints everything out for visit	High investment in finding E/C data/information

Spec 4 - Nathan

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	Patient is the only important person in this deal
	Access to information is critical to medicine

EMR Use	Uncertainty
Very high integration with work	Seeks availability of clinical information
High feature use	High investment in making data/info E/C
Very high tracking/trending/reporting	High investment/skill manipulating E/C data
Very high tailoring of templates	Seeks to create information out of clinical data
Agile in EMR use	Little talk of uncertainty related topics, really
Some documentation before and during visit	

Helen

Demographics	Professional Values/Beliefs	
Demographic data removed to maintain subject confidentiality	Golden rule	
	Treat patients efficiently	
	I'm part of a medical practice	
	I treat diseases	
EMR Use	**Uncertainty**	
High EMR integration into work flow	All clinical interaction should be documented	
High use of templates (menus and check boxes)	Documents to remind herself what she did and to have on record in case patient needs chart	
High EMR-enabled communication (MDs and nursing)	Invests in retrieving E/C data/information	
High use of nursing staff in completing work	High use of nursing in seeing patients and managing phone calls	
Uses EMR as a reference tool		
Types frequently – dislikes voice recognition tool		
Intended use of flags and phone notes		
Prints out summary sheet and uses in exam room		
Rarely uses EMR during visit		

Urielle

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	I take care of patients
	Getting to know patients is part of medical care
	I'm part of a medical group
	Uses play, game language in discussing job
	Health care is essential
	Hearing patients' stories is part of my job
EMR Use	**Uncertainty**
High EMR-enabled communication (MDs and nursing) - High use of flags	"Life is like a box of chocolates… you never know what you're gonna get when you open that door."
High use of nursing staff in completing work	Documents everything – "neurotic"
Does Rx depending on situation (e-fax/write)	High use of nursing in seeing patients and managing phone calls
Documents at lunch and end of day	Nursing can anticipate MD needs/actions
Moderate integration of EMR into work	Clinical documentation needs to be complete so that someone who has not seen that person can see where you're going
Prints out summary sheet and uses in exam room	Documents at nurses station and office
Rarely uses EMR during visit	Has exchanges w/ nursing between each patient

Percy

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	I'm about efficiency
	I treat diseases
	Explaining the problem/treatment in ways that patient understands is important
	Cross training staff in OR is bad idea - inefficient
	Golden rule

EMR Use	Uncertainty
Low integration of EMR into work	I treat everything as a protocol
High EMR-enabled communication with nursing	Seems to separate various work tasks – review, exam, documentation, ordering, all separate tasks
High use of macros/quick text feature	Documents for legal reasons – if didn't have legal to consider, probably would not document at all
Documents efficiently – a fxn of muscle memory	
Prefers flags over phone notes – efficiency	
Nursing does all ordering tasks	
Does not use EMR in exam room	
Documents at lunch and end of day	
Types, does not use voice recognition tool	

Medium EMR Users

Tula

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	Each physician is unique
	I'm a physician, I'm not a transcriptionist
	Dictation plays an important role in documenting medical information
EMR Use	**Uncertainty**
Low integration of EMR and practice of medicine	Uses hybrid strategy for documentation
Very low feature use	I document everything I can – tedious
High nurse involvement using EMR	Documentation strategy changes with patient complexity
High EMR-enabled communication with MDs	Interacts with other MDs – inside and outside practice – in practicing medicine
Documents via dictation and typing in office	"On the fence" with many topics – perhaps demonstrates comfort with ambiguity
Uses EMR templates for routine cases; dictation for complex cases	High interaction with nursing staff throughout practice – both social and task oriented
Primary work space: office	I don't want a computer making decisions for me

Brian

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	Physicians are busy
	Analyzing complex problems all day long
	I'm not a technophile
	Data and information are important in my work
	I am responsible for the care of my patients
	Mission to improve the health of my patients
	I am part of a medical group
EMR Use	**Uncertainty**
High integration of EMR and practice of medicine	Questions where we're going with this IT
Moderate feature use	There are limits to the amount of information that I can review for patients
Low nurse involvement in EMR use	The system is only as good at the data in it
High input and retrieval of data/information from EMR	Struggles with responsibility/expectations regarding amount and accuracy of E/C data
Maintains and refers to paper medical records	I enter all the data/information for my patients so that I know it's accurate
Primary work space: office and exam room	Focused on information that can be codified/organized/captured

Patrick

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	Physicians are busy
	Physician time should be protected
	Interaction with others should be about patients
	I run my own small practice
	Whatever it takes to provide care for my patients
EMR Use	**Uncertainty**
High (unintended) use of flags	Irreverent toward explicated data/information
High nurse involvement in EMR use	High use of nurse to filter/absorb cases
High EMR-enabled communication with nurse	
Primary work space: office and exam rooms	

Abby

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	This job is a little bit of everything (priest, social work, medicine, teaching, etc.)
	Values open/honest communication
	Open to non-Western approaches to medicine
	Pays attention to costs of care
	Spends time with patients
EMR Use	**Uncertainty**
Highly integrated into work, but in the background	Focuses on relationship with patient
Communicates with nursing via flags	Tends to be thorough in documentation
EMR use highly habitual and rarely changes	Has access and uses full nursing staff
Types clinical documentation	
Very little template modification	
Feature use highly clinical, not administrative	

Taylor

Demographics		Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality		Patient comes before employer
		Insurance should not dictate care
		I perform a lot of procedures
		I run my own small practice
		I wish we all recognized we are a group
		I treat patients
EMR Use		**Uncertainty**
Uses one template for all patients		Seeks certainty through E/C information
Distinct nurse involvement – only has one document per visit as opposed to nurse document and MD document (nurse intake documentation is in MD form)		Uses rich and lean media for communicating messages to nursing staff
High patient involvement – education		Recognizes value of E/C information
Moderate EMR-enabled communication		Works to streamline inputting of E/C information, keep E/C information uncluttered
		Has access to full nursing staff; prefers one

Morgan

Demographics		Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality		I take care of patients (holistic perspective)
		Getting relevant info from patients critical
		Relationship with patient is very important
		Analyzing complex problems all day long
		Likes to be informed about patient before visit
EMR Use		**Uncertainty**
Reviews patients charts before patient visit		Invests in making data/information E/C
Does not document in exam room, but will look up labs, order prescriptions		Constant worry I have missed something; I try to be thorough in my documentation
Uses EMR to involve patient in visit		I don't know if the information I need is really in there (EMR)
Types clinical documentation		Has access and uses full nursing staff

Wendy

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	Patient & MD walking side by side toward health
	I am a conduit for health
	I'm a consultant
	Listening and processing patient words important
	Patients have responsibility for their care

EMR Use	Uncertainty
Moderate integration of EMR into work	Seeks routine, structure
Uses EMR to help keep track of pending jobs	Focuses on processing what patient says in exam
Moderate feature use	Does not like templates because they cannot convey the specialized care given
Types notes, does not dictate	Shares information with patient and lets them decide how to proceed with care
Uses flags for semi-social purposes	"I'm pretty OCD"
Does not use EMR in exam room	Use the E/C data/information to review cases prior to visit, anticipate issues, devise semi-constructed plan
Minimal use of macros/quick text feature	Let patients tell their story
Has nurse print out previous labs/notes	
Low nurse involvement	

Mirelle

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	Every doctor wants to feel a little bit like a hero
	It's refreshing to see a handwritten note
	Patients should be responsible for their records
	Money has never been a priority; medicine was more fulfilling there
	I'm here to explore/see how things are done here
	Being here makes me feel like I'm betraying my medical school
	This typing up notes business makes me feel less like a doctor
EMR Use	**Uncertainty**
Struggling to use the EMR in a way that helps her see and treat patients	Having a background in internal medicine helps me to be in tune with the whole patient
Uses EMR to prepare for visit	"And, I mean the notes are important but… …I really don't know if this is going to help anyone."
High frustration with voice recognition tool	
Documents during visit if feasible/simple case	

Frances

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	I run my own small practice
	It's important to help patients understand their condition and plan of treatment
	Physicians are individuals
	Treat patients like my family
EMR Use	**Uncertainty**
Clumsy integration into work	High nurse involvement in interaction w/patient
Low feature use – relies heavily on nursing staff to order labs, test, make referrals, etc.	Short cuts in explicating information makes sense to them, but not everyone else
EMR used for every patient contact	Known for looking in the old chart
Not very agile with EMR	Sometimes documentation creates information interference and static because we are no longer succinct and clear and we do unnecessary evaluations beyond the structure of positives and negatives
Dictates at lunch and end of day	We need a place with a running list of concerns
Prefers phone notes over flags	
High use of reports & letters to patients (nurse)	

Spec 4 - Sherman

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	Face-to-face time with patient is valuable
	Should work on quality not quantity
EMR Use	**Uncertainty**
Moderate integration into work practices	Not focused only on information
Moderate feature use	Reviews information in EMR before visit, but seems to be trying to get his head in the game
Reviews patients before visits – takes notes and sometimes starts documentation before visit	Not everything needs to be in the medical record
High use of flags – efficient for quick issues	
High EMR-enabled communication	
Low use of macros/quick text features	
One template that is universal for all visit types	
Documents as he goes – not at the end of the day	
Rarely uses EMR in exam room – only to clarify	

Low EMR Users

Charlie

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	My job is to treat patients
	I am not an information processor
	I run my own small practice
	IT dept doesn't understand what I'm trying to do
	Physicians are all doing different processes

EMR Use	Uncertainty
Low integration of EMR and practice of medicine	Believes information in patient (tacit) is accurate
Very low feature use	Retrieves E/C data/information
High nurse involvement using EMR	Narrative is key in understanding/making sense
Low EMR-enabled communication with nursing	Invests in tacit information, creating narratives in patient records
Documents via dictation at nurse station	Invests in interpreting others' narratives
Maintains and gives priority to paper medical records over EMR	One never knows if the explicated medication list is correct or not; you never have a complete list
Primary work space: nurse station and office	Knows the limits of technology
	Seems to acknowledge fundamental uncertainty

Henry

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	Forward thinking in terms of medical practice
	Places importance on medical expertise
	I run my own small practice

EMR Use	Uncertainty
Very low integration of EMR into work practices	Comfortable with his own labor in charting
Very low feature use	Frequently talks with nurse at nurses' station
Very high nurse involvement in completing EMR related work tasks	Sometimes when data is explicated, it's hard to figure out what is real information
High reliance on paper medical records	Sometimes it's difficult to discern what change has occurred in patient condition when using E/C data/information
"Why do I need an EMR when the paper system works great for me?"	Makes use of other nurses as needed
Uses IT in other aspects of life	

Tate

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	Doctors need a stable platform on which to work
	Doctors can be terrorists
	Doctors (& nurses) need a sense of nobility (good)
	Actions and artifacts are symbols – have meaning
	Billing phenomenon separate from science
	Humor important in dealing with medical tragedy
	Became MD to help all people
	Works at free clinic – "nourishes my soul"

EMR Use	Uncertainty
Low integration into work	Uses intuition to see between the lines
Low feature use	Information has no value unless it is quickly retrievable and in the right/useable form
Pays $800-1000/month to NOT use EMR	When I read other people's notes I don't get very much information; I'm interested in practitioner's assessment of putting it all together.
Very high nurse involvement, but more in terms of working as a team so each can do job better	The most important part of my job is detecting change
Completes clinical documentation at noon and end of day	Neurology can't be done by using templates
Carries his original doctor bag that contains neurological assessment tools into exam room	Psychosocial and family issues important and can't be captured in templates
Uses EMR to help anticipate	Educating patients inevitably leads to increasing their ability to bring unforeseen knowledge and skill to solving their own problems better
Uses EMR to locate specific information that is important to an established inquiry	I'm not worried about showing them that I don't know the answer – they can find the answer sometimes if I can put it in a context for them

Three dimensions

John (Patient, Profession, Organization)

Demographic Information	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	Integrating clinical information for patients is important
	I'm part of a medical group
	I make complex decisions in my head all day long
	I help patients
	I am responsible to my patients
	Information availability is critical to my work
EMR Use	**Uncertainty**
High integration of EMR and practice of medicine	Believes explicit/codified information is accurate
High feature use	Seeks certainty through E/C information
High use of reports/trending features	Invests in making data/information E/C
High use of EMR to provide literature to patients	High nurse involvement in accomplishing work
High EMR-enabled communication with nursing	Invests in finding E/C data/information
Documents in exam room	
Maintains and refers to paper medical records	
Primary work space: office and exam room	

Stella (Profession, Patient, Organization)

Demographics	Professional Values/Beliefs	
Demographic data removed to maintain subject confidentiality	I value efficiency	
	I am part of a medical group	
	I analyze complex problems all day	
	Knowing patients on personal level is important	
	I practice defensive medicine	
EMR Use	**Uncertainty**	
High integration of EMR and practice of medicine	Seeks certainty via E/C data/information	
High feature use	High reliance on nursing to accomplish work	
High use of letter feature	Nursing staff anticipate – high heedful interaction	
High use of quick text feature	Invests in making data/information E/C	
High modification/tailoring of templates	Invests in finding E/C data/information	
High EMR-enabled communication with nursing	Seeks information accuracy and completeness	
Primary work space: office and exam room		
Communicates frequently with MIS re EMR		
Frequently changes EMR use, learns features		
High documentation in exam room		

Cecil (Patient, Profession, Organization)

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	Values older generation
	Values time with patient more than money
	Narrative important in medical investigations
	Tries to live healthy lifestyle as model for patients
	Family is important (no 80 hour work weeks)
	Hard to define my medical specialty
	Patient is priority
	I'm part of a medical group
EMR Use	**Uncertainty**
High integration of EMR into work practices	Making data/information E/C improves accuracy & clarity of medical info
High feature use	E/C data/information can generate clutter/noise that he has to filter
High use of flags to communicate with nurse	Prefers paper chart for medical investigation
High modification/tailoring of templates – group	Discusses info/plan of care with patients to clarify
Primary work space: office and exam room	Reads E/C data/information to prepare for patient visit/anticipation
Changes EMR use/learns features as rolled out	
Starts clinical documentation before exam	
Uses EMR to improve chargeability	
Some patient involvement in EMR use	

Ted (Organization, Profession, Patient)

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	Efficiency in providing care important
	Reducing costs and increasing quality important
	I'm part of a medical group
	Improving safety of medical care is important
	"Lack of sloth"
	Combination of patient and disease focus
	Referral network of young-ish physicians

EMR Use	Uncertainty
High integration of EMR into work practices	Very little face-to-face with nurse
High feature use – prefers phone notes over flags to communicate with nurse	Everyone having the same information at the same time is important
Very high EMR-enabled communication - nurse	Seeks/values accuracy in medical information
High modification/tailoring of templates – group	Invests in making medical information E/C
Primary work space: office and exam room	Invests in retrieving E/C information
Changes EMR use/learns features as rolled out	Uses analytical language (ex. Venn Diagram)
Template modification	Seeks second opinions from partners (formally)
	Information symmetry emphasized

Norman (Profession, Patient, Organization)

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	Neurology is a linear specialty
	I'm part of a medical group
	I'm a consultant
	Organization, accuracy, completeness important
	Patient advocate first, regardless of cost

EMR Use	Uncertainty
High integration of EMR into work practices	Almost obsesses over clinical documentation
High focus on thorough clinical documentation	Seeks/values accuracy in medical information
High use of macros/quick text feature	Invests in making medical information E/C
Uses EMR to reset mind about patients	Invests in retrieving E/C data/information
High tailoring of templates based on condition	Focus on "better and more information"
Jumps around in EMR to help build story	Generates extensive records
Dictates sometimes days after visit (weekends)	It's comforting to be able to explicate care
Time with patient more important than time with EMR (dictating/documenting)	

Renee (Profession, Patient, Organization)

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	Works efficiently, no chatting over long lunches
	Values patient story as critical to investigation
	I'm part of a medical group
	Needs to be in control; know what's going on with patients (could not use MD extender like PA/NP)
	Focuses on patient and problem at hand

EMR Use	Uncertainty
High integration of EMR into work	Uses E/C data/information to anticipate, but in a "knowing" sense
High feature use	Sees most complex patients in the practice
High use of flag to MDs and nurse	Requires nurse document every pt interaction
High EMR-enabled communication with nurse	Co-signs every nurse document to be "up-to-date"
High documentation requirements – co-signs everything; high use of templates, macros/quick text feature and copy & paste features	Limits verbal conversations with nurse because it creates double work since every conversation needs to be documented
Reads nurse intake prior to visit	High nurse involvement (tailored to work style)
May dictate first part of note before visit	Makes high use of patient story/asks many Qs
Dictates each note immediately after visit	High investment in making data E/C ("meticulous, obsessive, compulsive")
Nurse prints everything out for visit	High investment in finding E/C data/information

Helen (Profession, Patient, Organization)

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	Golden rule
	Treat patients efficiently
	I'm part of a medical group
	I treat diseases
EMR Use	**Uncertainty**
High EMR integration into work flow	All clinical interaction should be documented
High use of templates (menus and check boxes)	Documents to remind herself what she did and to have on record in case patient needs chart
High EMR-enabled communication (MDs and nursing)	Invests in retrieving E/C data/information
High use of nursing staff in completing work	High use of nursing in seeing patients and managing phone calls
Uses EMR as a reference tool	
Types frequently – dislikes voice recognition tool	
Intended use of flags and phone notes	
Prints out summary sheet and uses in exam room	
Rarely uses EMR during visit	

Urielle (Patient, Profession, Organization)

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	I take care of patients
	Getting to know patients is part of medical care
	I'm part of a medical group
	Uses play, game language in discussing job
	Health care is essential
	Hearing patients' stories is part of my job
EMR Use	**Uncertainty**
High EMR-enabled communication (MDs and nursing) - High use of flags	"Life is like a box of chocolates… you never know what you're gonna get when you open that door."
High use of nursing staff in completing work	Documents everything – "neurotic"
Does Rx depending on situation (e-fax/write)	High use of nursing in seeing patients and managing phone calls
Documents at lunch and end of day	Nursing can anticipate MD needs/actions
Moderate integration of EMR into work	Clinical documentation needs to be complete so that someone who has not seen that person can see where you're going
Prints out summary sheet and uses in exam room	Documents at nurses station and office
Rarely uses EMR during visit	Has exchanges w/ nursing between each patient

Madeleine (Profession, Organization, Patient)

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	Responsibility to the patient (MD and practice)
	Nursing staff are critical to my work
	I am part of a medical group
	Practice improvement is important
	Patient experience is important

EMR Use	Uncertainty
High integration of EMR and practice of medicine	Seeks certainty through E/C data/information
High feature use	High reliance on nursing to accomplish work
High use of letter feature	Nursing staff anticipate – high heedful interaction
High use of quick text feature	Invests in making data/information E/C
High modification/tailoring of templates	Invests in finding E/C data/information
High EMR-enabled communication with nursing	Organizes work (nursing) to increase routine
Documents in exam room when possible	
Primary work space: office and exam room	
Communicates frequently with MIS re EMR	
Frequently changes EMR use, learns features	

Two dimensions

Nell (Patient, Profession)

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	People can heal themselves
	Timely access to accurate information critical
	I run my own small practice
	Patients can come to me with 3 or 4 problems
	Patients are responsible for their care
EMR Use	**Uncertainty**
High integration of EMR and practice of medicine	Focuses on instant access to patient information
High feature use	I order my own labs, etc. so there's no mistakes
High use of reports/trending features	Spends time at nurse station to give verbal orders and clarify instructions, field nurse questions
High use of nurse in work tasks	High reliance on nurse
High EMR-enabled communication with nurse	Seeks certainty through E/C information
Documents very little in exam room	Invests in making data/information E/C
Prefers electronic over paper records	Invests in finding E/C data/information
Primary work space: office and exam room	Spends more time with patients than partners
Types when brief; Dragon when extensive	

Morgan (Patient, Profession)

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	I take care of patients (holistic perspective)
	Getting relevant info from patients critical
	Relationship with patient is very important
	Analyzing complex problems all day long
	Likes to be informed about patient before visit
EMR Use	**Uncertainty**
Reviews patients charts before patient visit	Invests in making data/information E/C
Does not document in exam room, but will look up labs, order prescriptions	Constant worry I have missed something; I try to be thorough in my documentation
Uses EMR to involve patient in visit	I don't know if the information I need is really in there (EMR)
Types clinical documentation	Has access and uses full nursing staff

Wendy (Profession, Patient)

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	Patient & MD walking side by side toward health
	I am a conduit for health
	I'm a consultant
	Listening and processing patient words important
	Patients have responsibility for their care

EMR Use	Uncertainty
Moderate integration of EMR into work	Seeks routine, structure
Uses EMR to help keep track of pending jobs	Focuses on processing what patient says in exam
Moderate feature use	Does not like templates because they cannot convey the specialized care given
Types notes, does not dictate	Shares information with patient and lets them decide how to proceed with care
Uses flags for semi-social purposes	"I'm pretty OCD"
Does not use EMR in exam room	Use the E/C data/information to review cases prior to visit, anticipate issues, devise semi-constructed plan
Minimal use of macros/quick text feature	Let patients tell their story
Has nurse print out previous labs/notes	
Low nurse involvement	

Paul (Organization, Profession)

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	I am a consultant
	I am part of a medical group
	My team (practice) is important
	Information accessibility/availability is important
	Coordination of care is important
	Efficiency is important
	Hard to define my medical specialty
EMR Use	**Uncertainty**
High EMR use, but appears to be a separate task – not seamless with practice of medicine	Seeks certainty via E/C data/information
High feature use	Invests in making data/information E/C
High use of flowchart feature	Invests in finding E/C data/information
High use of quick text feature	Removes self from extraneous conversations at nurses' station ("chit-chat")
High modification/tailoring of templates – group	Uses nurse to give soft touch to patients
High EMR-enabled communication with nursing	Compartmentalizes work task/functions
Primary work space: office and exam room	Computers good at organizing/manipulating data
Documents some in exam room	↑ complex the patient = ↑ data needed
Changes EMR use/learns features as rolled out	↑ organs involved = ↑ specialists required
Uses flags to communicate with nurse and MDs	

Craig (Patient, Organization)

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	I take care of patients
	I'm part of a medical group
	Face-to-face discussions are important
	Patient must be the focus of the visit
EMR Use	**Uncertainty**
High integration of EMR into work practices	EMR helps organize the details/↑ accuracy by keeping track of dialogue with nurse
High feature use	Invests in finding E/C data/information
Changes EMR use as new features are rolled out	Uses nurses' station as primary work space
High use of flow sheets/tracking and trending	"Uses his nurse differently than the rest of us"
Heavy use for information gathering purposes	Uses face-to-face conversations often – with nurses and other MDs (will walk to another clinic)
Low use of EMR in exam room with patient	Seeks exchanges with others while doing work

Liam (Profession, Patient)

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	I am a gentle soul – try to listen to patients
	First do no harm, then try to help
	Focus on disease and patient
EMR Use	**Uncertainty**
High integration into work	Seeks information via (investigation)
High feature use	Doesn't believe that all patient information should be explicated (ex. no BM, use a laxative)
Learns new features as rolled out and by experience with EMR	Finds it difficult to remember one patient from another so documents immediately after each one
High use of flags – prefers over phone notes	"Armed with information"
High disdain for voice recognition tool	Focus on information availability
Documents immediately after each patient	
Does a little as possible computer work in visit	

Nathan (Patient, Profession)

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	Patient is the only important person in this deal
	Access to information is critical to medicine
EMR Use	**Uncertainty**
Very high integration with work	Seeks availability of clinical information
High feature use	High investment in making data/info E/C
Very high tracking/trending/reporting	High investment/skill manipulating E/C data
Very high tailoring of templates	Seeks to create information out of clinical data
Agile in EMR use	Little talk of uncertainty related topics, really
Some documentation before and during visit	

Percy (Profession, Patient)

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	I'm about efficiency
	I treat diseases
	Explaining the problem/treatment in ways that patient understands is important
	Cross training staff in OR is bad idea - inefficient
	Golden rule
EMR Use	**Uncertainty**
Low integration of EMR into work	I treat everything as a protocol
High EMR-enabled communication with nursing	Seems to separate various work tasks – review, exam, documentation, ordering, all separate tasks
High use of macros/quick text feature	Documents for legal reasons – if didn't have legal to consider, probably would not document at all
Documents efficiently – a fxn of muscle memory	
Prefers flags over phone notes – efficiency	
Nursing does all ordering tasks	
Does not use EMR in exam room	
Documents at lunch and end of day	
Types, does not use voice recognition tool	

Abby (Profession, Patient)

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	This job is a little bit of everything (priest, social work, medicine, teaching, etc.)
	Values open/honest communication
	Open to non-Western approaches to medicine
	Pays attention to costs of care
	Spends time with patients

EMR Use	Uncertainty
Highly integrated into work, but in the background	Focuses on relationship with patient
Communicates with nursing via flags	Tends to be thorough in documentation
EMR use highly habitual and rarely changes	Has access and uses full nursing staff
Types clinical documentation	
Very little template modification	
Feature use highly clinical, not administrative	

Taylor (Patient, Profession)

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	Patient comes before employer
	Insurance should not dictate care
	I perform a lot of procedures
	I run my own small practice
	I wish we all recognized we are a group
	I treat patients

EMR Use	Uncertainty
Uses one template for all patients	Seeks certainty through E/C information
Distinct nurse involvement – only has one document per visit as opposed to nurse document and MD document (nurse intake documentation is in MD form)	Uses rich and lean media for communicating messages to nursing staff
High patient involvement – education	Recognizes value of E/C information
Moderate EMR-enabled communication	Works to streamline inputting of E/C information, keep E/C information uncluttered
	Has access to full nursing staff; prefers one

Frances (Profession, Patient)

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	I run my own small practice
	It's important to help patients understand their condition and plan of treatment
	Physicians are individuals
	Treat patients like my family
EMR Use	**Uncertainty**
Clumsy integration into work	High nurse involvement in interaction w/patient
Low feature use – relies heavily on nursing staff to order labs, test, make referrals, etc.	Short cuts in explicating information makes sense to them, but not everyone else
EMR used for every patient contact	Known for looking in the old chart
Not very agile with EMR	Sometimes documentation creates information interference and static because we are no longer succinct and clear and we do unnecessary evaluations beyond the structure of positives and negatives
Dictates at lunch and end of day	We need a place with a running list of concerns
Prefers phone notes over flags	
High use of reports & letters to patients (nurse)	

Patrick (Profession, Patient)

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	Physicians are busy
	Physician time should be protected
	Interaction with others should be about patients
	I run my own small practice
	Whatever it takes to provide care for my patients
EMR Use	**Uncertainty**
High (unintended) use of flags	Irreverent toward explicated data/information
High nurse involvement in EMR use	High use of nurse to filter/absorb cases
High EMR-enabled communication with nurse	
Primary work space: office and exam rooms	

Sherman (Patient, Profession)

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	Face-to-face time with patient is valuable
	Should work on quality not quantity

EMR Use	Uncertainty
Moderate integration into work practices	Not focused only on information
Moderate feature use	Reviews information in EMR before visit, but seems to be trying to get his head in the game
Reviews patients before visits – takes notes and sometimes starts documentation before visit	Not everything needs to be in the medical record
High use of flags – efficient for quick issues	
High EMR-enabled communication	
Low use of macros/quick text features	
One template that is universal for all visit types	
Documents as he goes – not at the end of the day	
Rarely uses EMR in exam room – only to clarify	

Brian (Profession, Patient)

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	Physicians are busy
	Analyzing complex problems all day long
	I'm not a technophile
	Data and information are important in my work
	I am responsible for the care of my patients
	Mission to improve the health of my patients

EMR Use	Uncertainty
High integration of EMR and practice of medicine	Questions where we're going with this IT
Moderate feature use	There are limits to the amount of information that I can review for patients
Low nurse involvement in EMR use	The system is only as good at the data in it
High input and retrieval of data/information from EMR	Struggles with responsibility/expectations regarding amount and accuracy of E/C data
Maintains and refers to paper medical records	I enter all the data/information for my patients so that I know it's accurate
Primary work space: office and exam room	Focused on information that can be codified/organized/captured

One dimension

Charlie (Profession)

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	My job is to be a physician
	I am not an information processor
	I run my own small practice
	IT dept doesn't understand what I'm trying to do
	Physicians are all doing different processes

EMR Use	Uncertainty
Low integration of EMR and practice of medicine	Believes information in patient (tacit) is accurate
Very low feature use	Retrieves E/C data/information
High nurse involvement using EMR	Narrative is key in understanding/making sense
Low EMR-enabled communication with nursing	Invests in tacit information, creating narratives in patient records
Documents via dictation at nurse station	Invests in interpreting others' narratives
Maintains and gives priority to paper medical records over EMR	One never knows if the explicated medication list is correct or not; you never have a complete list
Primary work space: nurse station and office	Knows the limits of technology
	Seems to acknowledge fundamental uncertainty

Tula (Profession)

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	Each physician is unique
	I'm a physician, I'm not a transcriptionist
	Dictation plays an important role in documenting medical information

EMR Use	Uncertainty
Low integration of EMR and practice of medicine	Uses hybrid strategy for documentation
Very low feature use	I document everything I can – tedious
High nurse involvement using EMR	Documentation strategy changes with patient complexity
High EMR-enabled communication with MDs	Interacts with other MDs – inside and outside practice – in practicing medicine
Documents via dictation and typing in office	"On the fence" with many topics – perhaps demonstrates comfort with ambiguity
Uses EMR templates for routine cases; dictation for complex cases	High interaction with nursing staff throughout practice – both social and task oriented
Primary work space: office	I don't want a computer making decisions for me

Tate (Profession)

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	Doctors need a stable platform on which to work
	Doctors can be terrorists
	Doctors (& nurses) need a sense of nobility (good)
	Actions and artifacts are symbols – have meaning
	Billing phenomenon separate from science
	Humor important in dealing with medical tragedy
	Became MD to help all people
	Works at free clinic – "nourishes my soul"

EMR Use	Uncertainty
Low integration into work	Uses intuition to see between the lines
Low feature use	Information has no value unless it is quickly retrievable and in the right/useable form
Pays $800-1000/month to NOT use EMR	When I read other people's notes I don't get very much information; I'm interested in practitioner's assessment of putting it all together.
Very high nurse involvement, but more in terms of working as a team so each can do job better	The most important part of my job is detecting change
Completes clinical documentation at noon and end of day	Neurology can't be done by using templates
Carries his original doctor bag that contains neurological assessment tools into exam room	Psychosocial and family issues important and can't be captured in templates
Uses EMR to help anticipate	Educating patients inevitably leads to increasing their ability to bring unforeseen knowledge and skill to solving their own problems better
Uses EMR to locate specific information that is important to an established inquiry	I'm not worried about showing them that I don't know the answer – they can find the answer sometimes if I can put it in a context for them

Henry (Profession)

Demographics	Professional Values/Beliefs	
Demographic data removed to maintain subject confidentiality	Forward thinking in terms of medical practice	
	Places importance on medical expertise	
	I run my own small practice	
EMR Use	**Uncertainty**	
Very low integration of EMR into work practices	Comfortable with his own labor in charting	
Very low feature use	Frequently talks with nurse at nurses' station	
Very high nurse involvement in completing EMR related work tasks	Sometimes when data is explicated, it's hard to figure out what is real information	
High reliance on paper medical records	Sometimes it's difficult to discern what change has occurred in patient condition when using E/C data/information	
"Why do I need an EMR when the paper system works great for me?"	Makes use of other nurses as needed	
Uses IT in other aspects of life		

Mirelle (Profession)

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	Every doctor wants to feel a little bit like a hero
	It's refreshing to see a handwritten note
	Patients should be responsible for their records
	Money has never been a priority; medicine was more fulfilling there
	I'm here to explore/see how things are done here
	Being here makes me feel like I'm betraying my medical school
	This typing up notes business makes me feel less like a doctor
EMR Use	**Uncertainty**
Struggling to use the EMR in a way that helps her see and treat patients	Having a background in internal medicine helps me to be in tune with the whole patient
Uses EMR to prepare for visit	"And, I mean the notes are important but… …I really don't know if this is going to help anyone."
High frustration with voice recognition tool	
Documents during visit if feasible/simple case	

Traditional

John

Demographic Information	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	Integrating clinical information for patients is important
	I'm part of a medical group
	I make complex decisions in my head all day long
	I help patients
	I am responsible to my patients
	Information availability is critical to my work
EMR Use	**Uncertainty**
High integration of EMR and practice of medicine	Believes explicit/codified information is accurate
High feature use	Seeks certainty through E/C information
High use of reports/trending features	Invests in making data/information E/C
High use of EMR to provide literature to patients	High nurse involvement in accomplishing work
High EMR-enabled communication with nursing	Invests in finding E/C data/information
Documents in exam room	
Maintains and refers to paper medical records	
Primary work space: office and exam room	

Nell

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	People can heal themselves
	Timely access to accurate information critical
	I run my own small practice
	Patients can come to me with 3 or 4 problems
	Patients are responsible for their care
EMR Use	**Uncertainty**
High integration of EMR and practice of medicine	Focuses on instant access to patient information
High feature use	I order my own labs, etc. so there's no mistakes
High use of reports/trending features	Spends time at nurse station to give verbal orders and clarify instructions, field nurse questions
High use of nurse in work tasks	High reliance on nurse
High EMR-enabled communication with nurse	Seeks certainty through E/C information
Documents very little in exam room	Invests in making data/information E/C
Prefers electronic over paper records	Invests in finding E/C data/information
Primary work space: office and exam room	Spends more time with patients than partners
Types when brief; Dragon when extensive	

Madeleine

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	Responsibility to the patient (MD and practice)
	Nursing staff are critical to my work
	I am part of a medical group
	Practice improvement is important
	Patient experience is important
EMR Use	**Uncertainty**
High integration of EMR and practice of medicine	Seeks certainty through E/C data/information
High feature use	High reliance on nursing to accomplish work
High use of letter feature	Nursing staff anticipate – high heedful interaction
High use of quick text feature	Invests in making data/information E/C
High modification/tailoring of templates	Invests in finding E/C data/information
High EMR-enabled communication with nursing	Organizes work (nursing) to increase routine
Documents in exam room when possible	
Primary work space: office and exam room	
Communicates frequently with MIS re EMR	
Frequently changes EMR use, learns features	

Stella

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	I value efficiency
	I am part of a medical group
	I analyze complex problems all day
	Knowing patients on personal level is important
	I practice defensive medicine

EMR Use	Uncertainty
High integration of EMR and practice of medicine	Seeks certainty via E/C data/information
High feature use	High reliance on nursing to accomplish work
High use of letter feature	Nursing staff anticipate – high heedful interaction
High use of quick text feature	Invests in making data/information E/C
High modification/tailoring of templates	Invests in finding E/C data/information
High EMR-enabled communication with nursing	Seeks information accuracy and completeness
Primary work space: office and exam room	
Communicates frequently with MIS re EMR	
Frequently changes EMR use, learns features	
High documentation in exam room	

Paul

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	I am a consultant
	I am part of a medical group
	My team (practice) is important
	Information accessibility/availability is important
	Coordination of care is important
	Efficiency is important
	Hard to define my medical specialty

EMR Use	Uncertainty
High EMR use, but appears to be a separate task – not seamless with practice of medicine	Seeks certainty via E/C data/information
High feature use	Invests in making data/information E/C
High use of flowchart feature	Invests in finding E/C data/information
High use of quick text feature	Removes self from extraneous conversations at nurses' station ("chit-chat")
High modification/tailoring of templates – group	Uses nurse to give soft touch to patients
High EMR-enabled communication with nursing	Compartmentalizes work task/functions
Primary work space: office and exam room	Computers good at organizing/manipulating data
Documents some in exam room	↑ complex the patient = ↑ data needed
Changes EMR use/learns features as rolled out	↑ organs involved = ↑ specialists required
Uses flags to communicate with nurse and MDs	

Ted

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	Efficiency in providing care important
	Reducing costs and increasing quality important
	I'm part of a medical group
	Improving safety of medical care is important
	"Lack of sloth"
	Combination of patient and disease focus
	Referral network of young-ish physicians

EMR Use	Uncertainty
High integration of EMR into work practices	Very little face-to-face with nurse
High feature use – prefers phone notes over flags to communicate with nurse	Everyone having the same information at the same time is important
Very high EMR-enabled communication - nurse	Seeks/values accuracy in medical information
High modification/tailoring of templates – group	Invests in making medical information E/C
Primary work space: office and exam room	Invests in retrieving E/C information
Changes EMR use/learns features as rolled out	Uses analytical language (ex. Venn Diagram)
Template modification	Seeks second opinions from partners (formally)
	Information symmetry emphasized

Norman

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	Neurology is a linear specialty
	I'm part of a medical group
	I'm a consultant
	Organization, accuracy, completeness important
	Patient advocate first, regardless of cost

EMR Use	Uncertainty
High integration of EMR into work practices	Almost obsesses over clinical documentation
High focus on thorough clinical documentation	Seeks/values accuracy in medical information
High use of macros/quick text feature	Invests in making medical information E/C
Uses EMR to reset mind about patients	Invests in retrieving E/C data/information
High tailoring of templates based on condition	Focus on "better and more information"
Jumps around in EMR to help build story	Generates extensive records
Dictates sometimes days after visit (weekends)	It's comforting to be able to explicate care
Time with patient more important than time with EMR (dictating/documenting)	

Liam

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	I am a gentle soul – try to listen to patients
	First do no harm, then try to help
	Focus on disease and patient

EMR Use	Uncertainty
High integration into work	Seeks E/C information via clinical investigation
High feature use	Doesn't believe that all patient information should be explicated (ex. no BM, use a laxative)
Learns new features as rolled out and by experience with EMR	Finds it difficult to remember one patient from another so documents immediately after each one
High use of flags – prefers over phone notes	"Armed with information"
High disdain for voice recognition tool	Focus on information availability
Documents immediately after each patient	
Does a little as possible computer work in visit	

Renee

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	Works efficiently, no chatting over long lunches
	Values patient story as critical to investigation
	I'm part of a medical group
	Needs to be in control; know what's going on with patients (could not use MD extender like PA/NP)
	Focuses on patient and problem at hand
EMR Use	**Uncertainty**
High integration of EMR into work	Uses E/C data/information to anticipate, but in a "knowing" sense
High feature use	Sees most complex patients in the practice
High use of flag to MDs and nurse	Requires nurse document every pt interaction
High EMR-enabled communication with nurse	Co-signs every nurse document to be "up-to-date"
High documentation requirements – co-signs everything; high use of templates, macros/quick text feature and copy & paste features	Limits verbal conversations with nurse because it creates double work since every conversation needs to be documented
Reads nurse intake prior to visit	High nurse involvement (tailored to work style)
May dictate first part of note before visit	Makes high use of patient story/asks many Qs
Dictates each note immediately after visit	High investment in making data E/C ("meticulous, obsessive, compulsive")
Nurse prints everything out for visit	High investment in finding E/C data/information

Nathan

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	Patient is the only important person in this deal
	Access to information is critical to medicine
EMR Use	**Uncertainty**
Very high integration with work	Seeks availability of clinical information
High feature use	High investment in making data/info E/C
Very high tracking/trending/reporting	High investment/skill manipulating E/C data
Very high tailoring of templates	Seeks to create information out of clinical data
Agile in EMR use	Little talk of uncertainty related topics, really
Some documentation before and during visit	

Helen

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	Golden rule
	Treat patients efficiently
	I'm part of a medical practice
	I treat diseases
EMR Use	**Uncertainty**
High EMR integration into work flow	All clinical interaction should be documented
High use of templates (menus and check boxes)	Documents to remind herself what she did and to have on record in case patient needs chart
High EMR-enabled communication (MDs and nursing)	Invests in retrieving E/C data/information
High use of nursing staff in completing work	High use of nursing in seeing patients and managing phone calls
Uses EMR as a reference tool	
Types frequently – dislikes voice recognition tool	
Intended use of flags and phone notes	
Prints out summary sheet and uses in exam room	
Rarely uses EMR during visit	

Percy

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	I'm about efficiency
	I treat diseases
	Explaining the problem/treatment in ways that patient understands is important
	Cross training staff in OR is bad idea – inefficient
	Golden rule
EMR Use	**Uncertainty**
Low integration of EMR into work	I treat everything as a protocol
High EMR-enabled communication with nursing	Seems to separate various work tasks – review, exam, documentation, ordering, all separate tasks
High use of macros/quick text feature	Documents for legal reasons – if didn't have legal to consider, probably would not document at all
Documents efficiently – a fxn of muscle memory	
Prefers flags over phone notes – efficiency	
Nursing does all ordering tasks	
Does not use EMR in exam room	
Documents at lunch and end of day	
Types, does not use voice recognition tool	

Taylor

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	Patient comes before employer
	Insurance should not dictate care
	I perform a lot of procedures
	I run my own small practice
	I wish we all recognized we are a group
	I treat patients

EMR Use	Uncertainty
Uses one template for all patients	Seeks certainty through E/C information
Distinct nurse involvement – only has one document per visit as opposed to nurse document and MD document (nurse intake documentation is in MD form)	Uses rich and lean media for communicating messages to nursing staff
High patient involvement – education	Recognizes value of E/C information
Moderate EMR-enabled communication	Works to streamline inputting of E/C information, keep E/C information uncluttered
	Has access to full nursing staff; prefers one

Fundamental

Charlie

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	My job is to treat patients
	I am not an information processor
	I run my own small practice
	IT dept doesn't understand what I'm trying to do
	Physicians are all doing different processes

EMR Use	Uncertainty
Low integration of EMR and practice of medicine	Believes information in patient (tacit) is accurate
Very low feature use	Retrieves E/C data/information
High nurse involvement using EMR	Narrative is key in understanding/making sense
Low EMR-enabled communication with nursing	Invests in tacit information, creating narratives in patient records
Documents via dictation at nurse station	Invests in interpreting others' narratives
Maintains and gives priority to paper medical records over EMR	One never knows if the explicated medication list is correct or not; you never have a complete list
Primary work space: nurse station and office	Knows the limits of technology
	Seems to acknowledge fundamental uncertainty

Cecil

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	Values older generation
	Values time with patient more than money
	Narrative important in medical investigations
	Tries to live healthy lifestyle as model for patients
	Family is important (no 80 hour work weeks)
	Hard to define my medical specialty
	Patient is priority
	I'm part of a medical group

EMR Use	Uncertainty
High integration of EMR into work practices	Making data/information E/C improves accuracy & clarity of medical info
High feature use	E/C data/information can generate clutter/noise that he has to filter
High use of flags to communicate with nurse	Prefers paper chart for medical investigation
High modification/tailoring of templates – group	Discusses info/plan of care with patients to clarify message
Primary work space: office and exam room	Reads E/C data/information to prepare for patient visit/anticipation
Changes EMR use/learns features as rolled out	
Starts clinical documentation before exam	
Uses EMR to improve chargeability	
Some patient involvement in EMR use	

Mirelle

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	Every doctor wants to feel a little bit like a hero
	It's refreshing to see a handwritten note
	Patients should be responsible for their records
	Money has never been a priority; medicine was more fulfilling there
	I'm here to explore/see how things are done here
	Being here makes me feel like I'm betraying my medical school
	This typing up notes business makes me feel less like a doctor

EMR Use	Uncertainty
Struggling to use the EMR in a way that helps her see and treat patients	Having a background in internal medicine helps me to be in tune with the whole patient
Uses EMR to prepare for visit	"And, I mean the notes are important but… …I really don't know if this is going to help anyone."
High frustration with voice recognition tool	
Documents during visit if feasible/simple case	

Henry

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	Forward thinking in terms of medical practice
	Places importance on medical expertise
	I run my own small practice

EMR Use	Uncertainty
Very low integration of EMR into work practices	Comfortable with his own labor in charting
Very low feature use	Frequently talks with nurse at nurses' station
Very high nurse involvement in completing EMR related work tasks	Sometimes when data is explicated, it's hard to figure out what is real information
High reliance on paper medical records	Sometimes it's difficult to discern what change has occurred in patient condition when using E/C data/information
"Why do I need an EMR when the paper system works great for me?"	Makes use of other nurses as needed
Uses IT in other aspects of life	

Tate

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	Doctors need a stable platform on which to work
	Doctors can be terrorists
	Doctors (& nurses) need a sense of nobility (good)
	Actions and artifacts are symbols – have meaning
	Billing phenomenon separate from science
	Humor important in dealing with medical tragedy
	Became MD to help all people
	Works at free clinic – "nourishes my soul"

EMR Use	Uncertainty
Low integration into work	Uses intuition to "see between the lines"
Low feature use	Information has no value unless it is quickly retrievable and in the right/useable form
Pays $800-1000/month to NOT use EMR	When I read other people's notes I don't get very much information; I'm interested in practitioner's assessment of putting it all together.
Very high nurse involvement, but more in terms of working as a team so each can do job better	The most important part of my job is detecting change
Completes clinical documentation at noon and end of day	Neurology can't be done by using templates
Carries his original doctor bag that contains neurological assessment tools into exam room	Psychosocial and family issues important and can't be captured in templates
Uses EMR to help anticipate	Educating patients inevitably leads to increasing their ability to bring unforeseen knowledge and skill to solving their own problems better
Uses EMR to locate specific information that is important to an established inquiry	I'm not worried about showing them that I don't know the answer – they can find the answer sometimes if I can put it in a context for them

Hybrid

Tula

Demographics	Professional Values/Beliefs
	Each physician is unique
	I'm a physician, I'm not a transcriptionist
	Dictation plays an important role in documenting medical information
EMR Use	**Uncertainty**
Low integration of EMR and practice of medicine	Uses hybrid strategy for documentation
Very low feature use	I document everything I can – tedious
High nurse involvement using EMR	Documentation strategy changes with patient complexity
High EMR-enabled communication with MDs	Interacts with other MDs – inside and outside practice – in practicing medicine
Documents via dictation and typing in office	"On the fence" with many topics – perhaps demonstrates comfort with ambiguity
Uses EMR templates for routine cases; dictation for complex cases	High interaction with nursing staff throughout practice – both social and task oriented
Primary work space: office	I don't want a computer making decisions for me

Morgan

Demographics	Professional Values/Beliefs
	I take care of patients (holistic perspective)
	Getting relevant info from patients critical
	Relationship with patient is very important
	Analyzing complex problems all day long
	Likes to be informed about patient before visit
EMR Use	**Uncertainty**
Reviews patients charts before patient visit	Invests in making data/information E/C
Does not document in exam room, but will look up labs, order prescriptions	Constant worry I have missed something; I try to be thorough in my documentation
Uses EMR to involve patient in visit	I don't know if the information I need is really in there (EMR)
Types clinical documentation	Has access and uses full nursing staff

Craig

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	I take care of patients
	I'm part of a medical group
	Face-to-face discussions are important
	Patient must be the focus of the visit
EMR Use	**Uncertainty**
High integration of EMR into work practices	documenting helps organize the details/↑ accuracy by keeping track of dialogue with nurse
High feature use	Invests in finding E/C data/information
Changes EMR use as new features are rolled out	Uses nurses' station as primary work space
High use of flow sheets/tracking and trending	"Uses his nurse differently than the rest of us"
Heavy use for information gathering purposes	Uses face-to-face conversations often – with nurses and other MDs (will walk to another clinic)
Low use of EMR in exam room with patient	Seeks exchanges with others while doing work

Brian

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	Physicians are busy
	Analyzing complex problems all day long
	I'm not a technophile
	Data and information are important in my work
	I am responsible for the care of my patients
	Mission to improve the health of my patients
	I am part of a medical group
EMR Use	**Uncertainty**
High integration of EMR and practice of medicine	Questions where we're going with this IT
Moderate feature use	There are limits to the amount of information that I can review for patients
Low nurse involvement in EMR use	The system is only as good at the data in it
High input and retrieval of data/information from EMR	Struggles with responsibility/expectations regarding amount and accuracy of E/C data
Maintains and refers to paper medical records	I enter all the data/information for my patients so that I know it's accurate
Primary work space: office and exam room	Focused on information that can be codified/organized/captured

Abby

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	This job is a little bit of everything (priest, social work, medicine, teaching, etc.)
	Values open/honest communication
	Open to non-Western approaches to medicine
	Pays attention to costs of care
	Spends time with patients

EMR Use	Uncertainty
Highly integrated into work, but in the background	Focuses on relationship with patient
Communicates with nursing via flags	Tends to be thorough in documentation
EMR use highly habitual and rarely changes	Has access and uses full nursing staff
Types clinical documentation	
Very little template modification	
Feature use highly clinical, not administrative	

Wendy

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	Patient & MD walking side by side toward health
	I am a conduit for health
	I'm a consultant
	Listening and processing patient words important
	Patients have responsibility for their care

EMR Use	Uncertainty
Moderate integration of EMR into work	Seeks routine, structure
Uses EMR to help keep track of pending jobs	Focuses on processing what patient says in exam
Moderate feature use	Does not like templates because they cannot convey the specialized care given
Types notes, does not dictate	Shares information with patient and lets them decide how to proceed with care
Uses flags for semi-social purposes	"I'm pretty OCD"
Does not use EMR in exam room	Use the E/C data/information to review cases prior to visit, anticipate issues, devise semi-constructed plan
Minimal use of macros/quick text feature	Let patients tell their story
Has nurse print out previous labs/notes	
Low nurse involvement	

Frances

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	I run my own small practice
	It's important to help patients understand their condition and plan of treatment
	Physicians are individuals
	Treat patients like my family

EMR Use	Uncertainty
Clumsy integration into work	High nurse involvement in interaction w/patient
Low feature use – relies heavily on nursing staff to order labs, test, make referrals, etc.	Short cuts in explicating information makes sense to them, but not everyone else
EMR used for every patient contact	Known for looking in the old chart
Not very agile with EMR	Sometimes documentation creates information interference and static because we are no longer succinct and clear and we do unnecessary evaluations beyond the structure of positives and negatives
Dictates at lunch and end of day	We need a place with a running list of concerns
Prefers phone notes over flags	
High use of reports & letters to patients (nurse)	

Sherman

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	Face-to-face time with patient is valuable
	Should work on quality not quantity

EMR Use	Uncertainty
Moderate feature use	Not focused only on information
Reviews patients before visits – takes notes and sometimes starts documentation before visit	Reviews information in EMR before visit, but seems to be trying to get his head in the game
High use of flags – efficient for quick issues	Not everything needs to be in the medical record
High EMR-enabled communication	
Low use of macros/quick text features	
One template that is universal for all visit types	
Documents as he goes – not at the end of the day	
Rarely uses EMR in exam room – only to clarify	

Urielle

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	I take care of patients
	Getting to know patients is part of medical care
	I'm part of a medical group
	Uses play, game language in discussing job
	Health care is essential
	Hearing patients' stories is part of my job
EMR Use	**Uncertainty**
High EMR-enabled communication (MDs and nursing) - High use of flags	"Life is like a box of chocolates… you never know what you're gonna get when you open that door."
High use of nursing staff in completing work	Documents everything – "neurotic"
Does Rx depending on situation (e-fax/write)	High use of nursing in seeing patients and managing phone calls
Documents at lunch and end of day	Nursing can anticipate MD needs/actions
Moderate integration of EMR into work	Clinical documentation needs to be complete so that someone who has not seen that person can see where you're going
Prints out summary sheet and uses in exam room	Documents at nurses station and office
Rarely uses EMR during visit	Has exchanges w/ nursing between each patient

Not sure

Patrick

Demographics	Professional Values/Beliefs
Demographic data removed to maintain subject confidentiality	Physicians are busy
	Physician time should be protected
	Interaction with others should be about patients
	I run my own small practice
	Whatever it takes to provide care for my patients
EMR Use	**Uncertainty**
High (unintended) use of flags	Irreverent toward explicated data/information
High nurse involvement in EMR use	High use of nurse to filter/absorb cases
High EMR-enabled communication with nurse	
Primary work space: office and exam rooms	

References

Abbott, A. D. (1988). *The system of professions: an essay on the division of expert labor.* Chicago, IL: University of Chicago Press.

Agar, M. H. (2004). We have met the other and we're not all nonlinear: Ethnography as a nonlinear dynamic system. *Complexity,* 10(2), 16-24.

Agar, M. H. (1996). *The professional stranger: An informal introduction to ethnography*. San Diego, CA: Academic Press.

Agarwal, R., & Karahanna, E. (2000). Time flies when you're having fun: Cognitive absorption and beliefs about information technology usage. *MIS Quarterly*, 24(4), 665-694.

Ahuja, M., & Thatcher, J. (2005). Moving beyond intentions and toward the theory of trying: Effects of work environment and gender on post-adoption information technology use. *MIS Quarterly,* 29(3), 427-459.

Allen, P. M., Strathern, M., & Baldwin, J. S. (2005). The evolutionary complexity of social economic systems: The inevitability of uncertainty and surprise. In Reuben R. McDaniel, Jr. & Dean J. Driebe (Eds.), *Uncertainty and surprise in complex systems* (pp. 31-50). Heidelberg: Springer-Verlag.

Allen, P. M., Varga, L. (2006). A co-evolutionary complex systems perspective on information systems. *Journal of Information Technology,* 21(4), 229-238.

Anderson, P. (1999). Complexity theory and organization science. *Organization Science,* 10(3), 216-232.

Anderson, R. A., & McDaniel, R. (2000). Managing health care organizations: Where professionalism meets complexity science. *Health Care Management Rev*iew, 25(1), 83-92.

Arrow, K. J. (1963). Uncertainty and the welfare economics of medical care. *The American Economic Review*, 53(5), 941-973.

Ash, J., Berg, M., & Coiera, E. (2004).Some unintended consequences of information technology in health care: The nature of patient care information system-related errors. *Journal of the American Medical Informatics Association*, 11(2), 104-112.

Ashby, W. R. (1956). *An introduction to cybernetics.* London: Chapman and Hall, Ltd.

Ashforth, B., & Mael, F. (1989). Social identity theory and the organization. *Academy of Management Review,* 14(1), 20-39.

Ashmos, D. P., Duchon, D., Hauge, F. E., & McDaniel, R. R., Jr. (1996). Internal complexity and environmental sensitivity in hospitals. *Hospital and Health Services Administration,* 41(4), 535-553.

Ashmos, D. P., Duchon, D., McDaniel, R. R., Jr., & Huonker, J. W. (2002). What a mess! Participation as a simple managerial rule to "complexify" organizations. *Journal of Management Studies,* 39(2), 189-206.

Aydin, C. E., & Rice, R. E. (1991). Social worlds, individual differences, and implementation. *Information and Management*, 20(2), 119-136.

Axelrod, R., & Cohen, M. D. (1999). *Harnessing complexity: Organizational implications of a scientific frontier.* New York, NY: The Free Press.

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.

Basingthwaighte, J. B., Liebovitch, I. S., & West, B. J. (1994). *Fractal physiology.* New York, NY: Oxford University Press.

Beaudry, A., & Pinsonneault, A. (2005). Understanding user responses to information technology: A coping model of user adaptation. *MIS Quarterly,* 29(3), 493-524.

Benbya, H., & McKelvey, B. (2006). Toward a complexity theory of information systems development. *Information Technology and People.* 19(1), 12-34.

Benveniste, G. (1987). *Professionalizing the organization.* San Francisco, CA: Jossey-Bass.

Bettis, R. A., & Prahalad, C. K. (1995). The dominant logic: Retrospective and extension. *Strategic Management Journal,* 16(1), 5-14.

Bhattacherjee, A. & Premkumar, G. (2004). Understanding changes in belief and attitude toward information technology usage: A theoretical model and longitudinal test, MIS Quarterly, 28(2), 229-254.

Bohmer, R.(2009). *Designing care: Aligning the nature and management of health care.* Boston, MA: Harvard Business Press.

Boisot, M., & Child, J. (1999). Organizations as adaptive systems in complex environments: The case of China. *Organization Science,* 20(3), 237-252.

Brown, J. S., & Duguid, P. (1991). Organizational learning and communities-of-practice: Toward a unified view of working, learning, and innovating. *Organization Science,* 2(1), 40-57.

Brown, S. L., & Eisenhardt, K. M. (1997). The art of continuous change: Linking complexity theory and time-paced evolution in relentlessly shifting organizations. *Administrative Science Quarterly,* 42(1), 1-34.

Brown, S. L., & Eisenhardt, K. M. (1998). *Competing on the edge: Strategy as structured chaos.* Boston, MA: Harvard Business School Press.

Brynjolfsson, E., & Hitt, L. M. (1998). Beyond the productivity paradox. *Communications of the ACM*, 41(8), 49-55.

Burton-Jones, A., & Gallivan, M. J. (2007). Toward a deeper understanding of system usage in organizations: A multilevel perspective. *MIS Quarterly,* 31(4), 657-679.

Camazine, S., Deneuborg, J., Franks, N. R., Sneyd, J., Theraulaz, G., & Bonabeau, E. (2001). *Self-organization in biological systems.* Princeton, NJ: Princeton University Press.

Capra, F. (1996). *The web of life: A new scientific understanding of living systems.* New York, NY: Anchor Books Doubleday.

Capra, F. (2002). *The hidden connections.* New York, NY: Doubleday.

Chaudhry, B., Wang, J., Wu, S., Margaret Maglione, M., Mojica, W., Roth, E., Morton, S. C., & Shekelle, P. G. (2006). Systematic review: Impact of health information technology on quality, efficiency, and costs of medical care. *Annals of Internal Medicine*, 144(10), 742-752.

Chen, C., Garrido, T., Chock, D., Okawa, G., & Liang, L. (2009). The Kaiser Permanente electronic health record: Transforming and streamlining modalities of care. *Health Affairs*, 28(2), 323-333.

Chin, T. (2006). Avoiding EMR meltdown: How to get your money's worth. *American Medical News.* December 11.

Chu, D., Strand, R., & Fjelland, R. (2003). Theories of complexity: Common denominators of complex systems. *Complexity,* 8(3), 19-30.

Cilliers, P. (1998). *Complexity and postmodernism: Understanding complex systems.* New York, NY: Routledge.

Clemen, R., & Reilly, T. (2001). *Making hard decisions with decision tools suite.* Duxbury Press.

Clement, (1989). Learning via model construction and criticism: Protocol of evidence on sources of creativity in science. In *Handbook of creativity: Assessment, theory and research*, pp. 342-381. New York, NY: Plenum.

Cohen, M. D. (1990). Commentary on the organization science special issue on complexity. *Organization Science*, 10(3), 373-376.

Counte, M. A., Kjerulff, K. H., Salloway, J .C., & Campbell, B. C. (1987). Implementing computerization in hospitals: A case study of the behavioral and attitudinal impacts of a medical information system. In *Use and Impact of Computers in Clinical Medicine*, J. Anderson and S. Jay (eds.), New York, NY: Springer Verlag, pp. 109-122.

Crabtree, B. F. & Miller, W. L. (1999). *Doing qualitative research*. Thousand Oaks, CA: Sage Publications.

Curseu, P. L. (2006). Emergent states in virtual teams: A complex adaptive systems perspective. *Journal of Information Technology,* 21(4) 249-261.

Daft, R. L. (1989). *Organization theory and design.* St. Paul, MN: West Publishing Company.

Daft, R., & Lengel, R. (1984).Information richness: A new approach to managerial behavior and organization design. In L. Cummings, ed. *Research in Organizational Behavior.* JAI Press, Greenwich, 191-233.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use and user acceptance of information technology. *MIS Quarterly,* 13(3) 318-340.

DesRoches, C. M., Campbell, E. G., Sowmya, R. R., Donelan, K., Ferris, T. G., Jha,...Blumenthal, D. (2008). Electronic health records in ambulatory care – A national survey of physicians. *New England Journal of Medicine,* 359(1), 50-60.

DeSanctis, G., & Poole, M. S. (1994). Capturing the complexity in advanced technology: Adaptive structuration theory. *Organization Science,* 5(2), 121-147.

Dukerich, J. M., Golden, B. R. and Shortell, S. M. (2002). Is beauty in the eyes of the beholder? Predicting organizational identification and its consequences using identity and image. *Administrative Science Quarterly,* 47(3), 507-533.

Edmondson, A. C. (1999). Psychological safety and learning behavior in work teams. *Administrative Science Quarterly,* 44(4), 350-383.

Edmondson, A. C. (2003). Speaking up in the operating room: How team leaders promote learning in interdisciplinary action teams. *Journal of Management Studies,* 40(6), 1419-1452.

Edmondson, A. C., Bohmer, R. M., & Pisano, G. (2001). Disrupted routines: Team learning and new technology implementation in hospitals. *Administrative Science Quarterly,* 46(4), 685-716.

Epstein, J. M. and Axtell, R. (1996). *Growing artificial societies: social science from the bottom up.* Washington, DC: The Brookings Institutes Press.

Faraj, S., & Xiao, Y. (2006). Coordination in fast-response organizations. *Management Science,* 52(8), 1155-1169.

Fiol, C. M., & O'Connor, E. (2004). Stuff matters: Artifacts, identity and legitimacy in the U.S. medical profession. In A. Rafaeli and M. Pratt (eds.) *Artifacts and organizations,* Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Galbraith, J. R. (1973). *Designing complex organizations.* Reading, MA: Addison-Wesley.

Gell-Mann, M. (1994). Complex adaptive systems. In *Complexity: Metaphors, models and reality* (Ed, G. A. Cowan, D. P. D. M. E.). New York, NY: Addison-Wesley, pp. 17-45.

Greenwood, R., & Hinings, C. R. (1996). Understanding radical organizational change: Bringing together the old and the new institutionalism. *Academy of Management Review,* 21(4), 1022-1054.

Groopman, J. (2007). *How doctors think*. New York, NY: Houghton Mifflin Company.

Harrison, D. A., & Klein, K. J. (2007). What's the difference? Diversity constructs as separation, variety, or disparity in organizations. *Academy of Management Review*, 32(4), 1199-1228.

Hedberg, B., & Jonsson, S. (1978). Designing semi-confusing information systems for organizations in changing environments*. Accounting, Organizations and Society, 3*(3), 47-64, 1978.

Hedstrom, K. (2007). The values of IT in elderly care. *Information Technology & People*, 20(1), 72-84.

Hillestad, R., Bigelow, J. & Bower, A. (2005). Can electronic medical record systems transform health care? Potential health benefits, savings, and costs. *Health Affairs,* 24(5), 1103-1117.

Holland, J. H. (1995). *Hidden order: How adaptation builds complexity.* New York, NY: Addison-Wesley.

Holland, J. H. (1998). *Emergence: From chaos to order.* Reading, MA: Addison-Wesley.

Institute of Medicine. (2001). *Crossing the quality chasm: A new health system for the 21st century.* Washington, DC: National Academy Press.

Jasperson, J., Carter, P., & Zmud, R. (2005). A comprehensive conceptualization of post-adoptive behaviors associated with information technology enabled work systems. *MIS Quarterly,* 29(3) 525-557.

Jenson, T. B., & Kjaergaard, A. (2008). Making sense of electronic patient records: How users' values influence technology adoption. *European Conference on Information Systems Proceedings*, 2008.

Kaplan, B. (1987). The influence of medical values and practices on medical computer applications. In *Use and impact of computers in clinical medicine*, J. Anderson and S. Jay (eds.), New York, NY: Springer Verlag, pp. 39-50.

Kauffman, S. (1995). *At home in the universe: The search for the laws of self organization and complexity.* Oxford: Oxford University Press.

Kim, S. S., & Malhotra, N. K. (2005). A longitudinal model of continued IS use: An integrative view of four mechanisms underlying postadoption phenomena. *Management Science,* 51(5), 741-755

Knight, F. H. (1921). *Risk, uncertainty and profit.* Chicago, IL: University of Chicago Press.

Kruglanski, A. W. (1989). *Lay epistemics and human knowledge: Cognitive and motivational bases.* New York, NY: Plenum.

Langer, E. J. (1995). Mindfulness/mindlessness. In *The Blackwell encyclopedia of social psychology* (Eds, Manstead, A. S. R. and Hewstone, M.). Oxford: Blackwell, pp. 388-390.

Lanham, H. J., McDaniel, R. R. Jr., Crabtree, B. F., Miller, W. L., Stange, K., Tallia, A., & Nutting, P. A. (2009). How improving practice relationships among clinicians and nonclinicians can improve quality in primary care. *Joint Commission Journal on Quality and Patient Safety,* 35(9), 457-466.

Levina, N. (2005). Collaborating on multiparty information systems development projects: A collective reflection-in-action view. *Information Systems Research,* 16(2), 109-130.

Lewis, W., Agarwal, R., & Sambamurthy, V. (2003). Sources of influence on beliefs about information technology use: An empirical study of knowledge workers. *MIS Quart*erly, 27(4), 657-678.

Leykum, L. K., Parchman, M., et al. (2008). Integration of knowledge management and service delivery in primary care, Project ID IIR-06-063-2. Grant funded by Department of Veterans Affairs.

Liebovitch, L. S. (1988). *Fractals and chaos simplified for the life sciences.* Oxford: Oxford University Press.

Linder, J. A., Ma, J., Bates, D. W., Middleton, B., & Stafford. (2007). Electronic health record use and the quality of ambulatory care in the United States. *Archives of Internal Medicine,* 167(13), 1400-1405.

Linder, J. C. (1991). Outcomes measurement: Compliance tool or strategic initiative? *Health Care Management Review*, 16(4), 21-33.

Loomis, G. A., Ries, J. S., Saywell, R. M., & Thakker, N. R. (2002). If electronic medical records are so great, why aren't family physicians using them? *Journal of Family Practice*, 51(7), 636-641.

Maguire, S., McKelvey, B., Mirabeau, L., & Oztas, N. (2006). Complexity science and organization studies. S. R. Clegg, C. Hardy, T. B. Lawrence, W. R. Nord eds. *The Sage handbook of organization studies.* Thousand Oaks, CA: Sage Publications, Ltd.

Majchrzak, A., Rice, R.E., Malhotra, A., King, N., & Ba, S. (2000). Technology adaptation: The case of a computer-supported inter-organizational virtual team. *MIS Quarterly,* 24(4), 569-599.

March, J. G., Simon, H. A., & Guetzkow, H. S. (1958). *Organizations.* Cambridge, MA: Blackwell.

Markus, M. L. (1983). Power, politics, and MIS implementation. *Communications of the ACM*, 26(6), 430-444.

McDaniel, R. R., Jr. (1997). Strategic leadership: A view from quantum and chaos theories. *Health Care Management Review,* 22(1), 21-37.

McDaniel, R. R., Jr. (2004). Chaos and complexity in a bioterrorism future. In *Advances in health care management*, Vol. 4 (John D. Blair, M. D. F., & Albert C. Zapantam (Eds.), Oxford, UK: Elsevier, Ltd., pp. 119-139.

McDaniel, R. R. Jr., Lanham, H. J., & Anderson, R. A. (2009). Implications of complex adaptive systems theory for the design of research on health care organizations. *Health Care Management Review*, 34(2), 191-199.

McDaniel, R. R., Jr., & Walls, M. (1997). Diversity as a management strategy for organizations: A view through the lenses of chaos and quantum theories. *Journal of Management Inquiry*, 6(4), 371-383.

McDaniel, R. R., Jr., & Driebe, D. J. (2001). Complexity science and health care management. In J. D. Blair, M. D. Fottler & G. T. Savage (Eds.), *Advances in Health Care Management* (Vol. 2, pp. 11-36). Stamford, CN: JAI Press.

Menachemi, N., & Brooks, R. G. (2006). Reviewing the benefits and costs of electronic health records and associated patient safety technologies. *Journal of Medical Systems*, 30(3), 159–68.

Merali, Y. (2006). Complexity and information systems: The emergent domain. *Journal of Information Technology*, 21(4), 210-228.

Meyer, A. D. (1982). Adapting to environmental jolts. *Administrative Science Quarterly,* 27(4), 515-537.

Morgan, G. (1997). *Images of organization.* Thousand Oaks, CA: Sage.

Newman, M., & Robey, D. (1992). A social process model of user-analyst relationships. *MIS Quarterly,* 16(2), 249-266.

Nonaka, I. (1994). A dynamic theory of organizational knowledge creation. *Organization Science,* 5(1), 14-37.

Nutting, P. A., Miller, W. L., Crabtree, B. F., Jaen, C. R., Stewart, E. E., & Stange, K. C. (2009). Initial lessons from the first national demonstration project on practice transformation to a patient-centered medical home. *Annals of Family Medicine*, 7(3), 254-260.

Orlikowski, W. J. (1992). The duality of technology: Rethinking the concept of technology in organizations. *Organization Science,* 3(3), 398-427.

Orlikowski, W. J. (1993). Learning from notes: Organizational issues in groupware implementation. *Information Society* 9(3), 237-250.

Orlikowski, W. J. (1996). Improvising organizational transformation over time: A situated change perspective. *Information Systems Research,* 7(1), 63-92.

Orlikowski, W. J. (2000). Using technology and constituting structures: A practice lens for studying technology in organizations. *Organization Science,* 11(4), 404-428.

Orlikowski, W. J., & Robey, D. (1991). Information technology and the structuring of organizations. *Information Systems Research,* 2(2), 143-169.

Orzag, P. (2008). Evidence on the costs and benefits of health information technology. Congress of the United States, Congressional Budget Office, Publication number 2976, 1-46.

Parente, S. T., & McCullough, J. S. (2009). Health information technology and patient safety: evidence from panel data. *Health Affairs,* 28(2), 357-360.

Parthasarathy, M., & Bhattacherjee, A. (1998). Understanding post-adoption behavior in the context of online services. *Information Systems Research,* 9(4), 362-379.

Paul, D. L., & McDaniel, R. R., Jr. (2004). A field study of the effect of interpersonal trust on virtual collaborative relationship performance. *MIS Quarterly,* 28(2), 183-227.

Phelps, C. E. (1992). Diffusion of information in medical care. *Journal of Economic Perspectives*, 6(3), 23-42.

Polanyi, M. (1958). *Personal knowledge: Towards a post-critical philosophy.* Chicago, IL: University of Chicago Press.

Polanyi, M. (1966). *The tacit dimension.* London, UK: Routledge & Kegan.

Poole, M. S., & Desanctis, G. (2004). Structuration theory in *Information Systems Research*: Methods and controversies. In *The Handbook of Information Systems Research* (Eds, Whitman, M. E. and Woszczynski, A. B.), Hershey, PA: Idea Group Inc., pp. 206-247.

Prasad, P. (1993). Symbolic processes in the implementation of technological change. *Academy of Management Journal*, 36(6), 1400-1426.

Reddy, M., McDonald, D., Pratt, W., & Shabot, M. (2005).Technology, work, and information flows: Lessons from the implementation of a wireless alert pager system. *Journal of Biomedical Informatics*, 38(3), 229-238.

Rokeach, M. (1973). *The nature of human values.* New York, NY: The Free Press.

Schrader, S., Riggs, W. M., & Smith, R. P. (1993). Choice over uncertainty and ambiguity in technical problem solving. *Journal of Engineering and Technology Management*, 10(1-2), 73-99.

Schultz, U., & Orlikowski W. J. (2004). A practice perspective on technology-mediated network relations: The use of internet-based self-serve technologies. *Information Systems Research,* 15(1), 87-106.

Scott, W. R. (1981). *Rational, natural, and open systems.* Upper Saddle River, NJ: Pearson Education, Inc.

Scott, W. R. (1987). *Organizations: Rational, natural and open systems.* Englewood Cliffs, NJ: Prentice-Hall.

Scott, W. R. (1995). *Institutions and organizations.* Thousand Oaks, CA: Sage Publications.

Shannon, C. E. (1948). A mathematical theory of communication. *Bell System Technical Journal*, 27(4), 379–423, 623–656.

Shannon, C. E., & Weaver, W. (1949). *A mathematical model of communication.* Urbana, IL: University of Illinois Press.

Sidorov, J. (2006). It ain't necessarily so: The electronic health record and the unlikely prospect of reducing health care costs. *Health Affairs*, 25(4), 1079-1085.

Sornette, D. (2006). *Critical phenomenon in natural sciences.* Berlin: Springer.

Stewart, M., Brown, J. B., Weston, W. W., McWhinney, I. R., McWilliam, C. L., & Freeman, T. R. (2003). *Patient centered medicine: Transforming the clinical method*. Abingdon, UK: Radcliffe Medical Press Ltd.

Stinchcombe, A. (1990). *Information and organizations.* Berkeley, CA: University of California Press.

Strauss, A., & Corbin, J. (1998). *Basics of qualitative research: Techniques and procedures for developing grounded theory.* Thousand Oaks, CA: Sage.

Stroebel, C. K., McDaniel, R. R. Jr., Crabtree, B. F., Miller, W. L., Nutting, P. A., & Stange, K. C. (2005). How complexity science can inform a reflective process for improvement in primary care practices. *Journal of Quality and Patient Safety,* 31(8), 438-446.

Taylor, S., & Todd, P. A. (1995). Understanding information technology usage: A test of competing models. *Information Systems Research,* 6(2), 144-176.

Tushman, M. L. & Nadler, D. A. (1978). Information processing as an integrating concept in organizational design. *Academy of Management Review,* 3(3), 613-624.

United States of America Congress, 111th Congress, 1st Session, *American Recovery and Reinvestment Act of 2009*, Washington, D.C., H.R. 1, January 6, 2009.

Venkatesh, V., Morris, M. G., Davis, G. B., Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly,* 27(3), 425-478.

Vidgen, R., & Wang, (2009). Coevolving systems and the organization of agile software development. *Information Systems Research,* 20(3), 355-376.

Waldrop, M. M. (1992). *Complexity: The emerging science at the edge of order and chaos.* New York, NY: Touchstone by Simon and Schuster Inc.

Walter, Z., & Lopez, M. (2008). User acceptance of information technologies: an examination of physicians. *Decision Support Systems,* 46(1), 206-215.

Weick, K. E. (1985). Cosmos vs. chaos: Sense and nonsense in electronic contexts. *Organizational Dynamics,* 14(2), 1-64.

Weick, K. E. (1993). The collapse of sense making in organizations: The Mann Gulch Disaster. *Administrative Science Quarterly,* 38(4), 628-652.

Weick, K. E., & McDaniel, R. R., Jr. (1989). How professional organizations work: Implications for school organization and management. In *Schooling for tomorrow: Directing future reforms to issues that count.* Boston, MA: Allyn and Bacon, pp. 330-355.

Weick, K. E., & Roberts, K. H. (1993). Collective mind in organizations: Heedful interrelating on flight decks. *Administrative Science Quarterly,* 38(3), 357-381.

Weick, K. E., & Sutcliffe, K. M. (2003). Hospitals as cultures of entrapment: A re-analysis of the British Royal Infirmary. *California Management Review,* 45(2), 73-84.

West, B. J. (2006). *Where medicine went wrong: Rediscovering the path to complexity*. Singapore: World Scientific Publishing Co.

Wheatley, M. J. (1992). *Leadership and the new science: Learning about organization from an orderly universe.* San Francisco, CA: Berrett-Koehler Publishers.

Zhu, K., & Kraemer, K. L. (2005). Post-adoption variations in usage and value of e-business by organizations: Cross-country evidence from the retail industry. *Information Systems Research* 16(1), 51-84.

Zimmerman, B., Lindberg, C., & Plsek, P. (1998). *Edgeware: Insights from complexity science for health care leaders.* Irving, TX: VHA Inc.

Vita

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