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Holly Jordan Lanham

University of Texas at Austin, holly.lanham@phd.mcombs.utexas.edu

Reuben R. McDaniel, Jr.

University of Texas at Austin, reuben.mcdaniel@mcombs.utexas.edu

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Are We Putting the Cart Before the Horse? A Microcosm of Intended and Unintended Outcomes of Electronic Medical Record Implementation

Holly Jordan Lanham

The University of Texas at Austin

McCombs School of Business

Department of Information, Risk, and Operations
Management

holly.lanham@phd.mcombs.utexas.edu

Reuben R. McDaniel, Jr.

The University of Texas at Austin

McCombs School of Business

Department of Information, Risk, and Operations
Management

reuben.mcdaniel@mcombs.utexas.edu

ABSTRACT

Leaders in health care are calling for the implementation of electronic medical records (EMR) systems to help alleviate high costs of care delivery, high error rates, and uneven access to care. However, many of these leaders seem to be overlooking unintended outcomes of EMR implementation. Specifically, they may be overlooking the critical role physician beliefs and relationships play in the use of EMRs and in generating both intended and unintended outcomes. We studied a microcosm of the health care system through a qualitative field study examining EMR use in four clinics operating within a multi-specialty medical organization. We found that beliefs held by physicians about medical practice and the patterns of relationships in clinics influence EMR use behaviors in both expected and unexpected ways. Our contribution is to call attention to unintended outcomes of EMR implementation and to suggest that EMRs can be used as artifacts for learning.

Keywords

Electronic medical records, health IT, unintended outcomes, beliefs, relationships, learning.

INTRODUCTION AND BACKGROUND

Thought leaders in health care are looking to information technology (IT) to help deal with challenges associated with poor health care quality, high medical error rates, and uneven access to care (Institute of Medicine, 2001). At the same time public interest in patient-centered care and the escalating cost of health care are pushing health care systems to become more efficient and effective. Electronic medical records (EMR) systems are receiving significant attention. An EMR, at the most fundamental level, is a digitized version of a paper medical record. EMRs represent a qualitative technological advancement in the way medical information can be organized and manipulated both within and across health care organizations. A variety of EMR products exist and they range from fairly basic to highly sophisticated systems. Despite high expectations, EMRs have been poorly accepted by physicians. A recent report from the US reveals that only 13% of physicians report using a basic EMR and only 4% report using a fully functional EMR (DeRoches et al., 2008). Other reports estimate that 33% of EMR implementations fail within a year (Chin, 2006).

The National Health Service (NHS) of the United Kingdom (UK) has invested heavily in IT. The most recent IT initiative of the NHS, the National Program for Information Technology (NPfIT), was aimed at modernizing the NHS and improving the effectiveness of the services provided by the NHS. The NPfIT is marketed as the largest civil IT program in the world. In the United States (US), national health policy proposals continue to recommend investments in information technologies such as EMRs. Included in the Administration's recently passed American Recovery and Reinvestment Act 2009 (US Congress House Appropriations Committee, 2009) are appropriations for reforming the US health care system. The health care portion of this Act includes a plan for investment in IT infrastructure for improving the exchange of medical information. Discussions of challenges such as interoperability and standards development for the exchange of clinical information are underway. Fewer discussions, however, are focused on other important aspects health IT implementation. Are we perhaps putting the cart before the horse?

Health care leaders seem to be overlooking the challenge that unintended outcomes pose during the introduction of IT into health care systems. The UK is experiencing problems associated with failing to adequately consider unintended outcomes related to IT implementations in its health care system. Escalating costs beyond budget estimates are a well-documented problem. Lack of physician engagement has been an issue for NPfIT and many physicians are refusing to have their own medical records on the system. US health policy makers are in a position to learn from mistakes made in the UK. The current Administration's health care plan provides financial incentives to encourage all health care providers to have EMRs in place by 2014. Many believe that these incentives will prompt physicians to take the plunge and implement EMRs by this

deadline. However, if US health policy makers fail to consider unintended outcomes in this process to extend the use of EMRs, the results could be surprisingly bad as large numbers of medical providers simultaneously and rapidly implement EMR systems for reasons associated primarily with financial viability and with little consideration for unexpected outcomes.

Research has demonstrated the importance of paying attention to unintended outcomes of introducing IT into health care systems (Ash, Berg and Cioera, 2004). Studies of how physician identity shapes EMR acceptance (Fiol and O'Connor, 2004), how psychological safety influences surgical team learning (Edmondson, Bohmer and Pisano, 2001), and how health IT alters clinical work flow (Reddy, McDonald, Pratt and Shabot, 2005) each identified unintended outcomes of well intentioned IT interventions in health care settings. Without neglecting the many positive intended outcomes of EMR implementation, this study seeks to draw attention to important issues related to unintended outcomes of EMRs.

This paper has two main purposes: (1) to present findings from an in-depth investigation of EMR use in a setting that can be seen as a microcosm of the US health care system and (2) to call attention to the role of physician beliefs and relationships in contributing to intended and unintended outcomes of EMR implementation. We draw on social identity theory to explain the role of physician beliefs in EMR use behaviors. We draw on complex adaptive systems theory to explain the role of relationships in EMR use behaviors and to suggest that EMRs may be a conduit for learning.

Our setting is a multi-specialty clinic located in a major metropolitan area of one of the largest states. The clinic serves a wide variety of patients, providing family care as well as highly specialized medical care. There are 120 physicians in the clinic and approximately 500 employees. Many of its patients are Medicare recipients and many are privately insured employees of one of several local industries. The clinic has a close association with one hospital that is part of a multi-hospital system, but patients are admitted and treated in all of the community's more than 10 hospitals. This setting is typical of health care settings in the US with one significant exception -- the clinic purchased and installed an EMR system six years ago. Thus, we had the opportunity to study the actual use of the EMR and identify both intended and unintended outcomes of the implementation of a system-wide EMR system. Through a multiple case study, we studied EMR use by physicians working in four clinics operating within one multi-specialty clinic. This study contributes to information systems research by calling attention to unintended outcomes of EMR implementation and by suggesting that EMRs can be an artifact for learning in many health care organizations. Results from this study are applicable to research and practice in health IT contexts.

METHODS AND ANALYSIS

We conducted our study during academic year 2007-2008. At the time of the study, six years had passed since MetroClinic (a pseudonym) implemented an EMR system. Four clinics, two family medicine clinics and two specialty clinics, an endocrinology clinic and a rheumatology clinic, were selected for study. Selection criteria sought to optimize the potential for studying a wide range of EMR use behaviors. Selection criteria also sought to examine patterns of EMR use by health care generalists and specialists. By studying the same IT in the same organization, our study design allows us to look for differences in EMR use that might be explained by factors relating to physician and clinic differences, as opposed to technological or organizational factors.

Introduction to Field Sites

Family Medicine A

Family Medicine A is a family practice clinic with 16 clinic 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.

Family Medicine B

Family Medicine B is a family practice clinic with 22 total members including six physicians. Clinical support roles include a clinical manager, five LVNs, and six MAs. Non-clinical support roles include a business manager and three BAs.

Specialty Clinic A

Specialty Clinic A is an endocrinology clinic. This clinic is made up of two physicians, two LVNs, two MAs and one BA, for a total of 7 clinic members. Specialty Clinic A was the first clinic within MetroClinic to implement the EMR system and has been viewed within the organization as a model clinic for EMR use.

Specialty Clinic B

Specialty Clinic B is a rheumatology clinic with a total of 15 clinic members including 4 physicians. The clinical support staff are include a clinical manager, three LNVs, three MAs, and one referral coordinator.

Data Collection and Analysis

Using qualitative data collection techniques, we collected data about EMR use, physician beliefs and clinic relationships. Data collection methods included semi-structured interviews and non-participant observation. To obtain in-depth, rich accounts of EMR use we used an ethnographic interview approach (Agar 1996). All members at each clinic agreed to participate in a semi-structured interview. The interview guide was developed based on relevant IS, health IT, and organizational behavior literature and focused on observing physician EMR use, physician beliefs and patterns of relationships in the clinics.¹ Interviews were audio recorded and lasted approximately 30-45 minutes.

An observation template was developed using an observation guide previously used for research in health care organizations (Stroebel, McDaniel, Crabtree, Miller, Nutting and Stange, 2005). Included in the observation template were items such as clinic physical layout, work flow description, and patient flow description. Researcher field notes were written each day from jottings taken while in the field. In addition to observations made in the clinics at nursing stations, patient reception areas, support staff work areas, and employee break rooms, we shadowed workers in each role as they worked with the EMR.

Supplementing our observations, the research team conducted interviews with MetroClinic's Chief Information Officer, Chief Medical Director, Associate Director of the Board, and several members of MetroClinic's internal IT staff. This helped us gain a broader understanding of the history surrounding the EMR in this organization. The first author received clinical support staff EMR training from MetroClinic's EMR training staff to better understand observations made during the study.

The first author spent approximately one month collecting data in each field site, a total of approximately 480 hours in the field. The first week at each clinic was dedicated to non-participant observation. Semi-structured interviews were conducted in the second, third and fourth weeks. Non-participant observation was ongoing throughout the four weeks. Both investigators met each week during the data collection period to debrief. 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.

The comparative research design allowed for contrasting EMR use, physician beliefs and relationships between clinic members that were observed within and between clinics. We used a constant comparative approach to data analysis (Strauss and Corbin 1990). Interview data and observation fieldnotes were analyzed in three steps: 1) theme formation, 2) theme matching along dimensions of EMR use behaviors, beliefs and relationships and 3) theme comparison between physicians and between clinics. Both authors read the interview transcripts and fieldnotes separately, making methodological and theoretical memos and preliminary interpretations. Individual interpretations were followed by discussions whereby themes were further refined and new themes co-generated. Themes were developed by articulating a unifying idea that represented interpretations from multiple ideas in the interview and observation data. Conceptual labels were assigned to organize themes according to a common thread among ideas. At each step, themes were refined whereby similarly labeled ideas were combined into themes and given more general labels. Iterations of this process produced the findings described in the following sections and provided a platform for comparing physician EMR use, physician beliefs and relationships between members within each clinic and between clinics.

RESULTS

Analysis of the data generated findings connecting beliefs held by physicians about the practice of medicine with patterns of EMR use. We recognize that this finding is not entirely novel as others have written about the relationship between end-user beliefs and IT use in other contexts (Karahanna, Agarwal, and Angst, 2006; Taylor and Todd, 1995). Our findings move beyond simply describing how physician beliefs and relationships among physicians shape EMR use by considering intended and unintended outcomes of EMR implementation. Unintended outcomes were often viewed negatively. However, in some instances unintended outcomes had a positive impact on clinic functioning. Finally, our analysis suggests that failure to adequately understand unintended outcomes of EMR implementation may have contributed to missed opportunities for learning. The first part of this section outlines MetroClinic's goals and intended outcomes for EMR implementation. The second part of this section provides exemplar instances from the data linking physician beliefs with EMR use behaviors.² The third part of this section provides exemplar scenarios that show how relationships played a role in EMR use. The fourth

¹ The interview guide and observation template are available from the authors upon request.

² Because of limited space allowed for this submission, we use exemplar instances from our data to demonstrate our findings throughout the entire results section.

part of this section provides an exemplar scenario that demonstrates how unintended outcomes of EMR implementation at MetroClinic may have created conditions that led to missed opportunities for learning.

Intended Outcomes of EMR Implementation at MetroClinic

According to the Chief Information Officer, MetroClinic implemented their EMR system to: (1) improve information timeliness and availability to geographically dispersed users, (2) eventually be able to compile patient data and medical delivery data over time in order to learn about the population of patients being cared for by the organization, and (3) provide physicians with alternative tools for clinical documentation.

Physician Beliefs and EMR Use

Table 1 provides instances where physician beliefs seemed to influence EMR use behaviors. The beliefs are presented as quotes from the interview data and the EMR use behaviors were observed through non-participant observation techniques. The EMR use is then categorized as intended or unintended according to MetroClinic's stated goals and intended outcomes. If a behavior was not clearly unintended, we categorized it as intended.

Physician Beliefs (quotes from data)	Observed EMR use behaviors	Intended/Unintended
"All patients are unique."	<ul style="list-style-type: none"> • ↓ use of pre-written documentation templates • ↓ use of quick text features 	Unintended
"Knowing my patients on a personal level is important."	<ul style="list-style-type: none"> • Documents extraneous information about patient personal situation in EMR 	Unintended
"EMR will make me more efficient."	<ul style="list-style-type: none"> • ↑ EMR-enabled communication with nurses and other providers • ↓ face-to-face communication 	Intended
"I need the most accurate information about a patient's current medications and that information is in the EMR."	<ul style="list-style-type: none"> • ↑ feature use • ↑ reliance on medication list stored in the EMR 	Intended
"I need the most accurate information about a patient's current medications and that information is in the patient."	<ul style="list-style-type: none"> • ↓ feature use • ↑ reliance on medication list stored in patient 	Unintended
"I don't believe an EMR can help me do what I do when I practice medicine."	<ul style="list-style-type: none"> • ↑ reliance on telephone dictation system • Uses the "narrative" in dictation in to help practice medicine 	Unintended
"I am not here to do administrative tasks."	<ul style="list-style-type: none"> • Uses flags³ to communicate medical information • Relies on nurse to convert flags to documents in the EMR as appropriate 	Unintended
"I am a consultant for other physicians."	<ul style="list-style-type: none"> • Documents in the EMR as if having a conversation with referring physicians 	Intended
"I treat diseases."	<ul style="list-style-type: none"> • Tailors EMR templates around diseases 	Intended
"I treat patients."	<ul style="list-style-type: none"> • Uses EMR as a resource to care for patients • Uses EMR at nurses' station – engages nurses in care for patients. 	Intended

Table 1. Connecting Physician Beliefs to Intended and Unintended EMR Use Behaviors

³ Flags are a feature in this EMR system intended to be used for "post-it note" communication – i.e. reminders to oneself or others. Flags are not intended to contain patient medical information.

Relationships and EMR Use

Family Medicine A: Diversity Absorption

The physician work group in Family Medicine A was fragmented. Each of the three physicians had a unique approach to practicing medicine creating a clinic environment that supported three different medical practices. Conversations among physicians were cordial and tended to not focus on work issues. EMR use in Family Medicine A was diverse. Clinical and non-clinical support staff worked to absorb the differences in how the physicians used the EMR. Support staff in this clinic developed strategies for dealing with the diversity among the physicians. For instance, support staff paid close attention to both patient and physician characteristics and seemed to know how to effectively move patients through the system. Support staff routinely evaluated new patients as they entered the clinic to decide which physician would best meet the needs of the patient. These evaluations seemed to be improvised, not scripted.

Family Medicine A maintained an on-site medical records department containing paper medical records and these paper records were frequently used. Nurses and MAs worked closely with their physician and used the EMR in ways that facilitated work in the physician-nurse unit. Because physicians in Family Medicine A used the EMR differently from each other, the clinical support staff also used the EMR differently from each other. Differences in EMR use among clinical support staff were so great that nurses and MAs could not help each other with EMR related work issues. Patterns of EMR use in Family Medicine A were stable. Each physician-nurse unit developed distinct ways of using the EMR and they tended to use the EMR the same way over extended periods of time. In summary, the relationships in Family Medicine A were fragmented, particularly among the physicians, and the support staff were essential in absorbing the diversity at the physician level. Learning about the EMR was sporadic as users exhibited distinct and stable ways of incorporating the EMR into their work.

Specialty Clinic B: Respectful Laissez-Faire

The physician work group in Specialty Clinic B displayed a mixture of high respect for one another coupled with diverse ideas about how to approach rheumatology. This combination of respect and diversity created a clinic environment where physician-nurse units were free to carry out work tasks in ways they thought would help them to meet their goals. When not in an exam room with patients, three of the four physicians worked primarily in their offices and one physician worked primarily at the nurses' station. Physicians in Specialty Clinic B frequently helped each other review medical cases and spent time outside of work discussing both task and socially oriented topics. EMR use in Specialty Clinic B was tailored to physician preferences in terms of work flow and views about practicing rheumatology. For instance, one physician viewed his primary job as a consultant for referring physicians, another physician viewed his primary job as a disease specialist, and yet another physician viewed his primary job as focused on patients. Nurse use of the EMR in this clinic seemed to be determined by physician use of the EMR.

Specialty Clinic B did not keep paper medical records on-site and all of the physicians in this clinic were high users of the EMR. Nurses and MAs in this clinic worked closely with a physician and used the EMR in ways that facilitated work in the physician-nurse unit, but also in the clinic as a whole. Differences in EMR use among clinical support staff were nuanced, so nurses and MAs and BAs could help each other with EMR related issues. When new features of the EMR were rolled out, physicians in Specialty Clinic B tended to adopt them, particularly if they could find ways to make the use of a feature support their approach to medicine. In summary, the relationships in Specialty Clinic B displayed a respect for differences. Whereas each physician developed different approaches to practicing medicine, these differences were respected.

Missed Opportunities for Learning from EMR Use

EMR implementation created conditions where physicians who were using the EMR in ways that were different from how other physicians were using it and/or were different from how they were trained to use it developed a standard response to questions about their EMR use. Across all four clinics, when asked about unconventional EMR use behaviors physicians responded, "Efficiency." As we spent more time in the field, the efficiency argument began to explain less of what we were observing. When we probed into this issue, physicians spoke about additional rationales for why they used the EMR in ways beyond how they were trained. In response to our questions, we heard the following explanations. One family physician said that she⁴ 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 her thought

⁴ The gender assigned to individuals in this manuscript does not reflect the gender of the subject. This is done to help protect the identities of the subjects. While an interesting research topic, we did not include the role of gender in EMR use in the scope of this study.

process and decision making. Another family 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. A specialist physician eventually explained her unconventional use of the EMR as a way to best care for her 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 her patients. The "efficiency" explanation for unconventional EMR use behaviors is an example of an unintended outcome of EMR implementation that may have blocked learning about both the EMR and the practice of medicine.

DISCUSSION

Social identity theory (Ashforth and Mael, 1989; Pratt, Rockmann, and Kaufmann, 2006) may be useful in explaining the relationship between physician beliefs and EMR use. MetroClinic expected that physicians would use the EMR to inform medical practice and decision making. They did not, however, expect that physicians would opt for paper records over electronic records for seemingly simple aspects of medical care, such as medication lists. This may seem like a routine, non-ambiguous aspect of medical care, but several physicians cited distrust for the medication list stored in the EMR. One of the most interesting explanations for this distrust was provided by a technology savvy family physician when he said, "I know the limits of technology," and "this technology cannot help me practice medicine." He went on to explain how the best information about the medication list comes from the conversation with his patient about the medication list. The information contained in the order the medications are recalled by a patient, the pauses between medications, the inflection of uncertainty in a patient's voice when she describes her routine for taking medication, the degree to which a patient correctly states the medication list, etc. are key pieces of information to this physician. This physician also told us, "I am not a typist," and "it is not my job to make this EMR work for the clinic," and "my job is to care for my patients."

Complex adaptive systems (CAS) theory may be useful in explaining the role of relationships in shaping EMR use (McDaniel, 2004; Merali, 2004). Perhaps the nature of clinic relationships (i.e. diversity absorption and respectful *laissez-faire*) has more influence on EMR use than previously believed. Relationships among physicians in Family Medicine A created conditions where nurses could not help each other solve problems with patient care as it related to the EMR. The nature of the relationships among the physicians in Specialty Clinic B allowed them to see the EMR as an artifact that could be effectively used to support a variety of approaches practicing medicine. Clinic relationships across all clinics seemed to limit the ability of physicians to learn from each other. We suggest that CAS theory can help build a conceptualization of an EMR as an artifact that can enable learning about both the EMR and the practice of medicine.

Models of intended use were reflected in EMR training programs. As a physician encountered situations where the model no longer made sense, s/he adapted the use of the EMR to fit his/her work practices. 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. The development of this efficiency clause is an example of an unintended consequence of EMR implementation. This particular unintended consequence may have created conditions where physicians were not able to learn from the differences in EMR use behaviors.

Unintended outcomes are not inherently positive or negative. Unintended outcomes are simply outcomes of action that were not expected/predicted before the action occurred. What can be learned from intended outcomes differs from what can be learned from unintended outcomes. Whereas learning from intended outcomes is limited to confirmation/disconfirmation of a priori assumptions, learning from unintended outcomes can be frame-breaking. And whereas learning from intended outcomes is relatively easy, learning from unintended outcomes can be extremely difficult.

Our study suggests that physician beliefs and relationships among clinic members should be considered when implementing an EMR. We show an association between differences in beliefs held by physicians and differences in how physicians incorporate an EMR into their work. These differences can be intended or unintended. We show that differences in relationships among clinic members can influence how a group of health care professionals incorporate an EMR into their work practices. Finally, we show that when differences in EMR use are viewed negatively, health care organizations can miss opportunities to learn. In addition to considering the role of beliefs and relationships in EMR use as a possible source for unintended outcomes, EMR implementations should find ways to help physicians use EMRs as an artifact for learning – learning about how to better use the EMR but also about how to practice better medicine. EMRs have the potential for generating conversations between physicians. Physicians who have difficulty talking with other physicians about differences in how they approach medicine may find it easier to ask tough questions if they can use an EMR as a focus of conversation.

CONCLUSIONS

Unintended outcomes of EMR implementation pose real challenges for leaders in health care. The goal is not to predict which unintended outcomes will occur. Rather, the goal is to plan EMR implementations according to the information

available while remaining open to the possibility of unintended outcomes occurring along the way. It is in the examination of both intended and unintended outcomes that learning from EMR implementations can occur. Finding ways to examine these outcomes will be challenging, but if we fail to do so large-scale and widespread EMR implementations could create a system with improved information exchange and compliance that inadequately supports the practice of medicine. Physician beliefs and relationships among clinic members are two sources for unintended outcomes of EMR implementation. EMR systems, if conceptualized as artifacts for learning, can be a tremendously positive resource for positive health care reform.

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