

Institutional Logics of the EMR and the Problem of ‘Perfect’ but Inaccurate Accounts

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ABSTRACT

Electronic Medical Records promise to simultaneously enhance coordination and provide transparency and accountability in work process. As such, EMR are purported to benefit both hospitals and patients. In this paper we use grounded empirical data to explore how this promise plays out in the everyday tasks of healthcare providers. Building on the small body of CSCW literature that suggests that the accounting functions of EMR are impinging on the ability of medical personnel to coordinate work, we draw on the theoretical lens of new institutionalism to outline how certain institutional logics around safety and accountability are shaping the experience of EMR systems in situ. We suggest that the institutional logics that currently characterize U.S. healthcare are embedded in the EMR design itself, structuring how institutional values such as “safety” are achieved and evaluated. Using over one year of ethnographic research in an obstetrical unit, we find that the institutional logics of “safety” embedded in the EMR create negative organizational outcomes, effectively undermining coordination and necessitating inaccurate accounts of work. We provide design implications to address these issues in the current institutional environment and envision how systems might be designed to promote alternate logics of safety that are social, dynamic, and cast humans as expert agents in the system.

Author Keywords

Electronic Medical Records; Accountability; Coordination; Organizations; New Institutionalism; Safety; Medication; Ordering

ACM Classification Keywords

H5.3 Computer Supported Cooperative Work: Miscellaneous.

INTRODUCTION

Healthcare is currently facing myriad challenges. Rising costs have resulted in calls for increased efficiency in

providing safe and effective healthcare. At the same time hospitals are experiencing mounting pressures to document every action and align daily work processes with pre-determined “care pathways” and evidence-based standards.

Technologically-based solutions, particularly Electronic Medical Records (EMR), are heralded by many as a pathway to address both of these challenges simultaneously. EMR are expected to increase coordination (thus enhancing effectiveness) and automatically document work process (thus allowing new forms of record keeping and evaluation). Using ICT to streamline workflow, import standards directly into practice, and enable digital retrieval of data used to evaluate practice [14], we can increase the quality, efficiency, and safety of healthcare [23]. In essence, EMR are imagined as systems that promote two related but distinct goals – coordination and accountability [15].

Looking for solutions to the complex challenges facing the healthcare system, policymakers have embraced the potential of EMR and are encouraging hospitals to implement these systems. The American Recovery and Reinvestment Act earmarked 20 billion in funding for initiatives related to EMR, and the Centers for Medicare & Medicaid Services are offering large incentives for implementing EMR. Beginning in 2015, organizations that have not begun using EMR in a meaningful way will be penalized through a downward adjustment in their Medicaid reimbursement. These policy changes are expected to dramatically accelerate adoption of the technology; rates are projected to exceed 70% by 2019 [35]. Development and implementation of EMR is a necessary priority for hospitals.

Yet, counter to expectations, a growing body of research is beginning to suggest that EMR provide only limited benefits and may actually hurt coordination and efficiency in primary clinical care. Beyond the challenges that occur during implementation that can lead to system failure [2], implementations of EMR support certain functions at the expense of others. For example, although EMR facilitates efficient data gathering for secondary purposes, efficiency of primary clinical care activities is simultaneously decreased [6,19].

The CSCW community has been at the forefront of responding to these challenges. Research in this arena has

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focused on enabling coordination by finding ways to better align EMR systems with everyday work practices in hospitals. Such scholarship suggests that effectiveness of EMR in primary care activities can be improved through leveraging appropriate social and organizational incentive structures, designing systems with a nuanced understanding of existing workflow, and designing work systems that facilitate collaborative work [34,29]. One notable line of work has examined “workarounds” in clinical practice (i.e. 13,42). Workarounds are temporary practices used to handle exceptions to workflow. Both unexpected contingencies of work situations and inappropriately designed ICT systems give rise to workarounds [42]. However, this literature does not examine deeply a crucial factor that gives rise to workarounds on the first place: the accounting function of EMR, and the institutional logics that shape the work processes programmed into EMR.

Dourish noted over a decade ago that workflow technologies incorporate two related functions: coordination and accountability [15]. A handful of CSCW oriented studies on health ICT build on this insight. These scholars have begun to focus attention on the accountability function of EMR, suggesting that the accountability function might impinge on the coordinating function [7,8,9]. We contribute to this burgeoning stream of research and argue that the relationship between coordination and accountability needs to be further untangled through an examination of institutional logics.

Thus, we examine how EMR is designed with underlying logics of *safety*, a crucial goal of healthcare organizations at present. Using clinical ordering as a case, we empirically investigate how logics of coordination and accountability affect daily work processes and organizational effectiveness; trace the origins of existing logics; and envision how such systems might be designed differently to reflect alternative logics of “safety” in coordinating and accounting functions of ICT in hospital settings.

Specifically, we draw on over a year of ethnographic research in the obstetrical unit of a mid-size hospital to show how the dominant institutional logics of “safety” and “human error” figure in to the design of EMR. We conclude with a discussion of alternate design logics drawn from a discourse that is slowly gaining ground in the healthcare quality improvement literature that sees safety as sociotechnical and a situated accomplishment.

LITERATURE REVIEW

The Dual Role of EMR: Coordinating and Accounting

Medical records are complex sociotechnical artifacts that play a fundamental role in constituting what healthcare is and how such work gets conducted. The record is a coordinating device that allocates work and collects evidence of successful task completion, thus promoting

processes of coordination and communication among heterogeneous teams of medical workers [5].

The shift to EMR is complex and, given the centrality of patient records in medical work, presents a myriad of design challenges. A rich body of CSCW related scholarship examines the situated practices of coordination in healthcare from a sociotechnical perspective. Key topics in coordination of medical work include: coordinating heterogeneous workflows [30]; the mobility of medical work [3]; informal, technology-mediated, and inter-organizational communication among providers [20,27,41, 42]; the role of informal documentation practices, transitional records, or “working records” in coordination [13,17]; and coordination surrounding handoffs [1,22,37].

Workflow systems such as EMR do not simply coordinate work, they also create accounts of work process. Thus, such technologies have a dual function in that they are both organizational coordinating devices and organizational *accounting* devices [15,21,36]. As mentioned above, Dourish [15] argues that workflow technologies provide a structure within which the activity of an organization is rendered visible and thus accountable to outsiders. Further, while the accounting function of workflow systems often goes unrecognized by scholars and designers, the accounts produced by such systems, and the promise of extended control through increased accountability, is a key driving force behind adoption and use of workflow technologies, including EMR [18].

The burgeoning stream of CSCW literature that discuss the accounting functions of EMR notes the potential downsides of the expanded use of EMR as an accounting tool. A handful of studies suggest that the accounting functions of EMR can interfere with situated coordination of work, thus leading to unintended negative consequences [7,8,9]. A recent meta-analysis goes so far as to assert that healthcare organizations are not actually re-shaping work practices around EMR systems in beneficial ways as had been previously hoped [19].

Claus Bossen, in particular, points to the emergence of a “flip over effect” where the work process embedded in EMR becomes a model *for* practice rather than a model *of* practice. This creates a situation where accountability does not emerge as a result of the work process representation inscribed in the EMR, but “at the cost of more work, redundancy of information, and the fragmentation of the overview of patient cases” [9, p. 490].

Such studies have begun to articulate the ways in which the dual functions of accountability and coordination designed into current EMR systems become problematic. However, scholars have yet to ask why these systems are being designed the way they are -- embedded with certain ideas about how work is coordinated, what kinds of accounts are legitimate, and how they should be created.

We argue that direct attention to such questions helps clarify why and how the accountability function of EMR matters for everyday practice and organizational effectiveness. Our logic is thus: healthcare organizations are embedded in the larger institutional environment of U.S. healthcare. As artifacts for coordinating and accounting, EMR are inscribed with particular ideas about what healthcare should look like; what is envisioned as “quality of care,” where the sources of error lie, and how tasks should be ordered and delineated to reach certain metrics of care and effectiveness. These broader logics influence the design and implementation of EMR. They shape how work is coordinated by these systems. Equally important, they are the backdrops of accountability.

EMR and New Institutionalism

Specific healthcare organizations must demonstrate that they are responsive to, and oriented toward, the overarching goals, ideals, and logics of the broader healthcare system of which they are a part. In other words, hospitals are not accountable in a vacuum. They must provide accounts that make sense according to a specific institutional environment. New institutionalism, a theory that takes a sociological perspective of organizations and institutions, provides one way to gain traction on this dynamic.

New institutionalism takes the perspective that organizations are embedded in larger institutional environments and must survive within these environments. A key aspect of survival entails gaining *legitimacy* [12]. Organizations gain legitimacy by adhering to norms for conduct drawn from other organizations as well as larger arenas of policy, culture, and public opinion [26]. Scott [32] outlines three main pillars through which institutions create order: regulative, normative, and cultural-cognitive. For example, a healthcare organization is subject to regulatory standards and sanctions for failure to meet institutional standards, norms for how the organization should “behave” drawn from quality improvement repertoires, and cultural elements drawn from membership in professional groups. From this perspective, the production of accounts in healthcare organizations is directly related to survival.

Recent scholarship in this realm focuses on how institutional policies, norms, and beliefs are enacted at the micro-level. This work arises from the observation that changes, such as new rules or policies that come “from above” (the institutional level) often do not result in expected changes in organizations [24]. This line of work focuses on how institutional elements shape actions in the day-to-day life of organizational work, and how those working in organizations, in turn, reinforce, re-frame, or alter institutional conventions [24].

Taking the perspective that “institutional logics are instantiated in and carried by individuals through their actions, tools, and technologies” [28], we argue that institutional logics of U.S. healthcare are shaping the work processes embedded within EMRs [28], logic of EMR

design itself, and the norms, myths, and beliefs about how key institutional values such as “safety” are achieved and evaluated. EMR carries institutional logics about healthcare work to the technical core of organizations and makes them central to individual work. Therefore we must examine these institutional logics if we are to gain new purchase on the debate about the accounting function of EMR and find useful footing to move forward.

RESEARCH CONTEXT

“We will make sure that every doctor’s office and hospital in this country is using cutting edge technology and electronic medical records so that we can cut red tape, prevent medical mistakes, and help save billions of dollars each year.”

-President Barack Obama, 12/6/2008

At present, practices of accountability in U.S. healthcare are shifting dramatically. Increasingly, hospitals and providers are being held accountable for the actual *content* of the work [38,40]. The organizational processes underlying basic activities such as ordering and dispensing medication are carefully examined by regulatory agencies and new quality surveillance organizations representing consumers. EMR and other ICT are seen as a key means through which this oversight can be achieved. Thus, we are currently designing and implementing the infrastructure through which a new generation of evidence-based medicine and best practices will be carried out.

A major focus of improvement efforts in the last decade has been around pinpointing errors and improving the safety of medical care. This focus was largely spurred by an influential report conducted by the Institute of Medicine in 1999 entitled “To Err is Human.” This report points out that almost 100,000 people die in hospitals every year from medical errors [23].

Several stakeholders operating at the institutional level are shaping the norms, logics, and values being promoted in local healthcare organizations regarding safety. One example that is relevant to the current case is Leapfrog. The Leapfrog Group is a private organization that serves large consumers of healthcare (i.e. insurance companies) by administering a survey to hospitals that evaluates the hospitals’ practices in terms of pre-determined metrics of quality and safety. Hospitals are ranked according to results and assigned a letter “grade.” Results are made publicly available via a website (hospitalsafetyscore.org). These grades are increasingly important to hospitals; a poor grade can result in negative media coverage and significant financial loss. One of the safety items on the survey is a hospital’s use of a computerized ordering system, and the specific work processes in which the computer system is employed for medication and other orders.

To maintain legitimacy in this institutional environment, hospitals must position themselves as healthcare organizations that engage in “safe” care. This vision of

safety is then evidenced by adoption of tools and practices that adhere to prevailing logics about the sources of error and appropriate tactics of prevention. Further, they must demonstrate this position by creating visible accounts of work practice. In our fieldsite, a new EMR “went live” during the eighth month of observation (the midway point). At this time, medication ordering policies and protocols were changed in multiple ways. These changes happened in tandem with EMR implementation and directly responded to evolving institutional logics for safety, such as those assessed in the Leapfrog Survey.

In order to design EMR systems that support complex cooperative work practices in situ, we suggest that research needs to focus on how certain assumptions about accountability are being designed into EMR systems. In the rest of the paper, we explore how these shifts in understanding and assessing healthcare at the institutional level affect: how EMR systems shape practice at the micro-level; the ways in which the accounting function takes precedence over coordination in these systems; and why the cultivation of a “perfect” (if often inaccurate) account can undermine organizational effectiveness and the experience of care.

METHODS

Relying on ethnographic methods (observation and interviews), the bulk of data collection for this research occurred in a single site, the Labor & Delivery (L&D) unit of a mid-size teaching hospital (H1). The L&D unit of H1 has 14 beds and approximately 55 nurses who work 12 hour shifts from 7AM to 7PM. About 1,000 deliveries per year occur in H1. H1 is well equipped to handle both very high risk pregnancies and sick and premature infants, so the unit sees an exceptionally large number of high-risk cases. Additional data collection included both observations and interviews: we attended nursing and obstetrical conferences where safety and quality improvement were discussed; interviewed key informants working in obstetrics at other hospitals; and interviewed individuals working at a policy level on maternal care quality improvement and policy recommendations.

The first author conducted observations in the L&D unit of H1 for 16 months for periods of time ranging from four to fourteen hours during all times of the day as well as at night. Observations took place once or twice per week, intersected by three four-week periods away from the field in order to reflect and analyze data. We also conducted observations of unit and hospital-wide staff meetings, daily rounds, Practice Council, grand rounds, computer documentation training sessions, and various other education and training activities. Field notes were recorded using pen and paper and typed after leaving the field in the manner described by Emerson, Fretz, & Shaw [16].

Informants included bedside nurses, charge nurses, nurse managers, and several other interdisciplinary personnel. Nurses were the focus, in relation to the larger context of

the obstetrical team. The first author also conducted a focus group interview with twelve L&D nurses and nine formal semi-structured interviews with bedside nurses in the L&D unit at H1, as well as interviews with nurse managers and various other stakeholders. In all, we conducted semi-structured interviews with 37 participants, a multitude of additional ethnographic interviews, and 400 hours of observation in H1.

FINDINGS

Micro-Institutional logics of medication safety

Observations in H1 made it clear that the larger institutional context is actively shaping the organizational context of the hospital. This was a huge factor in the everyday lives of clinicians. For example, the newly deployed EMR replaced an older-generation (implemented in 1990) computerized ordering system. The new EMR was embedded with up-to-date safety work processes and implemented in tandem with policy changes for medication and other medical orders. Changes included an organizational policy change stating that nurses were no longer able to manage and remove orders for medication as they had previously (only residents and attending physicians now had authority to do this). Simultaneously, the EMR was programmed with a permissions structure that placed large barriers in the way of nurses attempting to manage orders. Another change was an increase in system redundancies intended to prevent medication errors. All medication orders, regardless of risk, now had to be double-checked by a pharmacist and approved before administration could occur -- except in emergency circumstances, in which system over-rides or rapid protocols could be deployed. This requirement was programmed into the workflow logic of the EMR as well as the in-unit medication dispensary unit.

We found that local workers in the obstetrical unit were familiar with and fluent in the institutional logics for safety and error underlying these changes. For example, managers and bedside nurses alike often invoked the “swiss cheese”¹ model of patient safety. In explaining this statement informants described how the “swiss cheese” model envisions the hospital as a system comprised of multiple layers. Individual layers, be they organizational, technological, or human, are weak and full of holes, and can propagate errors. But, errors only reach the patient if holes in the different layers line up. Therefore, the system

¹ This language is drawn from the work of Reason (1990) who first proposed the “Swiss-Cheese Model,” now the dominant model for analyzing medical errors and patient safety mishaps (Perneger, 2005). We do not cite Reason directly since we are using informants’ language and do not know how people developed an understanding of the “swiss cheese” model. Reason’s name was not mentioned in conjunction with the error prevention model described by participants.

must contain redundancies, affordances, and obligatory passage points to prevent errors created in one part of the system from reaching the patient.

Personnel in H1 were not only cognizant of this broader institutional logic, they were acutely aware of the fact that these logics were driving technology and policy changes in the hospital. The nurse manager, when queried about the changes in ordering process that were implemented when the EMR “went live,” said: “That is all for safety, it comes from Leapfrog and their guidelines for safety.” It is clear that the changes occurring in the hospital through EMR implementation, and affecting ordering practices, were both technological and political in origin, and operated at both the organizational (micro) and institutional (macro) levels.

Such changes to ordering instantiate certain norms, values, and logics of safety, agency, and medical work. In particular they represent two fundamental principles of “safety” as imagined in current medical discourses. First, such changes suggest that humans at all levels of complex organizational systems are the originators of errors. The system thus locates responsibility for the prevention of error outside of humans and in the purview of technical systems. An RN expressed this logic of locating safety with technical systems rather than people: “We are very safe here. We have a lot of systems in place to prevent errors, a lot of checks and balances.”

Second, changes in ordering reflect an assumption that safety is not performed or enacted in daily practice. Rather, it is a semi-stable state that resides in organizational structures. Errors are thus seen as immutable events that are figured as existing almost independently from situated action. For example, nurses describe themselves as potential “goal keepers” protecting patients against errors. In order to perform these logics medical personnel must align personal actions with protocols and follow the directives of systems embedded with safety logics. This is easier said than done.

While medical personnel understand their work through a logic of safety that relies on preserving and following the system, personnel also carry situated logics of what constitutes good practice that can contradict (what we term) the “safety through systems” institutional logic.

For example, one morning a nurse felt frustrated because her patient was asleep but the worklist manager in the EMR listed that an order for a prenatal vitamin was past due. The nurse told the ethnographer that she did not want to wake her patient up for a vitamin even though she was going to have to provide a justification in the system for why the vitamin was given late. The nurse felt it was more important for the patient to sleep and she was angry that the system was prompting her to do something that went against her clinical judgment, telling the ethnographer: “Sometimes being a good nurse means breaking the rules.”

In order to more fully articulate what “breaking the rules” looks like in daily practice, and the implications for coordinating, accounting, and organizational effectiveness, we present an ethnographic vignette drawn from fieldwork that is representative of our data on performances of orders work using the EMR. This vignette depicts a mundane yet emergent situation in which a nurse is compelled to take action in a manner not expected or prescribed by the EMR system and must deal with the fallout of this action. Three professionals are involved – a nurse, a pharmacist, and a resident. All become enrolled in the system’s logic of how work *should* proceed. The story allows us to see how the institutional logics for safety conflict with situated logics of a nurse, resulting in some surprising and undesired effects.

Ethnographic Vignette: Changing an IV

Around 12:30pm, Sabrina (nurse) checks on her patient, who is being induced at 38 weeks for mild pre-eclampsia. The induction began around 6:00am that morning and Sabrina is worried her patient's contractions are not strong enough and that she will have a very long labor. The patient is tired and hungry, and Sabrina worries she might not make it through a long induction without extra energy. The patient has not eaten since dinner the previous night and Sabrina decides that in order to improve her situation the patient needs some sugar in her IV. Sabrina decides to switch her IV from lactated ringers (LR), or normal saline, to D5, a mixture of saline and sugar – this is a common practice, and can help give a patient the energy to withstand a long labor – for a tired and hungry patient will eventually become exhausted and ineffective at pushing. Once deciding on this course of action, Sabrina wants to get some sugar going ASAP for once a patient starts to go downhill it is hard to bring her energy back up. I follow her to the medication room to grab a bag of D5.

Back in the patient’s room, Sabrina fills out a sticker to label the bag and replaces the old bag with the new D5 bag. All the while she is chatting with the patient and her husband about how she is giving her some “lunch” in liquid form that should help her to feel better. Sabrina types a note in the bedside flowsheet noting that she has hung D5.

*Around 1:20pm, Sabrina is in the nurses’ station. After hanging the bag, she now needs an official order for the D5 to be entered in Quest, the electronic medical record system used for ordering in the hospital. Quest requires Sabrina to create a record showing that the IV was **first** ordered, **then** approved by the pharmacy, and **finally**, “completed” by the nurse.*

Since Sabrina has already hung the bag she attempts to enter an order for the D5 herself. The second year resident on duty is sitting next to Sabrina in the nurses’ station. So, Sabrina tells the resident that she switched the IV and is entering a D5 order. The resident says, “OK, sounds good,” so Sabrina spends a minute or so searching for the correct order in the system -- not a simple task as there are many potential orders for IV therapy.

I watch as Sabrina finds and selects the correct order. A box pops up requesting a password. Since Sabrina is a nurse and does not have jurisdictional authority over placing orders, she has to enter a special password to complete the ordering process. She tries several times, but her password doesn't work. 'Dammit' she mutters. Eventually, Sabrina turns to the resident sitting next to her and asks if the resident can enter the D5 order herself. The resident says "OK," gets up, and moves to a computer on wheels parked in the hallway. Sabrina turns and tells me, "Watch, she will be able to do it in seconds."

Seeing the resident is indeed entering the order Sabrina turns back to her computer and logs into a different computer program, QS, which is the bedside flowsheet program where nurses make notes about significant things that happen with the patient. She scrolls back through all of the notes she has recorded in the past hour, looking for the exact time she hung the D5. She then calls to the resident at the hallway computer that the D5 was hung at 12:30pm, so the resident can backdate the order for that time.

Sabrina tells me that now the pharmacy has to verify the D5 order and, once this has occurred, she will chart it as done in Quest. She logs into Quest and sees the D5 order, but she can't mark it as complete. If she does, she will receive an error message saying that the pharmacy has to verify the order before it can be completed. The pharmacy receives an alert each time a new medication order is entered and personnel from the pharmacy must review all medication orders in order to verify that each order is safe for that particular patient. Once the pharmacy verifies the order, the nurse can mark the order as complete. Around 2:00pm Sabrina checks to see if the pharmacy has verified the order yet. It has not, so Sabrina goes to lunch. She gets back around 3:00pm and is finally able to mark the order as complete in Quest.

Undermining coordination

When we examine how Sabrina goes about actually changing the IV, it is immediately apparent that the tasks she needs to perform to give what she considers good patient care do not align with the logics of the EMR. Further, the EMR adds time, burden, and coordination hurdles to what could be a relatively straightforward medical intervention.

There are multiple situational factors to take into account when understanding Sabrina's actions. The actions taken by a nurse take place in dialogue with a particular set of circumstances. The nurse has clinical expertise and knowledge of the patient's likely trajectory into the future. These factors prompt a clinical decision to act quickly to change the IV. All of the residents were off the floor (movement is common for residents) and this was not a "page-able" situation. While the sequence of actions technically deviates from protocol, Sabrina has the negotiated and informal authority to make this decision – she is confident that no resident would contradict this

decision. In fact, the vignette reveals that both Sabrina and the resident she was working with both felt the decision was appropriate and justified. However, the vignette also suggests the significant burden placed on Sabrina in her attempts to create an account of the IV change in the EMR. One can imagine how her time and expertise might have been used differently in the service of patient care.

Sabrina is unable to violate the logics of the EMR when creating the account, because, as noted by Bossen [9], there is a "flip over effect" where the EMR is not a model *of* practice, but a model *for* practice. Thus, although the IV has been hung, Sabrina must follow the logics of the EMR. She is forced to have a resident enter the order, the order then must be verified by a pharmacist, and finally she is able to "complete" the order. Notably, this series of accounting steps extends for two hours after the IV has been hung, and takes no small amount of time, attention, and stress.

Another common example of the "flip over effect" we witnessed during fieldwork emerged when nurses needed to print transmittals for lab specimens. The programming of the EMR links printing a transmittal to collecting a specimen for an order that must be entered by a physician. The problem is exemplified by a situation where a nurse noticed that the physician had entered a wrong order (surprisingly typical since physicians must select orders from a litany of potential orders listed in a drop-down box) yet the nurse had already drawn the sample. The nurse needed to send the specimen to the lab to get blood work underway but was prevented from doing so. She could not print a transmittal that was not connected to a specific order, yet was unable to alter the order in the system herself and no physicians were available to alter the order (or to cancel the previous, faulty order). The nurse carried the blood vial in her scrubs pocket for over an hour waiting until someone was available to change the original order so a new transmittal could be acquired, delaying bloodwork and causing multiple inefficiencies.

Forcing a "perfect" account

The logics of the EMR are such that any post-hoc account of work process is subject to system requirements. In other words, the EMR produces a "perfect" account – even when that account is inaccurate. In the account of Sabrina's IV order, it will appear as if the doctor entered the order at 12:30pm, it will appear as if the pharmacy verified the order sometime between 12:30pm and 3:00pm, and that the nurse hung the IV sometime after the verification took place. In fact, Sabrina hung the IV at 12:30pm – when it was needed by the patient to assist in a difficult labor.

This official account will conflict with another account, the computerized bedside flowsheet, in which the nurse typed a note at 12:30 explaining the patient's symptoms, noting that she was hanging an IV, and that the residents were off the floor. It will also conflict with the time that the nurse wrote down on the sticker she placed on the IV bag when she hung it next to the patient's bed. It is important to note here

that the nurse did not lie. Rather, she created accurate accounts in two places – although these accounts will reflect that protocol was not followed perfectly, since the situation required contingent work that deviated from protocol. However, the EMR is the primary source of “secondary” data used for billing, research, and regulatory accountability. The flowsheet is only used rarely. The primacy of the EMR is necessary in retrospective accounting for work practice. The “perfect” account is incompatible with the “accurate” account. If the flowchart is referenced in the future it will only cause confusion as to why the two records do not match.

The sequence of actions as it was recorded in the EMR makes it appear as if a resident entered an order for D5, the pharmacy verified the order, a nurse carried out the verified order and hung the D5, and the nurse then marked the order as complete in the EMR. What is interesting is that it looks this way because, basically, *it could not look otherwise*.

The account of work that the nurse must operate in terms of has been developed based on specific institutional logics emerging out of a specific view of safety. The current practice of accountability requires that the content of medical work increasingly contain a high degree of specificity and meet current standards for “best practice” [40]. Thus, the EMR’s rendering of a routine includes the actions to be taken, the role and necessary qualifications of different types of participants, the sequence of actions, and so forth.

Thus, the EMR as a tool has an expanded capability to *audit action as it is actually happening*, meaning it is built to force certain actions to occur and to stop or slow down other actions. As we see in the vignette, this does not actually cause the nurse (in this instance) to suppress her own logic of practice, but it does make it difficult for the nurse to create an account of work *post hoc*, because she has to work through the account as if she is actually coordinating the work in the manner prescribed by the account itself.

This particular scenario, where an action precedes an order, occurred frequently with IV changes and other mundane-yet-urgent scenarios. Another “perfect but inaccurate accounts” scenario was one in which something was ordered by a physician, but not carried out by the nurse because the action was deemed inappropriate. This was sometimes due to errors in the orders programmed into the EMR itself. For example, we witnessed a scenario in which the nurse adjusted the fluid balance of multiple IVs because she knew that the protocol given in the EMR order was resulting in a fluid balance that was too high. So, the order in the system was not being followed exactly, but the actions were nonetheless “correct” and necessary for safe patient care.

Disrupting Organizations

Here we see that the EMR produces an account that is not only inaccurate, but can be detrimental to organizational effectiveness and patient care. This account leads to various organizational costs: time, attention, and energy expenditure on the part of the nurse, the pharmacist and the resident; post-hoc difficulties in establishing a “true” line of action; and possible damage to patient safety when the expertise of nurses is undermined by the logic of the system.

The IV change story provides insight into the complex and messy aspects of medical work that sit in inherent tension with the logics of the “perfect” account embedded in the EMR. This situation presents an instance of institutional logics about “safety through systems” emerging at the micro-level of the hospital unit.

The institutional logic of safety embedded in the EMR collides with necessities of the body and the situated, practices of providing medial care. There is simply no way for the nurse to change or mitigate the messiness of the situation presented to her. We chose to present an ethnographic vignette that highlights how the EMR can render basic and mundane tasks unfeasible. However, the choice of this example should not diminish the potential hazards associated with the supremacy of creating a perfect account. While we find the simple issue of inefficiency, previously highlighted by Greenhalgh et al. [19], organizational effects extend beyond inefficiency. Our findings thus suggest that the tension between logics of work and the logics of a perfect account are not simply impinging on the coordination of situated work and creating an inaccurate account, they suggest substantial implications for the organization.

We must also question the implications of bad, i.e. inaccurate data for healthcare more generally. If accounts of work are meant for secondary data purposes such as quality improvement and clinical research, it is worth exploring the impact of bad data more broadly. How useful is the data at the hospital’s disposal? Where does this data ‘go’ and how does it reflect back on hospital practice? How do we understand what leads to medical errors or increased costs from accounts of work practices crafted by the EMR? In sum, what are the risks of measuring hospital effectiveness from inaccurate accounts, and what is the effect on research based on such data?

DISCUSSION

Our research reveals that institutional logics that understand “safety” as an organizational state that emerges when systems are in place to limit the situated contingencies of medical work underlie the design, implementation, and associated organizational processes for medication ordering in a hospital unit. This suggests that we need to understand ICT design, implementation, and use as political, as well as social and technical, phenomena. The EMR system effectively ‘freezes’ policy [10] and brings certain institutional norms, logics, and values for “safety” directly

to the point of care. Further, our research reveals that the ways in which the accounting and coordinating functions of the EMR are designed lead to issues with organizational effectiveness. Specifically, the ways in which accounting is operationalized in the system we studied leads to inefficiencies in coordination and inaccurate accounts of work post hoc.

In line with prior research, we find that a tight coupling between the coordinating and accounting functions of the EMR is problematic. Further, similar to Bossen [9], we find that this coupling effectively inverts these functions, such that the work of making a perfect account directs and disrupts attempts to actually coordinate work. However, unlike past studies, our findings highlight the fact that although the account that is created in the course of changing the IV is “perfect,” it is also inaccurate. What drives this sometimes problematic and potentially dangerous inversion between accuracy and perfection? We argue that the current institutional logics shape how EMR systems are imagined and implemented. Further, institutional level policies and measurement practices structure the nature of the accounts that EMR are designed to produce.

The theoretical lens of new institutionalism allows us to examine how the context and conversations around U.S. healthcare shapes the functionality of EMR systems at the micro-level in multiple ways. First, work process representations are imbued with a logic that clear delineation of work will increase safety by limiting human discretion over task and temporality. Thus, the work process representation is detailed and highly specified – including roles of actors, assigned actions, and specific sequences of steps that should be carried out. Second, because the EMR is designed with a logic of “safety through systems” it goes beyond simply delineating work in linear paths. It is designed to force certain actions, stop others, and pinpoint accountability when processes are not followed. Thus, the EMR system itself is designed with the notion that accounting and coordinating *should* be tightly coupled. Third, the system is designed with a logic that designing safety in systems is primarily a technical rather than a social concern. Errors are conceptualized as immutable entities that originate somewhere in a complex system and are prevented by various checks and “layers” designed into the work system through permissions and protocol. Finally, the dominant institutional logics of safety are reflected in the culture of the unit and the everyday discourse of workers.

Competing logics in healthcare

The current design of the EMR and accompanying policy changes are drawn directly from the dominant paradigm for healthcare safety. Informed by literatures of complex systems and safety science, the current safety paradigm of U.S. healthcare is reflected on the first page of the IOM’s 1999 report:

Human beings, in all lines of work, make errors. Errors can be prevented by designing systems that make it hard for people to do the wrong things and easy for people to do the right things...In health care, building a safer system means designing processes of care to ensure that patients are safe from accidental injury (p. ix).

This perspective is formally termed Organizational Accident Theory (OAT) and at present forms the overarching framework for patient safety in the U.S. [25], and was formally adopted by the Institute of Medicine in 2000.

However, a small but expanding body of work on safety in healthcare organizations takes the view that safety is social, situated, and agentic. This literature conceptualizes safety as “...a dynamic social process of collective responsibility and adaptation” [25]. Further, this literature problematizes approaches to “human error” (and even the term itself) that attempt to design systems as if humans are cogs in a system who need stricter monitoring and regimentation [11,31]. Drawing on management literature on high reliability organizations, this school of thought argues that we must develop safe practices and cultures along with technical systems. Promoting safety through systems that limit human action with a heavy hand is not the best way to achieve such a safety culture; in fact, promoting in situ adaptation is key to achieving safety on an ongoing basis.

Implications of the “perfect” account

Here we come to another important question – what are the various goals embedded in accounts of work process? From the perspective of new institutionalism, creating a perfect account through the EMR allows hospitals to symbolically and legitimately operate in an institutional environment. However, accountability is also an important value in and of itself. This is particularly true for organizations that provide highly complex services with high social value [33]. Healthcare is a public good.

Our findings reveal that accounts produced by EMR are not necessarily accurate depictions of work process. This is not the fault of providers. The logics of the system simply do not allow the account to be otherwise. We are not suggesting that medical records were ever completely accurate. We know that this is not the case [21]. However, our findings do suggest that the mechanisms designed to create a “perfect” account may unintentionally necessitate inaccuracy.

Our findings also raise questions about post hoc data uses, such as clinical and quality improvement research [19]. As researchers prepare to make use of the deluge of data made available by the adoption of EMR systems, our findings suggest a note of caution is needed. In our ethnographic vignette, the bedside flowsheet program was a more accurate source of information about the events that occurred. It is possible that researchers may need to consider other sources of data, triangulate data culled from

EMR systems with data from other accounts, or take the results of studies conducted using EMR-sourced data with caution.

Decoupling coordinating and accounting functions

In their classic work in new institutionalism, Meyer & Rowan [26] describe how organizations must “maintain face” in their larger institutional environments by adopting institutional standards, categories, and procedures, and that these often conflict with everyday uncertainties faced by organizations in the course of doing work. However, organizations may mitigate the impact of these conflicts through “decoupling” formal representations from everyday work practices – appearing to enact institutional standards in formal ways while continuing to work according to situational demands.

In the case of the EMR, institutional logics are built into the workflow technology itself, attempting to force actions in service of the formal account. Although EMR is designed to prevent decoupling by making it difficult or impossible to engage in work processes that do not match those programmed in the EMR, our data shows that workers effectively de-couple situated actions from EMR accounts of action. Further, we find that such de-coupling can promote situated and adaptive work processes that are beneficial. Although it may seem counter-intuitive, we propose that designing systems that allow for a degree of decoupling would prove beneficial for both the coordinating and accounting functions of EMR.

Implications for design

Design implications of this are twofold. First, in our current healthcare environment dominated by the “safety through systems” paradigm designers should consider what it would take to “decouple” the dual functions of workflow systems. In other words, what would it mean to decouple the formal need to create an account of work practice from the situated contingencies required by on-the-ground coordination?

Second, anticipating a possible shift in dominant logics stemming from the emerging conversation around healthcare as a dynamic social and technical process, we can begin to imagine designing an EMR system that reflects alternative logics of how to engender safe and effective healthcare.

Designing for decoupling

How might we design EMR for de-coupling? First, designers can recognize that hospitals need to produce charts that are detailed, accurate, and supportive of *in situ* coordination. This requires a delicate balance. At present, systems are designed with the assumption that real-time charting is ideal, and that clinicians will carry out work processes *through* the EMR, creating an account as by-product. However, it is essentially impossible to predict the intricate sequence of steps that clinicians will take in order to carry out a task. Thus, we propose that designing systems that facilitate what clinicians refer to as “backcharting,” or

charting after the fact, could result in more accurate accounts and less impact on coordination.

Supporting backcharting would require *decoupling* certain tasks in the EMR. Indeed, “forcing functions” are seen as a tool that promotes safety [4]. We argue that while tight coupling of tasks may be felicitous in certain instances, this technique can be quite problematic and should be deployed with care. For example, at present the tasks “collecting specimen” and “printing specimen transmittal” are coupled together. That is, the system assumes you cannot do one with the other and that they should proceed in a certain order. Yet, entering orders, collecting specimens, managing orders, preparing specimens, and engaging in double-checks can (and should) not always proceed in lock step. Designing systems that allow users to complete steps based on situated contingencies and then create accurate accounts of these steps would improve both efficiency of coordination and accuracy of accounts.

Another way to promote decoupling would be to increase use of unstructured data entry and narrative accounts of work. We found that accounts in the electronic bedside flowsheet were more accurate than those in the EMR. Because of the more open-ended interface clinicians were able to record narrative accounts of work more easily, and make “marks” on the flowsheet when significant events occurred but they did not have time to chart them. Automating some aspects of the process, such as providing markers for tasks completed or orders entered, while designing an interface that allows clinicians to chart either in the moment or go back and contextualize complex actions would increase efficiency and effectiveness during actual episodes of care.

We cannot discuss decoupling without acknowledging that a major potential benefit of EMR in terms of safety is decision support and systemic “hard stops” that prevent egregious errors. However, the present design of EMR does a poor job of distinguishing between situations in which an error has a large potential for harm versus those where the potential for harm is miniscule. The current mode of design has created a work system that feels like death from a thousand paper cuts – increasing complexity and heavy-handedness of the system have led to a proliferation of small inefficiencies and frustration.

Designing for a new safety paradigm

The emerging conversation in safety science and healthcare systems literature suggests an alternate path for re-imagining the design of EMR systems. What might it look like to create an EMR system designed with the notion that safety is “...a dynamic social process of collective responsibility and adaptation” [25]?

Such a system would be based on a logic of professional expertise and agency. In other words, hospital work is being carried out by skilled and mindful human agents. Thus, design interventions for safety such as redundancies and

forcing functions would be deployed conservatively, with the understanding that such functions can undermine situated work. One possible solution would be to create a hierarchy of ordering functions in the EMR, such that only those actions that present high risk are subject to systemic design constraints.

Designing for “dynamic social processes of collective responsibility” would also inform such a system. One solution is to draw on recent work by Valentine and Edmondson [39] on the development of “team scaffolds.” This approach recognizes the shifting and dynamic nature of teams in mission critical organizational environments (emergency rooms), and sees responsibilities as constantly in flux. An EMR design based on a team scaffold approach might imagine the “user” of an EMR system to be patient-centered “teams” lead by physicians or nurse practitioners. This approach would be based on the notion of appropriate fluidity of collective tasks and responsibilities. An EMR that supports teams of multiple users engaging in collective work would allow “captains” to cede discretion of certain tasks, such as manipulating orders, to other members of the team.

CONCLUSION

Our research suggests that it is imperative that CSCW researchers see design and implementation of EMR as occurring not just within sociotechnical systems, but also within systems that are political. Adoption of an EMR use of the system to produce real time accounts of work are necessary endeavors for hospitals hoping to maintain legitimacy in the current institutional environment of U.S based healthcare. We are currently building the infrastructure for new forms of evidence-based healthcare and oversight. However our findings show that EMR workflow tools designed to reflect a “safety through systems” logic are problematic for organizational effectiveness. The tight coupling of coordination and accountability built into current systems effectively inverts coordinating and accounting functions, hampering coordination and leading to the creation of a “perfect” but inaccurate account of work.

EMR systems are not simply tools for coordinating work or representing work practice. These systems are the manifestation of institutional logics about how healthcare should be practiced and attempt to dictate work along prescribed lines. In this view, it is not simply that increased accounting demands impinge on situated work practice, or that work process representations are out of synch with situated work practices. Rather, the very logic of work embedded in work process representations and the forcing functions of the EMR conflicts with situated practices and in-the-moment contingencies of doing work. By articulating the institutional logics embedded in current systems we are able to brainstorm how to re-design systems in the current institutional environment and envision how systems might be built to reflect evolving institutional logics of safe care.

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REFERENCES

1. Abraham, J. and M. Reddy (2008). Moving patients around: a field study of coordination between clinical and non-clinical staff in hospitals. *Proc. CSCW 2008*, ACM Press, 225–228.
2. Anderson, J.G., Aydin, C.E., and Jay, S.J (1994). *Evaluating Health Care Information Systems: Methods and Applications*. Sage Publications, Thousand Oaks, CA.
3. Bardram, J. E., and Bossen, C. Mobility work: the spatial dimension of collaboration at a hospital. *Computer Supported Cooperative Work* (2005). 14(2), 131- 160.
4. Bates, D.W., and Gawande, A.A. (2003). Improving safety with information technology. *NEJM*, 348, 2536-2534.
5. Berg, M., and Bowker, G. The multiple bodies of the medical record: toward a sociology of an artifact. *The Sociological Quarterly*. (1997). 38(3), 513-537.
6. Berg, M. (2001). Implementing information systems in health care organizations: myths and challenges. *International Journal of Medical Informatics*, 64, 143-156.
7. Bjørn, P., and E. Balka. Health care categories have politics too: unpacking the managerial agendas of electronic triage systems. *Proc. ECSCW 2007*. Limerick: Springer (2007), 371–390.
8. Bossen, C. (2006). Representations at work: a national standard for electronic health records. *Proc. CSCW 2006*. ACM, 69–78.
9. Bossen, C. (2011). Accounting and co-constructing: the development of a standard for electronic health records. *Computer Supported Cooperative Work*, 20, 473–495.
10. Bowker, G.C. and Star, S. L. (1999). *Sorting Things Out: Classification and Its Consequences*, Cambridge, MA: MIT Press.
11. Dekker, S. W. A. (2006). *The Field Guide to Understanding Human Error*. Aldershot, UK: Ashgate Publishing Co.
12. DiMaggio, P.J., and W.W. Powell, (1991). Introduction. In *The New Institutionalism in Organization Analysis*. WW Powell and P.J. DiMaggio (eds.) Chicago: University of Chicago Press.

13. Chen, Y. (2010). Documenting transitional information in EHR. *Proc. CHI 2010*. ACM Press, 1787–1796.
14. Dickerson, K., & Manheimer, E. The Cochrane Collaboration: evaluation of health care and services using systematic reviews of the results of randomized controlled trials. *Clin Obst & Gyn*, (1998). 41(2), 315–331.
15. Dourish, P. Process descriptions as organisational accounting devices: the dual use of workflow technologies. *Proc. GROUP 2001*, ACM Press (2001), 52–60.
16. Emerson, R.M., Fretz, R.I., and Shaw, L.L. *Writing Ethnographic Fieldnotes*. (1995). Chicago: The University of Chicago Press.
17. Fitzpatrick, G. Integrated care and the working record. *Health Informatics Journal*, (2004), 10(4), 291–302.
18. Fitzpatrick, G., and G. Ellingsen. A Review of 25 Years of CSCW Research in Healthcare: Contributions, Challenges and Future Agendas. *Computer Supported Cooperative Work* (21 June 2012), 1-57.
19. Greenhalgh, T, H., W.W. Potts, G. Wong, P, Bark and D. Swinglehurst (2009). Tensions and Paradoxes in Electronic Patient Record Research: A Systematic Literature Review Using the Meta-narrative Method. *The Milbank Quarterly*, 87(4), 729–788.
20. Hartswood, M., R. Procter, M. Rouncefield and R. Slack (2003). Making a case in Medical Work: Implications for the Electronic Patient Record. *Computer Supported Cooperative Work*, 12, 241–266.
21. Heath, C. and P. Luff. (1996). Documents and Professional practice: ‘bad’ organisational reasons for ‘good’ clinical records. *Proc. CSCW 1996*. ACM Press (1996), 354–363.
22. Hilligoss, B., and M. Cohen. (2011). Hospital handoffs as multifunctional situated routines: implications for researchers and administrators. *Advances in Health Care*, 11, 91-132.
23. Institute of Medicine. (1999). *To Err is Human: Building a Safer Healthcare System*. Kohn, L.T., Corrigan, J.M., & Donaldson, M.S. (Eds). Washington DC: National Academies Press.
24. Kellogg, K.C. (2009). Operating room: relational spaces and microinstitutional change in surgery. *The American Journal of Sociology*, 115(3), 657-711.
25. Lyndon, A., and Kennedy, H.P. (2010). Perinatal safety: from concept to nursing practice. *J Perinat Neonatal Nurs.*; 24(1): 22–31
26. Meyer, J.W., & Rowan, B. (1977). Institutional organizations: formal structure as myth and ceremony. *American Journal of Sociology*, 83, 340-63.
27. Østerlund, C. S. Documents in place: demarcating places for collaboration in healthcare settings. *Computer Supported Cooperative Work* (2007) 17, 195–225.
28. Powell, W.W., and J.A. Colyvas. (2008). Microfoundations of institutional theory. In *The SAGE Handbook of Organizational Institutionalism*, eds. Greenwood, R., Oliver, C., Sahlin, K., & Suddaby, R. Thousand Oaks, CA: Sage.
29. Pratt, W., Reddy, M.C., McDonald, D.W., Tarczy-Hornoch, P., Gennari, J.H. (2004). Incorporating ideas from Computer Supported Cooperative Work. *Journal of Biomedical Informatics*, 37, 28-37.
30. Reddy, M., P. Dourish and W. Pratt. (2001). Coordinating heterogeneous work: Information and representation in medical care. *Proc. ECSCW 2001*. 239–258.
31. Rochlin GI. (1999). Safe operation as a social construct. *Ergonomics*, 42(11):1549–1560.
32. Scott, W.R. (2001). *Institutions and Organizations*. Thousand Oaks, CA: Sage, 2nd ed.
33. Scott, W.R. (2003). *Organizations: Rational, Natural and Open Systems*. Prentice-Hall: Upper Saddle River, NJ. 5th ed.
34. Shekelle, P.G., and Goldzweig, C.L. (2009). *Costs and Benefits of Health Information Technology: An Updated Systematic Review*. London: Health Foundation for Southern California Evidence-Based Practice Center, RAND Corporation.
35. Steinbrook, R. (2009). Health care and the American Recovery and Reinvestment Act. *New England Journal of Medicine*, 360(11), 1057-1060.
36. Suchman, L. Making Work Visible. *Communications of the ACM*, (1995). 38 (9), 56–61.
37. Tang, C., and S. Carpendale (2007). An observational study on information flow during nurses' shift change. *Proc. ACM CHI 2007*, ACM Press, 219–228
38. Timmermans, S., and Berg, M. *The gold standard: the challenge of evidence-based medicine and standardization in health care*. (2003). Philadelphia: Temple University Press.
39. Valentine, M.A., and Edmondson, A.C. (2013). Team scaffolds: how minimal team structures enable role-based coordination. HBS Working Paper 12-062.
40. Wiener, C. L. *The Elusive Quest: Accountability in Hospitals*. (2000). New York: Walter de Gruyter.
41. Winthereik, B. R., and S. Vikkelsø (2005). ICT and integrated care: some dilemmas of standardising inter-organisational communication. *Computer Supported Cooperative Work*, 14, 43–67.
42. Zhou, X., M. Ackerman and K. Zheng (2011). CPOE workarounds, boundary objects, and assemblages. In *Proc. CHI 2011*. ACM Press, 3353–336.

