WHY SOME PHYSICIANS ACCEPT HEALTHCARE INFORMATION TECHNOLOGY AND OTHERS RESIST IT: AN ACTIVITY-THEORETIC ANALYSIS

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ABSTRACT

This paper examines why physicians react differently to the introduction of healthcare information technology (IT) in the same hospital at the same time. These diverse reactions, manifested as different forms of acceptance and resistance, are interpreted within the social-historical context of physicians' work at a large urban hospital in the USA, using Activity Theory as the theoretical lens. While prior IT research has examined patterns or "similarities" in user behaviors, we examine user "differences" and reconcile these differences within a meta-theoretic framework. We also extend current IT usage research from voluntary to mandatory settings and demonstrate the viability of activity theory as an interpretive lens for future research.

Keywords: Healthcare information technology, acceptance, resistance, activity theory.

INTRODUCTION

Healthcare information technologies (IT), such as electronic medical records (EMR) and computerized patient order entry (CPOE) systems, are widely expected to increase patient safety, improve healthcare delivery, and lower healthcare costs [14]. However, not every physician sees these technologies as equally beneficial, resulting in their successful acceptance at some hospitals (e.g., [13]) and staunch resistance in others [8]. In one particular instance, in 2003, physicians at the prestigious Cedars-Sinai Medical Center at Los Angeles rebelled against a newly installed CPOE system, complaining that the system was too great a distraction from their medical duties and forcing its withdrawal after the system was already operational in two-thirds of the 870-bed hospital [5].

Why do some physicians react positively and others negatively toward the same healthcare IT within the same organization at the same time? This is the central research question of interest to this study. Reactions, in this context, refer to users' perceptions (e.g., beliefs, emotions, fears) and behavior (e.g., acceptance or resistance) related to a given IT. Understanding such diverse reactions is the first step toward designing customized intervention strategies to meet the unique needs and concerns of acceptors and resistors, which are currently

missing in healthcare practice. For instance, current strategies directed at improving acceptance among acceptors may not help overcome resistance if acceptance and resistance are distinct behaviors triggered by different causative mechanisms.

Despite a vast body of prior research on IT acceptance, research on IT resistance has remained sparse. Acceptance research has primarily followed the positivistic paradigm, using such theories as the technology acceptance model (TAM) [3], the theory of planned behavior (TPB) [1], and the Unified Theory of Acceptance and Usage of Technology (UTAUT) [16]. This research has identified numerous factors, such as perceived usefulness, perceived ease of use, attitude, social norms, facilitating conditions, and self-efficacy, that are presumed to influence IT acceptance [16]. However, this research fails to explain why some users in the same population tend to resist the same IT despite the presence of the above factors.

Though some may contend that resistance is equivalent to IT non-acceptance, we argue that this is not the case for at least three reasons. First, non-acceptance may imply that potential users are simply *unaware* of a new IT or are still *evaluating* it prior to its eventual acceptance, while resistance implies that the IT has been *considered and rejected* by potential users. Second, IT acceptance or non-acceptance is a *voluntary* decision made in voluntary adoption settings, such as use of personal-use IT such as electronic mail and online social networks, while resistance tends to occur in *mandatory* settings, often within organizations, when a new IT is imposed upon users against their will via an executive decision. Third, resistance is often marked with open hostility toward change agents and/or covert behaviors to stall or undermine change (e.g., [5]), while non-acceptance does not generally engender such deviant behaviors. Even in organizations where blatant disregard for management policies may result in sanctions or job loss, apparent acceptance may be masked with covert forms of resistance such as procrastination, 'forgetting' certain tasks, and slow performance [11]. Hence, IT acceptance appears to be a distinctly different behavior than IT resistance, and factors that predict acceptance also appears to be very different from those that predict resistance [15].

Yet, IT resistance appears to be a pervasive problem in organizations, and has been observed not only among physicians [2, 8], but also among accountants [12], insurance underwriters [6], and others. Markus [12] found that divisional accountants resisted a new financial accounting system in a firm not because of system deficiencies (e.g., inadequate features) or individual limitations (e.g., lack of training), but because they feared losing control over key accounting data due to IT usage and consequent loss of organizational power. Lapointe and Rivard [8] observed that physician resistance to a clinical IT at three hospitals was also triggered by perceived threats, such as loss of power and reorganization of work. In a survey study, Bhattacherjee and Hikmet [2] found perceived threat to be a significant predictor of physician resistance to CPOE systems. Hirschheim and Newman [6] noted that insurance underwriters resisted a new commercial insurance policy processing system for a wide range of reasons, including little felt need for change, poor technical quality, minimal training, redistribution of resources, and poor fit with the underwriters' work.

Our review of the nascent IT resistance literature suggests that: (1) resistance and acceptance are different behaviors with distinct sets of predictors, (2) there is little consensus on what drives resistance, although perceived threat appears to be a recurrent theme, (3) resistance may be

manifested in different ways, ranging from deliberate non-use and sabotage to more subtle or covert behaviors such as procrastination, forgetting, and absenteeism, and (4) unlike acceptance, there is no core theory to inform or guide resistance research.

In light of the above findings, the goal of this study is to explore the varied nature of physicians' perceptions and behaviors in response to the introduction of CPOE at a large urban hospital in the southeastern USA. We adopt an interpretive case research approach to guide our inquiry. The interpretive tradition of inquiry is best suited for uncovering diverse reactions from the subjective perspectives of the participants, while the case research approach allows us to present a rich and detailed portrayal of the historical evolution of CPOE implementation at our study site and evaluate the physicians' reactions within the socio-historical context of their professional work. Our analysis is based on 47 face-to-face interviews of physicians conducted over an eight-year period, and is corroborated by internal documentation, field observations, and interviews with other constituents such as clerical staff, nurses, and hospital administrators. We use activity theory as a conceptual "lens" to structure our interpretive analysis.

The rest of this paper proceeds as follows. The next section describes activity theory and its relevance to understanding physician reactions to healthcare IT. The third section presents our research methods, including case background, data collection, and data analysis. The fourth section describes the study's findings. The fifth and final section discusses our study's limitations and implications for research and practice.

ACTIVITY THEORY

Activity theory was developed in the aftermath of the 1917 Russian Revolution by psychologists Lev Vygotsky, Alexei Leont'ev, and A. N. Luria at Moscow State University. Inspired by Marxist ideas, this theory was part of a broader effort to develop a new tradition of cultural-historical psychology based on the premise that human consciousness and actions are shaped by and shapes their socio-cultural context, as an alternative to Western psychology that viewed human minds and societies as distinct and separable entities in their own right [7, 9].

Activity theory is not a "theory" (i.e., a mid-range theory) in the strict sense of the term, but rather a general conceptual framework (i.e., a meta-theory) that can be used as a foundation for building predictive mid-range theories. It is centered on the notion of an *activity*, defined as a system of *actions* undertaken by *subjects* (actors) to transform an *object* in order to achieve a desired *outcome* [9]. Subjects perform these actions using *tools* (artifacts), which may be external (e.g., a computer) or internal (e.g., a plan of action). An example of an activity may be operating a call center, where customer service personnel (subjects) are entrusted with the task of serving incoming customer service requests (objects). These employees transform customer service requests (objects) into fulfilled requests (outcomes) using computers, customer databases, and standard procedures (tools). Objects may be a material entity (e.g., a specific customer service request) or an objective (a generalized goal such as higher customer satisfaction). The consciousness and actions of subjects are shaped by socio-cultural influences, which may include shared knowledge and practices (e.g., how to react to irate customers, escalation procedures for customer complaints), and hence, subjects' actions cannot be isolated from or interpreted

independently of the context. The unit of analysis is the activity system, within which subjects' individual actions are embedded.

The key principles of activity theory are: (1) hierarchical structure of activity: activities are composed of multiple goal-directed actions needed to transform an object, (2) object-orientedness of reality: we live in a reality that has objective properties (e.g., goals, norms, expectations) that are socio-culturally defined and that influences our actions, (3) tool-mediated actions: our interaction with reality is shaped by tools or artifacts at our disposal such as shared languages, knowledge, and standard operating procedures, and (4) internalization/externalization duality: human consciousness (mind – internal) and actions (external) shape each other through the simultaneous and inseparable processes of internalization (e.g., remembering, analyzing, planning, imagining, calculating) and externalization (e.g., manipulating real objects, collaborating), which must be analyzed jointly rather than separately.

The above principles can be illustrated using a simple example. Primitive hunters hunted in two groups: bush-beaters, whose job was to frighten game and move it in a desired direction, and catchers, whose job was to lay a trap and catch the game [9]. The actions of the bush-beaters would seem irrational if examined in isolation, but would make sense if evaluated within the context of the entire hunting activity. Hence, the individual actions of bush-beaters and catchers contributed to the collective hunting activity (hierarchy). Second, the hunting activity had certain objective properties: the goal of hunting down game, hunting as a collective effort, and the best way to hunt was to direct the game into a trap. Third, hunters' actions were mediated by tools, such as spears, knowledge about the game, and hunting strategies developed from prior experiences. Fourth, hunters learned more about the hunting activity as they performed the activity, which they used to improve their own actions (internalization) and their collective knowledge of hunting (externalization).

Tools occupy a special role in activity theory as the means that mediate subjects and their actions (objects). Tools embody the experiences of previous actors who tried to solve similar problems in the past and who modified the tool to make it work better (e.g., its design, material, knowledge about its use). Tools shape how we interact with reality, and we recreate and transform tools during the course of our actions. Tools provide the means of accumulation and transmission of social knowledge, and impact not only the way we act, but also how we think about our actions. Tools can enable and constrain our actions concurrently: they can empower us, while also limiting our choice of actions to those that are defined by the tool [7].

To structure and guide activity theoretic analysis, Engeström [4] proposed an *activity system model* (ASM) by distilling and extending the key ideas of activity theory (see Figure 1). ASM views activity systems as comprising of three activity structures (subject, object, and community) that are influenced by three mediators (tools, rules, and roles). Leont'ev's [9] version of activity theory included only subject, object, and tools, while community, roles, and rules were added by Engeström [4]. *Community* refers to a group of workers who share the same object; *rules* are norms, conventions, or social relations that define how a subject fits in a community; and *roles* refer to the organization of the community in relation to the transformation process (i.e., division of labor). In natural settings, human actions may only be mediated by tools. However, in social settings, actions are performed in collaboration with others (community), and are mediated by

socio-culturally defined rules and roles. This collective way of working, grounded in tradition and knowledge shared by a group of workers, is called practice or "praxis." The mediating processes in ASM are continually modified and recreated during practice, as better tools, rules, and roles are identified to improve the transformation process. An analysis of human actions must therefore take into account the socio-cultural context within which such actions take place as well as the historical evolution of the mediational processes employed in that action.

Engeström [4] employed activity theory to study physicians' activities at a medical practice in Finland. Through observation, discourse analysis, and historical reconstruction, he observed that physicians (subjects) held varying conceptions of their work (object) in bio-medical, socio-medical, administrative-economic, and system-interactive terms, which influenced their delivery of medical care (outcome). Because physicians were embedded within and governed by their professional community and the Finnish healthcare system, their ability to work was constrained by the biomedical concepts and techniques mandated by their profession (tool), the random allocation of patients to physicians in the Finnish system (rule), and the inflexible division of labor between physicians and other healthcare providers (role). These constraints forced physicians to treat all healthcare problems as biomedical problems with little consideration to socio-medical, economic, or other concerns. Conducted before the influx of IT in healthcare, this study did not examine the role of IT as a tool in healthcare. Our study augments Engeström's work by specifically focusing on healthcare IT as a tool and studying its impacts on the rules, roles, and object of physicians' work.

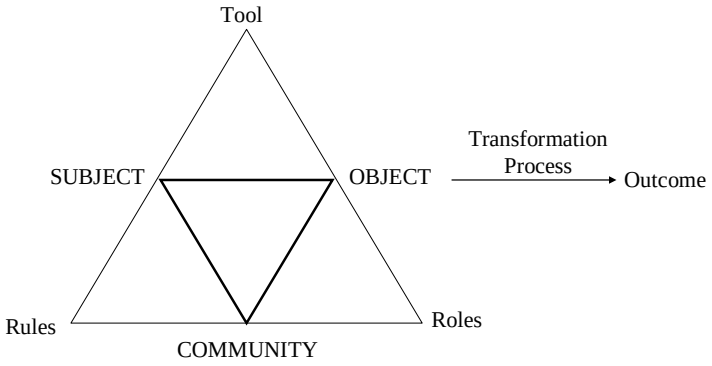

Figure 1. Activity System Model (Engeström [15])

RESEARCH METHODS

Case Background

Our case study was conducted at Memorial Hospital (a pseudonym), a large 800+ bed, regional medical center in the southeastern USA. Memorial Hospital is a community hospital where physicians enjoy practicing privileges but are not salaried staff members. Because they earn no salary from the hospital, many physicians feel little allegiance to the hospital or its IT initiatives.

Memorial Hospital is a technologically sophisticated facility with a large IT support staff, and was one of the earliest in the country to experiment with computerized patient order entry

(CPOE) systems. CPOE is an automated workflow system that physicians can use to enter or track orders and access the results of all orders for in-patient procedures, including laboratory orders such as blood culture or urine analysis, radiological orders such as X-rays, ultrasounds, computerized tomography scans, or magnetic resonance imaging scans, pharmaceutical orders such as medications, and special procedures such as biopsy or bronchoscopy. This computerized system, which can be used to track and audit orders by patients, physicians, or specialties, represents a major change from the erstwhile manual process involving paper forms that were subject to error, delays and duplication.

The first CPOE system was implemented in Memorial Hospital's cardiology department in 1997 on a pilot basis. This software, called Carevision, was a packaged solution that was not customizable to variations in medical diagnosis, physicians' preferences, or medical specialties. The system faced numerous technical and implementation roadblocks, with physicians complaining about the lack of job-relevant functionality and being unavailable for system training sessions, and frequent drops in wireless connectivity. Eventually, the system was discontinued in late 1998.

In 2001, as healthcare IT started gaining widespread traction in hospitals across the USA, Memorial Hospital decided to reintroduce the CPOE system as part of a broader IT modernization initiative. This time, hospital administrators vowed to learn from the mistakes of the previous project, and implement a solution that was tailored to physicians' work, reorganize training programs to work around physicians' busy schedules, and install a new wireless network. Following 18 months of process reengineering, a new CPOE system, Sunrise Clinical Manager (SCM) was introduced in 2003. This system was integrated with an electronic medical records (EMR) system and a picture archiving and communication system (PACS) for one-click access to patients' medical history and radiological images respectively. The new system incorporated many new value-added features such as cross-referencing physicians' prescriptions against patients' allergy records for possible unfavorable interactions. One-on-one training was instituted where IT staffers shadowed physicians on the job to show them how to enter orders into the system in real-time. Early adopters (physicians) who liked the system were recruited as project champions to spread the word about the system to their colleagues. A CPOE steering committee was formed, staffed by members from the hospital's executive committee and physician representatives, to represent physicians' concerns about the system and ensure that those concerns were addressed. A physician clinical support group was created, comprising of IT experts, to customize the system to individual physicians' personal preferences and their style of work.

The intended operation of the system was as follows. Physicians could log into the system from their home, clinics, or any hospital floor using a password-protected interface (the system tracked login date and time). They could then access complete medical records of patients assigned to them, check real-time status on existing work orders, place new or follow-up orders, and organize orders or results to their personal preferences. Physicians could automate repetitive ordering of labs, tests, and medications for typical medical conditions using standardized set of orders called "order sets." These order sets were organized by ICD-9 code (a medical diagnosis classification system) and could be further tailored to physicians' personal preferences. The system generated adverse drug alerts, tracked patients' medication schedule, and alerted floor

nurses when doses were needed, changed, or missed. Physicians could also dictate notes into the system for transcription using an outsourced service.

During our site visits to this hospital, we interacted with physicians who liked the CPOE system and those who hated it. One younger physician who liked the system (an early adopter), said that he logged into the system from home every morning to check on patient charts and retrieve up-to-date results and status reports, which helped him optimize his hospital rounds, saved time with paperwork processing at the hospital, and allowed him to spend more time with patients. However, other physicians hated the system and devised innovative strategies to avoid its use, such as continuing to use paper forms, calling in orders to nurses (to avoid direct interaction with the system), requesting work assignments on floors where the system was not yet installed, and devising workarounds such as sticking "Post-It" notes to patient charts. Common reasons for system non-usage included: "it is new and difficult," "it takes too long to learn," "every patient is different, so a common system won't help," and "there was nothing wrong with what we had before [paper-based ordering]." This wide range of physician reactions toward reflected a complex and diverse pattern of IT usage across the physician population at this hospital.

In 2005, system rollout was completed throughout the hospital. By this time, some physicians were using the system; however, there were many resistors. A new Chief Information Officer was appointed with the goal of improving CPOE (and in general, IT) utilization at this hospital. After several months of pleading physicians to use the system with little benefit, in 2006, the new CIO issued a 'mandate' requiring CPOE usage at the hospital and abandoning all paper forms. The mandate was not received positively among the resistors, and generated strong reactions. Some non-users grudgingly started using the system; others continued to use nurses and interns to enter orders on their behalf, and a few retired or moved their practice to local hospitals that did not have a CPOE system. Eight years after the implementation of the second CPOE system, by the end of 2011, it appears that the mandate was somewhat successful in coopting physicians to use the system. However, considerable resentment, dissatisfaction, and covert resistance persisted, and CPOE usage remained below expected levels.

Data Collection and Analysis

Our research team followed CPOE implementation at Memorial Hospital from 2003 until 2011. During this eight-year period, we conducted a total of 47 interviews with physicians in three rounds. Nine of these interviews were conducted in 2003, when the second CPOE system was being introduced on a pilot basis; 27 interviews in 2007 after completion of system rollout and issuance of CPOE usage mandate, and 11 interviews in 2011, to assess the final outcome of CPOE implementation. These samples were partially overlapping in that few physicians were interviewed at multiple points in time to assess if their reactions toward the system had changed over time. Interviews ranged in duration from 30 to 75 minutes, averaging approximately 45 minutes. A semi-structured interview protocol was used, which was approved by the institutional review boards at the researchers' university and at the study site.

Our initial interviews were arranged by our key contacts: the Chief Executive Officer and the Chief Medical Officer this hospital. Subsequent interviewees were identified using a "snowball

sampling" method, in which we asked our interviewees to identify their peers representing different patterns of behavior from acceptance to resistance. To ensure replication logic (for generalizability), we ensured representation of physician with different backgrounds, demographics, and medical specialties. Physicians in our sample ranged in age from 28 to 65 years (median of 50 years), medical practice experience of three months to 39 years (median of 20 years), and had worked at Memorial Hospital for 3 months to 33 years (median of 8 years). They had been using computers for 10 to 25 years (median of 20 years), and healthcare IT for 1 to 25 years (median of 8 years). Their specialties included internal medicine, pediatrics, cardiology, orthopedic surgery, neonatology, pulmonary medicine, emergency medicine, and psychiatry. Interviewees self-rated their use of the CPOE system as a median of 4 and mean of 4.88 on a seven-point scale (1 = non-usage; 7 = extensive usage).

Physician interviews were conducted by two researchers, with one interviewer being responsible for primary questioning, and the other taking notes and seeking clarifications when needed. All interviews were tape recorded, with interviewees' permission, and transcribed. To elicit candid responses, interviews were conducted in informal settings, often during lunch breaks, or in the physicians' lounge.

Physicians' responses were corroborated and supplemented by a variety of other data sources, including internal presentations, project reports, memorandums, public media reports (e.g., incidences of medical errors at this hospital, its technology modernization initiatives), and our own direct observations of physicians' behaviors during site visits. However, we were neutral external observers and had no role in the CPOE implementation process. In addition, we interviewed hospital executive committee members, CPOE steering committee members, IT support staff, and nurses to triangulate physicians' self-reported behaviors. Our extensive access to and intimate knowledge of this site helped us reconstruct the historical and socio-cultural context surrounding CPOE implementation in rich detail, and provided the contextual background for our activity theoretic analysis.

We analyzed the interview data by coding it using the ASM framework of activity structures (subject, object, and community) and mediators (tools, rules, and roles). The goal of this process was to identify the activity structures and mediators at our case site and potential interactions between them. To maximize variation in coding and minimize coder bias, coding was done independently by three coders with diverse backgrounds: a professor with a qualitative research background, a professor with a quantitative background, and a doctoral student with some experience in qualitative and quantitative methods. Inter-coder agreement was 75.2%. Dissenting codes were resolved through discussion among coders until consensus was reached.

FINDINGS

Our interpretive analysis revealed that physicians at Memorial Hospital exhibited considerable divergence in their perception of the CPOE system as a tool, and its relationship to their object of activity, community, rules, and roles, which resulted in a diverse pattern of behaviors toward the system. Specifically, we found four types of behaviors, as evident from the following quote from Dr. Sanford (a pseudonym), a nephrologist and early adopter interviewed in 2003:

"[T]here are people who are absolutely sophisticated doctors in their specialty, like some cardiologists who do the most sophisticated computer work in terms of pacemakers, defibrillators and so forth, but can't work on a simple computer… I do not think they will ever adapt to the system and will probably have to go elsewhere. [This group represents] under 5%, I would say 3%, maybe less. [Type 1: Active resistance]

[The] second group are [sic] people that are not totally negative. They say 'I'll learn it when I have to.' I have a young partner who could have learned this in an hour but he'd never meet with me, until September 1st, when he had to do it. [This] group would like to practice the way they have always practiced but they are not totally against [the system] and when the time came that they had to do it, they [will] do it. I think that is a significant number of people, larger percentage, 20-25%. [Type 2: Passive resistance]

Then there is another group that is very accepting that is trying to learn it, [and] having problems [with the system]. They come down and work with us and are more accepting and they were better prepared for the rollout because they had some skills. [Type 3: Superficial acceptance]

Then you have a super user group who are [sic] just fabulous, and who are much better than I am in using the software. They change their own practices. In the Infectious Disease Associates [a private physician group of five physicians], a couple [of physicians] were very enthusiastic about it. One is brilliant and uses it beautifully; another one made up the order sets for all of the ID group. He and one other [physician] turned the whole thing around and they are the largest users of [SCM] and the best users, I think, other than nephrologists… In my own group, seven of the nine [physicians] are super users, and the other two never used it at all." [Type 4: Enthusiastic acceptance]

Although we were only looking for acceptance and resistance behaviors, the above quote demonstrates four types of physician responses that be roughly categorized as active resistance, passive resistance, superficial acceptance, and enthusiastic acceptance respectively. Viewing these diverse reactions through an activity theoretic lens, our analysis found that physicians (subjects) in each category exhibited a different set of perceptions regarding their object of action, community, tool of work, professional roles, and rules of action. Conflicts among physicians with respect to these perceptions are elaborated in the following subsections.

Object Conflict

In activity theory, subjects transform objects in order to achieve a desired outcome. At Memorial Hospital, the primary object of physicians' (subjects) work was treating their patients' medical conditions. While some physicians saw CPOE order entry as a natural extension of this medical work, others viewed it as distracting from their primary goal of providing medical care, while still others viewed it as an additional activity (new object) imposed upon them by hospital administrators.

For example, Dr. Kelley, a surgery specialist interviewed in 2011, explained how the CPOE system helped him extend medical care delivery in unanticipated ways, and why he viewed the system as a natural extension of his work:

> "I like sitting at the airport and getting online and doing all my record keeping while I'm waiting for a plane. I can sit at the airport lounge and get on, sign all my charts… We used to have to go to the record room to look at microfilm, or call the record room and have them bring me old records. We don't have to do anything like that anymore… If they [patients] don't remember what medicines they took six months ago, just click on the computer and it's right there."

On the other hand, some physicians viewed the CPOE system as a distraction from their primary object of delivering quality medical care to their patients. This is evident from the following comments of Dr. Collins, an internal medicine specialist, during his 2007 interview, who complained that the system cut down the amount of time he could spent with patients, thus compromising the quality of care:

> "It used to be [that] I would take the chart into the patient's room, sit down pleasurably with the patient, and they would tell me what happened during the night. So I would examine them and I would write orders in the patient's room with them. So I used to spend as much face-to-face time with the patient as possible. Now however, you have to see them as quickly as possible, get out of the room quickly as possible, and get in the computer workstation as quickly as possible. Now I spend less time in face-to-face contact with the patient."

Finally, some physicians considered CPOE usage to be outside their domain of professional work. Dr. Hall, a cardio-electric physiologist, explained during his 2007 interview:

> "I think it [SCM] was jammed down our throats under the guise of evidence based medicine. It makes me, frankly, hostile… I don't want to come to the hospital to learn how to use computers. I wanna come to the hospital to take care of my patients. So I am not gonna take this four- hour time period or a week and go to a course and learn how to use this goddamn computer."

Physicians who viewed using the CPOE system as a natural extension of their work were accepting of the system, while those who saw it as a distraction to their work demonstrated passive resistance of the system, and those who considered it an unreasonable addition to their primary object of activity (serving patients) exhibited active resistance. Hence, the differential patterns of acceptance and resistance behaviors across the physician population can be linked to physicians' varying perceptions about the object of their professional work and the role of the CPOE system in their work.

Tool Conflict

Tools are artifacts used by subjects to transform and presumably benefit their object of work. However, at Memorial Hospital, CPOE acceptors and resistors had very different perceptions of

CPOE as a tool and its value in their professional work, and consequently, exhibited very different reactions toward the system.

One early supporter and enthusiastic acceptor of the CPOE system was Dr. Anderson, a physical medicine and rehabilitation specialist, who elaborated the system's utility during his 2007 interview:

> "[SCM] makes it easier for me as everything is more accessible… there are order sets which are basically automatic, so it takes away the tedious work of having to micromanage things… I can read the doctor's handwriting, you can track notes better so it is easier to communicate with physicians, cardiologists and orthopedic surgeon and I order an x-ray and if they are in the office they can access it from the office and we can make a more expedient decision… We can track graphically the level of acuteness of that patient that helps us determine whether or not the patient is ready for discharging."

Not surprisingly, Dr. Anderson used the system for 95% of his total orders. In addition, his enthusiasm about the system led him to volunteer to pilot a new CPOE module (medical reconciliation) and seek additional ways to leverage the system in his own professional practice (rehabilitation) by customizing a window to track his patients' daily ambulatory progress, as revealed from his following quote:

> "We *customized one window* where in one page I can see [patients'] daily living activities and how far they are walking… we are *piloting a new module*, the medical reconciliation module. I am *really excited* about that because it really makes it a whole lot easier when you discharge a patient." [emphasis added]

However, many other physicians exhibited a range of negative perceptions about the system from an unnecessary inconvenience an existential threat. The notion of inconvenience is evident from cardiovascular surgeon Dr. Green's 2007 comments:

> "I practiced thirty-something years and what I learned to do is based on paper I am very good at doing paper. I can go through a chart and pick up all the salient features in the data in a heartbeat. I've probably done it 50,000 times. It takes me a lot more time to get the same information reading an electronic chart because you have to go through different screens and different fields."

In contrast, Dr. Vasquez, a pulmonary critical care and internal medicine specialist interviewed in 2003, viewed the system as an existential threat to his profession because it increased the chances of medical errors, such as entering the wrong order for the wrong practice, and made him a potential target of medical malpractice lawsuits:

> "I cannot tell you how many times I put in orders on the wrong patient... Because [when] you have your patients' list and you think you were looking at the one on top, it is actually someone else that is highlighted when you put in the order, things can get confusing."

Physicians who viewed the system as an inconvenience resisted the system in a passive manner, while those who saw it as a personal threat demonstrated active resistance. We also observed that some physicians changed their perception of the CPOE system over time from negative to positive as they learnt more about the system and became comfortable with its use, which translated in a corresponding change in their behavior from resistance to acceptance.

Community Conflict

Community, in activity theory, refers to a group of subjects sharing the same object. For physicians at Memorial Hospital, the community refers to their professional society of practicing physicians both inside and outside the hospital providing medical care to patients in their own and related specialties. Physicians typically rely on their professional societies for best practice guidelines, professional protocols, and norms of medical care. One example of such dependence was the willingness among physicians to use standardized order sets created by other physicians within their specialty.

However, some physicians at Memorial Hospital viewed the CPOE system as threatening their community structure, and introducing non-community members such as administrators and pharmacists into the medical care delivery process. Dr. Hall, a cardio-electric physiologist and a strong CPOE resistor, noted during his 2007 interview:

> "We now have the [SCM] police. And the [SCM] police seem to like to monitor us very carefully... And these are predominantly run by non-clinical people… Administration [has] empowered the pharmacy to override a lot of the physician's orders [because] on a few occasions they've found mistakes… There are a lot of different people from different parts of the hospital intervening in the system and changing things. At times they are interfering with patient care and that is problematic."

The increased encroachment of non-community members was viewed by many physicians as interference with their professional work, an affront to their autonomy, and an unfair "policing" of their work. The CPOE system was viewed as the agent of this encroachment by non-credentialed people, and therefore generated strong resistance among many physicians.

Role Conflict

Roles refer to the division of labor among community members entrusted with performing a given activity. The issue of role conflict as engendered by the CPOE system surfaced in a few interviews, although this was perhaps the weakest of the five conflicts. For instance, describing how the CPOE system impacted the roles of primary care physicians vis-à-vis the specialists in the medical care process, Dr. Green, a cardiovascular surgeon, commented during her 2007 interview:

> "In this electronic age, SCM has been a deterrent to the effective functioning of the primary care physicians and/or coordinators of care, if you want to say that, just because you are not alone in knowing all the information that is in that chart and so everybody has access to everything that is in that chart and people have carved out different areas of interest in order

to influence the care of that patient based on the data that they have available to them. So what's happening is that you can go the way of either responsibility of the primary care physician for coordinating the care plan, which in [the] past has always resided with the [primary care] physician."

However, our interpretation, based on discussions with other physicians, is that such role conflict was caused by a general shift toward managed care in the USA, rather than by the CPOE system. Managed care is an approach of controlling overall healthcare costs by having primary care physicians coordinate their patient's medical needs, including interacting with specialist physicians. However, the advent of CPOE and other healthcare IT systems may have exacerbated the situation by making specialist physician's activities transparent to the primary care physician and by increasing confusion over the ownership of medical care in a complex, multi-physician environment.

Rule Conflict

Rules refer to community-driven norms, conventions, and social relations that define how a subject should perform her object of work. Some physicians felt that the CPOE system was changing the way they always practiced medicine, by forcing them to abandon practices that were consistent with the professional norms of their community and adopt practices that were not sanctioned by their professional community. Dr. Neville, a general and vascular surgery specialist, described this concern in a 2007 interview by saying that the system made it more difficult for her to prescribe the right medications and forced her to use order sets that were not appropriate for her job:

"The hospital has felt that they have to curtail my orders. They force us to use order sets which are not tailored to me. It is a means of the administration of constraining me… For example, they will have an order set and they will pre-check various drugs that I never use. So, for example, I always use a particular pain pill. They force me to use a pain pill that I disagree with, [which] I think it's too powerful and has too many side effects. So, I actually have to go through the effort on each one of my patients, I have to unclick what they do and click what I do."

It is worth noting in this regard that although the majority of physicians found order sets to be helpful in standardizing and improving medical care. Following its CPOE mandate in 2006, Memorial Hospital started restricting the extent to which these order sets could be customized, pushing physicians towards more standardized sets, contrary to their professional norms of practice.

DISCUSSION

Evaluation of Rigor

Qualitative research is often criticized as lacking in rigor and objectivity. To address this concern, Lincoln and Guba [10] recommend four criteria for judging rigor in qualitative research: credibility, transferability, dependability, and confirmability. *Credibility* refers to the

extent to which inferences from qualitative research are believable, and is similar to the notion of internal validity (causality) in quantitative research. We assured credibility in our analysis by triangulating our interpretations in three ways: (1) by comparing responses between physicians, (2) by comparing responses between coders, and (3) by comparing physicians' behavioral responses with our own observations of their behaviors.

Transferability refers to the extent to which findings from one context can be extended to other contexts. Given their context-situated nature, interpretive findings are often not generalizable to other contexts. Although our inferences were generalizable across physicians in different specialties and different age groups within Memorial Hospital, we could not infer generalizability to other facilities or other healthcare IT since all of our 47 participants were from a single hospital regarding their reactions to a single system (CPOE). In order to examine the generalizability of our findings, we recommend that our research be replicated at other types of healthcare facilities, such as smaller hospitals, university-affiliated hospitals, and long-term care facilities, and facilities implementing other healthcare technologies that may be less complex or less intrusive than CPOE systems.

Dependability is the extent to which qualitative data is accurate or consistent, akin to the notion of reliability in quantitative research. We addressed this issue in three ways: (1) by using a theoretical sampling procedure to ensure that our sample represented a diverse set of cognitive and behavioral reactions to CPOE usage, (2) by corroborating physicians' responses with formal and informal interviews of administrators, nurses, and IT staff and our own observation of physicians' behaviors, and (3) by building trust and rapport with physicians during our extended engagement in the field for eight years, conducting our interviews in the friendly confines of the physicians' lounge, and assuring participant anonymity and confidentiality to elicit truthful and candid responses.

Confirmability is the extent to which inferences can be independently confirmed by others, and is roughly equivalent to the notion of objectivity. We tried to ensure confirmability though a meticulous process of data collection and analysis, such as by using a structured interview protocol for all interviews, by maintaining detailed contact information and transcribed interviews, and by comparing our interpretations across members of the research team and with key personnel at Memorial Hospital.

Implications for Research

Our interpretive analysis complements and extends prior IT usage research that has been primarily positivist in nature. While positivist analyses seek to understand "similarities," our interpretive analysis explored "differences" in physicians' reactions toward the same IT at the same hospital. Our interpretive analysis found a complex and nuanced pattern of user reactions, not only regarding the target system (tool), but also regarding its impact on physicians' work (object), community, roles, and rules, which explained why some physicians accepted while others resisted the same system – an insight that is not available from the extant literature.

Second, current theories of IT usage, such as TAM and UTAUT, are designed to explain voluntary IT usage. Hence, they have limited explanatory power in mandated IT usage settings,

where users are coerced to use the target IT and harbor negative reactions and resentment toward it. Our study provides some insight into the wide range of user reactions typically encountered in mandated settings, which may help further theorizing of mandated IT usage.

Third, this study demonstrates the utility and viability of activity theory as a conceptual lens for structuring interpretive analysis. This "lens" is particularly relevant for studying complex processes that cannot be isolated from their socio-historical contexts, such as organizational implementation of IT. Being one of the earliest papers in information systems to use activity theory, this study provides a comprehensive description of the core concepts and an illustrative example of how to derive interpretations using this theory**.**

Implications for Practice

This study also has important implications for IT practice. First, managers should understand that IT implementation is not simply a matter of buying and installing a new IT, but a complex process of orchestrating organizational change. Technologically sophisticated systems with clear organizational benefits may still be resisted by users if they conflict with the object of their activity, community, professional rules, and roles. Managerial efforts should be directed at mitigating the adverse effects of IT on these inalienable dimensions of professional work.

Second, we demonstrate that acceptors and resistors may coexist within the same user population, and hence it is unwise to ignore resistors and just focus on acceptors during IT implementation. Most managerial strategies are directed at enhancing IT acceptance, which are rarely successful in overcoming IT resistance in organizations. Managing user resistance requires identifying potential resistors, understanding the reasons for their resistance, and taking steps to ameliorate the conditions driving their resistance.

Lastly, though resistance is commonly viewed in a pejorative sense, managers must realize that not all resistance is bad, and sometimes resistance can help identify unanticipated system or organizational problems, especially under circumstances when users had little or no input into the IT selection or implementation process. An appreciation of these problems, coupled with well-intentioned efforts to ameliorate them, may go a long way in alleviating IT resistance in organizations.

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