

ABSTRACT

Title of Dissertation:

THE WORK NETWORK MODEL:
UNDERSTANDING THE INTERPLAY OF
ACTOR, ARTIFACT AND ACTION IN
TECHNOLOGY-BASED CHANGE

Yong Kwang Adrian Yeow
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Directed By:

Associate Professor Samer Faraj,
McGill University
Professor Ritu Agarwal,
Department of Decisions & Information
Technologies,

Organization and IS scholars interested in the impact of IT on organizational change have acknowledged the indeterminate relationship between technological and organizational change. This reality stems from the complex interaction of the institutional context with human cognition and action that determine the path that technological change take in order to bring about organizational outcomes. Yet in this milieu there is little account for why specific context or conditions are salient. The goal of this research is to understand how technological change is related to organizational change by opening up the blackbox of the work context and analyze how the material aspects of the IT artifact relate to the actors and their actions. Specifically, I studied 1) How do the design and implementation of an EMR system impact the configuration of the system? 2) How do users and their practices interact with the configured system? 3) How do these interactions influence organizational outcomes so that one site is more “successful” than another? I explore these research questions using the perspective of work an organization is engaged in, specifically how IT artifacts are relationally linked to actors, actions and the organizational context. As my research questions deal with a process issue, I conducted a longitudinal field study of an EMR system implementation beginning from the implementation phase to deployment and use phases. I analyzed archival, interviews and observations data to develop a grounded theory of technology-based organizational change. Based on my findings I developed the Work Network Model of technology-based change. The model proposes that the main mechanism of change is the network within the context of an organization’s work. It also proposed that analyzing the process of multi-level political negotiations during the configuration of a new technology allows us to understand how technology-change evolve once it is introduced in an organization. Finally it shows how institutional, infrastructural and work practices play a role both during the configuration and use phase of the new technology. Apart from its theoretical contributions, this research attempts to provide a new method to consider and design work practices with new technologies via the Work Network lens. (350 words)

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By

Yong Kwang Adrian YEOW

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Advisory Committee:

Associate Professor Samer Faraj, Co-Chair
Professor Ritu Agarwal, Co-Chair
Professor Henry C. Lucas
Associate Professor David A. Kirsch
Professor Bartholomew L. Landry

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Dedication

This dissertation is dedicated to Diane, Joshua, Dora, and Anna.

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I would like to acknowledge God for His enabling strength and daily provisions that have sustained and kept my family and I through this wonderful academic journey during the past four years.

Next, I would like to express my appreciation for my precious wife and three kids who have provided me joy and laughter and have been a refreshing fountain after a full day of reading, writing and internal grumblings and despair. I would also like to thank Samer Faraj who has been and is still a wonderful mentor and friend since the early days of my Ph.D. life. He has injected life into what may have been a dull and highly “academic” exercise by introducing interesting twists and turns to my Ph.D. training.

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Chapter 1: Introduction

Organizational changes have often been linked to changes in the technologies utilized by the organizations (Barley 1986). Having eschewed strong technological-deterministic perspective, IS and organizational researchers have in general adopted a more balanced view that technology-based changes are usually indeterminate. Research findings have shown that the same technology can result in different structures when embedded in different contexts (Barley 1986; Orlikowski 1992; Orlikowski 1996). While these studies offer a strong conceptual foundation to describe and understand the impact of technology on organizations, they fail to fully account for the reasons change events happen.

For example, Barley's (1986) paper that studied the impact of CT scanner technology on the radiology departments in two Massachusetts hospitals attributes the change to contextual logic including historical processes, social interactions and institutional properties but does not theorize as to why those processes and properties are salient. Similarly, Orlikowski (2000) in her study of an organizational knowledge system in an IT consulting firm ascribes the reasons for changes in the uses of Lotus Notes to the agents' "various technological visions, skills, fears, and opportunities, .. specific interpretations and particular institutional contexts" (pg. 420) but is silent as to why those visions are relevant and important. Even as these scholars' work have illuminated parts of the technological-organizational change puzzle, there appears to be still a significant gap in our collective understanding about when and why these contextual and individual conditions apply to the many permutations of the technology-organization change relationship.

The need to understand why and when organizational change is related to technological change is also driven by the debate on whether technology can bring about beneficial organizational change. The idea of technology-based change goes back to the early works on IT and organizational

structures in the 60s and 70s (Galbraith 1973; Leavitt and Whistler 1958), develops into the Business Processes Re-engineering (BPR) wave in the early 1990s (Davenport and Short 1990) and becomes the Business Process Management movement among IT and management practitioners (Smith and Fingar 2003) in the present-day. This general belief has been greatly challenged not only by the failures of BPR initiatives in the mid 1990s but also by scholars such as Nicholas Carr (2004) who have written off the “power” of IT to transform organizations.

This particular debate is also of great importance in the particular context of medical informatics. Like the overall business community it is believed that the injection of appropriate IT can help make clinical care and research work more efficient (Dick and Steen 1991). Over the years the Institute of Medicine has pushed for the increased use of IT to improve the quality of medical care and patient safety (Institute of Medicine 2001). However, parallel to the general skepticism in the business community, the medical community has been slow to warm to the use of technology in medical work (Blumenthal et al. 2006). One reason for hampering the push for adoption is the problems that have hit high profile projects (for example Kaiser’s project (Costello 2007) and Santa Barbara’s Regional Health Information Organization’s closure). Another reason is the frustrations medical staff face with using these new systems. Recent articles in the medical/health domain reported that about 20—33 percent of electronic medical records (EMR) systems fail within a year of implementation (Chin 2006; Conn 2007). Hence, despite the implicit belief that technology brings beneficial change, practitioners in the business and medical fields constantly struggle with a host of challenges to bring about the reality of that belief (Berg 2001).

These current practical issues present us with a compelling reason to deepen our grasp on this particular domain of technological-organizational change. Specifically my dissertation aims to understand the process by which EMR systems bring about changes in medical organizations that are essentially high-reliability organizations engaged in complex work with high input uncertainty

(Faraj and Xiao 2006; Weick and Roberts 1993). The process approach differs from traditional IS implementation perspective that focuses on the outcomes of implementation projects (Markus et al. 2000). This is because extant literature has shown that given the unique nature of such high-reliability organizations, it is difficult to pigeon-hole the outcomes of EMR system implementations as success or failure (Berg 2001). A more fruitful perspective would therefore be to tease out the “hows” and “whys” through which the varied organizational and system outcomes are achieved.

Besides taking a process approach, my dissertation also focuses on the enterprise aspects of the EMR system since current EMR systems are no longer limited to clinical work but attempt to integrate clinical work with the larger enterprise operations. This move to expand the scope of EMR systems brings about unique tensions between customization and standardization across the different domains of the clinical enterprise. These tensions arise because the work in each clinic within the medical enterprise is unique while the introduction of EMR system attempts to standardize medical work within the system. As a result this new trend brings the implementation of EMR systems closer to the work processes of clinicians and their support staff. Taking this trend into account my dissertation adopts a wider view of the medical enterprise and considers the process of change beyond clinical health work to include the other aspects of the clinical operations that are critical for the quality of patient care. Examples of such medical operations include clinic-patient communications and patient flow within a clinic. This approach extends current medical informatics research, which has largely focused on the impact of new EMR systems on clinical work (e.g. Cooper 2004; Goorman and Berg 2000).

While most of the existing research on medical informatics and organizational change have discussed how organizations change via various ways, for example through the informal social networks (Barley 1986) or through changes in job scope and descriptions (Kraut et al. 1989) or

through practices (Orlikowski 1996), there has been no clear and direct method to describe and trace changes in the work. In tandem with the lack of methods, there has also been a lack of a comprehensive theoretical framework to understand the process of change that can be connected to the method for studying change. This dissertation therefore seeks to explore new methods to empirically trace changes in the organization as a result of the introduction of a new system. It also aims to generate a theoretical framework of technology-based change that can be potentially applicable in other contexts such as enterprise package systems implementation.

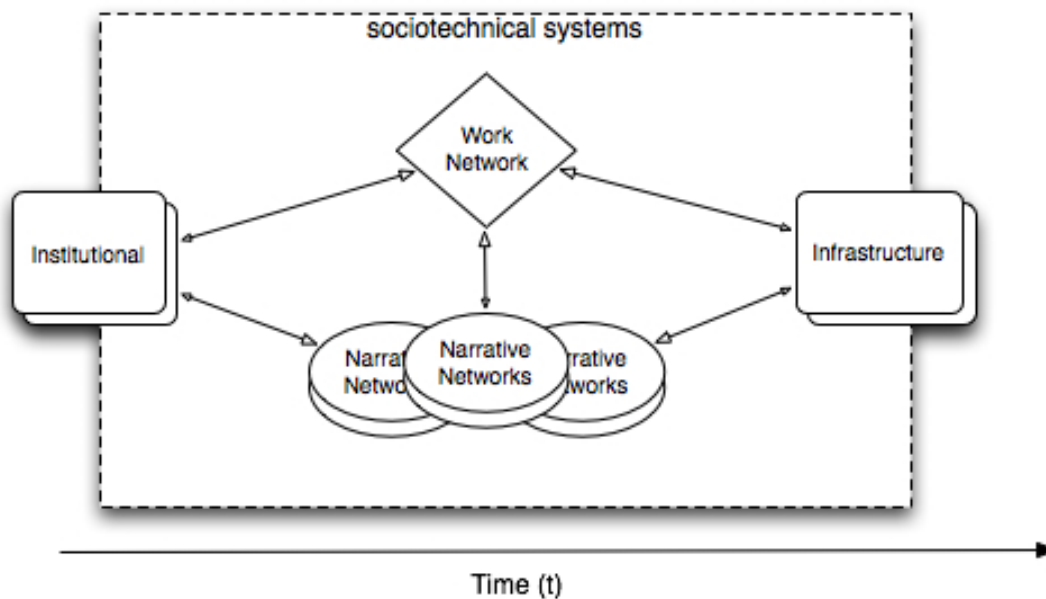
Formally, my specific research questions are

- 1) How does the implementation process of an EMR system impact its configurations and the work process in an ideal clinical operation?
- 2) How do users and their current work practices interact with the configurations of new work processes implemented in the EMR system and in turn how do these interactions influence organizational outcomes?
- 3) How do the configuration and user practices make one site more “successful” than another?

From my findings I proposed the Work Network Model as a plausible answer to my research questions. Central to this model is the “Work Network” concept that posits that the role of a technical artifact on organizational change has to be examined at the network level rather than at the level of individual organizational elements or individual actors. Moreover this network pertains to the way work is practiced in the organization. The “Work Network” concept is based on a sociotechnical systems approach as each network includes interconnected actors, actions and artifacts. Methodologically, the Work Network provides a new empirical approach to document and trace changes in organizations through the work that the organization engages in. The Work Network is based mainly on the narrative network method as proposed by Pentland and Feldman

(2007). The method essentially attempts to capture organizational routines as a “network” of actions. Each action is described as a “narrative fragment” as it captures intrinsically an actor, artifact and their actions. I use the narrative network to first capture the work conducted by each organizational role. The Work Network builds on the narrative network of each role to develop the network of actions and artifacts, thus linking the various roles since the organization carries out different key organizational processes (see figure 1). By documenting the Work Network and its attending narrative networks over time in each site as well as the “ideal” form Work Network/narrative networks, researchers are able to empirically trace how changes occur when new technologies are introduced.

Figure 1: Overview of Key Components of Work Network Model



The Work Network concept complements existing theoretical perspectives such as the Structuration Theory and the Practice Lens’ perspectives by shifting the focal point of analysis from user’s perceptions and practice context to the work occurring across groups of organizational actors. It also addresses the current push by IS and organizational researchers to have a better account of the material aspect of IT in organizations since the artifact and its various functions are explicitly captured in the Work Networks and narrative networks.

Besides placing the researcher at a different vantage point with respect to the artifact to view the process of change, the “Work Network” model also seeks to widen the scope of research by considering the process of technological and organizational change from the configuration phase through to the usage phase of the technology. In each of the phases, institutional factors such as existing organizational policies or external government regulations and infrastructural factors such as organizational staffing or existing legacy systems have direct and indirect influence on the narrative networks and Work Networks that explain the changes observed in the medical organization (see Figure 1 above). These key factors affect the Work Network and narrative networks during the configuration phase via a multi-level political process of negotiations and contests while the various institutional and infrastructural factors found in each local site influence the Work Network and narrative networks via an iterative process of tensions and fitting-work. Putting them together and tracing the changes in the Work Network and narrative networks allow researchers to have a better account of the process by which changes emerge when new EMR systems are introduced in high-reliability organizations.

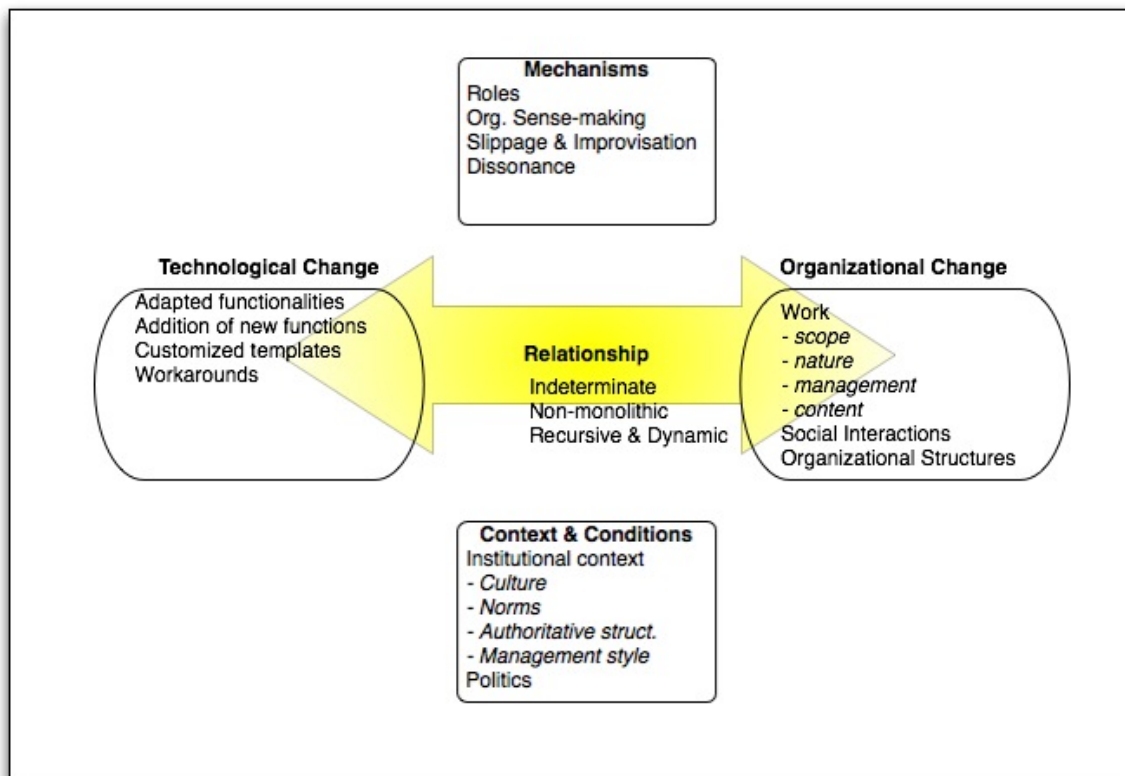
The rest of the dissertation starts with a review of the literature and theories on the problem of technology-based organizational change in chapter 2, followed by a description of the methodology applied in the research (chapter 3). I discuss the important aspects of the research sites and its unique context in chapter 4. Chapters 5 to 7 covers the findings of the research: the process of the EMR configuration (chapter 5), the existing Work Networks and issues (chapter 6), and the tensions, fitting-work and change that emerged after the EMR system is introduced in the sites (chapter 7). Using the findings that I have presented, I provide details of the Work Network Model in chapter 8 and that is the key contribution of the dissertation. In chapter 9, I discuss the key findings of the dissertation and in chapter 10 I conclude the dissertation by discussing the path of theorizing and the implications of the new process framework on current IS and organizational

theories as well as on future research in this area of technology-based change.

Chapter 2: Extant Theoretical and Empirical Motivation

This section provides a review of the empirical evidence and the theoretical roots that have characterized the domain of research on organizational impact of technological change. For the empirical evidence review, I will use the framework below. The key components of the framework – which are the major findings in the literature include: a) Organizational Change, b) Technological Change, c) Relationship between Technological Change and Organizational Change, d) Context and Conditions Influencing the Relationship and Content of Change, and the e) Mechanisms that Account for Change.

Figure 2: Empirical Evidence Review Framework



Organizational Change

The first type of impact technological change has on organizations is its influence on the work of the users of the technology. Kraut, Dumais, & Koch (1989) found that many aspects of work in the customer service department of a large public utility company have changed after the implementation of a computerized record system. Specifically, the system has changed the locus of task knowledge from supervisors to individual representatives and has reduced the amount of filing and routine clerical work. But while it has made these routine tasks easier, infrequent and exception related tasks have become more difficult to handle. They also found support for the deskilling of work in that workers have reported that they have become less satisfied with their work, which now offers less variety and is less challenging. They are less able to see the results of their work, and have less social contact with other colleagues. Similarly, Orlikowski's research (1996) found that a software company's customer support department work have changed with the replacement of an in house system to track customer calls by Lotus' Notes technology. Like Kraut et al. (1989), the workers now carry out more digital documentation/search and the nature of knowledge has also changed. In addition to that, Orlikowski documented how the nature and texture of customer care work have changed from tacit to articulated, private to public. This is reflected by the fact that the scope of work has been redistributed from individual to group responsibility and that has led to changes in the evaluation of performance, forms of accountability and mechanism for coordination. Other recent studies (for example Leonardi (2007) and Boudreau & Robey (2005)) have reported the same changes to work. Together these studies as well as others in the literature show that technological change is associated with changes in the scope, nature, management and content of work.

As pointed out in other reviews (Robey and Boudreau 1999) these changes are neither consistent nor deterministic. Instead, contradictory evidences abound. For example Orlikowski (1993) found that while the introduction of CASE Tools in the IT department within a petro-chemical firm has

resulted in major changes in IS employee responsibilities, skill sets, and work norms (pg.326), the same introduction in a software firm has reinforced existing work practices and led to lower job autonomy and creativity. Sahay & Robey's (1996) study also found similar pattern of contradiction: a Geographical Information Systems in one county has "redefined key aspects of work and organization" (e.g. GIS changed the variety, efficiency and accuracy of spatial analyses) while in the other county the system has limited use i.e. generation of attractive maps and hence little impact on work.

The second type of impact is in the social interactions of the users of technology and its organizational structure. As such changes occur in the social dimension of workplace, they are inherently dynamic and complex. Barley's (1990) seminal study on the impact of CT scanners in two community hospitals in Massachusetts looked at the roles and social interactions that revolved around the users' (radiologists and technologists) work. He collected data on the tasks and activities typically engaged by the users, the social interactions among users in the course of work and the social network of the group. He found that with the introduction of CT scanners, the roles and social interactions among users have changed radically relative to users of different technology. Using social network as a proxy for the organizational structure, he also found that the organizational structure of the group has to be re-organized around the new technology. Following Barley's work on medical technologies, others have found similar effects in the introduction of specific information systems. Schultze and Orlikowski (2004) conducted a field study of the use of an online web-based infrastructure to support a health-insurance broker's business connection and communication with its agents. They found that the social interaction between the broker's sales reps and the agents have been negatively altered, in terms of the frequency of interaction as well as the nature and quality of information shared among the users. Furthermore, they found that because these sales reps have to "spend their social capital" to promote the use of the system, the network relationship of the company and its agents has also changed from that of a gatekeeper to a liaison

broker (pg. 103).

The two studies show that technological change can form the basis for a myriad of social interaction changes: in one case it may raise the social standing of certain groups associated with new technologies, in the other case, it may detract from the social capital of groups charged with encouraging the use of new technologies. Moreover, such changes in social interactions can and will change over time as Majchrzak, Rice, Malhotra, King, & Ba (2000) found when they tracked the use of a new groupware technology in an innovative virtual team environment. In this field study, they found at the early phase of the project, that the initial introduction of the groupware technology has created new organizational structures and social interactions. However due to discrepant events i.e. issues with the new structure, the virtual team decides to adapt the use of the new technology as well as revert their organizational structure to the former model. Eventually, the virtual team uses the former organizational structure but adopts emergent group structures, taking advantage of both the existing social interactions as well as new social interactions that are formed as a result of the groupware technology.

Finally, while organizational structures (formal and informal) may change with the introduction of new IS technology, oftentimes these changes may occur simultaneously. Leonardi's (2007) field study of a large government funded research center's IT department observed changes in both technology and organizational structures. The IT group has recently been reorganized from autonomous support roles into a central support division and has implemented a new help-desk queuing application to track work activities. He found that after discrepant events where social pressures are exerted, new uses of the IS application have created new informational functions that result in changes in the team's advice networks – a form of informal social structures and interactions. Over time the advice network move from a traditional model (i.e. tenure and seniority) to a knowledge-based model (i.e. consulting with members “who knows what about what”). Like

Barley, he was able to clearly link the emergent informational “affordances” of the IS system with the new dynamic interactions in the advice networks via micro-practices that have transformed the impact of the new technology into a social force. These information affordances refer to the technological capabilities of the help desk application that are favorable to various emergent uses – for example the assignment of problem tickets by expertise where the expertise of a technician is derived from the type of problems he/she has worked on. A particularly interesting finding of this research is that the new advice network as well as the new uses of the technology slowly aligns itself with the new organizational structure.

Technological Change

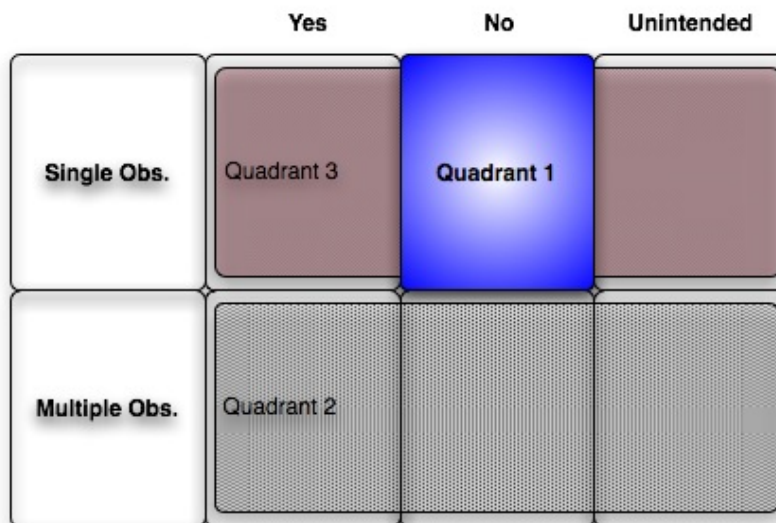
As described in the abovementioned studies (Leonardi 2007; Majchrzak et al. 2000), even as new technologies are associated with organizational changes, the new technologies are themselves subjected to change. For example, Kraut et al. (1989) reported that customer service agents have used two screens to deal with limitations of the screens and the use of the customer record descriptor field to “pass” notes to other agents. Orlikowski’s (1996; 2000) extensive studies into the use and modification of the Lotus Notes software package show how users actively modified the IS e.g. creating customized database and templates. Her studies as well as Leonardi’s (2007) show how these new IS have been modified to support closer and more effective collaboration – e.g. tagging and additional documentation. Vaast & Walsham (2005) found that a French insurance company’s intranet functionalities have been transformed as users interacted with it over time (e.g. addition of a FAQ application). A recent field study by Boudreau & Robey (2005) found that users of an ERP system in a state government institution are engaged in many workarounds as they learn to interact and adapt to the rigid work processes embedded in the system. These technical workarounds give users better control over the system making it more understandable. Like Kraut et al.’s (1989) finding of adapting fields for unintended use, Boudreau and Robey (2005) reported similar adaptations such as the use of statistical code field to capture credit card information, use of

header comments field for additional space, use of additional line for purchase orders. Besides, they also found other workarounds such as creating multiple records for vendors with multiple geographical locations.

Relationship Between Technological Change and Organizational Change

As I survey the research in organizational change that is associated with technological change, I conclude that there are several important characteristics in this relationship.

Figure 3: Permutations of Outcomes



Indeterminate: One of the key characteristics of the relationship between the two changes is that it is highly indeterminate (Markus and Robey 1988; Robey and Boudreau 1999). Using the categories that Robey & Boudreau (1999) developed as well as the literature reviewed, I have summarized the many possible permutations in the diagram above.

From Robey & Bourdreau (1999), there are several cases that fit into Quadrant 1 (blue box) where expected changes do not occur. For Quadrant 2, we refer to the findings of Orlikowski’s (1993) study of CASE technology, Robey & Sahay’s (1996) study of GIS technology and Barley’s (1990)

study of CT scanners across comparative sites. Finally, Orlikowski's (1996; 2000) study of Lotus Notes use, Majchrzak et al.'s (2000) study of groupware, Leonardi's (2007) study of customer support tool are some examples of Quadrant 3 where there are observations of intended changes as well as unintended changes. This indeterminate nature of the technological/organizational change relationship suggests that there is no one strong causal element but that causality is rooted in the "complex intertwined interactions between technology and human actors in organizations" (Markus and Robey 1988 pg. 595). Thus while technological change can be identified as one of the antecedents of change, it is nevertheless a necessary but not sufficient condition for organizational change.

Non-monolithic: While on the one hand the relationship is indeterminate, the changes observed are themselves non-monolithic. In other words, technological change does not have a uniform impact across all aspects of an organization and the work involved. This means that a single technology may have a positive impact on one type of work or one aspect of an organization while simultaneously it may have a negative impact on another type of work or another aspect of an organization. This point is first raised by Kraut et al. (1989) when they observed that the customer service system has affected the customer reps' routine tasks positively but made exception tasks more difficult. This is also evident across roles where the supervisors' work is made more challenging by the increased amount of transactions even as the reps' work has become more effective. Similarly, Barley (1990) found that radiologists' work and role changed at different pace depending on their tenure and experience with the new technology and Leonardi (2007) found that social interaction has shifted from longer tenured members to more knowledgeable members. Boudreau & Robey (2005) found that during the early phases of the ERP implementation, power users have their work increased as other less experienced users channeled their interactions with the ERP through them.

A recent study by Lapointe & Rivard (2005; 2007) on three hospital clinical information system implementations reported that users across the three hospitals have found the system either improved or worsened their work depending on what job they held within the organization. Specifically, nurses find the order entry module of the CIS has reduced their workload since the orders are now entered by the physicians themselves. The physicians in turn are unhappy for they have to allot more time to managing the system. As a result the system added 1.5 to 2 hours of work to their daily schedule.

Recursive and dynamic: Finally, as we have discussed in the technological change section, the changes that occur in the organizational domain can and do have a recursive impact on the new technology itself; the source of technological change. This relationship is also highly dynamic as longitudinal field studies such as Barley (1990), Orlikowski (1996), Majchrzak et al. (2000), Boudreau & Robey (2005), Vaast & Walsham (2005), and Leonardi (2007) have shown. The technological change and organizational change are co-evolving as intrinsic and extrinsic conditions change. Starting from Majchrzak et al.'s (2000) paper – which has adopted Tyre & Orlikowski's (1994) notion of discrepant events, we have seen how important discrepant events along the organizational experience and use of the system can spark off new trajectories of change in both the technology and organization.

Context and Conditions

Although the literature review has shown that technological change and organizational change do not follow deterministic contingency models, there are salient contextual issues and conditions that add a spin to the dynamic mix of social and technological factors. I discuss the issues and conditions below.

Institutional context: I define the institutional context to be inclusive of the organizational culture, norms, authoritative structures, and management styles (Barley, 1990)¹. Kraut et al. (1989) found that different organizational cultures of the business customer support reps versus that of the residential customer support reps have accounted for part of the differing impact of technology on work. Different management styles also play a significant role in the impact of technology on work in Kraut et al.'s (1989) study. Orlikowski's (2000) own review of her research on Lotus Notes use in various organizational environment resonated Kraut et al.'s (1989) finding. In those studies, she found that institutional context that supports collaboration encourages the use of technology along collaborative lines while norms that encourage individual evaluation leads to lesser use of the same technology's collaborative features. Moreover, collegial culture that encourages experimentation engages features of technology that support process and improvisation as opposed to a competitive culture that discourages such use. In Orlikowski's (1993) cross-case study of CASE tools adoption provides another dimension to the institutional context – competitive conditions and corporate strategies. Finally, these institutional conditions may sometime influence technological and organizational change in a more complicated and indirect manner. Barley (1986) proposed that the culture of the organization that determines staffing decisions will in turn lead to different social dynamics and technology use. A recent study by Davidson and Chismar (2007) argued that micro-level analyses of organizational change can benefit from taking into account the institutional forces surrounding an organization that may either inhibit or promote change. They studied the adoption of a new computerized physician order-entry system (CPOE) in a hospital environment and found that institutional forces complement and in some cases overlap with technological changes. Ultimately their study showed that institutional forces account significantly over and above the technological triggers for the change processes in the hospital even though the two

¹ Barley (1990) suggests that institution to be "sets of overarching principles and practices that have the normative force of taken-for-granted assumptions or cultural blueprints for action" p.g. 65.

factors have a cumulative effect on the final observed changes.

Politics: While the institutional context guides and directs the dynamic interplay between users and systems, the users themselves are also engaged in political activities that influence the course of events. The classic work on politics and IS impact is Markus' (1983) study on the implementation of financial data reporting system. Markus' analysis showed that though the organization is traditionally decentralized, the choice to implement a centralized reporting system has been motivated by political will from central office to control divisions that are perceived to be too independent. Likewise, Bloomfield, Coombs, Cooper, & Rea (1992) found the political will of Britain's National Health Service pushing forward the adoption of information systems that focused on cost reporting. Recent studies such as Lin & Silva (2005) and McLoughlin & Badham (2005) review the salience of political dynamics in implementation and its underlying influence on organizational change. Notably Lapointe and Rivard (2007) applied Markus' political variant of interaction theory to understand the process of resistance during the course of the clinical information system implementation. They surfaced the political tactics used by the physicians, nurses and hospital administrators in order to push their group's respective agenda and how these tactics resulted in different organizational and project outcomes. Of interest in this study is the use of strong lobbying tactics by the physicians in all three cases they studied. They found that in all cases the physicians have resorted to ultimatums and demands to force the nurses and administrators to comply with their agenda.

Mechanisms

Beyond describing what is the impact of technological change on organizational change and vice versa, as well as the relationship between them, I turn to some of the ways or mechanisms proposed by the literature through which technological change and organizational change have been able to

work on each other. This is not meant to be exhaustive though; I have selected those mechanisms that are soundly grounded in organizational theory as well as empirical research. The first two mechanisms: roles and organizational sense-making deals with intended and unintended outcomes while the latter two (slippage and dissonance) deal mainly with unintended outcomes. In addition, while roles and slippage are related to the abstract and material conditions, organizational sense-making and dissonance are related to the cognitive dimension. I discuss them in detail below.

Roles: In his 1990 ASQ paper, Barley proposed to explain the technology occasioned organizational changes observed through the notion of roles. Specifically, Barley used Nadel's (1957) monograph to build on the notion of roles by distinguishing between two types of roles: relational roles and non-relational roles. Relational roles need an alter ego to be played out while non-relational roles "need only engage in bundle of behaviors deemed by members of a culture to be characteristic of the role" (pg. 68). Though separable from an analytical standpoint, Barley points out that it is more appropriate to conceive roles as bundles of non-relational and relational roles. From his field study analysis, he found that technological induced changes have a first order impact on a work role's non-relational element since these elements deal with skills and tasks tied to material technology. In turn, non-relational elements of a work role are intimately tied with its relational aspects thus allowing changes in technology to have a channel to influence organizational structures. However, Barley found that role relations are themselves subjected to dynamic negotiations and interactions, the outcome of that change remains indeterminate; viz. the outcome can be expected changes or unintended consequences. Hence he concluded that "it is plausible to observe different social systems from the same material conditions" (pg. 99).

While the notion of roles (non-relational and relational) is a neat set of conceptual mechanisms to trace and analyze the impact of technological change, it fails to fully account for how and why the role relations are negotiated in the pattern observed in his study. We turn next to the organizational

sense-making as another mechanism that might shed some light on the social negotiation process.

Organizational Sense-making of Technology: While sense-making has been typically tied to Karl Weick's work on organizational learning and sense-making, I have adapted this notion as a catch-all phrase to include all the mechanisms that relate to the social meanings and shared cognitive structures that organizational members have with regards to technology, and in our specific case, new information technology. Organizational sense-making includes symbolic interpretations of technology, technological frames, and interpretive conditions and refer to how individuals and groups within an organization perceive, understand, organize, and give meaning to technology. While each of these terms is derived from different theoretical roots, there is a general pattern by which they become a mechanism for technological induced change.

Using Symbolic Interaction as her theoretical framework, Prasad (1993) found that symbolic interpretations of new technology, specifically in her study of a computerized clinical and hospital information system, within an organization are not monolithic. Symbolic interpretations of technology tend to be found in different forms and are of varying intensity and durability. More importantly these different interpretations influence how the members interact with the technology and with each other with respect to the technology. For example, since computers have become symbols of professionalism there is little resistance to it among users and users are less willing to voice concerns about the technology with each other and with the management. However, these interactions, like all social conditions, tend to result in both intended and unintended consequences. Prasad (1993) discussed how the management of symbolic interpretations might also lead to dysfunctional consequences e.g. computer-hype. Orlikowski (2000) also pointed to the same idea, albeit not in similar terms. In her review, she discussed the impact of individual "technological visions, skills, fears and opportunities" (pg. 420) as well as the "meanings and emotional attachments that users have of the technology" (pg. 423) on the enactment of technological

features.

Another similar organizational sense-making mechanism is the technological frames concept. Drawing from the social cognitive research as well as constructionist perspective technological evolution, Orlikowski and Gash (1994) proposed that members of organizations make sense of IT systems through their “technological frames”. They defined the concept of technological frame as the “set of assumptions, expectations, and knowledge of the technology’s nature and role within the organization”. Furthermore, as each social group within the organization may have a shared technological frame -- one that is highly contextualized in its own local setting and influenced in part by the institutional context surrounding the group -- different social groups within the organization inevitably will come to have different technological frames. Orlikowski and Gash (1994) found that in their study of Lotus Notes use in a large multinational consulting firm, the incongruence among these frames has led to different unanticipated outcomes, for example initial barrier of skepticism and frustration. Following their work, other studies of the production and consumption of IT within organizations have also applied the technological frame perspectives (see Davidson 2006 for a recent review).

Notably one of the papers reviewed above, i.e. Sahay & Robey (1996) also considered how the technological frame acts as a mechanism for technological induced change. In their findings, they found that the complex interplay of technological frames of different groups within the context and implementation processes bring about different outcomes. For example, congruent technological frames of different groups involved in the implementation of the GIS technology have provided initial agreement on the value of the system and affected the configuration of the system to be implemented later.

Although symbolic interpretations and technological frames both point to the importance of

socially constructed meaning of technology in determining the outcome of technological change, there are key differences in the two sense-making mechanisms. Comparing symbolic interpretation with technological frame, the former is a broader and less restrictive view of the meaning of technology e.g. technology as a utopia or as a human mind while the latter is focused on specific dimensions of what the technology is e.g. what is the nature of and rationale for the technology. Symbolic interpretation starts from an individual and his/her own identity and trace how that meaning becomes sedimented within social groups. In contrast technological frame comprises first and foremost shared cognitive structures and unlike symbolic interpretation is not just what one understands the technology to be but also what the technology is used for in a given context. Finally, symbolic interpretation looks at the process of sedimentation but does not address how different interpretations actually interact or compete in the process. Technological frame congruence, on the other hand, provides a basic analytical foundation to understand how different frames compare and how different elements of frames can be modified to align with each other.

Slippage and improvisation: From roles and organizational sense-making, we now turn to the third set of mechanisms that have been identified mainly with unintended consequences. Slippage refers to a general situation where templates and actual practices and actions are misaligned, as a result systems breakdown occur. According to research, when slippage occurs and persists, organizational members engage in new patterns of action that may be replicated and slowly reverberate through the organization as structural changes. So unlike the mechanism of roles where the material aspects of technology directly impinge on the organizational tasks and required skill set, slippage occurs when the material technology unexpectedly breaks down or creates unanticipated misalignment between the system and practices.

This is similar to the discrepant events that Tyre and Orlikowski (1994) and Majchrzak et al. (2000) found in their research on organizational change. While slippage is more expansive in nature and

probably occur all the time, discrepant events refer to a specific juncture in time when organizational members recognize the slippages that have occurred and decide how they have to respond to it. While some of these responses may be deliberate, some of them may be emergent. Orlikowski (1996) cast all of these new patterns of actions as forms of “improvisation” (Weick and Roberts 1993). Together slippage and the attending improvisations provide a set of mechanisms by which unintended organizational consequences of technological change occur.

Dissonance: While slippage deals with material and structural breakdowns in the system, Vaast & Walsham (2005) pointed to the cognitive “slippage” or dissonance which occur when representation of roles, actions and contexts are not aligned or are inconsistent with one another. They reinterpreted Schultze & Boland’s (2000) results as a case of dissonance between the users’ expectations of the new technological system and their representation of their work role. In their own study, they traced how the notion of dissonance helps explain why and when changes have or have not occurred. For example, the lack of change in practice in the first phase have been due to the dissonance between insurance sales agents’ representation of work and the sharing of best practices via the system. Not acting and using that feature is consonant with the agent’s representation. Subsequent changes to the system have introduced new content to the system and created dissonance to the previously consonance that agents have experienced. This new event triggers organizational changes as agents attempt to remove this new dissonance.

Summary: Drawing from a diverse stream of research in IS and organizational studies, the literature suggests that organizational change and technological change are connected in a complex, recursive and dynamic manner. Research has shown that technological change is related sometimes to positive, sometimes to negative, and sometimes to no change in the organizations. The indeterminate and uncertain nature of this relationship is rooted in the fact that such change is

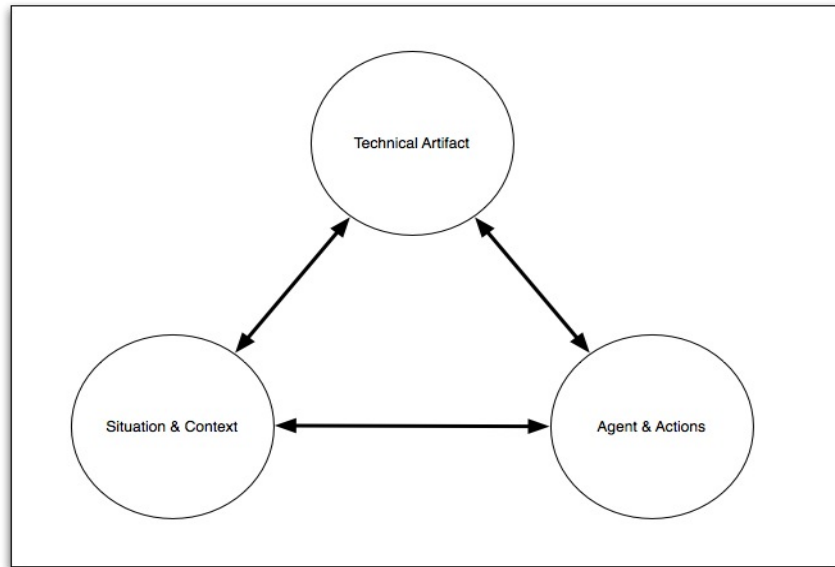
influenced by a wide range of contextual conditions such as institutions, culture, management style and political dynamics. While research has provided rich descriptions of the relationship, little is done in the attempt to drill down to the why's and how's. Some of the key studies have suggested various mechanisms through which this change relationship occurs – for example roles, sense-making, improvisation and dissonance. I consider next the theoretical perspectives in which these mechanisms are grounded in.

Theoretical Review

Following the previous section where I reviewed the key empirical findings in the literature concerning the substantive points of technological change and organizational change, I now turn to the theories underlying technological and organizational change.

While there are many empirical findings in this area, most of their theoretical roots can be traced to three key theories which also matches the three key elements of change. The theories and their respective elements are: Structuration Theory (Agents & Actions), Practice Lens (Agents and Situatedness), and Social Construction of Technology Theory (Socio-cognitive view of the artifact). See Figure 4 below.

Figure 4: Key Elements of IT-related Organizational Change



Structuration Theory

The application of structuration theory to understand the relationship between technological and organizational change begins with the papers by Barley (1986) and Orlikowski (1992). The key notion from the Theory of Structuration (Giddens 1979) that has been appropriated to the IS field is the notion of the duality of structure. The duality of structure states that “structural or institutional properties of social systems are created by human action and then serve to shape future human actions” (Orlikowski and Robey 1991 pg. 146-7). Hence, the process of structuration is posited as a “social process that involves the reciprocal interaction of human actors and structural features of organizations” (Orlikowski 1992 pg. 404).

As Structuration Theory is focused mainly on social structures, it does not directly consider the role of information technology. In Barley’s work, technology only acts as a trigger or an occasion for structuring and does not directly relate to the process of structuring itself. Orlikowski (1992), on the other hand, proposed that information technology or technology is not just a trigger but instead is a

type of organizational structure as “it embodies and is an instantiation of some of the rules and resources constituting the structure of an organization”.

In her 1991 paper with Robey, Orlikowski examined how IT embodies the three modalities of interpretive schemes, resources, and norms. In terms of interpretive schemes, IT institutionalizes interpretive schemes by formalizing and encoding them, making them standardized, shared, and taken for granted. In terms of resources, IT is a resource whose design and implementation is part of the system of domination. Finally, in terms of norms, IT enables the formalization of sanctions and thus allows formalization of norms that indicate accepted actions, interests and practices within the organization.

Orlikowski (1992) went further to propose that IT is interpretively flexible, that is the degree to which users of a technology are engaged in its constitution (physically and or socially) during development or use. Interpretive flexibility is “an attribute of the relationship between humans and technology and hence it is influenced by characteristics of the material artifact, characteristics of the human agents, and characteristics of the context” (pg. 409). Therefore, she posits that IT has flexibility not only during the design but also in its use and interpretations, albeit she acknowledges that this flexibility is bounded by its material constitution and institutional context.

Thus according to the structuration theory adapted by Orlikowski, technological change and organizational change comes from a process of structuration where technology is a form of structure. The key principle is that when technology is changed, it depends on whether the agent enacts that change. The indeterminateness of this process is due to the interpretive flexibility of the technology. Thus if the agent accepts or agrees with the intended design of the technology and acts accordingly, and if change is part of the design of the technology, then technological change may lead to the desired organizational change through repeated enactments of agents. However if there

is slippage, or a misalignment in interpreting the technological structure, or if the agent actively rejects the structure, in which all cases will lead to agent not using the technology as planned. These unanticipated actions may lead to observations where no change occurs or where unanticipated changes occur.

Thus, based on the structuration theory of IT, the crucial components of the explanation for why and when technological change leads to organizational change are:

- a) the agent's interpretation of the technology or situation (i.e. slippage) and
- b) the actions that result from that interpretation.

Practice Lens

Complementing the Structuration Theory of IT, some IS researchers have (Orlikowski 1996; Orlikowski 2000; Schultze and Boland 2000; Schultze and Orlikowski 2004; Vaast and Walsham 2005) recently approached the issue of technology-based organizational change from the Practice Lens perspective which is adapted from Practice Theory (Bourdieu 1977) as well as from research that have applied Practice Theory in the areas of computing and learning (Lave 1988; Suchman 1987).

Bourdieu's Practice Theory is basically concerned with the everyday practices of agents in a social world (1977). Adapting from Bourdieu's work, Orlikowski (2002) defined practice as "recurrent, materially bounded and situated action engaged in by members of a community" (pg. 256). Like Structuration Theory, there is an emphasis on the actions or in this case practices of the actors and similarly it focus our attention to the fact that these practices are recurrent and shared by members of a community. Unlike Structuration Theory, practice theory explores the dynamic interplay between the actions of the agent and the situation and context the agent is in. This second emphasis on the situated-ness of action (Lave 1988; Suchman 1987) brings our attention to the emergent

nature of practices and to fully appreciate what a practice is, one has to take into account the situation and context that the agents are engaged in and the actions they do to deal with the situation at hand. Bourdieu (1977; Bourdieu and Wacquant 1992) goes on to elaborate on the interaction among practice, an agent's habits and the field of power. But these other components of the theory have mostly been ignored with the exception of Schultze & Boland's (2000) work.

Using the notions of practice and situated action, Orlikowski (2000) re-conceptualized technology as two parts: the artifact (material properties) and its structure. Instead of her previous notion that technology artifact embodied structures, she proposes that the structure of technology emerges from the recurrent situated practices that agents engage in with the technology at hand. She refers to these enacted structures as "technology-in-practice". Formally, Orlikowski (2000) defines "technology-in-practice" to be "sets of rules and resources that are (re)constituted in people's recurrent engagement with the technologies at hand" pg. 407.

Therefore, when one applies the practice lens to understand technology-based organizational change, one has to understand what "technology-in-use" is in that particular case. This lens shifts the focus from the user's interpretation and action to his/her situation and practice. When a user's situation changes – "change in awareness, knowledge, power, motivation, time, circumstances and the technology", the practices change, which in turn result in organizational changes (Orlikowski 2000 pg. 411). Using this logic, Orlikowski provided a set of provisional generalizations based on her previous studies of how conditions might influence use and the organizational consequences of that use (2000 pg. 422).

Social Construction of Technology

Social construction of technology (SCOT) theory is grounded in the tradition of sociology of science and technology studies that view technical artifacts from a socio-cognitive angle (Bijker

1995; Bijker et al. 1987). While SCOT theory's focal point is the artifact, it does not consider the artifact to exist apart from social interactions within and among social groups. Artifacts are therefore imbued with interpretive flexibility, which Orlikowski appropriated in the Structuration Theory of Technology. The theory is concerned with how shared interpretations of the technology arise. Using empirical studies of various types of technologies, Bijker and his associates (1987) proposed that the social processes would involve the negotiations of technological frames of the different relevant social groups. The technological artifact becomes stabilized when negotiations among the groups end and closure is achieved. Technological frame contains the goals, current theories and problem-solving strategies of the social group; the frames are socially and culturally constructed and deeply embedded in the context. SCOT has been applied widely to various technologies – from bicycles, to bakelite and even inter-continental ballistic missiles (Bijker et al. 1987; MacKenzie 1991).

Orlikowski and Gash (1994) first proposed the notion of technological frames to explain how the different groups in an organization make sense of a new technology and how that affects the way they interact and use the technology. Sahay & Robey (1996) also found that the frames of the different groups are instrumental in influencing the impact of GIS technologies. Compared with structuration theory and practice lens, SCOT perspective sensitizes researchers interested in change to the specific socio-cognitive dynamics within the organization. Instead of focusing on agents' actions and context, this perspective shifts us towards the process by which the agent perceives the technology. More importantly it highlights the social interactions – negotiations – that give rise to the shared technological frame. These negotiations often reflect the cultural and political landscape within the organization and how the groups exercise their power to influence the design, configuration and use of the technology (Davidson 2006; Lapointe and Rivard 2007; Yeow and Sia 2008).

While closure may be reached in most cases, the reality is that many times organizational sub-groups will resist the dominant frame and a state of non-closure and incongruence of frames persist. This incongruence is oftentimes the source of conflict and resistance (Davidson 2002; Wagner and Newell 2005) and is one plausible explanation for the slippage that occurs in organizational use of the system.

Summary

The three theories discussed above have illuminated how each of the elements portrayed in Figure 4 can play a role in influencing the organizational outcome of technological change. Research has shown that the influence of technological change on organizational change is often a dynamic interplay among the agent's actions, situation, and technology (Gasser 1986). Without accounting for each of the elements, we may end up with an incomplete understanding of this phenomenon. Although these theories have been useful, they have their limitations and shortcomings. I discuss some of the more salient critique of these theories in the next section.

Critique

Firstly, the review suggests that all three theories place a stronger emphasis on human agency, cognition, and action and minimize the role of the technical artifact and its materiality (Boudreau & Robey 2005). For example Barley (1986) wrote that the scanners have occasioned change "because they (scanners) became social objects whose meanings were defined by the context" (pg. 106). Orlikowski (2000) argues that examining what the technical properties of the artifact is not as important as what users actually do with them.

Because it gives short shrift to the material artifact, we argue that these theories and related research fail to be specific about how and what aspects of the artifact constrain or enable actions or

why slippage happens or why specific use are enacted (Leonardi and Barley 2008; Monteiro and Hanseth 1996). It also fails to realize that the technological artifact is not a medium but an active coevolving actor that transforms work, roles, and organizations as itself is being transformed (Berg 1999). Even the idea that only a restrictive set of material features are relevant – Orlikowski’s (2000) notion of technology-in-practice – assumes that technological artifact has no ability to act autonomously and is dependent solely on agent’s situated actions. This conception of technology therefore privileges on-the-spot use over the original intent of the technical inscriptions; it also ignores the possibility that current technologies have a more proactive role.

Yet by examining new technologies, one will realize that technological artifact and its inscriptions can be equally influential as agency, context and actions. For example, networked technologies, once activated, can and do enact inscribed rules, which in turn constrain users who cannot and do not “interact” directly with these systems. Another example that is more commonly experienced in the course of our daily lives is the IT system that runs the traffic light signals for a city. This traffic system does so with minimal human intervention (apart from monitoring) but is enforcing specific traffic rules on drivers along the roads. The point therefore is that one has to open the black box of the technical artifact further and to recognize that its ability to constrain action is more material and physical than abstract structures. This argument echoes those discussed in editorial pieces written by leading IS and organizational researchers (Leonardi and Barley 2008; Orlikowski and Yates 2006) in which they highlighted that research should pay more attention to the materiality of artifacts when studying their implementation and use.

Three recently published papers capture the thrust of this material perspective of IT-based change. Volkoff et al.’s (2007) longitudinal case-study of an ERP implementation within a manufacturing firm found that the overall mechanism of change is the “embedded” organizational elements in the IT system. They proposed that through the process of embedding the data, routines and roles within

an organization these organizational elements not only have a performative and ostentative quality but also gain a material quality. It is this material quality that enables or constrains the performative quality of organizational elements leading to new interactions and relationships (e.g. “new relationship among routines in the form of work sequences” pg. 842) that result in organizational change. Leonardi (2007) also focuses on the materiality of the IT artifact, however, the level of analysis shifts from organizational elements to advice networks. He studies the impact of the informational capability of the IT artifact on work practices and social structure of the IT department within a government-funded research laboratory. He found that social pressure in the workplace creates discrepant events that lead to changes in the IT artifact. The change in the informational quality of the IT artifact in turn reverberates through the organization when it affects the advice networks found within the department. Finally, Davidson and Chismar (2007) also attempted to understand how the material aspect of the CPOE system affects the hospital practices. Like Leonardi they attempted to trace how the IT system impacts on the social networks within the organization. But instead of investigating the advice networks they focused on the role networks that are present in the hospital settings to show new roles and new interdependencies are enacted because of the new system.

Together these studies show us that the material aspect of the IT artifact plays an important role in the process of organizational change. However specifically how the IT artifact interacts with the organizational context remains open for further research. The insights provided by the three papers discussed here seem to point towards a need to understand the way IT artifact embeds and is embedded in the organizational fabric – be it the informal advice networks or the formal role networks. They also highlight the fact that one has to gain a better understanding of how the material aspect of IT is related to the work done (e.g. IT and the work of helpdesk or IT and the factory operator or IT and the clinician) (Barley and Kunda 2001; Leonardi and Barley 2008).

Secondly, a corollary to the above point is that we need to understand how the configuration of material aspects is inscribed into a technical artifact. For this, I subscribe to SCOT's perspective that the material artifact is itself a product of social constructions situated within specific cultural and structural contexts and that this process is subjected to political and social pressures (Kling 1980). This contrasts with both the implicit assumption of both Structuration Theory and Practice Lens where they assume that this process of inscribing cultural and structural properties into the IT artifact is unproblematic.

Because this process is problematic and has implications for the subsequent use of the technology, I argue that it is important for research about organizational change to take a holistic view of the technological artifact. In other words, when one studies the impact of technological change on organizations, one should not start their data collection at the point of time when system is in use but should take into account the moment the system is introduced into the organization through to the use phase. This approach allows us to take into account the "acts, interpretations, and intentions of those who design and purchase technologies" (Barley 1990 pg. 62). Orlikowski and Robey (1991) also point out this fact when they challenged future research to "... tie the development and use of technology together into a single, albeit more ambitious research program" (pg. 163). Leonardi (2005; 2008) also refers to this when he proposed that IS researchers should drop the theoretical and analytical blinkers that artificially separate IS development and implementation from IS use phase. Unfortunately, those blinkers have resulted in few studies considering the implementation phase and its impact on the systems use together, with the exception of some for example Orlikowski & Gash (1994) and Sahay & Robey (1996).

In summary, I argue that the current set of research and theories have left us with a limited understanding of the role of the technical artifact, specifically the way it embeds and is embedded in the organizational fabric. In turn I also argue that there is a need to understand how the artifact's

inscriptions are decided upon and that to do so requires researchers to take a holistic view that begins when the technology is accepted into the organization, that is, the implementation phase.

Chapter 3: Methodology

Introduction

For this research, I conducted a longitudinal field study of EMR system implementation in three family clinics owned and operated by a leading hospital in the Mid-Atlantic region in the United States. I followed the process of system implementation from the design and analysis phase in July 2007 through the implementation and use phase in May 2008. Here I discuss the rationale for the choice of this context and then define and describe the focal technological artifact. I also examine the methodology and data analysis employed for the dissertation. The clinics and project background as well as other details of the research context are provided in chapters 4 and 5.

The Medical Context and the EMR Artifact

Why EMR: Although the American medical industry and community is one of the earliest adopter of information technology (IT), there has been very little progress in computerizing the most basic and core component of medical work – the patient record system (Burt et al. 2007). This situation exists in spite of the efforts of key medical authority's endorsement of the technology (e.g. Institute of Medicine's (1991, 2001, 2003) reports) and US government's 2004 proposal to roll out EMR to the entire American population by 2010. Many practitioners as well as medical informatics researchers have analyzed this problem and approached it mainly from an adoption perspective. They have identified various key issues like lack of training and implementation plans, uncertainty and fear of system and alignment of incentives (Baron et al. 2005; Cooper 2004). However, another key finding that has emerged from this literature is the need for medical practitioners to have a better grasp in managing the change that occur with the introduction of EMR (Baron et al. 2005; Marlin et al. 2006).

IS research is traditionally lacking in this particular domain (Chiasson and Davidson 2005; Wilson

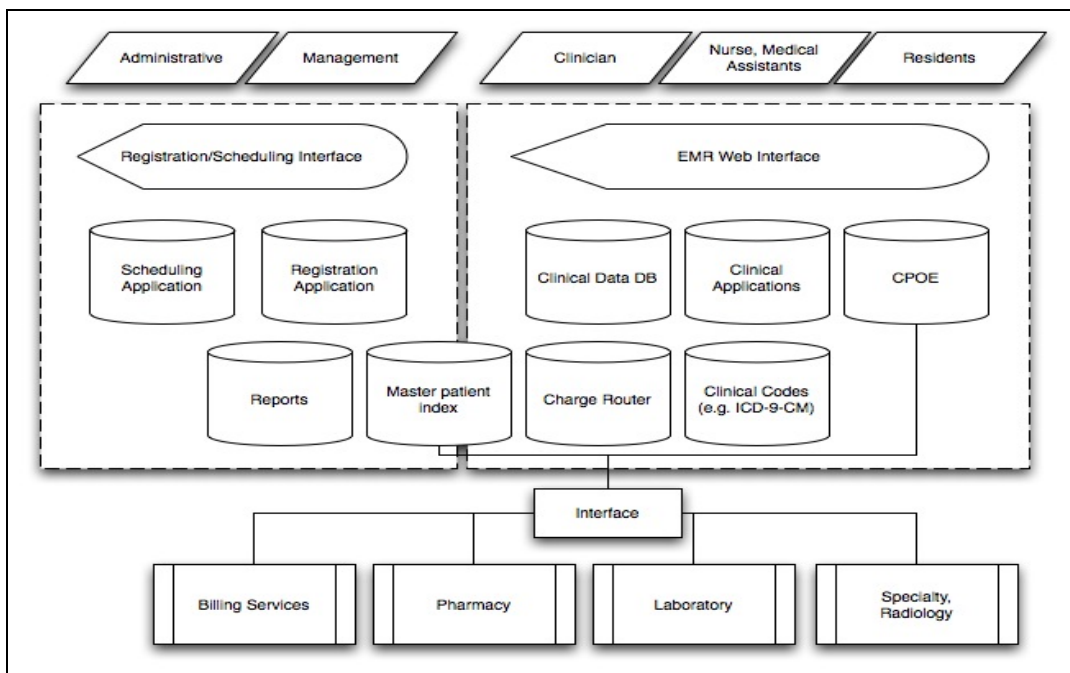
2004) but there have been recent efforts by IS research to study the adoption issues of EMR (Agarwal and Angst 2006) as well as the health IS implementation process and its implications for medical practices (Ellingsen and Monteiro 2003a; Ellingsen and Monteiro 2003b). This trend points to a strong interest among practitioners, medical informatics and IS researchers to better understand the change issues surrounding EMR implementation as a way to tackle the challenge for increasing the use of EMR in the US. Hence, in my dissertation proposal I have chosen to focus on the EMR artifact and build on the more recent work on EMR implementation and use. As discussed in above sections, I aim to explicate the impact of the EMR on organizational change.

Definition and Scope: Electronic Patient Record (EPR), Electronic Medical Record (EMR) and Electronic Health Record (EHR) are used sometimes interchangeably but have nuanced differences. While all of them refer to the electronic capture, storage and retrieval of patient information, EHR is significantly different from EPR and EMR in that it contains the “longitudinal personal health data across the continuum of care” (Balka 2004; Institute of Medicine 2003). It may include other information that is health-related but not necessary medical. EPR is a patient view of the artifact and attempts to collate all medical information of the specific patient from various relevant medical institutions. EMR not only keeps track of the patient’s medical information but also includes medical practice and office information connected to that patient and which support and surround that electronic record (Institute of Medicine 2003).

The formal definition given by the Committee on Improving the Patient Record of the Institute of Medicine defines the computer-based/electronic patient record as “an electronic patient record that resides in a system specifically designed to support users through availability of complete and accurate data, practitioner reminders and alerts, clinical decision support systems, links to bodies of medical knowledge, and other aids” (Dick and Steen 1991). There is generally a lack of consensus among the health informatics community concerning the various definition and as such I propose to

adopt the more formal definition provided by the Institute of Medicine. In my specific study, I am not interested in the patient focused view of the electronic medical record and as such I am not concerned with the Patient Health Record (PHR) or EHR. Instead, I am specifically interested in the EMR system as used within the hospital and/or clinic environment. I am therefore biased towards the clinical and medical practice orientation of the artifact and as such will focus solely on the EMR definition of the artifact.

Figure 5: Architecture of EMR



An EMR system in my context, therefore, refers to a system “used to specify, routinize, and make uniform the type and format of clinical information to be collected”. An EMR can also be used to coordinate the activities of different team members, departments/clinics within a hospital, and across hospitals. It is usually built on existing technical standards and is embedded with “clinical procedural standards as well as numerous classification schemes and terminologies” (Timmermans and Berg 2003). In principle, EMR systems can be standalone or shared and can be either bought off-the-shelf product or co-developed as a proprietary system. (See Figure 5 above for current project’s EMR architecture and Appendix A for a condensed history of EMR).

Methodology

Since the goal of this research is to generate a grounded theory of technology-based organizational change, I have conducted an in-depth, longitudinal case study of the EMR system implementation (Walsham 1995) and employed methods of grounded theory (Glaser and Strauss 1967). While grounded theory typically requires multiple cases so that researchers can implement the constant comparison method (Suddaby 2006), conditions surrounding the phenomenon of technology-based change require researchers to focus on one case over a period of time. Specifically, an EMR system like other package software systems (e.g. ERP system) involves a complex and lengthy process of implementation (Volkoff et al. 2007). Furthermore, the potential organizational and technological changes typically emerges after a period of time following its implementation (Markus et al. 2000).

The research site for the case study involves three family practice clinics that belong to a private hospital system in the US called MATH . MATH is a private, not-for-profit multi-hospital organization with academic, community and specialty service missions around a Mid-Atlantic state in the US. The three family practice clinics are Alpha, Beta and Gamma clinics. MATH initiated the EMR project for these three clinics in early 2007 and I gained access to the EMR project as part of a larger research study on the impact of EMR systems. Details of the research sites are provided in chapter 4 and details of the EMR project are provided in chapter 5. I followed the EMR implementation project for 11 months (July 2007 to May 2008) to collect data for the longitudinal case study. I collected data from both the EMR project team and the three clinical sites and that allowed me to follow the “technology within and between a number of social settings and groups” (Leonardi and Barley 2008 pg. 168).

Data Collection

The data collected as part of my case study comprises archival data, interview data and field notes

gathered from my on-site observations. The motivation and rationale for collecting data from multiple sources have been succinctly discussed by Pettigrew (1990) where he explains that archival data provides us with facts but are subjected to “selective deposit and survival”, interviews provide rich, subtle and personal feeling but may be biased by personal emotions, observations provide direct access to individual and group activities and processes and allow the researcher to confront discrepancies between what people say and what people actually do. Together these three methods allow the researcher to cross check the data as well as draw on each method’s particular strengths to answer my research questions.

Archival Data: As part of the negotiation for access to the research site, I was given permission to access the MATH’s intranet as well as the EMR project team’s website where pertinent project documents were stored. These documents included project-proposal reports, system requirements, user manuals, internal and external meeting minutes and presentations, project reports, policy minutes, system documentation, requests for change, bug and issue reports, job and process descriptions and promotional documents. In addition to the EMR project documentation, I also collected documentation pertaining to the operations and policies of the three clinics. Specifically I collected samples of their sign-in sheets, vitalization forms, minutes of their operation meetings and operational reports generated by the EMR system. The wide range of documents was essential in my data analysis in the following manner. The project-proposal reports and early meeting minutes enabled me to establish the background and the motivations for the project. By reviewing the names in these documents I was able to identify the key participants involved in the implementation process and the project. I also used the flow of the meeting minutes together with other project documentation to build the chronology of events for the implementation process (see Appendix B). Together these data elements provided an archival-perspective of the project. The system documentation collected by the project team during the intense requirement analysis phases of the project provided the basis to understand the policies, functionalities work-flows, and job

descriptions existing currently in the clinics. I corroborated the EMR project team documentation with documentation from the clinic to ensure that they were presenting a consistent picture. The system documentation of the design of the system on the hand provided information of what will be implemented with the system. Lastly the operational meeting information and other post-go live documentation from the clinics provided information concerning the impact and consequences of the EMR system on implemented site's work and organization. This was supplemented with the EMR project team's online database that captured roll-out issues and bugs. It was updated frequently by the EMR project team and captured the resolutions to issues and bugs. In total, I collected and archived 1,928 files from the EMR project team and 63 files from the EMR system vendor. See Table 1 below.

Table 1. Archival Data Collected

Type	Source	No. of files
Meeting Minutes	EMR project team	477
Documentation (e.g. system specifications)	EMR project team	848
Site-specific documentation	EMR project team and clinic	603
System Documentation	EMR system vendor	63
	Total	1,991

Interviews: I conducted both informal and semi-structured interviews with key participants from the EMR project team and at the clinical sites. The informal interviews were spontaneous discussions between the participants and I that took place during the routine observation sessions at the EMR project office and clinical sites. These informal interviews provided information about issues surrounding both the EMR project and clinical sites that I might not have been sensitized to given just the archival data. They were especially important at the clinical sites, as they helped clarify aspects of the clinical work that were not clear to me as an external observer or that were not clearly documented in the project archives. Many times the informal interviews provided the bridge to understand why specific issues were discussed in various meetings. They also provided important information nuggets that became part of my semi-structured interview questions. The

notes from these informal interviews were recorded as part of my field notes.

With regards to semi-structured interviews, I conducted a total of 94 interviews – each lasting between 20 and 45 minutes – with 19 EMR project site participants and 29 staff from the three clinical sites. About half of the interviews were done during the configuration phase (N=46) and the other half, during the use phase (N=48). I interviewed management staff from MATH and the EMR project as well as project team members. At the clinical sites I interviewed their management as well as clinical providers and support staff. See tables 2 and 3 below for a breakdown of the interviews. All semi-structured interviews were transcribed during the interview session or after the session from tape, when permission was granted. All participants were kept anonymous in the writing of the study. The list of key participants was developed from reviewing internal meeting minutes and the formal project structures.

Table 2. Details of semi-structured interviews

Level	No. of Interviews	No. of Interviewees
MATH Management	11	4
EMR project management	10	5
EMR project staff	12	10
<i>Sub-Total</i>	<i>33</i>	<i>19</i>
Alpha clinic Management	9	3
Alpha clinic Clinical Providers	7	3
Alpha clinic Support Staff	15	8
<i>Sub-Total</i>	<i>31</i>	<i>14</i>
Beta clinic Management	6	2
Beta clinic Clinical Providers	NA	NA
Beta clinic Support Staff	9	5
<i>Sub-Total</i>	<i>15</i>	<i>7</i>
Gamma clinic Management	4	2
Gamma clinic Clinical Providers	4	2
Gamma clinic Support Staff	7	4
<i>Sub-Total</i>	<i>15</i>	<i>8</i>
Total	94	48

Table 3. Number of semi-structured interview by phases

Level	Configuration Phase	Use Phase
MATH Management	5	6

EMR project management	5	5
EMR project staff	10	2
<i>Sub-Total</i>	<i>20</i>	<i>13</i>
Alpha clinic Management	3	6
Alpha clinic Clinical Providers	3	4
Alpha clinic Support Staff	5	10
<i>Sub-Total</i>	<i>11</i>	<i>20</i>
Beta clinic Management	2	4
Beta clinic Clinical Providers	NA	NA
Beta clinic Support Staff	5	4
<i>Sub-Total</i>	<i>7</i>	<i>8</i>
Gamma clinic Management	2	2
Gamma clinic Clinical Providers	2	2
Gamma clinic Support Staff	4	3
<i>Sub-Total</i>	<i>8</i>	<i>7</i>
Total	46	48

My initial interviews with the project team and the management at MATH were aimed at understanding the background and vision of the project and what they perceived were key issues in the configuration of the system. The goal was to understand the key design issues of the project and the process by which decisions concerning these issues were made. The background information of the project and their roles formed the “grand tour” questions while the “mini tour” questions focused on specific project issues and tasks. After the system went live I re-interviewed most of the project team (management and team) members to follow up on those implementation issues that had been raised and to explore the impact of those issues for each of the deployment site. I also asked MATH management about their perception of how each of the organization had changed following the EMR system implementation and why these changes emerged.

Clinical staff initial interviews focused on understanding their work (grand tour) and what perceived impact of the EMR system would have on their work given their perception of the EMR system (mini tour). I also asked clinical sites’ management what some issues at each of their sites were and how they perceived the EMR’s impact on their organization. After the go-live of each of the site, I conducted another round of interviews of the clinical site management and staff. This

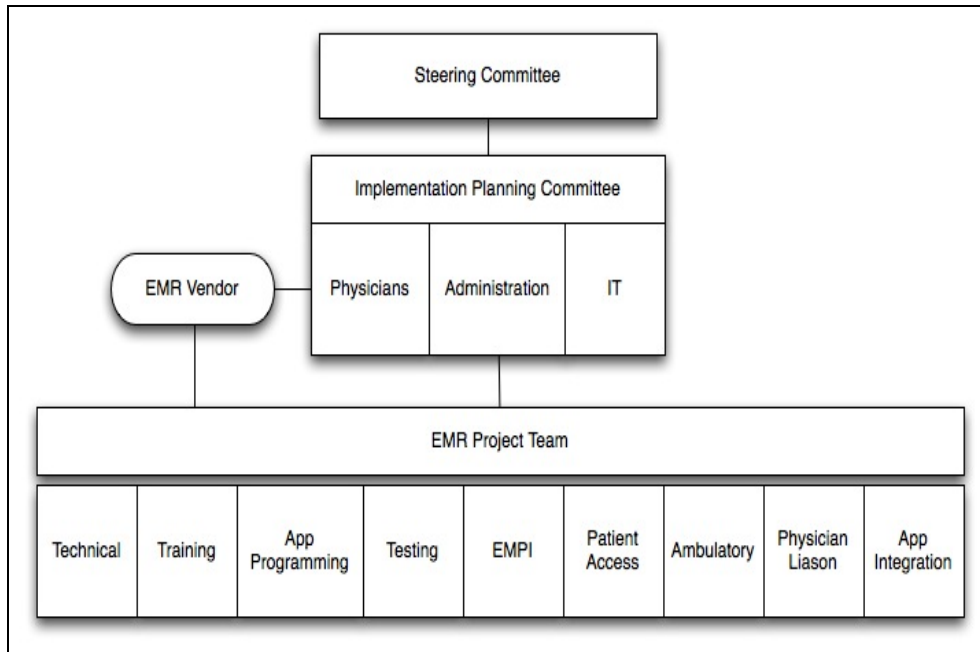
round of interviews was focused on specific issues that occurred after the system go-live and explored what aspects of work had changed and how the staff had been coping with it. As I was able to spend more time at Alpha after its go-live (six months), I conducted a final round of interviews with them to understand how those issues they faced immediately after go-live had evolved and what new changes had occurred. Given the dynamic nature of the project, interview protocols for each round of interviews were amended and supplemented as the conditions of the site changed. This was especially true of the interview protocol for clinical site participants as the issues were different at each of the site. See Appendix C for the interview protocol and Appendix D for the various groups interviewed at the site.

Observations: While archival data and interviews can enable one to develop a sense of the project, the dynamic interactions among project participants as well as the rich story behind the dry bones that are recorded in official minutes are often lost. To get the dynamics of the situation, I sat in and observed project meetings at the project site as well as the clinical sites' operational meetings. As different issues and decisions were made at various levels, I also attended, where possible, meetings that were held at the Project sub-team level (e.g. Charting Tool Meeting), the Project level (e.g. Fortnightly Project Meeting or Project Leadership Meeting), the Advisory Committee level (e.g. Physician Advisory Group Meeting), and the Steering Committee level. These meetings were important as they “provide insights into areas where problems in the project surface and recur; those that are malleable, those that are not; ... gaps and dilemmas at varying organizational levels” (Gregory 2000). All observations were transcribed during the meetings and they typically lasted between 1 and 2 hours. At the end of my fieldwork, I attended altogether 57 meetings and spent 60 days of observations at the project site. (See Table 4 below and refer to Figure 6 for Project Organizational Structure).

Table 4. Details of meeting observations

Meeting Level/Types	No. of meetings
High Level: Implementation planning committee and advisory groups	5
Project Level: Project team, Site leads	9
Sub-Project Level: Ambulatory team, Roll-out team	16
Site specific meetings: Review-build-validate, Go-live prep	23
Clinical site operational meetings	4
Total	57

Figure 6: Structure of Project Organization



Because I was interested in how the system affected the three clinics, I also carefully observed how work was conducted in each of the three sites before and after the system implementation. I conducted in total 106 days of observations for all three sites – 52 days were spent before and 54 days were spent after the EMR system implementation. See Table 5 for a breakdown of the number of days of observation.

Field memos were written up at the end of each observation day. My field memos captured the tasks that each role undertook in the clinic as well as the interactions among the staff. These observations served to triangulate what I read from the archives and what I heard from the

interviews. After spending the first two months at the clinical site, I also took note of exception events as I had become accustomed to what constituted as routine work. As each role had a well defined set of tasks I employed structured observations to code the different work tasks each role engaged in and the duration of time used for each work tasks (Mintzberg 1970). Structured observation refers to the use of observation data to develop categories of events that organizational actors take (Mintzberg 1970, pg. 90) and to structure the observation around those empirically grounded categories. As the clinic was separated into various work domains (e.g. front-desk, clinical areas, medical records room), I divided up the structured observations into each of these work domains and focused on specific roles in each domain e.g. MA and providers in the clinical areas, front-desk staff at the front-desk and phone operators in the phone room. I also bounded each of the structured observations by the interaction episode that were specific to each domain e.g. MA-provider interaction in the clinical domain and customer transaction at the front-desk domain. The breakdown of the structured observations by site is provided in Table 6. Each observation work-day lasted between 4 and 8 hours as dictated by the conditions at the site and the total number of hours spent at the site was 425 hours. The total span of the observational portion of the study was 11 months from July 2007 to May 2008.

Table 5. Details of clinical site observations

Site	No. of days (before)	No. of days (after)	Total no. of days	Total hours of observations
Alpha clinic	25	24	49	228 hrs
Beta clinic	15	15	30	109 hrs
Gamma clinic	12	15	27	88 hrs
Total	52	54	106	425 hrs

Table 6. Details of structured observations by site

Site	MA-Provider	Front-desk
Alpha clinic	213	529
Beta clinic	187	616
Gamma clinic	207	437
Total	607	1,582

Data Analysis

As mentioned above I have adopted the grounded theory method for my research and that typically involves an iterative process of data collection, analysis, and then further rounds of data collection and analysis. The emerging concepts around the phenomenon of interest guides each successive round of data collection and analysis. Below I describe the process for developing my grounded theory by outlining the data analysis and how it relates to the data collection efforts detailed above. As I have posited a priori that the configuration and use phases are intricately connected I begin my data analysis from the configuration phase and then work my way through to the use phase to track the observed issues and changes.

Building the narrative: The first step in my analysis was to develop a basic narrative that captured the chronology of events within the configuration phase. This narrative formed the foundation for arranging the vast amount of information available in the primary dataset of archival, interview transcript and field-notes that I had collected in this early part of the data collection. Specifically it allowed me to focus on the key actors and artifacts, their behavior and actions, and the sequence of events surrounding these focal actors and artifacts (Van de Ven et al. 1999). Because I was interested in knowing how the configurations of the technological artifact were decided (my first research question), I focused my analysis on the project issues that directly relate to the functionalities of the artifact. Here I started with the interview data gathered from the project team members as well as the clinical site participants and began coding for specific EMR functions and identifying the issues that arose from the configuration of these functions. At this

stage I used open coding to draw out substantive codes concerning the artifact configurations based on the interview data (Strauss and Corbin 1998). Specifically I derived codes pertaining to the content configuration, functions, integration and workflows as well as codes pertaining to the key stakeholders involved in the configurations. The TAMS (text analysis mark-up system) Analyzer software package (version 3.43) was used to keep track of the codes as well as for further data analysis. Using the codes as starting points, I triangulated them with archival and field notes gathered from project meetings to trace the events and actors that were involved in these issues. This set of information was the foundation for building my narrative. At this point of my analysis, I began to have an understanding of the political process of the configuration – it was neither linear nor singular but multi-level and iterative. At the same time the interview data also surfaced the background issues that had significant impact on the political process viz. the larger political conflict between the sponsors. The data also made salient the impact of the configurations on the workflows for three clinics.

Understanding current practices: As I was building the basic narrative, I also began analyzing the data collected from the first two sites (Alpha and Beta clinics). This analysis was driven by the second research question that is to understand how users and their practices interact with the technical artifact. To understand this interaction I first had to surface what the users' current practices were – this meant that I had to review and code the interviews of the clinical site staff and compare that with the observations in my field notes. This was built on top of the structured observation data that I had collected in the field. As I built a picture of what each role in the clinic did it also became apparent to me that these practices were related to many of the operational issues faced by each clinic. The variance in the three clinics' documented and actual practices as well as their contexts facilitated the process of “constant comparison” and the development of codes and categories for the emerging framework (Glaser and Strauss 1967).

Coding for change and building theory: The last step involved coding the interviews and field notes for the changes in the clinic. This involved “axial coding” where I attempted to organize the codes concerning changes to surface clusters of categories that represented similar activities or issues. Strauss and Corbin (1998) recommended analyzing codes for conditions (causal or contextual), interactions, and consequences. Throughout this process, the researcher is iterating between data and coding and that ends when the researcher reaches “saturation”; this may be signaled by repetition of information and confirmation of existing conceptual categories (Suddaby 2006). The main set of codes involved here were the changes, impacts and problems faced at the three clinics as a result of the EMR system. What was significant was that these codes were tightly linked with the workflow design issues that had been salient in the configuration phase. Therefore I focused on understanding conditions and interactions that were linked to the codes. At this juncture I moved to “selective coding” as I attempted to abstract and integrate the codes from the use phase and the configuration phase as well as codes from the project and clinical domains. Besides the comparison among the codes, I also compared the codes with the literature. From these comparisons, the concept of the “Work Network” emerged² and the attending conceptual categories of infrastructure, institutional environment, tensions and fitting. Finally, I incorporated evidence with the text from which the categories emerged to illustrate the concepts (Glaser and Strauss 1967).

Visualization: As part of data analysis, I also created data displays -- “an organized, compressed assembly of information that permits conclusion drawing and action” -- that would complement and enrich the theoretical model generated from the coding analysis (Miles and Huberman 1994). Specifically, I constructed network diagrams depicting the core concept of “Work Network” and

² I discuss the theoretical path by which I arrived at this analytical concept in chapter 9.

“narrative networks” and used them to trace how each organizational and technological change co-evolved. The first step in this analysis was to create the narrative networks. The method of constructing narrative networks is based on Pentland and Feldman’s (2007) paper where they proposed a new method for “representing and visualizing patterns of technology in use”. At the center of the narrative network method is surfacing the actor, artifacts and the actions that connect them as a narrative fragment. Organizational work and routines can be described as narrative fragments connected by the sequence in which they occur. The relationship between the narrative fragments does not only capture the sequence but also a coherent story (pg. 789). The examples of narrative fragments include “I turn on the computer”, “I log into website” etc. They proposed that narrative networks are bounded by using a purpose or an agent as their focal point. By depicting organizational work in this way, the narrative network method allows researchers to build “actual and potential narratives that can be created within some sphere of activity” (pg. 789).

Compared to other existing tools e.g. flow chart for work processes, narrative network is more flexible as it is not simply focused on the decisions points and the work that the actor does. The narrative network allows us to capture the process by which work is currently done and how it can be potentially done. It also allows us to explicitly capture the actors, artifacts and actions whereas other methods place less emphasis on either actors or artifacts and focus more on the actions.

Theoretically, the narrative network is similar to my conceptualization of work as a network rather than a deterministic process akin to Taylor’s concept of a production line. It is also especially appropriate for assisting researchers to describe organizational change and design – both of which are key goals in my research.

After creating the narrative network to describe and visualize the work that each role is engaged in. This narrative network uses the task and the agent as its focal points. So for example I would create a narrative network of the front-desk staff and their check-in task or the MA and their vital/rooming

task. In each narrative network there are “connecting” narrative nodes that joins each of the role with each other. For example the front-desk staff’s FDNN1.25 connects its role to the MA’s role as that narrative node describes the handover from front-desk to the MA. Detecting these points moves my analysis to the second step that is to build the Work Network.

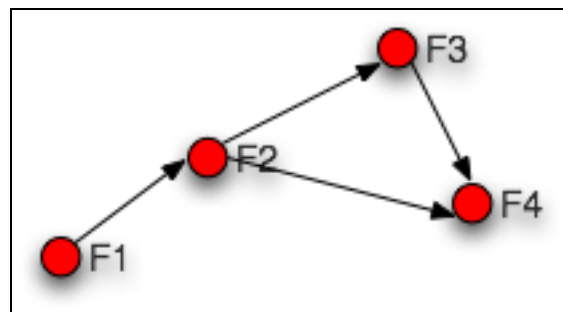
The Work Network step involves examining how each of the individual roles/tasks is interrelated in the course of carrying out specific organizational processes. So for e.g. the front-desk check-in and MA vitals/rooming are part of the overall Work Network of checking-in and prepping a patient for examination. To describe this Work Network, I use the connecting narrative nodes found in the narrative network analysis to link the different roles and artifacts. In a sense the narrative networks are now “rolled up” as part of the nodes of the Work Network.

Putting these steps together, I begin with reviewing my field notes as well as structured observation data for each domain and roles observed. I then derive the narrative fragments or nodes (I choose to use the label narrative nodes as they are part of a network diagram) for the each role’s work narrative. For example in the front-desk domain for a front-desk staff, I would extract the following as a narrative node – “FD asks patient for name and date-of-birth to verify patient present with IDX record”. These narrative nodes capture the actors, artifacts, and actions that constitute a sub-task (Pentland and Feldman, 2007). Next, I would examine how each of the narrative nodes are linked in sequence. Going back to the front-desk example, the narrative node “FD asks patient for name and date-of-birth to verify patient present with IDX record” is followed by the narrative node “FD asks for patient’s insurance card”. These two narrative nodes would therefore be linked together in a narrative network. As I derive more narrative nodes, they would be linked as they appear in observed/documentated sequences.

In order to visually depict these narrative networks I have followed one of Pentland and Feldman’s

(2007, pg. 791) suggestions to input the narrative nodes into a social network analysis software (e.g. UCInet) to be represented as a valued, directed graph. Practically this involves labeling each narrative node with a short label and entering them as a network matrix. This network matrix is essentially a co-occurrence network matrix where each node is linked to another if they occur in sequence. For example I may label the narrative node “FD asks patient for name and date-of-birth to verify patient present with IDX record” as FD1 and “FD asks for patient’s insurance card” as FD2. I would put a “1” in the matrix where FD1 (row) intersect with FD2 (column). When all the possible/observed nodes and their sequences are entered in the software can provide a graph to visualize the narrative network. A plausible narrative network might look like the figure (Figure 7) below where F2 links with both F3 and F4 because the sequence of events could be F4 after F2 or F3.

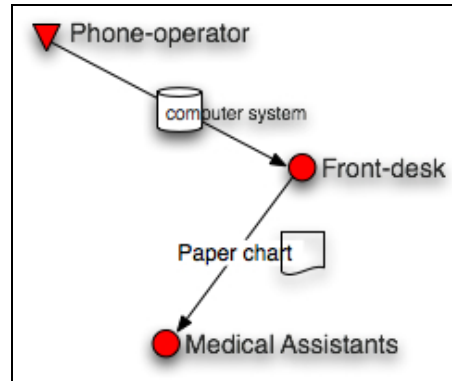
Figure 7: Narrative Network Example



The Work Network graph that I propose builds on top of all the narrative networks by first representing all the relevant nodes i.e. roles involved in the course of a specific work process. For example, the processing of patient in a clinic would be a Work Network and relevant nodes may include front-desk staff, phone operators, MAs. Using the narrative networks of each of the nodes, I ascertain the links among these nodes e.g. front-desk staff hands over patient to MA by placing a paper chart on the provider’s rack. I would connect these role nodes and depict the artifacts used in those connections. A sample Work Network graph would therefore be like Figure 8 below where it depicts the roles and connections between roles via artifacts. In this example, I show how the

front-desk staff's role is connected to the MA via a paper chart while the phone-operator is connected to the front-desk via the computer system.

Figure 8: Work Network Example



Validity: The goal of this research is to build a mid-range process theory that seeks to explain rather than to predict how change in organizations occur with the introduction of a new technology (Gregor 2006). Unlike predictive models the validity test for this type of grounded study is validity and plausibility of the data and how well the theory or model fits the data (Glaser and Strauss 1967; Strauss and Corbin 1998). Replication within and across cases is one way to verify the extent to which findings apply (Yin 1994). These broad principles serve as guidance as I develop the findings and construct the theoretical model in the following chapters.

Chapter 4: Context of Research Site

Introduction

As the title suggests, this chapter provides an overview of the three clinics where the new EMR system is implemented. I document in this chapter the history and organizational structure of the three clinics as well as their key organizational policies. I also provide pertinent characteristics of each clinic's patient base. A key point to be made here is that unlike many medical informatics studies that either focus on a hospital setting or on small independent family practices, my research is unique as it focuses on ambulatory settings such as a family practice but with strong organizational ties to an institutional hospital system. This is unique as it provides a view of how an EMR system works in the ambulatory setting, and there are fewer studies in this area. At the same time it allows us to explore how the larger organizational policies and politics that are prevalent in a hospital system come to play in the configuration and use of an EMR system.

The Research Site

The research site involves two main areas: the Hospital System (referred as "MATH") that owns, manages and initiated the EMR implementation project and the pilot sites for the system, Alpha, Beta and Gamma clinics.

MATH is a private, not-for-profit multi-hospital system with academic, community and specialty service missions around a Mid-Atlantic state in the United States. It owns and manages seven hospitals and health systems that together account for 1,800 beds. MATH is also a national and regional referral center for trauma, cancer care, neurocare, cardiac care, women's and children's health, and physical rehabilitation. While MATH manages the hospitals and the support staff, the clinical providers belong to a separate organization, Clinical Providers Inc. (CPI). MATH works

closely with CPI to provide care across its entire multi-hospital system.

The pilot sites are the three clinics that belong to a MATH-CPI initiative that began in 1995³. The initiative grew from a realization that 35 percent of MATH's patients came from the West End of the city. The combined leadership of the CPI and MATH decided then to reach out to this segment of their customer base and provide direct community care to these patients. The main mission of this initiative is therefore to provide primary health care to the neighborhood the clinic is situated. Alpha clinic was setup in February 1995 as the first clinic of the initiative in the West End of the city. The clinic grew from zero patients to about 13,000 patients and a load of 15,600 visits a year. It has five full-time providers that provide family care as well as psychological counseling and on-site laboratory facilities.

Beta clinic was formerly a private practice before it was acquired by MATH in 2004 and absorbed as a clinic under the MATH-CPI initiative. It is the "newest" clinic to be introduced as part of the initiative. Like Alpha clinic, Beta clinic provides family care services but does not provide on-site laboratory services. Instead Beta clinic is located in a medical park built in 1997 where external laboratory and specialist clinics are co-located. It has three full-time providers prior to the implementation of the EMR and handles 8,600 visits a year.

Gamma clinic was formerly part of CPI's general internal medicine clinic founded in 1984. Gamma clinic was folded under the MATH-CPI initiative around 1997. It is housed in a Senior Citizens Center located in the city's downtown area. Unlike Alpha and Beta clinics, the two physicians are not full-time at Gamma. The lead provider practices in two other locations and is only in the

³ 2003-2004 School of Medicine Faculty Resource Handbook, pg. 56

practice on Mondays, Thursday and Friday. The other provider practices only half the day each day of the week. Moreover, the lead provider also trains residents at the Gamma clinic. Gamma clinic caters mainly to geriatric patients and provides specialist services such as podiatry and rheumatology and has also on-site laboratory facilities. It has an annual visit volume of 6,000.

Each of the clinics is managed by a practice manager who is in charge of the administrative and operational aspects of a clinic. These duties include managing the administrative staff and medical support staff (e.g. payroll, leave), the billing and financial processes as well as handling patient issues and complaints. See Table 7 below for a breakdown of the staffing in the three clinics.

Table 7. Staff and Clinic Size

Staff Types	Alpha	Beta	Gamma
No. of practice manager	1	1	1
No. of Providers	6	3	3
No. of RN Supervisor	0	1	N.A.
No. of MA	5	3	2
No. of Ph. Operators	3	2	1
No. of Front Desk	3	1	Phone operator
No. of Referral Coord.	1	1	1
No. of Medical Records	2	N.A.	1
Total Personnel	20	12	9
On site Lab Tech	1 (Lab Corp)	N.A.	1 (Quest)
Other onsite clinical staff (not part of clinic)	Psychologist	N.A.	Residents (N=5), Podiatrist, Pharmacist, Psychiatrist, Psychologist

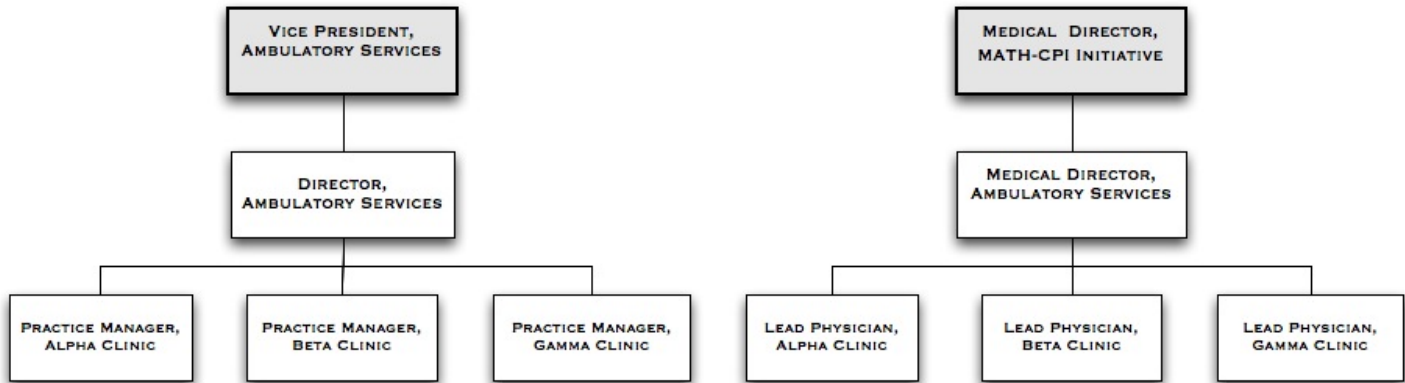
Organizational Structure of Pilot Sites

Overall: A single Medical Director oversees all three clinics and practices in the Alpha clinic.

There is a Lead Provider in each of the three clinics and he oversees the operational issues of the clinic together with the Practice Manager. All support staff (including MAs) report to the Practice Manager but MAs also works closely with the provider. The Practice Manager in turn reports to the Director for all three clinics. The Director is part of the Department of Ambulatory Services in

MATH. See Figure 9.

Figure 9: Organizational Structure of MATH-CPI Initiative



Each clinic essentially has two main sections: the front office that handles the administrative aspects of patient care and the back-office that handles the clinical aspect of patient care. While the structure of the front office and the back-office is relatively straightforward, each clinic implemented its own custom organizational structure.

Back-Office: In terms of the back-office, Alpha clinic has a rotating arrangement where a MA is attached to a designated provider for a month and then rotated out to another provider in the next month. While this assignment is usually in effect, providers sometimes have to work out the assignment with each other at the beginning of the day when their designated MA is unavailable due to sick leave or other issues. On paper, a Licensed Practitioner Nurse is supposed to manage the MAs, but in reality, the Practice Manager for the Alpha clinic is in charge of all the administrative and operational issues pertaining to the MAs. At the Beta clinic, they use a “provider team” i.e. a MA is permanently attached to one physician. The only time a MA will work with another provider is when they are covering for each other when a MA is on leave or sick. A Registered Nurse oversees the issues related to the MAs and in turn she reports to the practice manager for MA related issues. Finally at Gamma clinic, providers work with a “nursing pool” of MAs (technically

there are only two of them). In this arrangement, the provider can work with any of the MA who is available to assist him/her. Like at Alpha clinic, both MAs report to the practice manager for administrative and operational matters.

Front office: The Alpha clinic has two check-in and one check-out counters at their front-desk. Although it plans to have all three counters staffed, it usually has only two front-desk personnel upfront. The front-desk staff deals with registration of patients, checking out patients as well as other patient walk-in requests (e.g. pickup of prescriptions and letters or request for appointment due to emergency). It also assists the practice manager to manage patient related reports and billing related administrative work. The front-desk staff is physically separated from the back-office and other support staff. Alpha clinic has a separate team that deals with phone calls and that is located in the phone room. The phone room has three terminals (phones and computer workstations) and handles all scheduling requests as well as other patient requests that come in from the phone (e.g. messages for providers). They are also in charge of handling all mail correspondence for the clinic. Alpha clinic has its own medical records staff to deal with all medical record related matters, namely: pulling charts for visits and for patient requests and paperwork, filing of charts after visits, and corresponding with external parties who require specific information from patient charts. Finally, Alpha clinic has a referral coordinator (located in a separate office adjacent to the providers' examination rooms). Her job is to assist patients and providers for specialist referral requests and orders.

The Beta clinic front office has one check-in counter manned by one staff. Like Alpha clinic's front-desk, she deals mainly with patient registration and other patient over-the-counter requests. Like the Alpha clinic front-desk staff, she also works on patient related reports. The front-desk is located beside two other staffs handling the phone lines. There is no dedicated phone room and phone staff. The two phone staffs not only deal with phone lines but also assist the front-desk staff

when the latter is either busy or not available at the front. Beta clinic does not check out patients. The entire front-desk/phone team also doubles up as medical records staff as the medical charts are shelved just behind the front-desk workstations. The front-desk staff is usually in charge of pulling charts for upcoming appointments while the other two phone staff works on filing charts back and pulling charts for phone messages, mail correspondence and faxes. Other medical records work e.g. corresponding with external parties on specific information from patient charts is outsourced to a medical records administrative company. Beta clinic has its own referral coordinator who is located at an office near the providers. On top of referral work, Beta clinic's referral coordinator assists the practice manager on billing related administrative work.

Gamma clinic's has two front-desk check-in counters but only one staff. Like her counterparts in Alpha and Beta, her primary work is to register patients and to checkout patients and she assists the practice manager with patient related reports. However, she also doubles up as the phone operator as there is no separate team or facility for phone operations. Like Alpha clinic, Gamma clinic has its own medical records room and a dedicated staff and a referral coordinator (or technician). The practice manager manages all billing related administrative work by herself. See below figures 10-12 for graphs depicting each clinic's organizational structures.

Figure 10: Alpha clinic's organizational structure

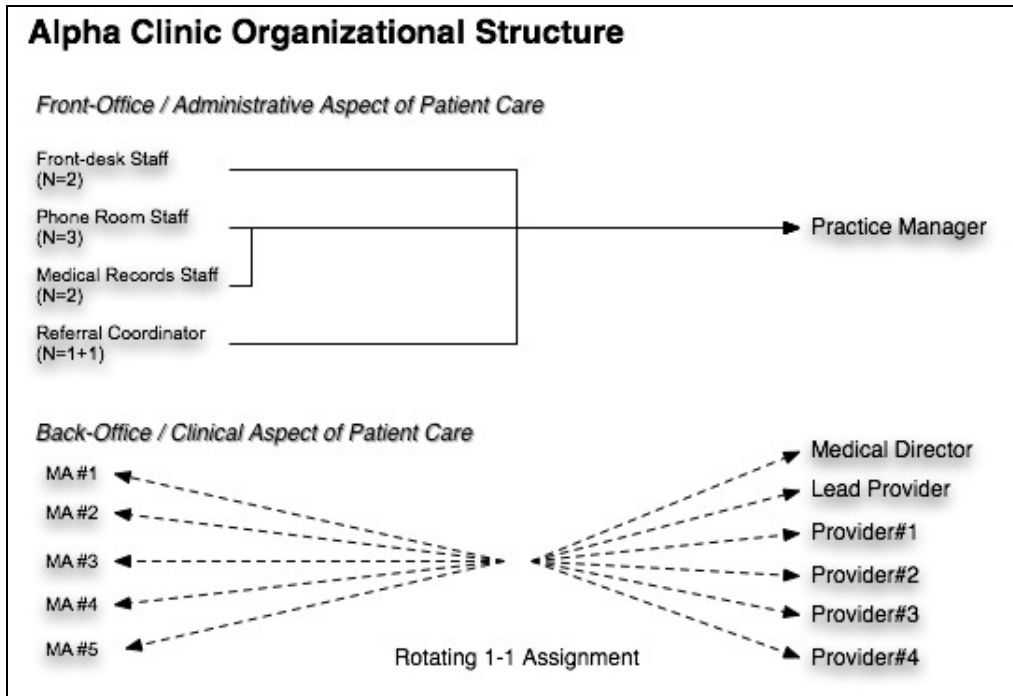


Figure 11: Beta clinic's organizational structure

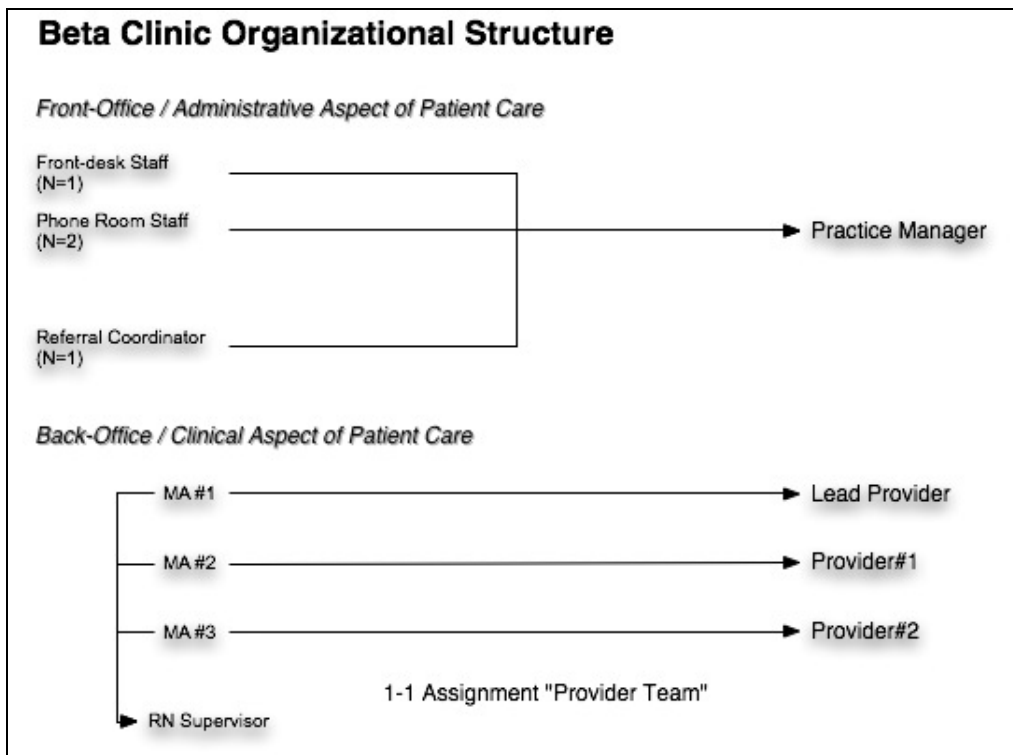
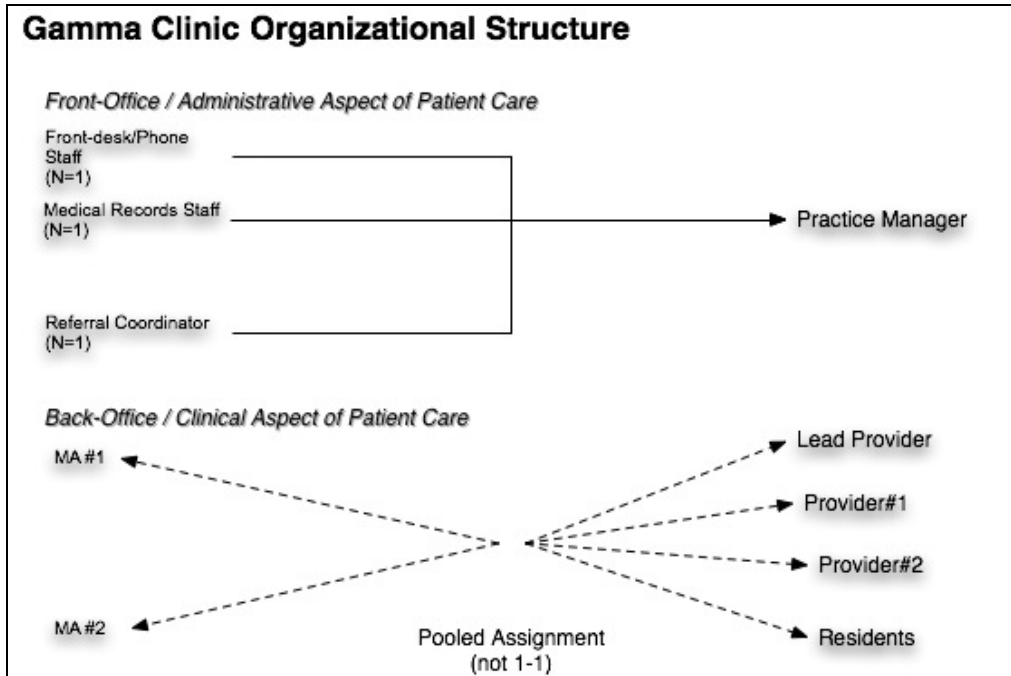


Figure 12: Gamma clinic's organizational structure



Business and Operational policies

Office Hours: Alpha Clinic opens at 8:30 every morning and has late nights (till 8pm) every night except on Friday where it ends at 5 pm. Only one provider is available on each of the late nights. Beta Clinic opens at 8 am and closes at 4:30 pm for Monday, Wednesday through Friday. It opens at 10 am on Tuesday and closes at 6:30 pm. Gamma Clinic opens between 8:30 am and 5 pm everyday. It has no late nights.

Scheduling Policies: Scheduling policies refer to the rules that the clinic set with regards to how and when a patient can make an appointment with the provider. According to the organization's terminology, there are two types of scheduling policy: Open access and Closed access. The open access scheduling policy means that patients can call the practice to make a same-day appointment. Closed access requires all appointments to be made prior to the date of appointment. Of the three

clinics only Alpha Clinic practices the open access policy. While Beta and Gamma Clinics practice the closed access policy, they do unofficially allow patients to “get in” on the same day if they have open slots available for the provider on that day.

In addition to the open vs. closed access, scheduling policies differ among the clinics in terms of how far ahead patients can schedule appointments. For Alpha Clinic, they allow patients to schedule an appointment two weeks out from the current day. For Beta Clinic, patients can schedule three months out while Gamma clinic allows up to four months.

While walk-in appointments are not officially available across the three clinics, some patients do get triaged when they walk-in and providers determine if they should be scheduled. This process requires the front-desk staff to work with the back-office to conduct the triage process.

Furthermore, all three clinics allow their schedulers to “overbook” a provider (this takes into account the fact that there will be a percentage of no-show patients). However, schedulers have to adhere to specific rules with regards to the type of appointment to be made at specific times of the day. The rules differ across the three clinics. For example at Beta Clinic, one rule is there should be no coloscopy appointments on Thursday.

Length of each appointment slots is also different among the three clinics. For example, Alpha Clinic typically schedule 20 minutes block for follow-up visits and 60 minutes for initial visits. While Beta and Gamma schedule 15 minutes block for follow up and 30 minutes for initial visits. See Table 8 below for different types of appointments and duration.

Table 8. Appointment (Visit) Types and Duration by Clinic

Typical Visit Type	Alpha	Beta	Gamma	Gamma Resident
F/U Adult	20	15	15	30
F/U Peds	20	15	n/a	n/a
GYN	30	30	15?	30?
GYN Peds	30	30	n/a	n/a
Initial Adult	60	30	30	60
Initial Peds	60	30	n/a	n/a
Lab Only	10	n/a	15	n/a
Nurse Visit	15	15	15	n/a
Nurse Visit Peds	15	n/a	n/a	n/a
OB F/U	15	n/a	n/a	n/a
OB New	30	n/a	n/a	n/a
Physical - Peds	30	30	n/a	n/a
Physical - Adult	40	30	30	60
Pre-Operation	30	30	30	60
Pre-Operation Peds	30	30	n/a	n/a
Procedure	40	30	n/a	n/a

*Peds - Pediatrics

*GYN - Gynecology

*OB - Obstetrics

*F/U - follow up

Check-in & Registration Policies: One of the key insurance requirements for a patient visit is that all patients are required to provide their insurance information at time of visit. Otherwise, they will not be seen. However on the ground, this requirement is practiced in different forms. Over at Alpha Clinic, front-desk staff is expected to verify patients with medical assistance for every visit and patients with commercial insurance, every 30 days. At Beta Clinic, patients with commercial insurance do not need to show their insurance cards unless they have changed or renewed their insurance for the year. At Gamma Clinic, they have the same insurance requirement policy as Alpha but because their patient population is relatively stable, the front-desk staff typically uses the insurance information that is on the patient files.

Paperwork, Medication Refills and Referrals: Turnaround for laboratory results, medication refills and other requests are usually 24-48 hours. Medical records requests however

have a one to two weeks turnaround. In terms of referral coordination work, Alpha Clinic referral coordinator assists providers and patients to get the required authorization for the referral, schedule initial appointments as well as re-schedule appointments for the patient. The Beta Clinic's referral coordinator does referral authorization and documentation but scheduling of appointment with specialist is the patient's responsibility. At Gamma Clinic, the referral coordinator will handle the authorization, scheduling and documentation for the patient. She will send out the referral details and information via mail to the patient once that is completed. In the event that the patient misses the appointment, the onus is on the patient to reschedule the appointment directly with the specialist. Most of the referrals are to specialists in MATH and they use existing software to fax the referrals to the specialists.

Characteristics of Patients (Payor-Mix)

Half of Alpha Clinic's patients are on Medicaid while the other majority of the patients are Medicare patients. (Dr S#3) The Alpha Clinic also has high volume of patients on a daily basis – on average, they have five providers at the clinic and operate on a longer business hours. Each provider normally has a schedule load of 20-25 patients per day and in total the clinic sees about 100-150 patients a day. As the providers are still accepting new patients, the clinic encounters around 30-50 percent new patients each day. However, Alpha clinic suffers from a high patient no-show rate (around 18-20 percent). Part of the reason for the high no-show rate is due to the fact that Alpha cannot financially penalize Medicaid patients for not showing up for their appointments. Medicare patients on the other hand can be penalized but a clause in their contract states that they cannot be treated worse off than other patients in the clinic. This clause effectively means that Medicare patients also are not penalized for not showing up.

Beta Clinic's patients tend to be of higher social-economic status and the majority of their patients have commercial insurance plans. The three providers in the Beta Clinic see about 20 patients per

day and in total, the clinic has around 60 patients each day. Their no-show rate is constant around 15 percent (or 3-6 patients). Gamma Clinic caters mainly to geriatric patients (64 percent) and do not see any pediatric patients. There are not many new patients at Gamma. They have recently begun taking younger patients (around 20s-30s age range) but previously their youngest patients were around mid-40s. As the providers are in only for half a day, each provider sees around 12-16 patients and in total the clinic has around 20-30 patients each day. The clinic sees a peak of 60 patients on Thursday when all three providers are practicing in the clinic.

EMR Rollout Plan for clinics

The three clinics have been selected to be early adopters of the EMR system within MATH. Specifically Alpha clinic has been slated to be the first pilot site of the new EMR system. Beta and Gamma clinics have been actually chosen to be early adopters but not among the first few sites. The other two pilot sites are Cardiology and General Internal Medicine clinics within the MATH hospital itself. However due to political and logistical issues both Cardiology and General Internal Medicine clinics have chosen to withdraw from the pilot site program and to be rescheduled as part of the later roll-out. In place of these two sites, Beta and Gamma clinics have become part of the pilot program (Minutes Project Team 070817). Alpha clinic go-live date was on October 30, 2007 while Beta and Gamma clinics went live with the new EMR system on February 11, 2008 and March 10, 2008 respectively. (Refer to Appendix B for the chronology of key project events).

In conclusion, this chapter provides an in-depth look at the three clinical sites where the EMR system has been implemented and aims to provide insights into both the unique and common features of each site's context. Table 9 provides a summary of the key issues discussed above.

Table 9. Summary key characteristics of three clinic (at July 2007)

Profile	Alpha clinic	Beta clinic	Gamma clinic
Year founded	1995	2004*	1997 ⁺
Annual volume of visits	15,600	8,600	6,000
Daily volume of visits	100-150	Around 60	20-30
Payor-mix ^{NB}	Around 50% Medicaid and another 40% Medicare	Majority commercial insurance plans	Majority Medicare (64%)
No-show rate ^{NB}	18-20%	15%	N.A.
Size of center	13 exam rooms	6 exam rooms	6 exam rooms
Other on-site facilities	Lab. (Lab Corp)	N.A.	Lab (Quest)
Staff strength	21	12	9
Non-clinical staff	10	5	4
Clinical staff	11	7	5 ⁺
Clinical staff structure	Rotating 1-1 assignment (monthly change)	Permanent 1-1 assignment	Pooled assignment
Support staff structure	Dedicated referrals, phone and medical records operations	Outsourced part of medical records; front-desk doubles up as phone operator and medical records; dedicated referral coordinator	Dedicated referrals and medical records operations; front-desk doubles up as phone operator
Scheduling policy	Open-access; schedule 2 weeks ahead	Closed-access; schedule 3 months ahead	Closed-access; schedule 4 months ahead
Go-live date for EMR	Oct. 30, 2007	Feb. 11, 2008	Mar. 10, 2008

Notes:

* Beta was founded as a private practice prior to 2004's acquisitions by the MATH-CPI network; Beta has a MATH specialist clinic situated within the same office space in the medical center.

+ Gamma was founded in 1984 as a CPI clinic; two of the providers practice part-time at the clinic

NB Payor-mix refers to the types of insurance that a clinic's patient base holds;

NB No-show refers to the percentage of patients who fail to turn up for an appointment without notification/cancellations

Chapter 5: The Framing of the Configuration Process

“EMR has a dark side ... integration is the dark side of the project that I have to deal with.”
Project Director, 071204 PAG Minutes

This chapter is the first of three chapters (5 to 7) covering the key findings of the dissertation. In this chapter, I detail the history of the EMR project and discuss in depth the process by which key configuration decisions with regards to the EMR are made (or not) by the project stakeholders. Chapter 5 provides data with respect to how and why specific features of the EMR system are present or absent. Chapter 6 covers a detailed discussion of the work practices observed in the three clinics using the narrative network and Work Network analytical lens, which I have briefly introduced in chapter 3. I also discuss the operational issues facing each clinic. In chapter 7, I first review the configured EMR system discussed in chapter 5 and then apply the narrative network and Work Network lens on the configuration design. Next I discuss the tensions that arise when the configured EMR system replaces the existing Work Networks. Finally I examine the “fitting” work that emerges as a response to these tensions and organizational outcomes observed at the three sites.

This chapter demonstrates that the process of configuration not only entails multi-level of decision makers and forums but it is also iterative and dynamic as each level both impacts and gets impacted by the other level’s decision making. I first detail the larger project level issues and negotiations and then discuss the enterprise level. I conclude with details of the local level configuration process.

Project History

In 2003, MATH welcomed a new CEO and President who quickly introduced his vision to take MATH forward. A key component of his vision is a strategy to develop MATH’s ambulatory care

service by building a new \$350-million ambulatory care facility that will consolidate all outpatient services in a single location (RQ00B; JR#20). This new facility will be served by a robust technological platform – an integrated EMR system. This latter initiative is the kernel of the EMR project. In Spring 2004, the CEO and President of MATH and the Dean of the School of Medicine (SOM) jointly sponsored a visioning exercise to develop the design principles for the EMR and establish a common vision for the EMR project (DBV0-10-3-06, JR#20). The vision of the EMR is to “enhance the experience of our patients; sustain the highest quality care, clinical research and education; and support the continuity of care through seamless access to clinical information” (statement from the vision – DBV0-10-3-06). According to a key informant, the goal for the EMR is not just to support the new ambulatory care center (ACC) but also to integrate processes within and across the organization by providing “transparent flow of information” as patients move from one department to another (DBV0-10-3-06; JR#20). Its aim is to “radically change the way business is done in and between the SOM, MATH, and CPI” (ITSCMin041001).

Because the vision has galvanized all the key stakeholders i.e. MATH and SOM and their attending organization, the ownership of the EMR project is shared between the MATH and the CPI IT Management group with the CIO from MATH and the CIO from CPI chairing the team. From their internal minutes taken between 2004 and 2005, this project was called the “Joint Clinical Information System between SOM and MATH” or the “Clinical Management System” project. The CIO of CPI regularly reports on the progress of the project to the SOM’s IT Steering Committee. According to the various minutes, the CPI IT Management group and the MATH drew up the specification – notably the request for proposal (RFP) and the submission of proposal for funding – with the State of Maryland in Fall 2004. By the end of 2004, they narrowed the project contenders to three vendors – who were invited to demonstrate their systems on the hospital site. After getting feedback from all members of the MATH and CPI physicians, the project team decided on the winning vendor in early 2005 (BD#2, JR#20, DrNS#3, JG#15). The project stalled

in the middle of 2005 as the project team awaited the decision from the State in terms of project funding issues. This was resolved in December 2005 with the State giving a waiver on the project's funding request (ITSCMin). With the approval in terms of funding, the vendor was announced and the project was then referred to as the "EMR project" – given that EMR was the final vendor. In the Spring 2006, MATH and CPI's CIOs reported that a project organizational structure had been finalized (ITSCMin060407).

In parallel with the IT group's work on the EMR specification, MATH had progressed in the ACC and EMR projects by hiring a new Senior Vice President (SVP) and Chief Operating Office (COO) of Ambulatory Services in the Fall 2004 to oversee the two new initiatives. In the summer of 2005, MATH began looking for a new CIO to oversee all the IT development for MATH. When the project got its go ahead in early Spring 2006, MATH hired its new CIO as well as the Project Director for the EMR project. The EMR project is now officially governed by the Ambulatory EMR Project Steering committee that comprises members from MATH and its hospital and SOM and CPI. It is jointly chaired by the CEO and President of MATH and the Dean of SOM. The Steering committee oversees the Implementation Planning Committee (IPC) who in turn oversees the EMR project team.

The leadership of the IPC comes mainly from MATH and its hospital management teams and the day-to-day operation of the project is effectively controlled by the new MATH CIO and the MATH project director. The Ambulatory EMR project team itself is also unique as it is not built from existing IT teams within the MATH's Information Services and Technology group (ITG) but is created from scratch (BD#2). The project team also has close linkage with the ACC project – in terms of its goals and operating guidelines (JR#20). Around the time when the project was going forward in the winter of 2005, the Dean of SOM announced that he was stepping down in September 2006 (SOM Newsletter Winter 2005). So in the fall of 2006, while the ACC project and

the EMR project were in their formation stages, there was significant transition in the leadership at SOM.

These two major events – MATH’s governance of the EMR project as well as the transition in SOM’s leadership – serve as the backdrop for the emergence of the major rift among the EMR project stakeholders.

A Rift in Stakeholders’ Original EMR Vision

The original vision of the integrated Ambulatory Care Center (ACC) requires heavy investment from both MATH and the SOM (RQ00B) and this is supported by the partnership between the then new President and CEO of MATH and the Dean of SOM. However, the SOM and its CPI entity have a unique organizational structure. The CPI is made of 22 professional associations (website CPI) – each with its own president. These presidents are also the Chairs of their departments within the SOM. Although they fall under the umbrella of SOM and CPI, each of these departments and professional associations operate independently and are loosely affiliated with the SOM (Meeting Minutes JB). With the SOM going through leadership transition in 2006, disagreements arose among the deans/presidents of SOM/CPI and the MATH leadership over the governance of the ACC. Without the backing of the old Dean of the SOM for the common vision, the disagreements over governance become stumbling block for the ACC project (JR#20). As a result the ACC project was paused in the middle of 2007 (BD#2).

The tensions and politics in the ACC project in 2006 spilled over to the EMR project since the two projects were intricately linked (JR#20; SVP, Ambulatory Care Services DBV0-10-3-06 presentation). Like the ACC project, the EMR project is conceived as an “over-arching” concept that incorporated the visions of both entities (MATH and SOM) as well as “respects each entity’s unique character and distinct mission” (BD#2; Vision of EMR). However with the growing divide

between the two major sponsors over the ACC and the clear ownership of the EMR project by MATH, the SOM Department Chairs projected their disapproval of MATH over the ACC project to the EMR project (JR#20, BD#2).

Concretely the rift in vision of the two stakeholders concerns less of the main vision and more of the specifics of the EMR's role in relation to the vision statements and guiding principles. This is reflected in the comments by the VP of Ambulatory Services on the overall state of the project:

“I have been jazzed about the ultimate vision which is to provide excellent medical records and improve the patient experience. I believe that EMR will help us to do: to be safer, effective, and more efficient. ... Now having said that because of the political tension of the organization, the operationalization, and implementation has been more difficult and it is more difficult to get a consensus on critical issues. (JR#20)”

The difficulties in the EMR project operationalization revolve mainly around CPI and the Department Chairs' concern over using the new EMR in place of its existing registration/scheduling IT infrastructure (BD#2) within the hospital. The Project Director spells this out clearly:

“However CPI had never liked the idea of using EMR as their registration and scheduling veneer. They never liked that from the beginning. As for the EMR, that's all good. They can see the benefits of better patient care and clinical research and getting the documentation done. But this practice of registration and scheduling was not something they embraced. (BD#2)”

The background to this problem lies in the unique symbiotic relationship between MATH and SOM. The MATH and its hospital provide the facilities to practice as well as train residents while the SOM and CPI physicians provide clinical services in the hospital (Organization brochures,

BD). In addition to practicing in the hospital, CPI physicians also practice in CPI Office practices housed within MATH facilities. The CPI practices are considered private practices and are separate from the academic and hospital based practices. The MATH flagship hospital uses an existing billing system from Mckesson (STAR) to bill the patient for hospital and facility fees while CPI manages the IDX system (IDX) that serves as the registration and scheduling software for MATH clinics and the billing system for the physicians' professional fees. CPI Office practices use only the IDX system for registration/scheduling and billing. Currently the MATH pays CPI for using the IDX system as its registration and scheduling platform. As a result there are significant differences between these two key stakeholders' frames. The notion of frame here follows Orlikowski and Gash's (1994) definition as discussed in chapter 2 and I discuss the salient differences below.

CPI and SOM: Research, Academic and Revenue

Given that CPI and SOM already has a registration/scheduling and billing system and that it derives a revenue stream from it, it is natural for them to desire that this architecture remains status quo. Furthermore, CPI's mandate is to serve the SOM's practices and its aim is to "continuously improve the financial and operational performance of our medical practices". While this mandate does not conflict with the vision and guidelines of the clinical systems, the choice of who the "integrated enterprise vendor" and which "enterprise-wide system" is has to be understood from each stakeholder's self interest (BD#2). From a purely self-interest perspective, the new EMR with its mandate to become the "enterprise-wide system" for registration/scheduling becomes a sore point as it probably means losing a current revenue source as well as a reduction of its role within the overall IT infrastructure (BD#2). All this feeds into the existing tension between MATH and SOM.

The CPI/SOM also places a different emphasis on the vision and guidelines of the EMR. As a teaching and research institution, the mission of SOM is two-fold: academic (teaching and clinical)

and research (Dean W's in CEO PR, Dean R's, 2006 letter). The new Dean explicitly states that SOM is a "research enterprise" and that one of SOM's imperatives is "research" as it "elevates the quality of [its] clinical care and [its] educational programs" (Dean R's 2006 Open letter). SOM's thrust is to "protect and nurture [its] current research portfolio" and its faculty handbook's vision statement clearly echoes this in that it "will achieve international eminence as an academic institution ...; basic and clinical research; clinical practice and service; public health and prevention; and responsiveness to its community." From this lens, their interest in the EMR is mainly from the research and education angles (vision statement #5). This is also evident from their early reference to the system as a clinical information system or clinical management system with the emphasis on the clinical aspect of the system rather than the enterprise nature of the project (Meeting Minutes JB).

MATH: Patient Care and Enterprise Systems

MATH's view of the EMR, on the other hand, can be seen from two perspectives – the Ambulatory Care Strategy perspective and the Enterprise Systems perspective.

From the Ambulatory Care strategy perspective, the EMR is an important complementary infrastructure to its one-stop ambulatory service facility as stated by its SVP and COO of Ambulatory Services (DVBO). The EMR goals are to improve Patient Access, Customer Service, Quality of Care and Patient Safety. These goals are part of enhancing patient-centered care and patient experience in inpatient as well as outpatient/ambulatory facilities. The first two components i.e. patient access to service and customer service are intrinsically tied to having an "integrated enterprise wide patient ID registration and scheduling system" approach.

From the Enterprise Systems perspective, the EMR is a key component to bring about

standardization and consistency in processes to a highly disparate organization so as to create value, impact operations and growth for the MATH organization. As the CIO explains: “currently patients who move from one clinic to another clinic in the hospital are required to provide their information to each clinic ... the patients do not have a continuity of care. (Minutes JB 07072).” Furthermore the hospital runs on multiple systems for various administrative and clinical functions – for example, current hospital clinics use an internal STAR system to register a patient and then switch over to another system (IDX) to do scheduling for the patient (AG#9).

The EMR vision from an enterprise systems perspective is centered around principles #3 and #4 i.e. “transparent flow of information as patients move between ambulatory and inpatient settings, across departments and entities” and to “integrate *processes* across the organization to deliver care that is based upon best practices and evidenced-based medicine”. The CIO argues that current practices in the hospital are disjointed because each practice thinks that it is unique and different. He therefore has to constantly remind the Department Chairs to think about how their processes can integrate with each other and not to focus only on their own practice (Minutes JB 071129). More importantly, he wants to impress on the Department Chairs “the need to have consistent flows as that allows the clinics to gain economic efficiency and therefore improve their bottom-line” (Minute JB 070920). Technically, the implications of the Enterprise Systems perspective is the need to create a centralized patient database that is connected to all the existing billing and administrative systems as well as the development of standardized workflows built on top of the new EMR system.

Table 10. Summary of EMR project stakeholder frames

	CPI/SOM	MATH: Ambulatory Services	MATH: Enterprise Systems
Background	<ul style="list-style-type: none"> - The physicians from SOM practices in MATH facilities - CPI manages the financial and operational practices on behalf of these physicians. - CPI bills MATH for physicians' professional fees as well as manage the physicians' private practices 	<ul style="list-style-type: none"> - MATH's new CEO and president identified the MATH's ambulatory services as one key component of his overall vision - Decision to build a new ambulatory care center to consolidate all of MATH's ambulatory clinics in one central location 	<ul style="list-style-type: none"> - MATH's CIO was hired to drive the EMR project as well as standardize the IT platforms in MATH
Motivations	<ul style="list-style-type: none"> - CPI's goal is to improve financial an operational performance - SOM's goal is to achieve research and academic excellence 	<ul style="list-style-type: none"> - To improve patient access, customer service, quality of care and patient safety 	<ul style="list-style-type: none"> - To develop an enterprise systems that provide transparent flow of information across all of MATH's entities and departments
Goal of technology	<ul style="list-style-type: none"> - EMR to support the clinical research and education; patient care - EMR to be purely a clinical information/management system 	<ul style="list-style-type: none"> - EMR provides the infrastructure to the vision of a one-stop ambulatory service 	<ul style="list-style-type: none"> - EMR provides the infrastructure to integrate processes across organization and drive standardization and consistency in MATH

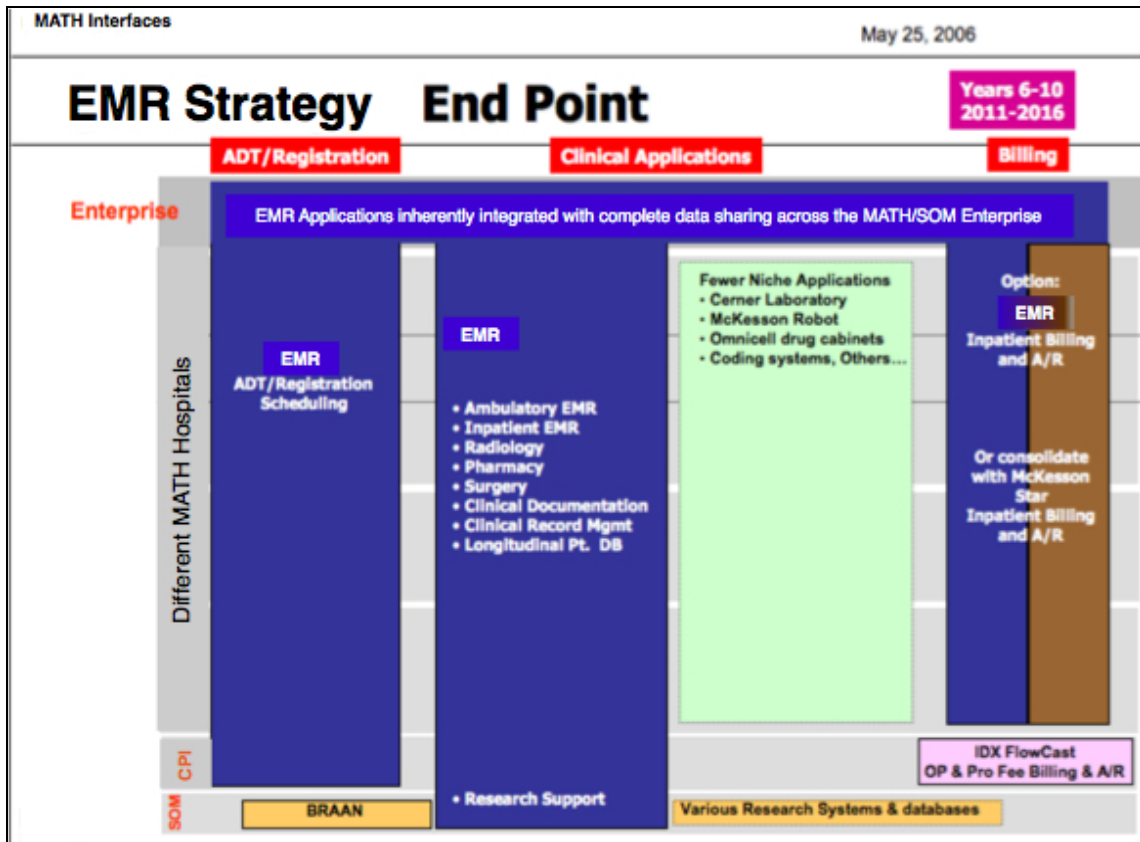
In summary, the SOM and CPI have vested interests to retain existing registration/scheduling systems although they are supportive of developing a clinical information repository to support research and academic programs. On the other hand, the MATH is interested in enhancing its customer i.e. the patient experience while improving the operations through tight integration of systems, standardization of processes and building an enterprise-wide patient repository. While an enterprise-wide patient repository is something that is desirable from a research/academic perspective, the main conflict or misalignment between the two stakeholders is the standardization of the registration/scheduling systems with the EMR. The result of this conflict and misalignment is significant: on one hand, it impacts on the final architectural design of the system – CPI/SOM decides that they will have only limited integration between their IDX system and the EMR system (JR#20); on the other hand, the conflict has also impacted the process of the implementation of the EMR.

Implication of Rift: Architectural Constraints

The EMR system is built around an integrated system i.e. the Ambulatory Care (the electronic medical record system for clinical support) and the registration/scheduling modules are fully integrated. For this particular implementation, MATH and CPI have not purchased the selected EMR vendor's billing module – instead, the project team has been instructed to integrate with the existing billing systems used in hospitals and CPI practices.

Logically, the Project team has planned for a complete two-way integration for billing between the EMR system and the billing systems (IDX for CPI and STAR for MATH) and complete two-way integration for patient database between the EMR system and the registration/scheduling system (IDX). (See Figure 13 for proposed architecture of integration taken from Interface overview EMR Meeting May 25 2006v3.ppt). This integration represents essentially the heart of the project as it would give the organization a complete view of its patient base and support the complete flow of information across units and locations. This is reflected in the fact that it is the first item in the Project Director's EMR Implementation 90-Day plan (IPC060511) and a meeting has been called to present the plan of the implementation as seen in the figures (Minutes 06-05-25). The integration piece is inherently complex. According to one of the analysts involved with the project, most of the EMR sites have interfaced with only one system (either a STAR or an IDX system) and most have done it in a uni-directional approach i.e. EMR to STAR or EMR to IDX. This is the first time that EMR has to build two interfaces to two different systems using a bi-directional approach for specific modules of integration.

Figure 13: Proposed architecture for interface integration



The bi-directional approach is specifically for the registration and scheduling modules. Based on the integration teams' documents, there are three modules of integration – the first module deals with the registration data i.e. all patient demographics and insurance plans and this involves EMR, STAR and IDX; the second deals with billing and other financial transactions which is single directional and involves all three systems; and the third deals with the scheduling information which is proposed to be bi-directional but only pertains to IDX since STAR does not support this function in the MATH (EMR Interface Status).

The rift between the key stakeholders (MATH and CPI) creates immediate impact on the design of the integration. After looking at the presentation in May 2006, CPI reportedly reacted negatively as they perceived the ultimate goal was to replace their existing IDX registration/scheduling system

(see Figure 12) and essentially they felt that the EMR system was “being forced down their throats” (JR#20). The threat was so real that they questioned the Project Director outright why they were doing this integration (BD#25). This interface project therefore fed directly into the rift between the teams and as a result the CPI team had a different agenda for the interface project. Specifically, in April 2007, after months of discussion and preliminary integration design, discussions and work among the project teams, the CPI team decided not to have an electronic interface from the EMR to the IDX billing. Instead they would fall back on a paper report (called a Charge Report) for all billing related output from the EMR system (Minutes IPC070921; EMR Interfaces Status Minutes).

CPI CIO (when asked by a committee member why there is no electronic linkage between EMR and IDX for billing): “We have a third party billing – pro fee services that is performed in the IDX. Our CPI policy is followed by MAS (the third party billing) and they have electronic interfaces for registration, insurance, patient identifiers, and interfaces. The interfaces are not finalized (for EMR).”

MATH CIO (following up on CPI CIO’s answer): “The request from CPI is **not** to send those transactions (electronically) but continue to do the paper model that we have been doing in the last few hundred years. This is not a CPI procedure – we are sending the paper transaction to the same billing company. (Minutes IPC070921)”

As a result of this decision, the flow of updated billing information from IDX to EMR is also significantly affected. According to the Project Director, the updated data from IDX will only be sent to EMR through a batched incremental feed (JR#20; DA in FN Beta #13). Together this final design to limit the integration between the EMR system to the IDX billing system has significant trickle impacts on the configuration and design of functions and workflows at the system and local levels as well as the project rollout planning. As the MATH CIO points out – this is a “prime example of organizational politics” (Minutes JB 080221). (Please refer to Appendix B for a

timeline of project events).

Implication of Rift: Process Obstacles

The rift does not impact just the architectural design of the system but also the process of developing the EMPI, which involves the integration of registration and other EMR project processes.

Payor-plans master-files: With respect to the EMPI development, the first step is to analyze and understand the data structures within each of the existing two systems (STAR and IDX) and how they currently work and communicate with each other. The next step is to map these data structures with the new EMR system and understand what happens with the new data flow so that the new system “does not break the system” (AG#9). The complexity comes from various points: a) the systems are inherently different using different databases, b) the data structures are also different in that similar fields may use free text fields as opposed to table fields, and c) the data flows may originate from any of the three systems given that they are all bi-directionally linked and they have to understand how the different origination point impact the data flows (AG#9, Minutes EMR-IDX interface analysis meeting 060711). In addition to these technical complexities, the existing integration between the two systems (STAR and IDX) is only partial and the main hurdle is to get all data synchronized in this new system. Essentially, EMR has to “serve two masters” (AG#9). (See Figure)

The process of data synchronization becomes a major political contest – another manifestation of the rift described above. The key data to be synchronized are the Master-files. These master-files included: provider lists, departments, and payor-plans. Among the three master-files, the main issue is on deciding whose data structure for the payor-plans should be employed (JR#20, BD#2,

AG#9). According to the key informants, the payor-plans – essentially a patient’s insurance plans that includes information on the name of the plan, type of coverage, group name, etc. – differs among the stakeholders due to their technical operations. At MATH, who runs hospital operations, payor-plans reflect the hospital billing needs and it has 200 payor-plans in its list. For CPI the billing system is geared towards private practices and professional fees and hence features a more defined structure; it currently has around 1,000 to 1,200 payor-plans (DA#29, AG#9). The goal for the project team is to get both sides to agree on a common list and compromise on how big that list should be.

This process started in October 2006 drawing resources from the Patient Access team, the EMPI team in EMR, Financial operations from the MATH and the IT departments from the hospital and CPI (IPC061122). As each month passed by, the Co-chairs for the Patient Access team could only report that they were either finalizing or refining the common payor-plan (IPC070316, IPC070420). In June 2007, they reported that both parties were still making significant revisions to the common payor-plan and that this item on the project was now officially behind schedule. This issue of payor-plan master-file also apparently affected the department and provider master-files development (IPC070615, HP#6).

Unlike the situation with the billing integration, CPI is reportedly more cooperative and willing to “add a few more plans from STAR side” (DA#29). They are also keen to work on this common payor-plan as they have been working a major clean up of their payor-plan structures to remove superficial plans and inactive plans. However MATH is more reluctant to cooperate as the initial idea is for STAR to build up their payor-plans to CPI’s list. Practically this means MATH has to build from 200 to 1,200 payor-plans which not only requires a significant amount of resources but also a major rework to workflows in the hospital system (DA#29). Furthermore, the changes to the payor-plans may also have revenue ramification for the MATH organization itself (JR#65). As one

analyst points out: “The thing is that CPI and MATH have separate needs and it is hard to get them to agree on the way that should be (HP#6).” According to the Project Director and the VP of Ambulatory services, they have been pushing both the CIO at the MATH and the Finance VP to cooperate on that end. This has also been escalated to the CIO of MATH who has brought the matter up to the CEO and President for consideration (BD#25). Unfortunately, by the end of December 2007 the issue remained deadlocked⁴. In May 2008, the VP of Ambulatory Services reported that they would eventually switch to the STAR payor-plans with some compromises to include a minimum number of additional payor-plans from CPI’s IDX list (JR#65). This decision comes after a long debate among the operational team from the hospital, the hospital finance team and the IT team. The implication for this decision is currently being studied as the project rolls into another phase of implementation on the hospital campus. But politically, this shows the added political challenges the project has to endure as it attempts to build a technically complex system.

Interface development and rollout planning: Even while the discussion over the master-files continues, the technical development of the interface is also impacted by CPI internal development decisions. Specifically, after the go-live date for the first pilot site has been set, CPI announces that its IDX system will be undergoing an upgrade about four weeks prior to the go-live (BD#2, BD#25). The Project Director charges that this move is deliberate given that the CPI IT team is privy to all the EMR Project timelines and activities. She explains that the Project Team has asked CPI to delay their IDX upgrade project, as this will impact the interface development that will take place at that time. The response from CPI is “No, we have to do what we have to do” (BD#2). Further, they have held out that the upgrade is a requirement for the integration development – a point that the Project Director disagrees (BD#25). Moreover the upgrade project

⁴ The pilot site Alpha clinic was based on the IDX billing system and the project team did not have to worry about integrating with MATH’s STAR billing system. The interim solution was to build in IDX’s

will be staggered so in effect the EMR interfaces have to be built for both the existing IDX system as well as the upgraded IDX system. This decision by CPI to move ahead with their staggered upgrading project for the IDX system forces the EMR project team to resort to a workaround such that they were taking only incremental feed from the IDX system for registration and scheduling data (BD#25, Minutes PAG 071204, IDX Patient Demographic Data Mapping Specification 9-2007.XLS). The interface building efforts still continues between the EMR Project team and the CPI IT and MATH's STAR teams.

In addition to these decisions and impasse, another major fallout from this ongoing rift is the decision by CPI to pull out its clinics from the Registration/Scheduling implementation of the new EMR. According to the CIO of MATH, CPI has requested that they only want the EMR Ambulatory module to be implemented for their CPI practices and that to be integrated with their existing IDX registration and scheduling systems (Minutes JB 080221; Minutes Rollout 080207). While this point is being negotiated among the senior management, EMR's analysts as well as senior project team members have expressed their skepticism over its technical feasibility (Minutes Rollout 080207). By pushing for this "new" configuration of the EMR implementation within their CPI practices, CPI forces the EMR project team to rework their rollout plans as they have to factor in this new "flavor" of the EMR system (BD#25). The strategy for the EMR project team is to move the CPI office practices to the last phase of the rollout plan (as compared to earlier plans to implement them during the mid-point of the rollout (IPC070119)).

Using information gleaned from archival data, interviews and meeting minutes, I trace the historical development of the EMR project within the organization and attempt to show how the socio-political landscape of the organization influences the framing and negotiations within the

payor-plans that Alpha clinic commonly used and then build out to STAR's payor-plan (DA#29).

EMR project itself. I show that while the vision statements and the design principles of the EMR project are agreeable to each major stakeholder in theory, their vested interests, motivations and goals naturally generate an inherent tension in the process of implementation. I find that due to the rift among the stakeholders of the EMR project, there is a significant impact on the design of the EMR architecture that hamstrung the EMR's ability to support the lofty goals stated in the EMR vision. It also impacts the project process by creating impasse on important standardization decisions, roadblocks to interface development and rollout planning. See Table 11 below for a summary of the key configuration issues.

Table 11. Summary of organizational level configuration issues

Configuration issues		Institutional Negotiations
1	Integration between EMR and CPI's Billing system (IDX)	MATH & SOM/CPI conflict MATH's vision of information flow & integrated registration
2	Integration between EMR and MATH's STAR system	MATH's vision of information flow & integrated registration
3	Payor-plans master-files synchronization	MATH & SOM/CPI conflict MATH's vision of integrated registration

These architectural and process issues serve as major institutional and infrastructural relief and boundaries that define the subsequent set of design and configuration activities as described below. Based on the data, I have categorized these configuration activities into two major categories: Enterprise Level configuration and Local Level configuration.

Enterprise Level Configuration

The Enterprise level configuration refers to the project activities that attempt to determine and configure the functions, content, and workflows in the EMR system that would have direct impact on all organizations within the entire organization. The Enterprise level configuration activities start early in the project lifecycle and occur in two main forums. The first forum is the advisory

groups (see project organizational structure) that are formed to advise the EMR project team on specific subject areas and the second forum is the vendor sponsored configuration meetings that are referred to as “Design-Build-Validate” meetings or DBVs. The two forums are closely interlinked as the forums deliberate the DBV issues prior to and after each DBV sessions. I provide an in-depth discussion of the structure of the advisory groups below, as they are the key drivers of the Enterprise Level configuration.

Structure of configuration: There are several key advisory groups to the EMR project and the Implementation Planning Committee. They are namely: Physician Advisory, Patient Access Advisory, Technology Advisory, Radiology Advisory, Training Advisory, Research Advisory, and Compliance Advisory. While the Technology and Radiology focus on specific implementations, the main clinical and administrative design and workflow issues are discussed and considered by the Physician Advisory (PAG) and the Patient Access Advisory (PatAccG). As such these two advisory groups form the focal point of my analysis.

As stated in their minutes, the role of the PAG is to “addresses core workflow, content, compliance, physician documentation and adoption issues for implementation of EMR and makes recommendations to the DBV process and to the IPC” (Minutes PDT 060726). These design and policy recommendations are submitted to the IPC for review and decisions. The physicians in this group are asked to review all key design decisions from a “preferred physician point of view to the project team and the IPC” (Minutes PDT 060726). They are also asked to keep in mind how the system can support educational, research roles as well as integrate with existing inpatient clinical systems. Specifically, their charter document states that their responsibility is to provide “recommendations based upon ‘Best Practice’ and ‘Evidenced Based Medicine’ in alignment with policies (i.e. compliance, risk management, billing etc.)” (PDT Proposal 061219). In other words, the PAG represents the physicians’ interest and attempts to configure the EMR from this

perspective.

The PatAccG comprises “representatives with authority” covering all aspects of Patient Access Functions within MATH/CPI & its member entities and are charged with “decision making authority on design and configuration of Patient Access related applications & functions in the Portfolio (EMR) Project” (Patient Access Charter). Their goals are to “streamline and standardize” patient access processes, improve efficiency in scheduling and accuracy in registration and in sum provide the “tools to get it right the first time” (Minutes IPC060925). They also aim to achieve this via the following means: establish “best practice” as the standard, automate processes and reduce dependency on paper, and engage physicians on areas where patient access functions impact on clinical work, The PatAccG represents the operational aspect of the organization and they are mainly motivated and guided by patient experience (efficiency, accuracy, accountability) and how that translate into revenue for the organization.

The role of each of the advisory group revolves around three components: evaluation and analysis of existing technology and processes, participation in the design and configuration of the new EMR systems, and providing policy formulations and recommendations to the EMR project team and the Implementation Planning Committee. While these three components describe the work of the two advisory groups, the approach and execution taken by the two groups however differ significantly.

The PAG’s approach centers on how the tools can assist the physicians in their current work. Part of the reason is because of the nature of the existing IT systems in the hospital. Not only is the IT infrastructure non-integrated, it is also built around niche areas e.g. order entry system, nursing documentation, laboratory test; as such there is no “robust clinical documentation” available to physicians within the organization (JG#15). Therefore the PAG’s main activities revolve around the design of specific EMR functions and workflows and how these designs would impact

physicians' practice. Moreover, since physicians are located across a diverse set of specialties as well as entities and locations, there is a strong emphasis by the PAG on their outreach activities to all the relevant physician stakeholders within the organization.

The PAG's design activities are built around the Project team's DBV process. The DBV is a series of workshops conducted by EMR "experts" to review, discuss and consider approaches to EMR configurations with organization's subject matter experts. The DBV sessions for MATH began in October 2006 and ended in March 2007 (IPC060925). Subject matter experts from the PAG would attend the DBV sessions depending on the topic and function considered and provide input to the design process. These subject matter experts would then bring back key issues raised during the DBV session to the PAG for further consideration before making decisions and recommendations to the EMR project team. Given that the EMR would directly impact how and what physicians document during and after a medical visit, a dedicated group of physicians are enrolled into the Charting Tools group. The Charting Tools group is formed to evaluate and refine vendor-supplied charting templates to match specific medical specialties' needs, in other words to deal with the nuts and bolts of the EMR documentation. These design sessions are organized around specific medical specialty for e.g. family medicine, pediatrics, and cardiology.

However because some of the issues revolving around important physician practices overlap with physicians billing, compliance and audit as well as the Health Information Management (HIM) policies for medical documentation, the PAG and the EMR Project team create specific advisory groups to assist in formulating recommendations on functions and workflows within those domains. The two groups are the Compliance advisory group and the Health Information Management (HIM) advisory group. The Compliance advisory group deals with a host of policies within the compliance, legal, risk management, government regulation and graduate medical education domains. Their members advise the PAG concerning specific issues such as billing

compliance, privacy compliance, medical malpractice, audits, and regulation guidelines (e.g. Joint Commission on the Accreditation of Healthcare Organizations (JCAHO)). The HIM advisory group focuses on the EMR artifact and advises the PAG on the definition of the EMR, release and access of the EMR as well as procedures for working with the EMR e.g. maintenance and its costs, ownership, storage requirements, staffing, and HIM functions. While these advisory groups all work directly with the EMR project team – specifically the Ambulatory unit within the EMR project team, they also actively work together on overlapping issues.

Like the PAG, the PatAccG participates actively in the DBV to give its input on the functions and policies relating to patient access operations. But because there are existing IT infrastructures supporting patient access operations (see earlier discussions on IDX and STAR) and at least two sets of operational processes (CPI and MATH), the PatAccG's approach is to do a current state analysis and begin the process of synthesizing and optimizing the current state systems and processes. The goal of PatAccG is to create an optimized and standardized set of processes to be configured into the system.

Compared to developing specific charting tools for each physician's specialty, the PatAccG's main components are relatively well defined. Specifically, the patient access process is made up of three interconnected process components: Scheduling, Registration and Managed Care Authorizations (referrals). Within each component, the PatAccG's original intent is to first understand each department's tools, rules, methodology and process policies, then identify operational issues, and subsequently work together to consider areas for consolidation and rationalization (Minutes PatAccG 060824). However, PatAccG encounters major challenges in its goal to standardize and integrate disparate practices among the stakeholders. Specifically, as I have briefly pointed out, the politics and rift between the stakeholders stymied the entire integration process. The EMR project team has attempted to lead and drive the PatAccG's issues – e.g. the process of reconciling and

creating a set of common master files for the two groups and developing future-state operational processes for scheduling and registration. The EMR project team proposed a new advisory committee in January 2007 to plan for a future operating model for patient access functions (IPC070119). By March 2007, the group reported that it was not able to form the joint committee and was “looking for a resolution for this proposal” (IPC070316).

The EMR project team also releases its assessment on this state of collaboration saying:

“To date, no inter-entity effort has emerged as a result of discussions at Patient Access Advisory Committee Meetings with key Access Leadership. Near term deliverables and ongoing maintenance of a live EMR system will be *impeded without collaboration across entities with regards to specific functions that will be inherently shared in the new EMR environment*. It would be preferred if this came from within the organization, yet can be initiated by consultant if supported by all entities.” (Emphasis added)

(Minutes PatAccG 070104)

The result is that many of the enterprise-level design issues are left open-ended and unresolved. Moreover, the decision to pull CPI office practices out of the EMR registration/scheduling system rollout puts another formidable obstacle to this process of standardization and integration (Minutes Rollout 080207).

Hence, given the political landscape as well as existing (or in the physician’s non-existing) infrastructure, the two key advisory groups have two differing strategies toward the configuration activities. In essence both groups attempt to grapple with two levels of work: a) configuring the nuts and bolts of the functions and b) determining and designing policies and workflows. The PAG initially focuses all its attention on the configuration aspects – to the extent of setting up an entire group to focus on adapting vendor templates (Charting Tools group). It also recognizes the need to get compliance and other regulatory inputs in these configuration issues. The PAG only recognizes

the issues of workflows and process later in the process. Once it becomes aware of them, it uses the same compliance and regulatory groups to assist in addressing those issues. The PatAccG, on the other hand, is fully aware of the policies and workflow issues as this set of problems represent their bread and butter (all of the members come from the administration and operation units of MATH and CPI). However the goal to build a standard future operating model falls to the wayside as the group attempts to get the two stakeholders to agree on the foundational elements for that process: the common master files and integration of existing systems. As a result of the PatAccG's current stalemate, I shall focus mainly on the configuration issues that the PAG faces and discuss that in detail below.

PAG Configuration Issues: As the EMR is a complex IT system, the PAG has considered a whole host of issues. I will highlight only the key issues that require significant deliberation to illustrate the configuration process as well as those issues that significantly impact the three sites where the EMR is implemented. For the PAG, the key issues include: 1) After-visit summary, 2) Level of service, 3) Copy-forward function, and 4) Mark-as-reviewed function. I provide below the description of the issue, the stakeholders involved, the process of deliberation and the final outcome.

After-visit summary (AVS): The AVS is a paper print-out that the provider gives to a patient at the end of a clinical encounter to summarize and highlight key medical advice and medications that are given during the current visit and to capture future scheduled follow-ups, if it is relevant. This issue has been brought up during the first DBV (Oct 2006) session as part of the discussion on a standard office visit. The question then is when this paper printout should be given to a patient e.g. after a visit or during checkout at the front-desk and who should retrieve and give the printout to the patient e.g. physician gives it with other prescription or nurse/medical assistant or the front-desk checkout staff.

The physicians in the PDT do not consider much of the workflow question but are more interested in the content of the print-out (Minutes PAG 061107) e.g. questions are raised about the wording of patient instructions such that they do not confuse patients. Further discussions in the PAG deals with the changing of medication names to layman language – again appealing to the need for the printout to be patient friendly. The problem with that is the medication names are determined by external database (Medispan) feed that the project has no control over but they point out that for information that has been entered by the providers, the providers can edit and change the name to layman terms. Other discussions revolved around including specific sections that are relevant to each specialty e.g. Psychiatry with its requirement for recovery goals section. The project team claims that they can design that into the printout as the system offers flexibility in configuring the print-groups. The project team also explains to the providers how they can place their standard patient instructions using their EMR electronic notewriters. However the project team points out that one of the goals is to ensure a level of standardization to the processes and it hopes to limit the amount of customization to the AVS so that patients can have an AVS printout that is consistent in its look and feel (Minutes PAG 070914).

The PAG also has a similar discussion on the need for patient-friendly terminology for future appointments. The main point raised here is the decision to put in all the multiple appointments that a patient have in the AVS. Some physicians have raised the issue of privacy but the project team advises that they could put security and privacy tags to appointment so that they do not show up in the AVS (Minutes PAG 070914).

After the design has been decided, the AVS is presented to the IPC (IPC070921). Here the main contention arises on the workflow aspect of the AVS. Specifically, the Compliance group is wary about the existence of a paper printout of a clinical encounter in the hands of the patient and how

that corresponds to the electronic version of the encounter within the EMR system. The concern therefore focuses on whether the AVS can be printed before an encounter is closed, and if so, would the AVS be updated once the encounter is closed and therefore present a possible situation that different versions of an AVS might be present. This line of reasoning touches directly on the risks that might be present when patient uses the AVS to complain against providers for malpractice. The project team explains that the AVS is not the progress notes and so it is not directly linked to the changes in progress notes. However there is a date-time stamp for all reports generated by the EMR and that should facilitate any audit checks that might be required. Further discussion ensued in the Compliance Advisory group. The contention ends when they have determined that the major parts of the provider input into the progress notes would be fixed prior to the printing of the AVS (Minutes Compliance 070927).

From this example we see that the physicians' main configuration issue focuses on the content of the artifact and that has to be negotiated with the EMR system via the EMR project team members. The impact of the AVS on practice and workflow has not emerged until other key stakeholders viz. the legal and compliance team members are exposed to the artifact and the workflows that the project team has designed. Here the negotiations are focused on leveraging functions and designs of the EMR system to meet the compliance's frame of issues i.e. audit and malpractice risks.

Noticeably absent is explicit discussion about the workflow of how the AVS may be implemented – issues that have been raised at the DBV 1 session. The general decision is for the AVS to be printed at the front desk but that the physicians would review it at a later time (Minutes Ambulatory team 070710).

Level of service (LOS) calculator: When a provider finishes a clinical encounter, he/she will have to document the medical service that has been rendered during that encounter. A provider currently documents this “level of service” (LOS) with a paper form and enters the LOS by circling the

relevant codes from a list found in the form. However this method has its flaws as a provider may or may not have fully captured the LOS provided in an encounter. In fact, this has been raised as one of the desired goals of implementing the EMR i.e. to improve a provider's billing capability by providing a more accurate and reliable LOS coding (Minutes PAG 060726).

According to the DBV1 session, there are three ways to enter the LOS in the EMR system. One is to follow existing method i.e. manually enter the LOS from a list of codes. The difference here is that the list of codes is dynamic and is configurable for the provider and their departments. The second method is to use a "medical decision matrix" that guides the providers through a list of services/procedures that they have completed in the encounter and then generate the final LOS. The issue with the matrix option is that it is not configurable and therefore is "visually more complex" to use. It however allows providers to choose either item or time based service. The final option is to use a LOS calculator that has an internal logic to derive the LOS based on discrete data entered in the provider's progress note. The provider can amend and make changes to the final calculated LOS given that it does not calculate the LOS if the provider uses freetext to document the progress note. The logic is based on current Center for Medicare & Medicaid Services (CMS) guidelines but is configurable by the user. The recommendation by the vendor and the project team is to use the LOS calculator.

The physicians are interested in the LOS calculator and in fact want to also add a customized HelpText to assist them with meeting compliance rules with respect to coding visits (Decisionmatrix). The Compliance group however are not comfortable with the "hard coding" by the calculator but encourages the use of manual input with assistance from the LOS as "suggestion" of a suitable LOS code. The Compliance group also assures the providers that it does audit their LOS coding and in fact provides departments with reports to show the accuracy of the providers' coding (Minutes PAG 061017). The physicians from MATH's flagship hospital however are not so

keen on the LOS calculator as they bill on time and other specialty such as psychiatry do not bill on the same type of code and would require their own preferred list. Further demonstration of the functionality was made to the Compliance group in 26 Oct 2006 (IPC061122). After further discussion among the physicians and the compliance team, it is decided that the LOS calculator would be the method for LOS code input (Minutes PAG 061107).

The implementation however hit a roadblock due to the billing integration situation that impacts the design of the LOS calculator as well as the integration of compliance guidelines from the Compliance group (Quickbase March 12, 2007). As such the LOS calculator is not “turned on” and not taught to providers during training (Minutes PAG 070927, Quickbase Oct. 17, 2007).

Like the AVS, the providers’ main concern is on the functionality and design of the LOS calculator and how that can enable them to achieve their goal of providing better service and accumulating more revenues. However the providers do not have a uniform frame as it depends on where they practice and what specialty they practice in. The compliance’s frame however dominates the physicians’ view in that they would require the providers to use in a limited fashion (i.e. not hard coding) and that it is used as a suggestion. However, in this case, we see that the issues occurring on the broader infrastructural level have a direct impact on the design and function of the system – in this case the LOS calculator depends on the direct billing interface to run the coding logic.

Copy previous note: The copy previous note function is the function that enables a provider to select from previous clinical progress notes and bring that forward into a brand new clinical encounter (Minutes Compliance 070927). A critical aspect of this function is that it not only brings the existing notes in, it also allows the provider to update all the “smart” links embedded in the previous clinical note e.g. vitals or medication list by refreshing the note (Minutes Compliance 070927). According to the vendor, this feature is provided especially for inpatient clinician’s

documentation where a patient's condition is monitored and updated regularly or for patients who are frequently examined due to chronic or complex medical conditions (Minutes Compliance 070927). This feature – clearly a timesaving feature – allows providers to be more efficient in documenting their notes, as they do not have to repeat the same information in the clinical encounter. Physicians recognize easily the benefits of this feature especially those in specialties such as psychiatry and neurology where certain elements of their clinical encounters do not differ significantly from one visit to another. However, physicians who have had some experience with an EMR system caution that this feature can be easily abused in that the ease by which notes can be copied may result in “garbage notes” or “bastardized notes” with lots of “junk” piled into a single note (Minutes PAG 070914, Minutes Compliance 070927). Evidently physicians who are also attending physicians for residents foresee that residents may be tempted to use the function. Their main worry is that it will create greater chance for errors in the documentation as some providers do not update their note when they see the whole note imported into their new encounters (Minutes PAG 070914).

The physicians who are for the feature countered by saying those who want to use the system in this manner can use other ways to “achieve” the same time-saving, for e.g. by copying and pasting notes or by creating smart-phrases that brings in a whole chunk of pre-written notes. The project team adds that the direct copy-and-paste creates more issue than the copy previous note feature, as it does not have the ability to refresh “smart links”. Another line of argument by the pro-feature physicians is that the quality of the progress note is ultimately the responsibility of the physician and even by CMS guidelines, physicians need to put in effort to ensure the usefulness and readability of their own progress notes. The CMIO of MATH also points out another benefit of the copy previous note feature in that bringing in previous notes allows providers to “build on each observations” so as to resolve a medical problem and thereby provide better patient care (Minutes PAG 070914). In line with this argument, the Chair of the PAG points out that in complex cases,

without a way to copy and paste some of a provider's previous notes, certain documentation may be lost as it may take too much time and thus reduces the efficiency of a provider (Minutes Compliance 071001).

In order to help the group, the PAG director also consults other EMR-based medical institutions to understand how they deal with this "function". According to the vendor, this function is hard coded into the system and cannot be removed without major reprogramming on the vendor's end (Minutes Ambulatory Team 070608, 070626, 070710). The PAG director finds that since they cannot remove the function without a huge cost, some institutions have come out with an explicit policy that they will neither train it nor support the function e.g. University of Chicago. Others have a milder policy e.g. Loyola where they don't teach it but doesn't disallow its use (Minutes PAG 070914) and some others who decide to audit its use in an attempt to control it (Minutes Compliance 070927). According to Ambulatory Team minutes, the physicians hit a stalemate and have wanted to leave the function as-is but will confer and defer to the Compliance Team (Minutes Ambulatory Team 070724).

The Compliance group, on the other hand, is strongly against the copy previous note function. Their initial reaction is to make a statement of their disapproval to the vendor (Minutes Ambulatory Team 070724). In a Compliance advisory meeting (Minutes Compliance 070813), Compliance makes clear that their main contention is that the function allows an entire progress note to be brought into the visit. From an audit perspective, this action may create potential issues with insurance companies as they "have been targeting EMRs specifically looking for abuse regard copy and paste functionality". The problem is that "elements that are documented were not actually performed" (Minutes Compliance 070813). By a vote of 8-1, the Compliance group "strongly discouraged the use of the functionality".

In September 2007, both groups came together to deliberate on this matter. The ultimate stand of the PAG is that the PAG “is not happy on endorsing its use but understands where it could fit in some cases” (Minutes Compliance 070927). The Compliance group on the other hand explicitly expresses their unhappiness – the Chief Compliance & Legal Affairs Officer said (to the EMR representative): “My colleagues are furious of this functionality, furious, I can tell you that there is a great talk to get a union group to talk to EMR ... as it has not gotten the attention that it should from EMR.”

However given that the function cannot be technically “turned off”, the Compliance and the PAG groups concurred with their approach to dealing with the function. While acknowledging that the function is in line with the goal of efficiency in medical practice, they emphasize the need for “notes to be accurate” so that the medical practice’s integrity and credibility are not affected. Going forward, the Compliance group feel that there must be ways to monitor the function’s use so that they can review it and make users who adopt the function vigilant about not abusing it. Both groups agree that they will need to build the policy of using the copy previous note function into the training and compliance guidelines as well as set up the infrastructure to audit the function’s use.

This particular case is in contrast to the LOS calculator case where the system itself does not allow the function to be removed (whereas LOS calculator cannot be implemented). However, we see how the two stakeholders (physicians and compliance) have to work it out by weighing the various perspectives and imagined scenarios of the function’s use. We also see how the system design activities while focusing on the technological artifact is also equally involved in determining the “appropriate” use of the artifact within the organizational context and hence the energy that is spent in building the policies as well as enforcing those policies with regards to this function.

Mark-as-reviewed (MAR): The MAR function evolves from the desire by the physicians to have an

abstraction process put in place prior to each EMR go-live. The abstraction process essentially involves converting existing information found in a paper medical records chart into electronic format within the EMR system. The PAG and the EMR project team have studied the abstraction process (Minutes PAG 070515) and proposed that trained clinical staff will abstract a specific sub-set of the patient's chart (e.g. Problem List, Medication List) into the EMR. Because this information will be entered by clinical staff other than the actual provider attending to the patient, the EMR system provides the function – Mark-as-Reviewed – to ensure that the provider reviews and accepts abstracted medical information into the patient's chart. A question arises among the PAG as to what the exact practice should be for the MAR function – some members propose it means as it is described i.e. a physician has reviewed the data while others propose that it means that a physician has reviewed the data directly with the patient (Minutes PAG 070515). The main discussion revolves around the practice of reviewing a patient's history. For some physicians the review of history is done before the visit and is part of the preparation for a clinical encounter – this practice is especially pertinent for residents as they usually review the notes without the face-to-face contact with a patient. For providers who operate in private practices and are more conscious of professional fee billing, the review is considered part of the clinical encounter itself (Minutes Compliance 070927). The group decides that the Compliance and audit group should weigh in on it and provide a policy perspective on the function.

The Compliance perspective is rooted in two key concerns – the billing processes and the audit issues. First, from a billing perspective – does the act of documentation result in patient charges and if it does then there is an audit component to the practice, and from an audit perspective – how would the organization define the practice from a policy standpoint such that the organization can collectively point to an agreed set of statement of what that practice entails (Minutes Compliance 070927). From a policy angle, the Compliance group decides that the act of clicking the MAR function means that the provider has “verified and updated the information with the patient in the

current visit” and that this has to be executed during the patient’s clinical encounter. The view is that reviewing the information and clicking it prior to a visit does not count (Minute Compliance 071001). To ensure that this policy is consistent, the PAG and the Compliance group have decided that the explicit policy statement has to be incorporated into the EMR training and that the Compliance group would also build a report and audit mechanism to track the time-stamp trail of provider’s MAR use (Minute Compliance 071001). As the discussion evolve, it also becomes clear that the policy discussion around the MAR function has to become part of a larger body of policies specific to the EMR as the Chief Compliance & Legal Affairs Officer admits, “we don’t have an EMR policy” (Minutes Compliance 070927). The larger policy issues that surround the MAR function include chart etiquette use as the MAR function may allow an increasing list of patient history information to be included into the EMR and a new EMR audit and reporting policy.

Table 12 summarizes the configuration issues covered under the PAG and PatAccG advisory discussions.

Table 12. Summary of organizational level configuration issues

Configuration issues		Institutional negotiations
1	Standardization of scheduling & registration processes	MATH & SOM/CPI conflict
2	After-visit summary (AVS)	Patient care; audit risk assessment
3	LOS calculator	Compliance and audit policies; CMS guidelines
4	Copy-previous note	Other adopting institution’s policies; Compliance & audit policies; insurance companies audit
5	Mark-as-reviewed	Billing policies, EMR policy and chart etiquette

Local Level Configuration

RBV and its origin: The Local level configuration refers to the project activities that deal with EMR system issues and configuration with respect to individual implementation sites. Unlike the Enterprise level configuration activities, this Local level configuration is not initially planned but

has emerged during the process of project, as I will explain below. Specifically, I look at the Review-Design-Validate sessions that the EMR project team has initiated with the pilot sites.

When the DBV sessions ended in April 2007, the two pilot sites had been finalized and installation of hardware had begun. The original idea based on the vendor implementation model is to have the DBV sessions lead into the validation and testing phase and subsequently the go-live phase for the pilot sites (DBV intro 061003). However the DBV for the EMR project has failed to drive the issues enough to reach closure. As the VP of Ambulatory Services explains:

“The directors and managers of ambulatory services participated on behalf of operations and the billing, registration and finance people from CPI (were in the DBV). Looking back it seemed that sometimes the directors and managers were not familiar with the system and the outcomes. So there was some hesitance to push on some issues that potentially (we) could and should have pushed from an operational perspective.... There was also organization tension that made people uncomfortable. Another pressure with the DBV was the Ambulatory Care Center project was putting pressure on us to bring the (ACC and the EMR) up and so the time frame got much more condensed and there was not enough time for debate over issues.” (JR#20).

The Project Director concurs with the VP of Ambulatory Services’ observations, she says, “I was just not hearing enough (from the DBV), it was too quiet. The build was going to be done (after the DBV) but it didn’t ring true to me. ... I think that the enterprise sessions with lots of people in them who are not necessary the stakeholders didn’t understand the ramification of their decisions.”

(BD#25). My review of the decision matrix file that captured the key issues and decisions made during the DBV showed that more than half of the decision cells were empty

(DecisionMatrix_020907).

The EMR project team decides that it needs another series of design sessions to help them connect with the pilot sites and capture concrete design decisions so that the EMR implementation can move forward. The Project Director explains:

“I told them take all the pieces that are there (in the DBV) and bring it closer to the (clinic) people, that's where it is going to work. I asked them to put some structure around it – PowerPoint and framework. That became the RBV (review-build-validate) sessions.”
(BD#25)

The EMR project team presented the concept of the RBV to the IPC on 15 June 2007. The rationale for the RBV is that RBV sessions are “focused on the integration of the existing (post-DBV) system into the current workflows of the site in order to enhance processes to meet best practice standards” and its main purpose is to “assist in workflow analysis, identify gaps in process planning and assist with (system) build” (IPC 070615). It was approved for the pilot sites and the RBV sessions for the pilot sites began in July 2007.

Structure of configuration: The RBV involved the Site Leads – EMR project team has designated as the liaison between the project team and the implementation site’s management and users, the Site’s management and the MATH’s Ambulatory Services management. Depending on the topic discussed, the Site Lead and the Site’s management will tap on various local users e.g. the front-desk staff, the medical records staff and the medical assistants to provide input the topic at hand. The vendor staff is also involved on ad-hoc basis depending on the need for input on specific system functionalities but most of the time the EMR project team will be in charge of fronting the system issues. The RBV sessions will, on occasion, surface issues or defer their decision making to Enterprise-level forums e.g. the Charting Tools Working Group or the HIM Advisory groups when the issues are beyond the scope of their authority (e.g. AVS use, charge capture function, Medical Records workflow).

Alpha clinic configuration issues: The RBV sessions mirrored the DBV sessions in terms of the broad topics but are more specific on the content and workflow decisions that applied to the particular site. Although the EMR project team has planned to run two simultaneous RBV sessions – one for Alpha clinic site and the other for the General Internal Medicine (GIM) site, the GIM RBVs are put on hold after they have decided to withdraw from their pilot site status (LK#1). My analysis and findings are focused on the Alpha clinic’s RBV sessions and like the Enterprise-level configuration, I will focus on specific issues that are salient to the impact of work and change in the three clinics.

In total, the RBV sessions have discussed and built up to 26 different workflows covering all aspects of the Alpha clinic’s operation. All of the 26 workflows are adopted for the second and third pilot sites but additional workflows (around 5) are built for the third pilot site – Gamma clinic – as it has other specialists as well as residents practicing at its site. The RBV sessions also provide the basic build information for the three main components of the EMR system viz. Scheduling, Registration and EMR Ambulatory. Specifically, it enables the analysts in the EMR project team to put in department names, visit types, medication and order lists, pharmacy lists, letter templates, billing codes and other site specific data into the basic build of the EMR modules. More importantly, the RBV sessions enable the Ambulatory Services’ operational team to develop its own Standard Operating Policy manual for its MATH-CPI clinics based on this new EMR system.

Scheduling and Registration Workflow: The Scheduling and Registration workflow has been tabled during the DBV session (#2) and the vendor has recommended various best practices to impact overall patient experience. Two key recommendations are demographic verification before appointment entry where schedulers verify basic patient information prior to appointment entry and jumping to registration during appointment entry. The rationale behind this is that it helps the

operation capture as much of the data upfront as possible and thereby reduces the wait time at the check-in desk when a patient presents himself/herself at their appointment time (Minutes Walkthrough 070822). According to the vendor representative, “95 per cent (of their) clients use this for pre registration visits and found them to be a useful tool. (There was) no increase in workflow except that you do the collection at different times” (Minutes RBV 070725). During the DBV, the attendees have agreed to collect name, address, emergency contact, and insurance “if user has access to it” and that the scheduler should do the registration (DecisionMatrix_020907). MATH-CPI’s network director and her colleague in the Ambulatory Services have been involved in those sessions and both agree that the best practice of full registration prior to scheduling an appointment is preferable to current workflows (Minutes WFWT Feedback).

The practice in Alpha clinic however is different (I provide an in-depth discussion on this in chapter 6). As MATH-CPI network director points out, “we don’t collect that information upfront, we collect that when the patient arrives. That aspect in our operations ... will change the most” (Minutes Walkthrough 070822). Not only will it change Alpha clinic operations the most, it also impacts one of Alpha clinic’s most operationally challenged areas – the phone operations. Specifically, patients have given negative feedback about the ability to get through the phone lines to get an appointment (Minutes Alpha clinic Ops 070824). The main reason for the backup in the phone lines is due to the Open Access Schedule policy of the clinic as well as its current staffing and infrastructure configuration (Alpha.1 Workflow notes)⁵.

The choice to redesign the recommended workflow however is met with some skepticism. The MATH-CPI network director has some apprehension about the time per patient they have on the

⁵ See Chapter 6 Operational Issues in Alpha clinic for more details.

phone to finish the designed workflow (Minutes Walkthrough 070822). Another network director in the Ambulatory Services group feels that this new workflow would require “the ‘navy seals’ collecting that information (and) putting in less talent at checking the patients in” (Minutes RBV 070727). The Ambulatory Services project manager also fears that given the workload the schedulers may “try to get through and the information might not be accurate” (Minutes RBV 070727). A front-desk staff from Alpha clinic that is called into one of the demonstration meeting has the same misgivings as the management. As she puts it, “I try to get them on and off the phone ... I don’t see the time to work off the work queues, not with the number of calls coming in. They don’t want to wait for five minutes” (Minutes Walkthrough 070822).

The EMR project team and the vendor however feel that this new design would aid in the front-desk registration. They demonstrate that it is a “pay-now or pay-later” situation where a front-desk registration will waste more time if registration is not done during scheduling. This is due to the fact that the registrar will have to “bounce to and fro” in the system to enter all the pertinent insurance information (Minutes Walkthrough 070822). The MATH-CPI network director, despite her apprehension, also feels that an upcoming upgrade in their existing scheduling system will assist them to meet this higher service level. The upgrade is also pushing for an early registration workflow, albeit with a smaller scope. The Alpha clinic management team also weighs in on this matter and agrees that this new process is the way to go (Minutes RBV 070711). The new registration/scheduling workflow was validated and approved by the MATH-CPI management on July 11, 2007.

In Basket Workflow for Telephone Encounters and Prescription Refills: The In Basket is a function within the EMR systems that allows users to read, respond, and print messages sent within the EMR system. It is a communication hub function analogous to an e-mail system. Unlike an email system where messages are sent to email addresses, In Basket is a closed system and messages are

sent only to users registered in the EMR system, class of users, or a pool of users. It is a key function that supports the various workflows within the entire EMR system e.g. the system allows providers to review results, approve and deny medication requests and close encounters by clicking the “done” button to a message (EMR Ambulatory Spring 2007 Quickstart, Physicians’ Edition, pg. 81). The In Basket function is unique in the sense that it bridges across the front-office applications e.g. Prelude Registration and Cadence Scheduling with the Clinical back-office applications (EMR Ambulatory). It is also vital in routing messages originated from external systems such as Laboratory systems to users.

For the Alpha clinic provider and management, the In Basket workflow represents a totally new format to the way they currently coordinate work. Based on observations as well as site lead notes, the workflow in Alpha clinic is currently supported by a loose set of paper artifacts. At the core of this set of artifact is a patient’s paper medical record. When a patient calls the clinic for advice, the phone operators take down the message on a Telephone Encounter Form. Prescription refills usually are sent by fax. These forms and faxes are collected by the Medical Records staff who will pull the patient’s medical record (PMR) and append the Telephone Encounter Form or Refill requests to the front of the PMR. The Medical Records staff will collate all these forms and deliver the PMR to the respective provider’s box for the provider to address the message or request. The provider will address each of these messages or request and transfer the PMR with their instructions or the handwritten prescription to the MA’s box. The MA will attend to the instructions and return the PMR to the Medical Record via the internal return tray system (Minutes RBV 070808, 070829)⁶.

⁶ See chapter 6’s discussion on the production narrative network discussion for more details.

During the DBV session, the best practice recommendation by the vendor is for phone operators to send a staff message to the clinicians (provider or nurse or MA) rather than open a telephone encounter, as the telephone encounter becomes part of the clinical documentation in the medical record. The idea is that the determination of whether a telephone message is clinical or not should be left to the clinical staff (DecisionMatrix_020907). For the Alpha clinic site, it is decided by the management that the MAs will be in-charge of converting the staff messages for medical advice and prescriptions requests to telephone encounters. They will tee-up these messages for the providers for their actions. The new In Basket-based workflows for telephone messages and prescription refills are tabled and although the Alpha clinic management has accepted this design recommendation, the RBV discussion throws up three key gaps.

One is the role of Medical Records in the new process as there is decision to continue pulling the PMR for all patient encounters at least for a year after implementation of the EMR. The second is the prescription printing workflow and the fraud risk that may be involved with prescription being printed around the clinic. The last gap is the use of MA pool for all staff messages originating from the front-desk and the phone operators.

The Medical Records role is addressed by training the phone operators to send a second staff message to the Medical Records staff to pull the patient's PMR for the telephone encounters. The prescription refill requests that come via the phone operator room will utilize the same workflow (Printing Workflow_091407; Minutes RBV 070829). The second issue of fraud is addressed when the Center for Medicare and Medicaid Services (CMS), on August 17, 2007, issued a new mandate that required prescription in written (and non-electronic) form to be executed on tamper-resistant pad. The EMR project team and the Alpha clinic management have to re-look at their policy on prescription printing as well as the printing workflow. They decide that a second-tray has to be installed in their premises to hold watermarked tamper resistant paper for printing out prescriptions

that are delivered directly to patients. However prescriptions that are faxed directly to pharmacies will continue to be printed on plain paper (Minutes RBV 070829).

The last issue about the MA pool is that each MA is actually attached to a provider on a monthly rotation. The Alpha clinic and EMR project team decide on a simple solution for MA to review the pool messages – that is for the telephone operators and front-desk staff to put the provider’s name into the subject line. This allows the MA to quickly sort the messages in the pool In Basket by the name of the providers and thereby review the messages from the provider that they covering for the month (Minutes RBV 070815). The other issue related to this is that MA must be trained to cover each other’s In Basket in the event that one of them is out of contact or in the case where the MA is covering for multiple providers (Minutes RBV 070829).

Checkout Workflow: The third major change to the Alpha clinic operations is the AVS and checkout workflow. During the first operational workflow-mapping meeting (a precursor to the RBV) in early July, the Alpha clinic management and the EMR project team realized that there were several unknowns with regard to the checkout process. This is because in the current workflow only patients who require a follow-up appointment go to the front-desk to check out. Otherwise the patients will simply leave (UCEDM.7 Checkout). The vendor’s recommendation is for the nurse to deliver the AVS to the patient at the end of the visit. The management however is undecided – some wanted it to be done by the provider so that the provider can review it with the patient while others want it to be done at the completion (DecisionMatrix_020907).

The initial idea at Alpha clinic is to have the patient collect their AVS at the check-out together with other documents e.g. Work Slips (Minutes Operational Workflow 070702). The Alpha clinic management however has some concern about the privacy of the information listed (e.g. sensitive notes) in the AVS and it wants to have a process established that would support the HIPAA

(Minutes EMR Ambulatory Team 070717). This issue is then set aside for PAG’s perspective on this issue. The PAG and the Compliance groups both weigh in on the policy as well as verbiage of the AVS but has not directly dealt with the exact workflow for the AVS. In the end, the decision of who and when and where the AVS would be printed and delivered comes back to the Alpha clinic management. After much deliberation on this issue, the Alpha clinic management decides that the AVS will be printed after the patient has completed all possible clinical encounters including laboratory and referral. Therefore the AVS will be printed only at the Front-desk and delivered by the checkout staff (Minutes RBV 070829). The team has validated the new workflows during the user acceptance tests (Minutes GLP 071008). See Table 13 for a summary of the key configuration issues in Alpha clinic’s RBV sessions.

Table 13. Summary of local level configuration issues in Alpha clinic

Configuration issues		Institutional negotiations
1	Scheduling & registration workflow	Vendor “best practice” accepted during DBV Existing clinic policies
2	In Basket workflow	Vendor “best practice” accepted during DBV Existing clinic policy CMS mandate
3	Check-out workflow	Existing clinic policy; HIPAA

Beta clinic and Gamma clinic configuration issues: By the time the second and third sites have their RBV sessions, the EMR project team has developed a fairly structured approach to the RBV process. As its agenda is to roll out to over a hundred clinics within a limited time, its plan is to build a standardized approach. The Site Lead for Gamma clinic alludes to this in their kickoff meeting with the site management, “we are going for standardized process where (the design) will be the same or as close as possible going from clinic to clinic. But something can be individualize for example letters” (Minutes RBV 071003).

The goal of standardization within the EMR system is not only the EMR Project’s agenda, but also

the MATH-CPI and Ambulatory Services management's agenda as well. As such, not only the Beta clinic and Gamma clinic's site management are involved in their RBVs, the Medical Director, the Network Director and Ambulatory Services' project manager also play a large part at those RBV sessions (Minutes RBV 071003). On the one hand, their presence allows the two new sites to leverage on their experience; on the other hand, they are also there to subtly enforce the design decisions that are made during Alpha clinic's RBVs. As a result the constant refrain that one hears throughout the RBV session is how "Alpha did this", "Alpha used this", or "that's how it is setup in Alpha". In effect the RBV sessions are mainly focused on validation of Alpha clinic's existing build in these new sites and the enforcement of new workflows. Based on my review of all the RBV sessions, I observe limited discussions on design issues for these two sites. Of those discussions that arise, most revolve around building new templates for specialties and roles (e.g. residents and attending or nurse practitioner) that are not present in Alpha clinic. In fact, the MATH operations team has developed a Operational Procedure Handbook based on Alpha clinic experience and has based most of their workflow discussions on that handbook. For example, there is a discussion about the collection of co-payments from patients and how that differs among the three sites. The Network Director and the VP state that Alpha clinic's rule is to continue with the existing paper-flow and that since it has set the precedence they want to keep it that way for the subsequent sites. This is partly due to the fact that the EMR solution is not flexible to suit the needs and requires a long development lead-time (Minutes RBV 071115). Another example is the decision to transfer the use of whiteboards as communication device between providers and MAs to the other two sites (Minutes RBV 071204).

Summary

This chapter documents the process of configuring the EMR system. I find that it is a multi-level process that involves a myriad of actors, each with his/her own perspective of what should constitute the EMR's configurations and how it should be conducted. At each level – organization,

enterprise and local – the actors are actively engaged in political negotiations as they attempt to frame the debate from their own perspectives, using specific factors from the institutions, infrastructure and work practices that they are embedded in. At the organizational level, I find that the political conflict arising from salient differences in the stakeholders’ frames negatively impact the integration of the EMR with CPI’s billing system as well as the synchronization of MATH and CPI’s payor-plans. Conversely MATH senior management’s imperative of transparent information flow has driven the integration between the EMR and MATH’s own hospital billing system. The institutional conflict also restricts the enterprise level configuration efforts – especially for the patient access group. The physicians group fortunately does not face that challenge and is able to move ahead with key enterprise level configuration issues e.g. AVS, LOS, copy-previous note and mark-as-reviewed functions. Like the organizational level, I observe stakeholders at this level negotiating the configuration issues from institutional, infrastructural and work-practice perspectives. While the organizational level process is largely concerned with infrastructural integration issues and the enterprise level process deals with functions and configurations that have wide scale implications, local level stakeholders such as the MATH clinic management and the EMR project team grapple with specific workflow configurations that directly relate to the clinic’s work. However their negotiations tend to be bounded by the organizational and enterprise level decisions. In this way the decisions derive from this iterative, complex multi-level political processes directly impact the final EMR configurations that in turn affect the existing work practices and operational issues that I shall discuss in the next chapter.

Chapter 6: Existing Work Networks and Operational Issues

Introduction

This chapter details the current work practices that were observed at the three clinics. In order to provide a rigorous and detailed analysis of the each of the key roles' work, I introduce the notion of narrative network (Pentland and Feldman, 2007) as an analytical tool to describe the work in the clinic. I use this tool to describe each of the key roles within the three clinic – Front-desk staff, Medical Assistants and the Providers. I focus on some of the key work that each role engage in and compare and contrasts that across the three sites. I also introduce the notion of Work Network to describe how these various roles as well as other relevant ones in the clinic work together to function as a single entity. I discuss two key processes using the Work Network lens – the scheduling, registration and rooming of patients and the handling of patient communication. I close the chapter with key observations of operational issues in each of the clinic and how that impacts the described production and narrative networks.

Nature of Work in the Clinics

The nature of work in a family clinic such as the three studied in my research is highly complex and social as others who have studied the medical context have noted (Berg 1997). Traditionally, a clinic can be divided into two domains: the clinical and the operational. The clinical domain encompasses the work carried out by clinical/medical professionals such as the physicians, nurses, medical assistants and other specialists (e.g. psychiatrist). In the three family clinics, the medical director or a lead physician leads and manages the clinical domain. The practice manager manages the operational domain and this covers the front office and the back-office. The front office staff are in charge of registering patients when they come in for their appointments and checking patients out when the examination is over. They also deal with patient enquiries and requests. The

back-office includes phone operators, schedulers, medical records staff and referral coordinators and their responsibilities include assisting patients to schedule appointments, setup specialist referrals and manage patients' medical records.

While much research in medical informatics has revolved around the use of IT by physicians and nurses, few have focused on the work carried out by the operational staff. This is in spite of the fact that medical work relies fundamentally on the operational work that surrounds and supports it. In this chapter, I describe in detail the work conducted by the front-desk staff as well as the medical assistants and providers. Further, I discuss how their work are deeply intertwined using an adapted concept – the Work Network. I provide some discussion of the Work Network concept as well as the notion of narrative network from which it is derived.

Front-desk

The official title for the front-desk staff is a “Medical Center Scheduling and Pre-authorization coordinator” and they are in charge of registration and scheduling of patients in the out patient clinic area. According to the official job description, their job has a broad scope of work as it covers from a) registration, b) verification of patient information and confirmation of insurance coverage, referrals and authorizations, c) scheduling of patients, d) collecting co-pay and prior balances, e) answering telephone calls and taking messages or transferring to appropriate provider or nurse, to f) assisting with billing encounter forms batching and data entry. They report directly to the practice manager. The practice manager is in charge of the administrative and operational aspects of a clinic. (Source: MATH Job description).

Using archival data collected by the EMR project team as well as interviews and observations at the various clinical sites, I attempt to provide an overview of the work that the Front-desk staff engaged in. Specifically, I found that while the job scope may be broad, the bulk of the front-desk staff's job

is to check-in patients for their clinical visit. The check-in process essentially involves a) registration, b) verification of patient information, confirmation of insurance coverage and d) collecting any co-pays that may be relevant for the patient's visit. Apart from the registration process, front-desk staff has to attend to walk-in patient requests and enquiries as well as checking out patients after their visits. Some clinics assign end-of-day tasks to front-desk staff; these end-of-day tasks such as batching of closed encounters support the overall billing process. As I show later, apart from the core work of check-in, patient requests and checkout the three different clinics have different scope of work for their front-desk staff.

In order to provide a grounded and detailed analysis of the work in the clinic, I decided to adapt Pentland and Feldman's Narrative Network model as my analytical lens⁷. Unlike a direct tayloristic depiction of work (process chain approach), Pentland and Feldman's (2007) notion of "narrative network" provides both a language and a concrete way to visualize and analyze the work and tasks undertaken by organizational actors. By describing work and production as interconnected narrative fragments or narrative nodes, this view allows us to "make movement visible" (Pentland and Feldman, pg. 781). It also allows us to make explicit how artifacts interact with the actors in the course of doing work as artifacts are located in each of the narrative fragments. Furthermore, the narrative network does not just explicate realized sequence of actions and events but can also be applied to make visible idealized and potential narratives. I use this model to analyze the Front-desk staff's check-in work.

Although the check-in work is a normal routine for all clinics, I found that upon closer analysis each clinic has its own adaptation of the check-in process. Therefore I will describe each clinic's

⁷ See chapter 3 for a detailed discussion of the adaptation of Pentland and Feldman's narrative network method for my data analysis.

check-in separately using the results from narrative network analysis as well as structured content analysis. After that I will discuss briefly how these narrative networks fold up as nodes of the clinic’s overall Work Network.

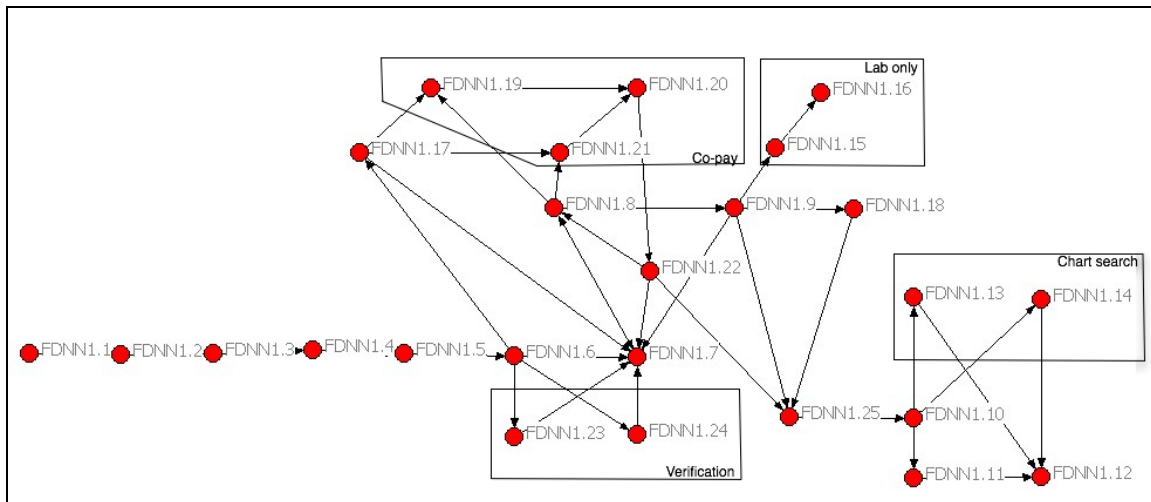
Check-in Alpha clinic: In total, the Alpha clinic’s check-in routine encompassed 25 different narrative nodes (see Table 14 and figure 13 below). I label these nodes as FDNN or front-desk narrative nodes and code them numerically e.g. FDNN1 is the front-desk narrative network for the check-in routine and FDNN2 is for a separate routine e.g. pickup of paperwork – these narrative nodes are derived based on the steps discussed in chapter 3 and I label each of the narrative node in running number order for example the first node for the check-in routine narrative network is FDNN1.1 and so on and so forth. The simplest case involved only 12 steps (or 13 nodes) where the front-desk staff simply verifies the patient’s information, collects the insurance card to make a copy and files that with the paper medical chart and gets that ready for the clinical staff to escort the patient for their appointment. The more complicated routes involve verification (nodes FDNN1.23 and FDNN1.24), co-payment collection (FDNN1.19, 20, 21, 22), and new patient form collection (FDNN1.17 and 18). The typical problems faced by the Alpha Clinic front-desk is the issue of missing charts which require them to engage in FDNN1.13 and 14 i.e. to search for charts in the back office. Alpha clinic has a lab-only check-in process that is unique among the three clinics. Based on structured observations, the simplest case takes on average 1 minute for it to be completed while the more complicated cases (specifically the verification cases) may take up to 25 minutes.

Table 14. Narrative Nodes of Alpha clinic’s Check-in

Node	Description of Narrative Node
FDNN1.1	Front-desk staff (FD) reads the sign-in clipboard and pulls label of patient off
FDNN1.2	FD calls out name of patient
FDNN1.3	FD click on IDX screen of patient record (on the FD’s desk)

FDNN1.4	FD asks patient for name and date-of-birth to verify patient present with IDX record
FDNN1.5	FD asks for patient's insurance card
FDNN1.6	FD asks for other demographics information (e.g. telephone number) from patient to update IDX record
FDNN1.7	FD makes photocopy of insurance card (at photocopier behind their desks)
FDNN1.8	FD prints the IDX encounter form from the computer
FDNN1.9	FD collects IDX encounter form from printer (behind their desks)
FDNN1.10	FD picks up paper medical record of patient from trolley (behind their desks)
FDNN1.11	FD files copy of insurance card and IDX encounter form into paper medical record (and other forms if present)
FDNN1.12	FD places paper medical record in provider's rack (on a table behind their desks)
FDNN1.13	FD goes to medical records room to search for paper medical record (if paper record is missing)
FDNN1.14	FD calls medical records room to request for paper medical record (if paper record is missing)
FDNN1.15	FD takes lab form for patient to fill up (if patient is here for lab work)
FDNN1.16	FD escorts patient laboratory (if patient is here for lab work)
FDNN1.17	FD hands HIPAA/Consent for treatment forms to patient for signature (if patient is new)
FDNN1.18	FD collects forms back from patient
FDNN1.19	FD collects copay from patient (cash)
FDNN1.20	FD writes up a receipt from receipt book for patient reflecting copay
FDNN1.21	FD collects copay from patient and swipe credit card at credit card terminal (CC) at FD 1
FDNN1.22	FD hands over receipt to patient
FDNN1.23	FD calls and verify insurance for Medicaid patient
FDNN1.24	FD clicks on browser and verify insurance for commercial insurance patient
FDNN1.25	FD informs patient to sit down and wait for their name to be called

Figure 14: Narrative Network of Alpha clinic's Check-in



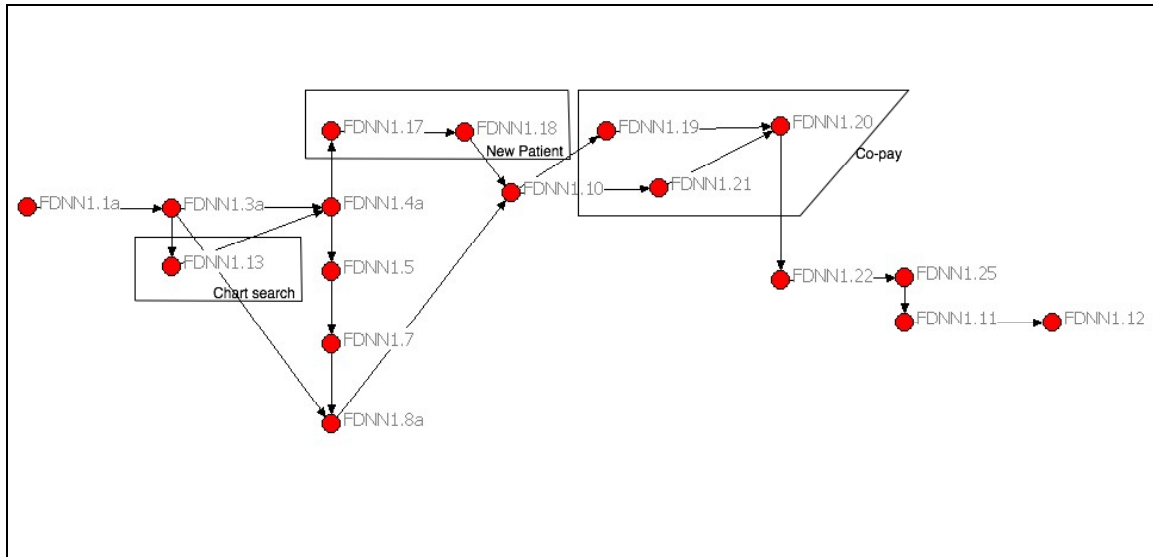
Check-in Beta clinic: Compared to Alpha’s clinic check-in process, Beta clinic’s check-in is simpler (it consisted only 17 narrative nodes – see table 15 below). The simplest case involved 9 steps (or 10 nodes). This is because Beta Clinic’s patients’ charts are usually prepped prior to the actual appointment and all the face-sheets from the IDX system have been printed and attached to the patient’s chart. As such I have renamed the nodes with “a” e.g. FDNN1.1a to differentiate Beta’s check-in narrative nodes from Alpha’s. I have also removed those nodes that are not relevant in Beta’s check-in narrative network. Moreover, Beta’s check-in narrative network has less complicated cases viz. new patient (FDNN1.17, 18) and the occasional walk-in patients that require the front-desk staff to retrieve the medical record from the medical records room (FDNN1.13). Also Beta Clinic has few medical assistance patients and since most of their patients’ have commercial insurances there is no verification of insurances at Beta Clinic’s check-in. A third-party billing vendor conducts all required verification for commercial insurance. Because check-in is relatively straightforward, most are completed under a minute.

Table 15. Narrative Nodes of Beta clinic’s Check-in

Node	Description of Narrative Node
FDNN1.1a	FD calls out/blacks out name of patient from sign-in sheet
FDNN1.3a	FD highlights name on IDX schedule printout
FDNN1.4a	FD asks if patient’s insurance is new
FDNN1.5	FD asks for patient’s insurance card, if it is new
FDNN1.7	FD makes photocopy of insurance card (at photocopier behind their desks)
FDNN1.8a	FD makes photocopy of IDX encounter form
FDNN1.10	FD picks up paper medical record of patient from shelf (beneath their desks)
FDNN1.11	FD files copy of insurance card and IDX encounter form into paper medical record (and other forms if present)
FDNN1.12	FD places paper medical record in provider’s rack (on the wall beside their desks)
FDNN1.13	FD goes to medical records room to search for paper medical record (if paper record is missing or if it is a slot-in)
FDNN1.17	FD hands HIPAA/Consent for treatment forms to patient for signature (if patient is new)
FDNN1.18	FD collects forms back from patient
FDNN1.19	FD collects copay from patient (cash)
FDNN1.20	FD writes up a receipt from receipt book for patient reflecting copay

FDNN1.21	FD collects copay from patient and swipe credit card at credit card terminal (CC)
FDNN1.22	FD hands over receipt to patient
FDNN1.25	FD informs patient to sit down and wait for their name to be called

Figure 15: Narrative Network of Beta clinic's Check-in

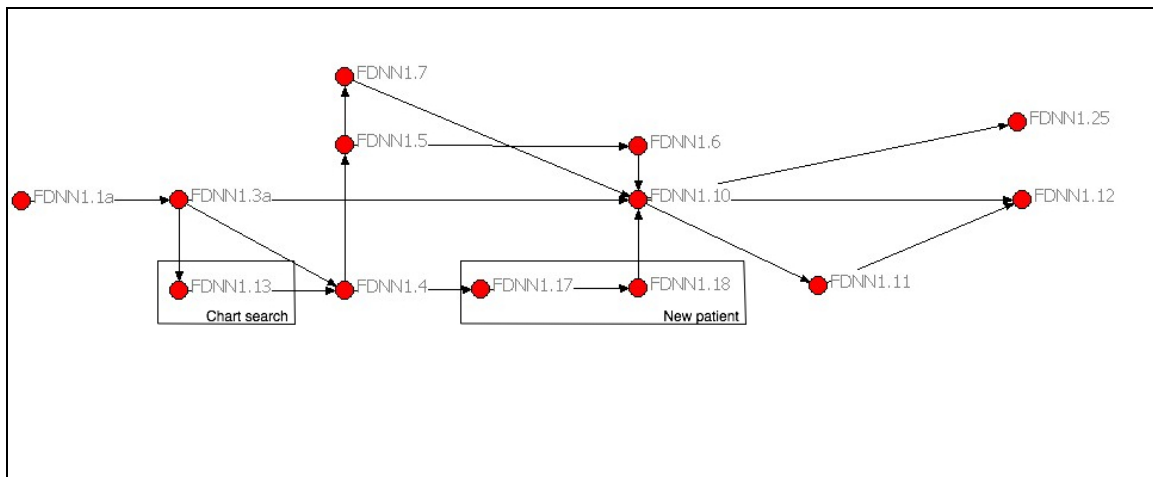


Check-in Gamma clinic: Gamma clinic's check-in narrative network has 13 narrative nodes (see table 16 below). The simplest case involved 3 steps (or 4 nodes). Like Beta Clinic, Gamma's patients' charts are usually prepared and the insurance verified before appointment day. The front-desk also knows most of the patients by face since these are geriatric patients with chronic illnesses. I observed that the front desk is able to recognize the patient as they come through the door and pick up that patient's chart and finish the check-in in that simple 3-step method. When there are new patients they would engage the new patient steps (FDNN1.17, 18) but this was rare. Although Gamma's patients are mainly on medical assistance or some are on special free/subsidized health plans, the front-desk staff verifies them one day ahead hence no verification is done at check-in. Gamma clinic also does not collect co-payment at check-in, instead they do it at check-out. All in all, I observed that Gamma's check-in is very straightforward and most check-ins are completed under a minute. The maximum time it took for any check-in was 5 minutes.

Table 16. Narrative Nodes of Gamma clinic's Check-in

Node	Description of Narrative Node
FDNN1.1a	FD calls out/blacks out name of patient from sign-in sheet
FDNN1.3a	FD highlights name on IDX schedule printout
FDNN1.4	FD asks patient for name and date-of-birth to verify patient present with IDX record
FDNN1.5	FD asks for patient's insurance card
FDNN1.6	FD asks for other demographics information (e.g. telephone number) from patient to update IDX record
FDNN1.7	FD makes photocopy of insurance card (at photocopier behind their desks)
FDNN1.10	FD picks up paper medical record of patient from shelf (behind their desks)
FDNN1.11	FD files copy of insurance card into paper medical record (and other forms if present)
FDNN1.12	FD places paper medical record on top of shelf
FDNN1.13	FD goes to medical records room to search for paper medical record (if paper record is missing)
FDNN1.17	FD hands HIPAA/Consent for treatment forms to patient for signature (if patient is new)
FDNN1.18	FD collects forms back from patient
FDNN1.25	FD informs patient to sit down and wait for their name to be called

Figure 16: Narrative Network of Gamma clinic's Check-in



In summary, using the narrative network analysis I found that Alpha clinic's front-desk check-in was the most involved routine among the three clinics and this is reflected by the fact that Alpha clinic's duration taken to complete check-in is the longest among the three. I also found in this analysis that Gamma and Beta clinics have specific routines that are adapted to their context e.g. insurance verification in Beta clinic is outsourced as they deal mainly with commercial insurance companies while Gamma clinic only collect co-pay at check-out since most of their patients require follow-up visits due to the nature of their complaints (most were geriatric patients with chronic

conditions). See Table 17 below that summarizes the key characteristics of the FDNN1 across the three clinics.

Table 17. Characteristics of pre-implementation check-in narrative network (FDNN1)

Characteristics	Alpha clinic	Beta clinic	Gamma clinic
Total no. of nodes	25	17	13
Shortest path for complete check-in	13 nodes	10 nodes	4 nodes
Average duration to complete FDNN1	4 mins.	3 mins.	1 mins.
Max. duration to complete FDNN1	25 mins.	5 mins.	5 mins.
Exceptions	Insurance verification (FDNN1.23-24) New patient (FDNN1.17-18) Chart search (FDNN1.13-14) Lab only visits (FDNN1.15-16)	New patient (FDNN1.17-18) Chart search (FDNN1.13)	New patient (FDNN1.17-18) Chart search (FDNN1.13)
Notes	Missing charts are common	Insurance verification outsourced	Collect copay at check-out Insurance verification completed prior to appointment

Other workflow and its narrative network: Like the check-in process, the checkout process differed among the three clinics. Beta clinic was an extreme outlier as it did not practiced any checkout process (albeit there was a checkout sign at its front-desk). Alpha clinic front-desk staff only checks out patients who require a follow-up appointment. This followed the scheduling workflow, which basically involves getting the patient’s name and the provider, accessing the IDX system, negotiating the appointment slot, and providing the patient with the appointment details. Alpha clinic front-desk also assists patients with work or school excuse slips when they checkout. Gamma clinic front-desk checks out all patients. They usually collected the co-pay at this point, assist patient with scheduling of follow-up appointments and validating parking tickets as Gamma clinic has no free parking facilities. See below for Alpha and Gamma’s checkout narrative networks.

Front-desk staff at the three clinics have also different administrative job scope apart from the typical check-in and checkout processes. For the Alpha clinic's front-desk staff, they are in-charge of the money log where they keep track of co-payments that they received from patients. At the end of the day, they assist the practice manager in compiling no-shows appointments and reconciling closed encounters with system printouts that will be sent to the third-party billing vendor. Alpha clinic's front-desk staff also encounter many patients who are only at the clinic to pick-up their letters, forms, and medications. For Beta clinic's front-desk staff, they are in-charge of the money logbook as well as preparing patients' charts for their upcoming appointments. This task includes printing out the encounter forms and labels, pulling the charts from the medical records and attaching the encounter forms, labels to the respective charts. They usually prepare the charts one week ahead. Beta clinic's front-desk staff does some pick-up too. However, the billing reconciliation is done by Beta clinic's referral coordinator. Finally for Gamma clinic's front-desk staff, she is in charge of money log as well but she is in charge of insurance verification (as mentioned earlier), appointment reminders and faxing of prescription scripts to pharmacies. Gamma clinic's front-desk staff also doubles up the phone-operator. Gamma's practice manager manages all billing-related duties. The table below summarizes the differences in scope of administrative duties engaged by the front-desk staff in the three clinics.

Based on my observations at each clinic, each of the front-desk staff has to juggle the different administrative duties with the "main" front-desk duties of registration and checkout. Because the Alpha clinic's registration narrative network is more fluid and tedious Alpha clinic staff tend to shift their other duties to either the beginning or end of the workday. Beta and Gamma clinic front-desk staff are able to shuffle between the registration work with these other duties. Regardless of the approach they take, each front-desk staff spends the next most significant amount of time on administrative duties that are unique to the clinic's context. For Alpha clinic's front-desk staff, the

next most significant work they do is handling patient’s pick-up requests. For Beta clinic’s front-desk, it is the chart preparation work while Gamma clinic’s front-desk is engaged with appointment reminders and phone operator duties.

Table 18. Comparison of other front-desk administration duties across three clinics

Admin. Duties	Alpha Clinic	Beta Clinic	Gamma Clinic
Pick-up	Yes	Sometimes	N.A.
Money-log	Yes	Yes	Yes
No-show status	Yes	N.A.	N.A.
Billing reconciliation	Yes	N.A.	N.A.
Insurance verification	Yes (at appt.)	N.A.	Yes (prior appt.)
Appointment reminders	N.A.	N.A.	Yes
Prescription Script Fax	N.A.	N.A.	Yes
Phone Operator/Scheduler	Sometimes	Sometimes	Yes
Chart preparation	N.A.	Yes	N.A.

Medical Assistants

The official title for the medical assistant staff is an “Ambulatory Medical Assistant” and their main role is to be “an assistant to nurses and health care providers in the delivery of patient care”.

According to the official job description, their clinical responsibilities include a) document brief history and chief complaint in the medical record, b) prepare patient for examination by the health care provider, c) perform routine office testing d) assist provider with procedures and minor surgical procedures, e) obtain necessary blood and urine specimens, f) administer and document injections and other medications given and g) assist in the MATH immunization program, including giving injections and tracking data in a computer program. In addition, their clerical and administrative responsibilities include: a) provide clarification of patient instruction such as, diagnostic test preparation, and medication administration, b) sterilize all reusable instruments and equipment as needed, and c) maintain necessary supplies in clinical area. Like the front-desk staff, they report directly to the practice manager. (Source: MATH Job description).

While officially the job of a MA is split into administrative and clinical, the MAs see them as three main tasks: vitals and rooming a patient (correspond to (a) and (b)), performing orders (which correspond to (c) to (g)) and administrative duties which mainly correspond to (a) of the administrative responsibilities. In my narrative network analysis, I focus mainly on the vital/rooming work and how that interacts with the administrative duties. I will briefly discuss how orders are carried out in the three clinics.

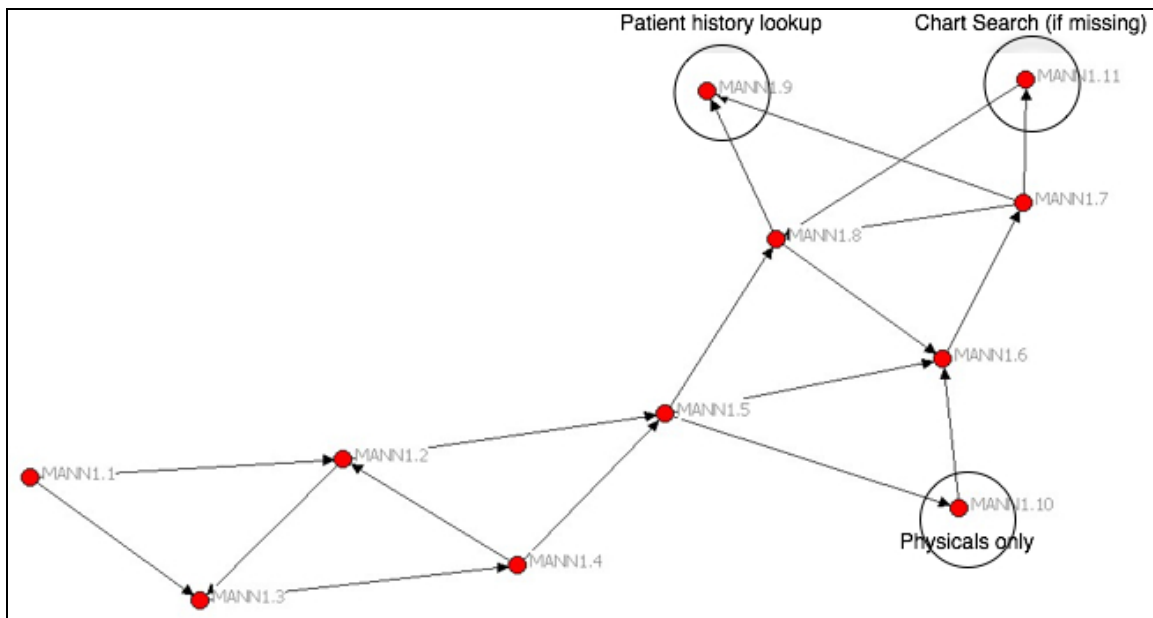
Vitalizing and rooming patients: In total, the Alpha Clinic’s check-in routine encompassed 11 different narrative nodes that I have labeled as medical assistant narrative network (MANN1) (see Table 19 and Figure below). The typical case involves 7 steps (or 8 nodes) – this involves verifying that a patient is arrived at the front-desk, taking the appropriate forms and calling for the patient at the front-desk. This is followed by taking the patients’ key vitals – weight and height – and then other tests such as temperature, blood pressure and pulse, whichever is appropriate. The MA usually brings the patient to the room to conduct the tests; there they also record the patient’s chief complaint for the visit as well as other pertinent vital information on the patient’s paper chart. The reading of patient vitals is considered completed and the MA will notify the provider that the patient is ready to be seen. Variation to this typical workflow depends on each MA as well as which clinic they are at.

Table 19. Narrative Nodes of Alpha clinic’s vitalizing/rooming

Node	Description of Narrative Node
MANN1.1	Checks FD Provider’s rack for patient charts/paper (or shelf)
MANN1.2	Gets relevant vital form depending on the patient (age group differences) from pigeonhole shelf
MANN1.3	Gets patient's paper chart/paper from stack in FD
MANN1.4	Calls and escorts patient from Front Desk to Vital Station
MANN1.5	Vitalizes patient -- weight, height at the Vitals Station using form clipped on patient's paper chart; get thermometer and blood pressure devices
MANN1.6	Rooms patient -- continues vitals to include blood pressure, temperature, and enters chief complaints
MANN1.7	Leaves room – places paper chart on door shelf
MANN1.8	Updates Whiteboard with Patient's Initials against room number

MANN1.9	In some cases, to check up IDX to verify patient visit history
MANN1.10	Take patient to conduct eyes and auditory tests
MANN1.11	Goes to medical records to retrieve paper chart (if missing)

Figure 17: Narrative Network of Alpha clinic’s vitalizing/rooming



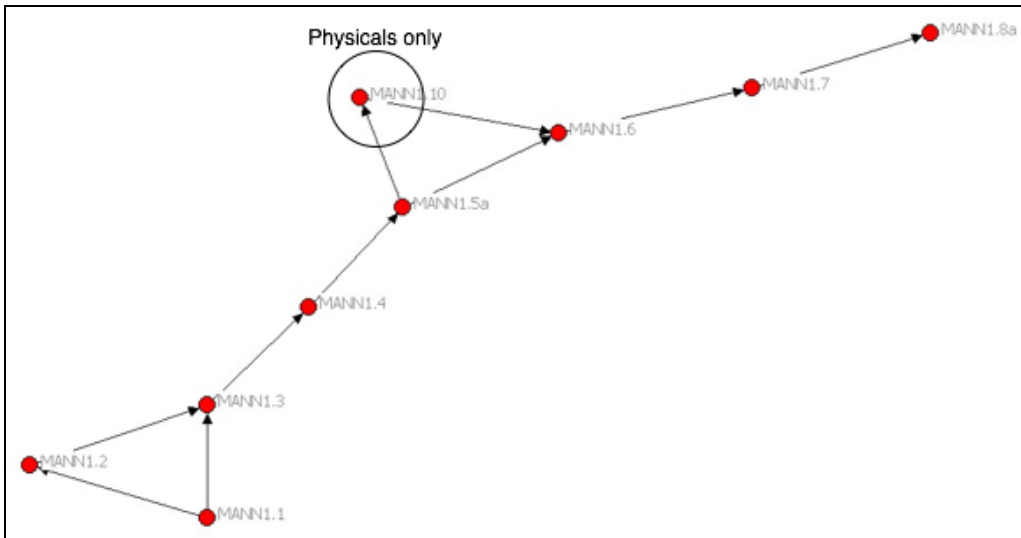
In the Alpha clinic, the MA is notified of patient status by the paper chart in the provider’s stack that is located at the front-desk. Alpha clinic uses a whiteboard to communicate between MAs and providers – so providers are notified that the patient is ready for examination when the MA writes the initials of the patients against the room number that the patient is in. MAs also note down the order by which patients were roomed (e.g. they use notation such as “ER 135 XX #1” or “ER136 YY #2” to signal that the patient in room 135 is to be seen first followed by the patient in room 136). Individual MA may also choose to “move” the tasks around e.g. some like to update the whiteboard prior to the completion of the reading of vitals as this alerts the providers to the presence of a patient in a particular exam room.

As for Beta clinic, the MA vitalization is very straightforward as the vitals station has all the equipment i.e. weight, height, blood pressure, thermometer etc (see table and figure below). The only variation is whether a MA takes the chief complaint at the vital station or within the exam room. Unlike the Alpha clinic, the Beta clinic has long hallways that are not conducive to the use of whiteboard (Dr P Interview). Moreover each provider (when there was three providers) has a set of assigned exam rooms that makes it easier for provider to keep track of patients. As such MA notify the provider either verbally or by noting it on the paper schedule pasted on the provider's door.

Table 20. Narrative Nodes of Beta clinic's vitalizing/rooming

Node	Description of Narrative Node
MANN1.1	Checks FD Provider's rack for patient charts or Hears "Chart Up" on intercom
MANN1.2	Gets relevant vital form depending on the patient (age group differences) from nurse station's shelf
MANN1.3	Gets patient's paper chart from stack in FD
MANN1.4	Calls and escorts patient from Front Desk to Vital Station
MANN1.5a	Vitalizes patient -- weight, height at the Vitals Station using form clipped on patient's paper chart; take temperature, blood pressure and chief complaint
MANN1.6	Rooms patient -- enters chief complaints (if not completed)
MANN1.7	Leaves room -- places paper chart on door shelf
MANN1.8a	Updates provider
MANN1.10	Take patient to conduct eyes and auditory tests (if physical)

Figure 18: Narrative Network of Beta clinic’s vitalizing/rooming



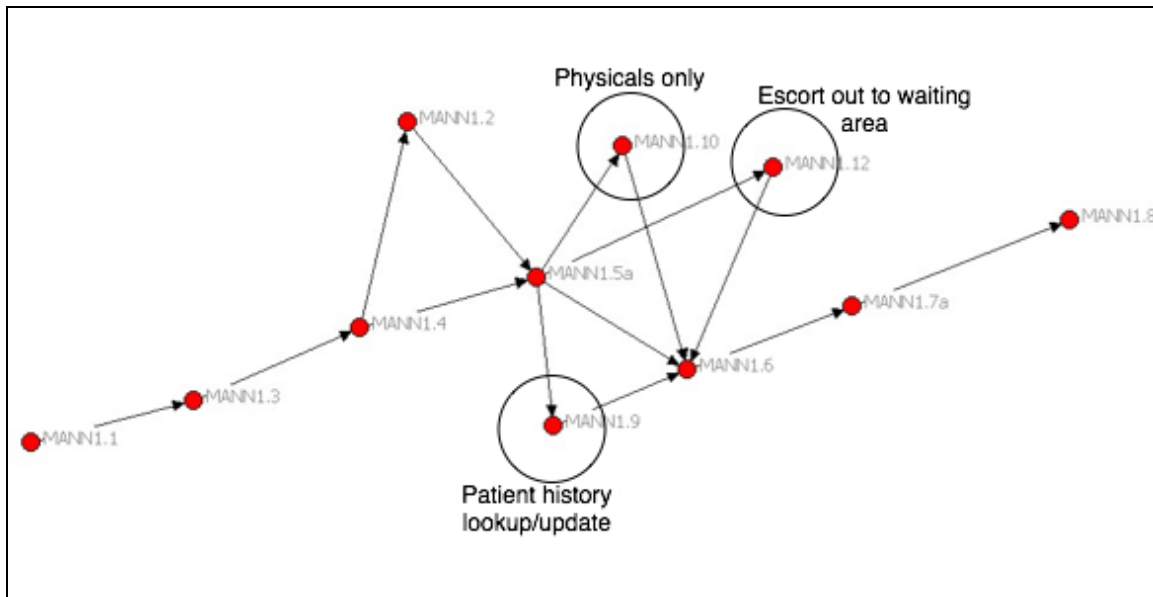
Gamma clinic’s MA are notified of patient arrival by an informal method where the patient’s chart is placed at the top shelf or corner of FD’s desk. Typically, the patients are vitalized and their chief complaint documented at the nurse’s station. Sometimes when the exam room is available the documentation may take place in the exam room. However as there is limited number of rooms (with each provider using only one or two room at most), some of the patients are escorted back to the waiting area after vitalization. Similar to Beta clinic Gamma clinic does not use any whiteboard to notify the providers when a patient is ready – they will verbally update the provider or place the paper chart on the doctor’s station or the plastic rack (for Dr A) to signal the readiness of the patient. (See Table 21 and Figure 19 below).

Table 21. Narrative Nodes of Gamma clinic’s vitalizing/rooming

Node	Description of Narrative Node
MANN1.1	Checks FD shelf for patient charts
MANN1.2	Gets relevant vital form depending on the patient (age group differences) from nurse station’s shelf
MANN1.3	Gets patient’s paper chart from stack in FD
MANN1.4	Calls and escorts patient from Front Desk to Vital Station
MANN1.5a	Vitalizes patient -- weight, height at the Vitals Station using form clipped on patient’s paper chart; take temperature, blood pressure, pulse and (chief complaint)
MANN1.6	Rooms patient -- continues vitals to include blood pressure, temperature, and enters

	chief complaints
MANN1.7a	Leaves room -- places paper chart on shelf (or doctor station table)
MANN1.12	Escorts patient back to waiting area until exam room is available
MANN1.8a	Updates provider
MANN1.10	Take patient to conduct eyes and auditory tests (if physical)
MANN1.9	In some cases, to check up IDX to verify/update patient visit history

Figure 19: Narrative Network of Gamma clinic’s vitalizing/rooming



Based on structured observations, Alpha’s vitalization takes on average five minutes (with a maximum of 15 minutes), Beta’s vitalization takes on average three minutes (with a maximum of 11 minutes) and Gamma’s vitalization takes on average five minutes (with a maximum of 12 minutes). The majority of Alpha and Gamma’s vitalization takes more than the average of five minutes while Beta’s vitalization are usually five minutes and below. See table below for a summary of the narrative network for MA’s vitalization.

Table 22. Characteristics of pre-implementation vitalizing narrative network (MANN1)

Characteristics	Alpha clinic	Beta clinic	Gamma clinic
Total no. of nodes	11	9	11
Shortest path for complete check-in	8 nodes	8 nodes	7 nodes
Average duration to complete MANN1	5 mins.	3 mins.	5 mins.
Max. duration to	15 mins.	11 mins.	12 mins.

complete MANN1			
Exceptions	History lookup (MANN1.9) Physicals (MANN1.10) Chart search (MANN1.11)	Physicals (MANN1.10)	History lookup (MANN1.9) Physicals (MANN1.10) Escort back to waiting area (MANN1.12)
Notes	Missing charts are common		Lack of rooms require prior vitalization and lagged rooming flow

Administrative duties: A MA's administrative duties which I labeled as medical assistant narrative network 3 (MANN3) include a) faxing out prescription refill requests to pharmacies (MANN3.2), b) calling patients to inform them of paperwork collection (e.g. lab results, controlled prescriptions) (MANN3.4, 3.5) or advising them of results or getting more information about their conditions (MANN3.3 and 3.6), c) preparing the paperwork for pick-up, d) taking calls from patients (MANN3.7, 3.8), and e) scheduling patient for appointments (MANN3.22). These administrative duties are usually interspersed among their clinical duties. A typical day for MAs may start off with "clearing" the charts stack that their appointed providers have left for them. Then as patients arrive, they will attend to the vitals/rooming as well as administer clinical orders as requested by the provider. They will return to these administrative duties whenever they are not attending to patients or providers. Each MA typically split the duties among calling patients, faxing, and preparing letters. In the case of Alpha clinic, the volume of patients can be high and some MAs do not attend to the administrative duties until their assigned provider is off-site and they have not patients or providers to attend to. For Beta clinic, the MAs split their stack into three groups: prescription refills, telephone enquiries and lab results. There are minor differences between Alpha and Beta administrative duties e.g. prescriptions are called in rather than faxed and abnormal lab results are mailed in addition to calling the patient. Time taken for the duties vary widely as it depends on the complexity of the issues involved.

In Gamma clinic, the MA does not deal with prescription refills i.e. MANN3.2 (this is handled by the front-desk) and the providers call the patient directly concerning results and triages (MANN3.3, 3.6) as well as handle the mail to patients (MANN3.5). Their main administrative duties are taking calls from patients or other providers and calling up laboratories to follow up on patients' tests. They occasionally assist the providers on phone triages and they sort out incoming laboratory results for providers to work on them. They do not have as high a volume as Alpha and Beta clinics and usually have administrative time during the afternoon period. See Table 23 below summarizing the key characteristics of MANN3 across the three clinics.

Table 23. Characteristics of pre-implementation MA admin. narrative network (MANN3)

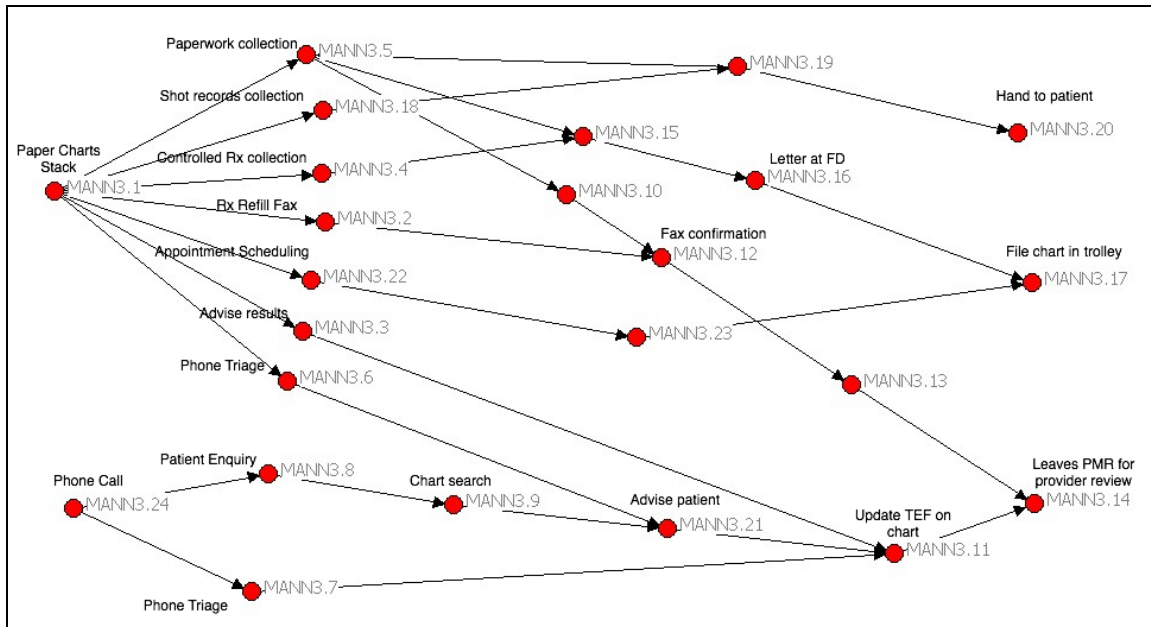
Characteristics	Alpha clinic	Beta clinic	Gamma clinic
Total no. of nodes	24	24	16
No. of different key sub-narratives	9	9	5
Duration	Varies widely depending on tasks involved	Varies widely depending on tasks involved	Varies widely depending on tasks involved
Notes	Fax in prescriptions requests	Call in prescriptions requests	- Prescriptions requests are handled by front-desk - Providers handles call-backs and letters directly - No shot records requests as they do not have pediatric patients

Table 24. Narrative Nodes of MA administrative duties (MANN3)

Node	Description of Narrative Node
MANN3.1	Check PMR stack from provider or as prompted by provider
MANN3.2	If Rx Refill: fax Rx to pharmacy
MANN3.3	If Results: Call patient to advise of results
MANN3.4	If Controlled Rx: Call patient to inform of collection
MANN3.5	If Paperwork: Call patient to inform of collection
MANN3.6	If Triage/TEF: Call patient to get information
MANN3.7	If Call-in Triage: take phone call and get information
MANN3.8	If Call-in Enquiry: take phone call and find chart or lookup information
MANN3.9	Get patient chart from MR
MANN3.10	Paperwork: if patient request fax; then acquire fax no. & fax
MANN3.11	Update TEF/Stickie on PMR

MANN3.12	Collect confirmation of fax
MANN3.13	Files into paper chart
MANN3.14	Leave paper chart on provider stack for review
MANN3.15	Prep paperwork for patient pickup
MANN3.16	Leave letter at FD for pickup
MANN3.17	File paper chart into trolley/MR
MANN3.18	If Shot records: fill it up
MANN3.19	Request for provider signature
MANN3.20	Hand to patient
MANN3.21	Advise patient
MANN3.22	If provider put in schedule appt; call pt
MANN3.23	Schedule patient on IDX
MANN3.24	Phone Call

Figure 20: Narrative Network of MA administrative duties (MANN3)



Other workflow and its narrative network: Apart from the vitals/rooming as well as the administrative duties, MAs are involved mainly with administering orders that providers issue. The type of orders as well as volume of order differ across the three clinics – as this is determined in part by the profile of the patients.

In Alpha clinic, the providers see the whole gamut of patients – pediatric to teens to geriatric and I

observed that there were a high number of orders for immunizations and injectable medications (on average six orders a day for each provider). There were also a high frequency of pap smears and lab samples requested. Beta clinic, on the other hand, has only about two orders on average a day per provider and these were either immunization or EKG readings. There are no laboratory services in Beta clinic and patients are usually referred to external laboratories. Gamma clinic on the other hand was the extreme case as they saw predominantly (almost exclusively) geriatric patients. The lead provider in Gamma was also a rheumatologist. The providers in Gamma clinic usually ordered shots, immunizations and blood/urine samples for most of their patients. Each provider in the clinic orders up to 4-5 shots or laboratory tests in a morning session.

The workflow for orders also differed in where the orders were administered. Both Beta and Gamma clinics had designated locations for administering immunizations and shots while Alpha clinic's shots were administered within the exam room. Alpha clinic providers use the whiteboard to communicate their orders (using the same notation of room number and patient initials) as well as verbal communication. Beta and Gamma clinical providers use only verbal communication albeit Beta clinic providers remind the MAs by placing a label on top of the paper chart outside the patient's exam room. Also as mentioned above Alpha and Gamma clinics have on-site laboratory services and their MAs occasionally will assist to draw blood and acquire samples for laboratory tests. MAs can also administer nurse visits e.g. taking blood pressure and administering follow-up tests (finger-stick) based on providers' instructions.

Finally all MAs are expected to clean up and prepare the exam rooms for the patients and providers. However only designated MAs are in charge of ordering and maintaining medical supplies and samples of medications. These designated MAs tend to be the senior MAs and they take charge of these housekeeping duties in addition to their normal administrative duties.

Medical Provider

In my interviews and observations there are two main categories of medical providers that were present in the three clinics: physicians and certified register nurse practitioner (CRNP). There were residents and specialists practicing in one of the clinic (Gamma) but I did not observe or interview them in detail. As my focus was not on clinical work of the providers (due to privacy issues as well as lack of domain knowledge), I review mainly the “supporting” or “articulating” work (Strauss, 1993) carried out by the medical providers in these clinics. By supporting or articulating work I refer to the work carried out by medical providers outside the examination room that are required to implement the plan of care developed from the exam room interactions. This work includes pre-encounter preparation and post-encounter documentation, orders and referrals and patient communications.

Documentation: Pre-encounter preparation and post-encounter documentation takes up most of the time of the provider apart from the obvious clinical examinations that they do. Most pre-encounter preparation involves reading up on the patients’ chart if the reason for the visit is a follow-up or a physical. Some visits require the provider to interact with the MA to look up pertinent patient information e.g. their previous visits so as to confirm the information found in the chart. Others may require the provider to prepare forms e.g. if it is a physical exam for a pre-operation procedure. Post-encounter documentation includes completing the assessment and documenting the plan (or orders) as well as the level of service for billing the encounter. It also includes writing prescriptions and filling up laboratory test forms as required. Non-clinical documentation may include updating their own schedule and whiteboard so as to track their workload and flow.

When and how post-encounter documentation takes place depends on each individual provider.

Some providers finish their documentation after each patient visit. Some providers choose to write short notes and then take a break from examination to finish up several patient charts. In Alpha clinic, providers work on the patient documentation at the nurse/provider station while in Beta clinic the providers work on the patient documentation in their offices (which is situated beside the exam rooms). In Gamma clinic, some providers do it in their office or at the doctor station outside the exam rooms. Time taken for documentation depends on type of visit, patient history and provider's style and speed. However all closed encounters with their level of service billing need to be submitted at the end of the day to the practice manager for prompt billing.

Orders and referrals: The orders and referrals workflow refers to the work that providers do to issue specific orders for their patient. Basically it refers to issuing orders to either the MAs (for orders) or the referral coordinator (for referrals). As mentioned earlier in the MA section, these orders can be communicated via an artifact like the whiteboard in Alpha clinic and/or verbally as in all three clinics. In Alpha and Gamma clinics referrals are completed by the referral coordinators and the providers have to communicate directly with the coordinators in terms of reasons for referrals and other clarification required for authorizing the referral. In Beta clinic, patients typically setup their own referral appointments with the provider's note and then call back to confirm their appointments with the referral coordinator who will then mail the referrals to the patients.

Patient communication: Patient communication refers to the paperwork, telephone enquiries and other patient related issues that require a provider's attention apart from the exam room encounters. They include dealing with a) laboratory test results – to diagnose the results and provide appropriate medical advise based on those results, b) request for signature on various clinical forms e.g. immunization records, c) correspondences from lawyers and other medical

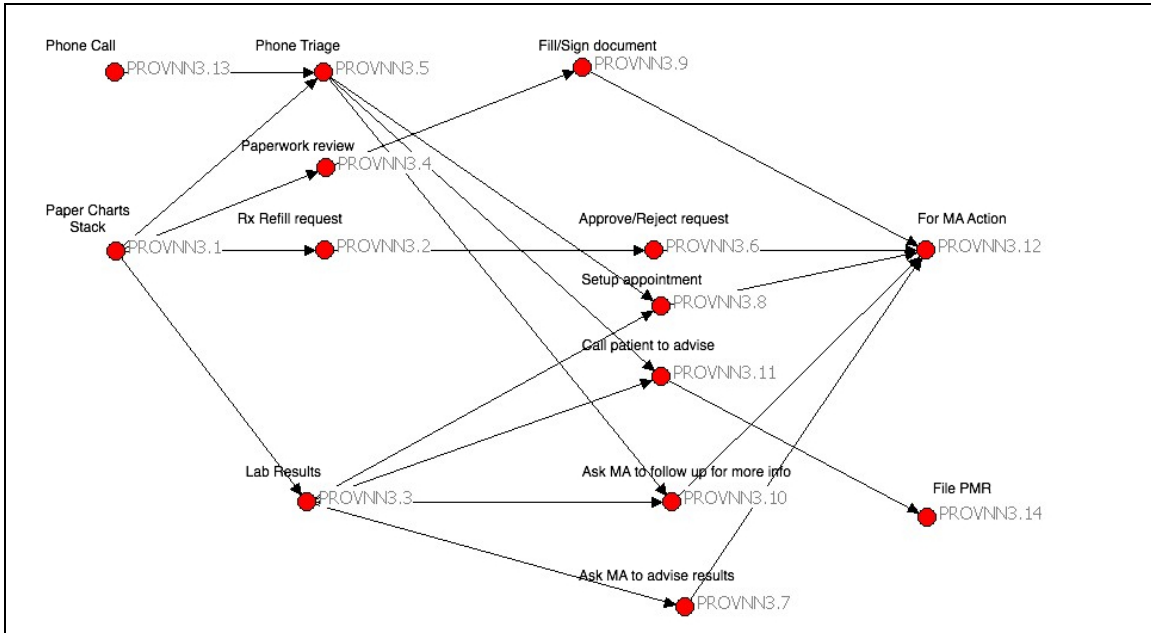
providers concerning patient issues and conditions, d) reviewing phone triages and enquiries that MAs or Phone operators or front-desk staff had taken down and providing appropriate medical advise, and e) reviewing and approving request for medication refills. Some times providers have to also determine if they are willing to cater to patients who are late or walk-in cases that have been triaged. (See Table 25 for the list of narrative nodes in this narrative network and Figure 20 for the network view).

Table 25. Narrative Nodes of provider’s administrative duties (PROVNN3)

Node	Description of Narrative Node
PROVNN3.1	Review PMR stack from phone room/medical records
PROVNN3.2	If Rx Refill: review chart
PROVNN3.3	If Results: review results
PROVNN3.4	If Paperwork: review document
PROVNN3.5	If Triage/TEF: review TEF
PROVNN3.6	Approve prescription refill (or reject)
PROVNN3.7	Assign MA to inform patient of results
PROVNN3.8	Ask MA to setup appointment
PROVNN3.9	Sign document
PROVNN3.10	Assign MA to request for more information
PROVNN3.11	Call patient to advise
PROVNN3.12	Leave paper chart on MA stack for action
PROVNN3.13	Phone Call or MA verbal communication
PROVNN3.14	File back PMR

In terms of patient communication, individual providers have their own mode of practice. In Alpha clinic, some providers delegate all communication to their MAs while others will deal with them directly during their administrative time. In Beta clinic, the provider also delegates all communication to the MA while in Gamma clinic, the providers handle all patient communication directly. As the lead provider explained, most medically urgent cases (e.g. important lab test results) will be attended first while those that are less urgent (e.g. request for signatures) will be dealt with in due time. Like the MAs, providers get to their documentation and communication work in between patient exams, during their administrative time or at the end of the day.

Figure 21: Narrative Network of provider’s administrative duties (PROVNN3)



Work Network View

I adopt there the Work Network perspective⁸ of the operations in the clinics. From the Work Network perspective, the above three roles can therefore be collapsed into individual nodes with interfaces that connect each role or production node with another. As it involves the clinic, I also include other production nodes that have previously not been fully discussed viz. the phone operators and medical records staff. These roles were not included in the detailed analysis partly because not every clinic had dedicated staff assigned to them or some of them were outsourced. However, they are significant nodes in he Work Network and are included in this section.

To provide illustration of the Work Network, I will first analyze the Alpha clinic’s operations. Unlike the link between narrative nodes in the narrative network, the link between each role or

production nodes does not refer to sequence of actions. Instead the links in the Work Network refer to the communication and interaction between each role as the clinic on a whole respond and engage with their patients. For this illustration I consider two important processes: the scheduling, registration and rooming of patients and the handling of patient communications.

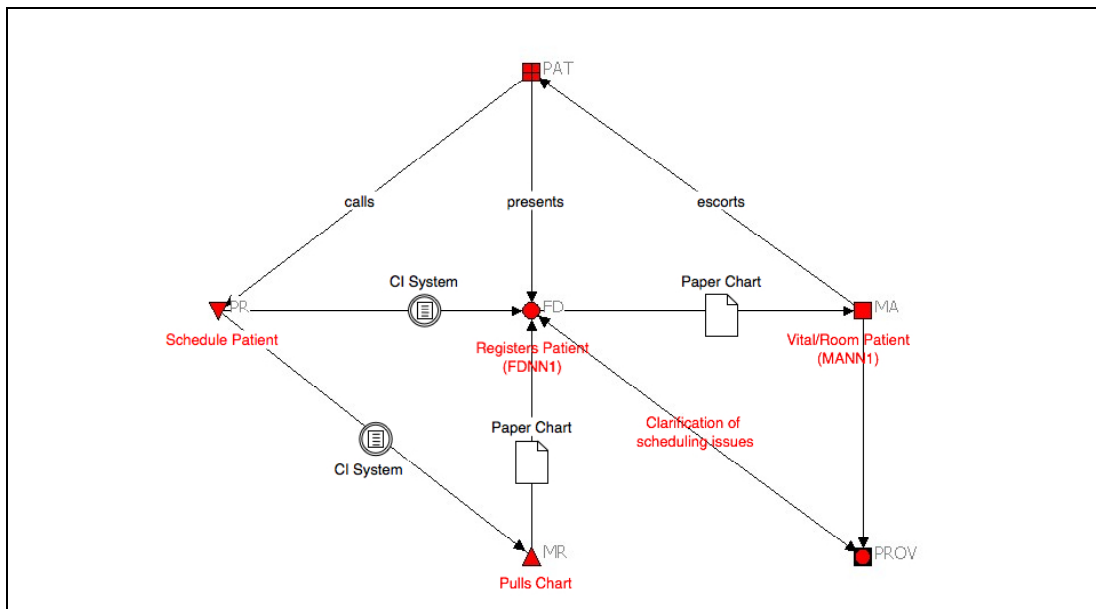
Scheduling, Registration and Rooming: The Work Network (WN) for this process involves the front-desk node (FD), the phone scheduler node (PR), the medical records node (MR), the medical assistant node (MA) and the provider node (PROV). In addition to these key internal nodes, I also include the patient node as an important external factor in this Work Network. Embedded in the links between the nodes, I show the specific artifacts used by the various nodes to communicate, coordinate and enable work to be done within this network.

The scheduling of a patient can begin in two flows: one is via the phone scheduler where the scheduler engages in the scheduling workflow (which is a scheduling narrative network by itself), the other is via the front-desk where a patient presents with serious condition and warrants a walk-in appointment. The former is the norm while the latter is the exception. In the phone scheduling (PR) narrative network, the scheduler gets the appointment date/time, appointment type, reason for visit, choice of provider as well as basic patient information from the patient and enters it into the scheduling system (Check-in system or CI system). This information is sent to medical records (MR) for the medical chart to be “pulled” and sent to the front-desk (FD) – this would be the medical record chart pull narrative network. Usually the charts for the next day’s appointments are pulled and arranged according to their last four social security digits at the front-desk. When the patient (PAT) presents at the front-desk, the front-desk begins the check-in

⁸ I provide a detailed explanation of the methods for deriving Work Network in chapter 3 and its theoretical aspects in chapter 8.

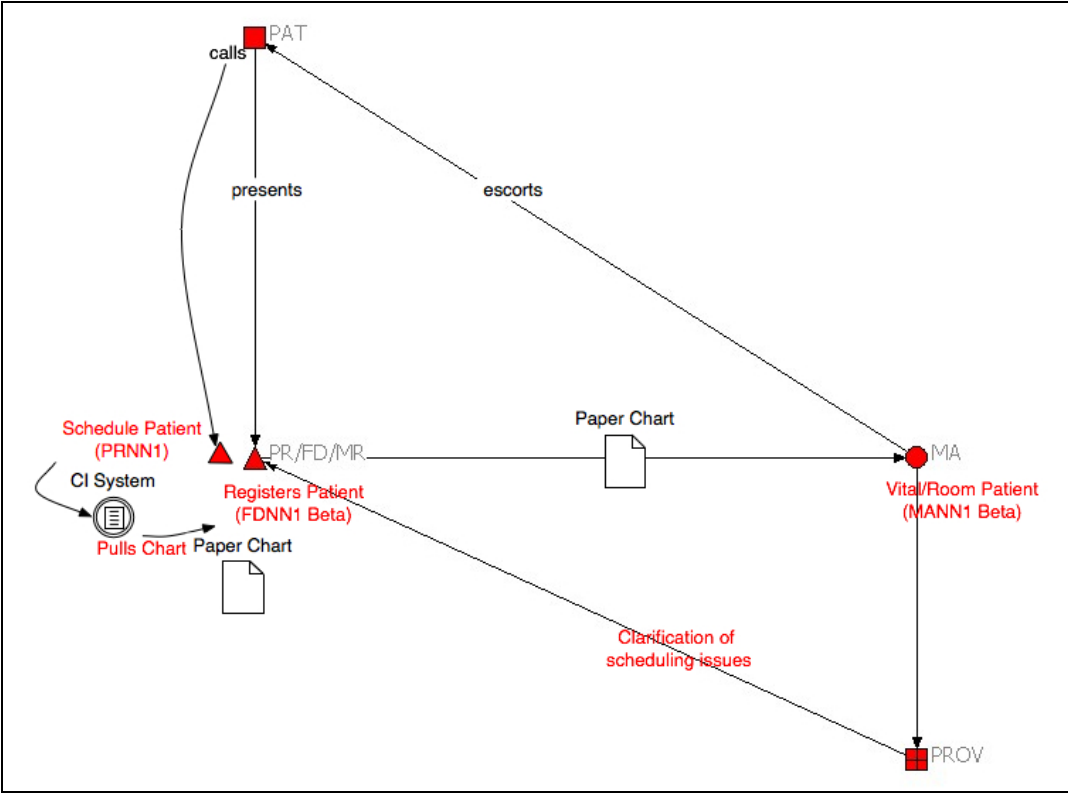
narrative network (FDNN1) as described above and pulls the appointment information from the CI. Depending on the patient’s insurance type, the FD will go through the insurance verification as required. Upon completion of the check-in, the FD retrieves the chart from the scheduled appointments rack and places the chart in the provider stack (FDNN1.12) thereby signaling for the MA to begin their vitalizing narrative network (MANN1). The MA completes the vitalizing and places the chart outside the exam room (MANN1.7) and informs the provider verbally or by whiteboard (MANN1.8 or 1.8a). This completes the Work Network for scheduling, registering and rooming a patient. See Figure 21 for the Work Network of Alpha clinic’s scheduling, registration and rooming process.

Figure 22: Alpha clinic’s Scheduling, Registration and Rooming Work Network (WN1)



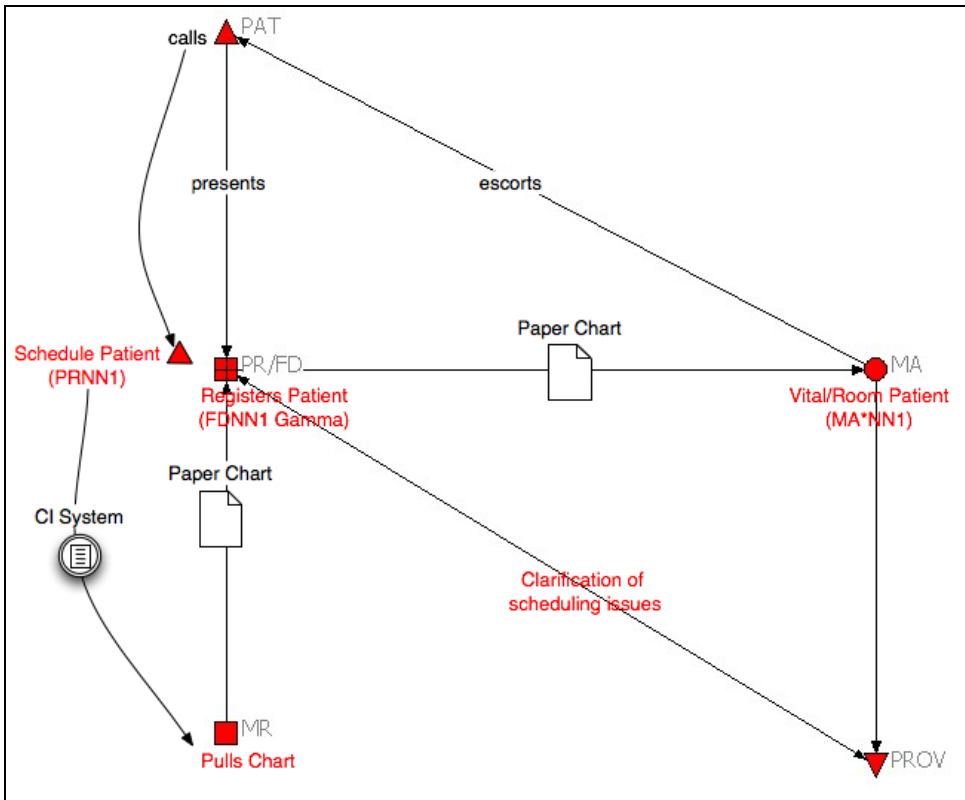
While the Alpha clinic – which is used to develop this Work Network – has a dedicated phone operator team, Beta and Gamma clinics do not. Beta clinic uses their front-desk as phone operators who also double up as the medical records staff. As such Beta clinic’s Work Network collapses into four nodes (with PR and MR merged with FD). The CI system however remains used the same way as depicted in the figure. See Figure 22 below.

Figure 23: Beta clinic’s Scheduling, Registration and Rooming Work Network (WN1)



Gamma clinic has a MR department (the position is currently vacant as the staff recently retired) and their one FD doubles up as phone operator. As such Gamma clinic’s Work Network collapses into five main nodes (PAT, FD, MR, MA, PROV). See Figure 23 below.

Figure 24: Gamma clinic's Scheduling, Registration and Rooming Work Network (WN1)

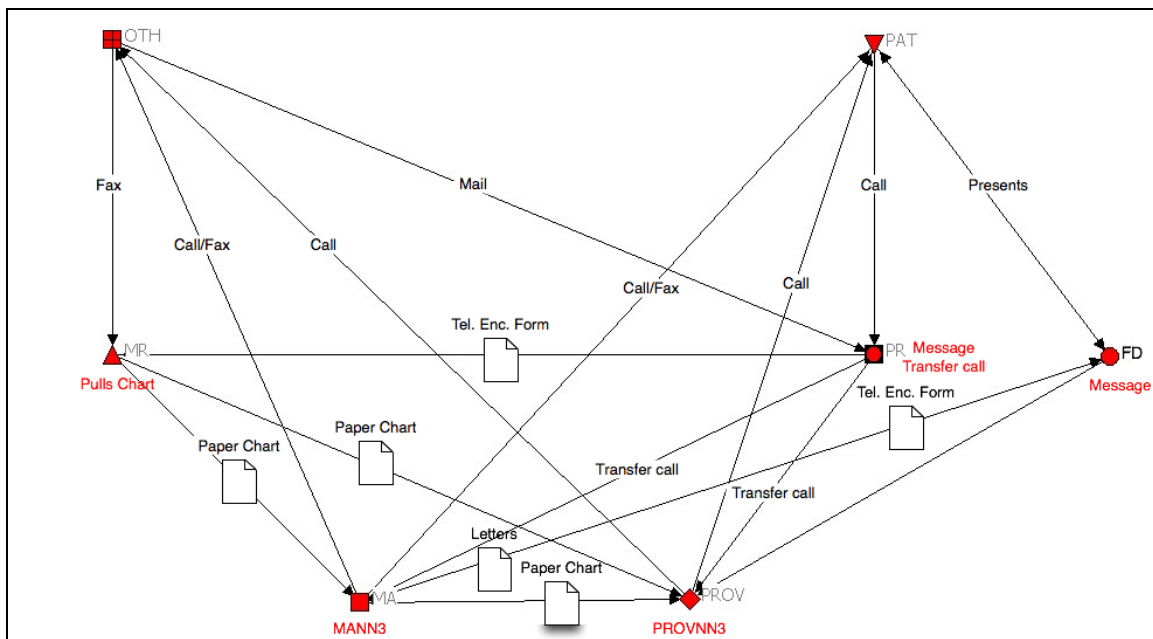


Handling of patient communication: The WN for patient communication (WN2) again involves the same set of nodes but each node activating different narrative networks and using a wider array of artifacts to communicate and coordinate to execute the work. Furthermore, unlike the first WNN this involves a wider range of narrative networks and hence a deeper and more complex set of interactions.

From the figure, we can see that there are two sources of patient communications: one is from the patient directly (PAT) and the second is from other sources that have an interest in the patient's health issues e.g. specialists, laboratories or their other medical providers (OTH). For the patients, they typically call into the clinic where their requests and enquiries are recorded by the phone operators. Sometimes patients may present themselves at the front-desk where they leave messages

for the clinical staff. OTH may call the clinic directly like the patients or they may fax in their messages or send it via mail. In the Alpha clinic, the medical records staff handles the faxed messages while the phone operators handle the mail correspondences. The medical record staff will consolidate all the fax, mail correspondences and telephone messages (recorded on telephone encounter forms) and pull the respective patient charts before sending them to the clinical staff (MA and providers). Front-desk staff usually send their messages directly to the MAs and/or providers. For urgent cases, telephone operators may directly transfer the calls to the MAs and/or providers. Depending on the type of messages and communication (e.g. prescription refills or laboratory results), the provider and the MAs will carry out specific narrative tasks (for the MA it will be MANN3 while for providers it will be PROVNN3). They will then respond directly to the patient or the others via phone, fax, or letters.

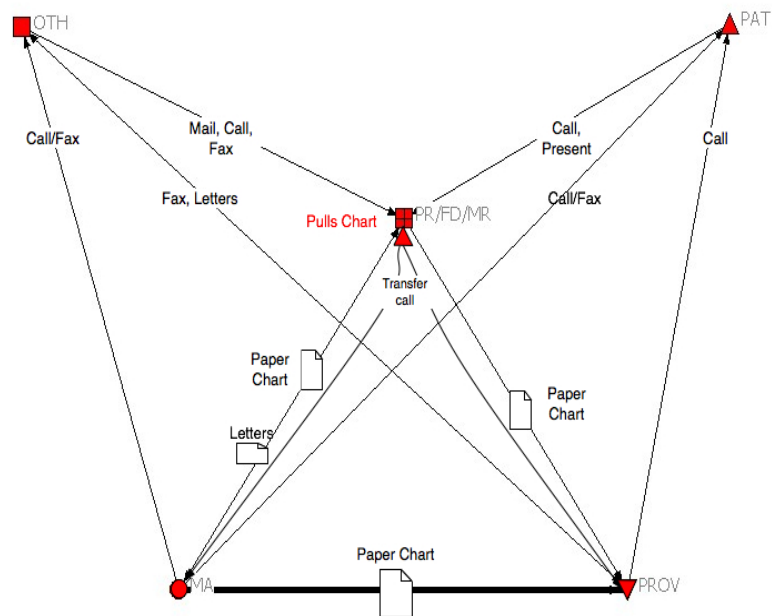
Figure 25: Alpha clinic's Patient Communication Work Network (WN2)



Again Beta and Gamma clinics' Work Networks are less complex as the FD, MR and PR are merged into one node (see Figures 25 and 26). Moreover for Gamma clinic, the MA collects the

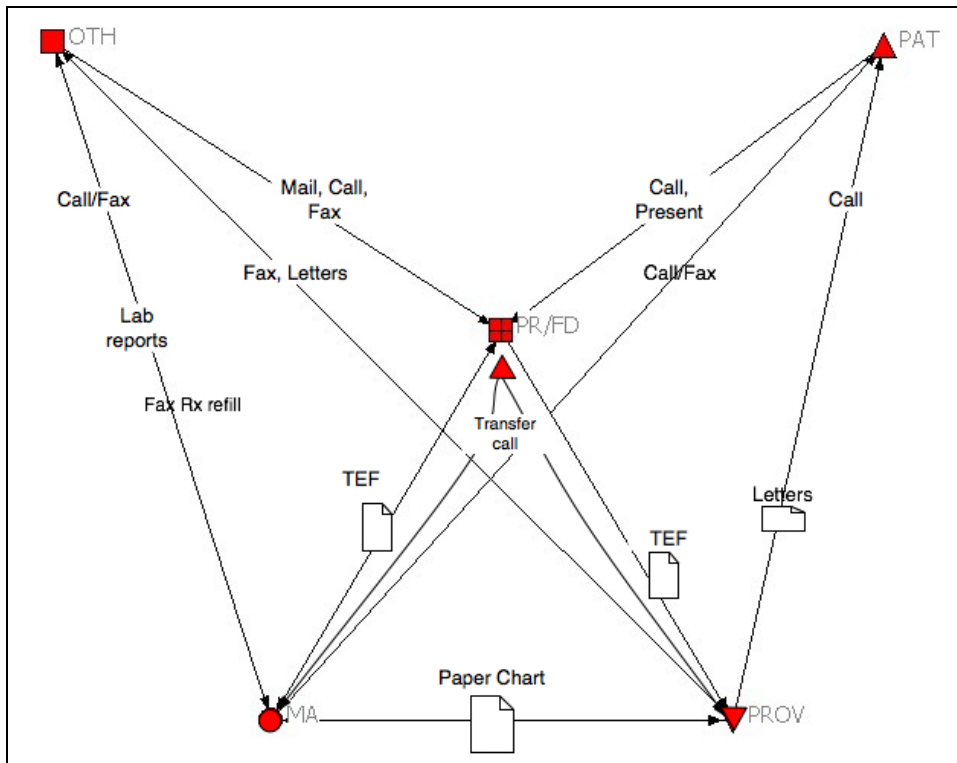
faxes from OTH while they do not call/fax/mail out documentation to patient (See Figure 26). Providers in Gamma clinic are involved directly in the communication with the patients. MAs are involved only when following information from other medical providers and labs. Instead of Gamma clinic's MR, MA or the practice manager typically pull the charts for the telephone encounters for their own or for the providers' follow-up.

Figure 26: Beta clinic's WN2



Note: Bold line between MA and PROV for Beta clinic's WN2 denotes a dedicated provider-MA arrangement.

Figure 27: Gamma clinic's WN2



Existing Operational Issues

Alpha clinic's issues: The problem of missing patient charts is one of Alpha clinic's critical operational issues. According to its own statistics, providers did not have the patient's chart for 25 percent of all visits. In my observations this problem of missing charts creates issues all throughout the PRNN for both key processes depicted above.

First, the problem of missing charts hits the MR first as the MR has to pull the chart once an appointment is made and when charts are missing it requires extra effort for the MR staff to search for them. For e.g. one day the medical records person was having a fit because the printout for the new schedule was delayed and she was still missing 13 charts. She said, "The doctors won't be happy and the phone (in the MR) is going to go off" (FN Alpha 24 Aug 2007). This problem in turn

is transferred to the FD as patients will be registered and arrived in the clinic without a chart. The FD usually calls back to the MR for the chart or if it is urgent they may leave their front-desk position and get bogged down with the medical chart scavenger hunt at the back office viz. FDNN1.13 and 14 (FN Alpha 6 Sep 2007). When FD staff leaves their station to hunt for charts it creates a lack of FD staff to deal with patient flow in a timely fashion. Further it also means that there is no artifact to hold pertinent patient information and no means by which important notes are attached and channeled to the patient e.g. controlled prescriptions are attached to charts but if charts are not available, they are simply attached to a piece of paper. In all these situations especially the last case, the outcome is reduced patient care for e.g. I witnessed how a controlled prescription was nearly misplaced because it was attached only to a piece of paper as the chart was not available. It also creates lower efficiency for the FD and MR staff as both can spend a significant amount of their work time searching for charts.

Second, when missing chart issue is not resolved at the FD, MAs and providers are forced to join in the search for charts. The lead physician observed with a sense of irony, “here the culture is that medical records is [the] responsibility of everyone – medical assistants, front-desk, doctors, referral; everyone is medical records” (Dr W#19). This is reason why MA frequently have to go through the process of chart search (MANN1.11). I have observed that physicians sometime end up in the medical records room themselves hunting for charts. Like the earlier situations, this reduces patient care because providers and MAs have to “wing it” as one provider puts it and it also reduces the overall efficiency of the clinic (Dr EV#39). It also created a situation of incomplete shadow charts as the medical records staff have to create new charts for ones that were missing and later found (FN NS 070906).

According to the staff there are several factors that led to this issue. First, this clinic has a relatively large patient population; in fact patients from two other clinics that had closed were transferred to

this clinic. While the number of charts in the medical records room has grown, the number of staff handling the correspondences and chart maintenance remains the same. From the staff's perspective they feel that they are under-staffed to handle the volume of work (FN MR 070824). From the management's perspective, they feel that the volume has largely remained the same since the number of providers had remained the same despite the consolidation. They feel that the staff is basically inefficient in dealing with the medical records work (CM#27). This difference in perspectives over the MR situation has led to a level of animosity between the management, providers and the medical records staff. Second, the clinic is physically large as well and since charts are used for many purposes they may be at several locations at everyone time. For e.g. they may be at the providers' stack as there may be outstanding paperwork to be completed by the providers. They may be at the referral coordinator's office as she has a backlog of referrals to be cleared. In other words, as the network manager puts it "charts have many places to hide" (DS#18). Third, the medical records staff observed that they don't have a system for tracking the charts as they move from one place to another (FN MR 070824). Finally, as the Alpha clinic practices open access scheduling, the medical records can't fully prepare for the charts required for each day as new charts requests will come in during the day itself. The fact that the two staff have to search for a backlog of charts as well as prepare the next day's as well as current day's chart pulls compounds the problem (Minutes Ops 070831).

Another critical operational issue is Alpha clinic's patient appointment scheduling. This was raised during one of its operations meeting as the clinic was gearing up for the new EMR system. The Network director brought up the fact that many patients have complained that they cannot get into the phone system to get their appointments (Minute Ops 070824). An employee in Beta clinic who was a patient at Alpha confided in me that she used to go to Alpha but gave up after having a hard time getting an appointment.

Based on interviews and minutes, this issue is created partly due to another problem that Alpha clinic is facing and partly due to the aging infrastructure. First, Alpha clinic has a high number of no-show rate i.e. patients who made an appointment but did not turn up. The providers I observed had many days where there was a significant number of no-shows (FN NS 070816, 070904, 070917). The front-desk staff mentioned during their internal operations meeting that they have one day when there was 31 no-shows (Minute Ops 070824). The reasons for the high no-show rate are diverse but one of the more pertinent one is that many (around 53%) of these patients are on Medicare or Medicaid. According to the Medical Director, Medicaid patients cannot be penalized financially for no-show. Medicaid on the other hand has a policy that their patients cannot be treated worse than other patients in the same clinic. In the end, since a majority of the patients cannot be penalized when they no-show, Alpha clinic does not have a no-show penalty policy (FN NS 070904). To deal with this issue, the clinic's management decided to implement the open access schedule (Dr W#19). Open access schedule means that patients have to call the same day they need to see a provider to make an appointment for that day. Alpha clinic management claims that the open access schedule has significantly brought down the no-show rate. But it has resulted in high number of calls each morning since all the open access slots are normally filled before 11 am (FN PR 070909, 071126). The Network director also observed that this model has contributed to the access issue (DS#32).

Second, Alpha clinic has a relatively old phone system. It is configured with 12 phone lines but Alpha clinic has only two full-time phone operators. I observed that because of the volume of calls coming in, each phone operator has to put at least three lines on hold while attending to the call they already have (FN PR 070909). Moreover the system has occasionally failed such as it hangs up patients who are put on hold (Minutes Ops 070831). Although various suggestions have been made to improve the phone system e.g. putting a message to advise patients how long they have to wait before their call is taken, the clinic found that the system is too old to receive this type of upgrade

and may have to be overhauled (PR#56).

Finally Alpha clinic's front-desk operations also pose as a significant bottleneck (CM#57). Like many of the operational issues in Alpha clinic, it is a culmination of several issues. First, Alpha clinic's front-desk not only handles a significant number of registrations and insurance verification, it also handles a significant number of pickup requests (FN FD 070918). This high volume is one reason for a bottleneck at the front-desk. Second, there are frequent cases where patient who have signed-in get overlooked during registration. According to observations as well as meeting minutes, the reason for overlook is due to occasions where front-desk staff misplaced the patient's "name". Apparently because of HIPAA requirements Alpha clinic implemented a sticker check-in sheet so that front-desk personnel can remove the patient's name when the patient is attended to. However some front-desk personnel may take more than one sticker in order to process several patients at once. Sometimes due to the need to move between the front-desk and the back-office (e.g. to find charts or look for pickup items), these stickers become misplaced – resulting in-patient overlooks (Minutes Ops 070824). Furthermore, the sticker system does not reflect when a patient's scheduled appointment time is; it only shows the order that they arrive at the clinic. In the hustle of things, front-desk staff frequently check-in the patients in the order of they arrival time rather than their actual scheduled time (DS#32, Minutes Ops 070824). Lastly, front-desk staff often may check-in a patient without their actual insurance cards as many of these patients have a photocopy of their card in their chart. However, due to billing requirements it is Alpha clinic's policy that all patients have to present their valid insurance cards for each visit. This policy however is not uniformly and consistently applied by the front-desk staff resulting in cases of unhappiness when patients are turned away for not having a valid insurance card during registration (Dr W#19). In sum the high volume, the occasional misplacement of names, the rush to check-in patients, and the problems of inconsistent application of insurance card policies all add together to create a significant bottleneck at Alpha clinic's front desk.

Beta clinic's issues: Beta clinic and Alpha clinic are worlds apart in terms of its operations.

Although Beta clinic does not have full-time medical records staff, in fact it outsourced the correspondence and copying of medical records to an external vendor, it does not have significant missing chart issues (SL#33). The reason is partly because Beta clinic does not have as many providers and therefore the volume of patients as Alpha and partly because the paper charts are located only in limited number of places (front-desk, provider offices, and nurse stations). As far as I can see the referral coordinator does not have charts stacked in her office as they practice a different referral workflow. They also do not have an open access model so most patient charts are prepared a week in advance of their appointments (FN FD 080111). Similarly they do not have a problem of appointment scheduling as their patients have to schedule in advance and they have a four-month window for scheduling. Finally, the front-desk staff is able to typically handle the flow of patients coming in for appointments and pick-up. Since charts are normally available and there is relatively low frequency of pick-up, the front-desk functions relatively efficiently. The minor problems they have with the operational aspect deals mainly with clarification over providers' prescription instructions and providers' coding of diagnosis where the support staff need to go back to the providers and get additional information to close their end of the work such as prescription refills and bill reconciliations (SL#33, TY#41).

The issues at Beta clinic were however more in terms of its staff and morale issues (Dr S#64). Due to undisclosed reasons – the medical director claims that it was a confidential issue (Memo #14, Minutes Beta RBV#5), two of the providers at Beta clinic decided to leave the clinic. This was followed quickly by the departure of the nurse supervisor and the senior medical assistant. As a result there was only one provider and one MA left in the clinic dealing with a three-provider load of patients. Many of the patients who had the two providers as their family doctor also transferred out of the clinic. When I arrived at the clinic two of the front-desk staff were contemplating of

resigning and one of them did eventually leave prior to the EMR system going live (FN Beta FD 080124, 080205). As such the management had worried that Beta clinic's rollout would have been impacted more by the "challenged morale and office teamwork"; they worry that individual frustration might carry over to the new system albeit it has nothing to do with the system per se (Dr S#26). Concretely, the main issue was the significant increase in workload for the lone provider left in the clinic. The interim solution for this was the transfer of some of Alpha and Gamma providers to Beta clinic to assist during different days and sessions while the management began hiring new providers and MAs to staff the clinic.

Gamma clinic's issues: Gamma clinic is staffed by long-time employees who were working there before it became part of the new network. The practice manager has been working there for nearly 20 years and the senior MA 13 years. One of the providers who is semi-retired has been there for nearly 24 years. In a sense, as the medical director described it they operated almost like a "mom-and-pop" shop (Dr S#26). The overall culture for the small team (staff strength of nine) is indeed very family-like and during one of the staff lunches, everyone on the team commented how well they worked together ("this is a good team", "nice and small knitted group", "people can just work with each other without much fuss"). This positive culture has translated to positive relationships with their patient as well. Gamma's management claims that they have very good patient satisfaction scores all around and the senior provider has been voted as one of the city's best family medicine physician (FN Gamma 071220). The practice manager takes pride in the operational efficiency of the clinic saying that "they have a system here for things" and that "she has the best girls" (FN Gamma 071220).

Moreover as Gamma providers see mainly geriatric patients (64%), the volume of the clinic is significantly lower than either Alpha or Beta clinics (Dr S#26). When I was there, a typical day's volume averages around 24 patients and the only really busy day is on Thursday when all three

providers are working the morning session. Even then, the clinic's maximum number of patients seen hovers around 40 patients (in comparison that is Alpha clinic's typical morning session). Because of relatively low volume as well as the providers' practice of mailing out patient communication, the front-desk operation is uneventful. This also explains why Gamma's single front-desk staff is so multi-tasked (i.e. phone operator, scheduler, registrar and check-out).

In terms of missing charts, Gamma clinic does face some issues. This was more apparent during my observation period as the one medical records staff had just retired and the practice manager had to double up as medical records as well. However, as the clinic does not practice open access, I did not observe many cases where providers had to examine patients without their charts.

The main challenge for Gamma from Gamma team's perspective was the aging infrastructure and how that would support them as they go forward with the new EMR system. According to the EMR project team, they found that the wiring in the building where Gamma clinic was housed to be old and unable to support new infrastructure (FN Alpha 071029). In fact, the Practice Manager had complained many times to the IT department about their computers and network as these equipments had failed repeatedly on them (FN Gamma 071220, 080128). There were also not many offices and rooms – the one nursing station was actually only a desk placed along the hallway so there was no real patient privacy, the medication store was housed in a converted exam room and basically each provider has only one exam room to work with (FN Gamma 071220).

The operational challenge for Gamma from the management perspective is the deeply entrenched routines that are not necessarily standardized with the other two clinics. As the Network director puts it, "Gamma doesn't have the attitude or structure as each doctor has their own style" (DS#32). The MAs who work there alluded to the same issue when we discussed the changes that will come with the new system. Their view is that nothing much will change as the doctors will not change the

way they do things. For e.g. Gamma was asked to adopt Alpha's whiteboard communication method but the MA was skeptical. She said, "We used to have the board but nobody uses it. Dr. AS will just tell us verbally to do orders and ignore the whiteboard" (FN Gamma 080104). The Medical Director pointedly described Gamma's 30-year history as problematic. For example he explained that some significant aspects of the administrative "stuff" had been offloaded by the providers onto the practice manager. The practice manager is also very protective of the staff and providers and while that was generous of her, it also "sometimes get in the way" (Dr S#26). He suggested that there were several policies peculiar to Gamma that was uncovered during the RBV that had to be settled.

Summary

In chapter 4, I provided an overview of the three clinics with respect to their organizational history and structure, policies and client base while in chapter 5, I discussed the impact of the clinic's context and work practices on the EMR system configuration process. This chapter completes the picture of the three clinics by giving us an in-depth analysis of the clinics' existing work practices as well as the operational issues found in each of the clinics. While most empirical research on enterprise system implementation (Volkoff et al. 2007) and organizational change have assumed that organizational work is relatively routine and homogeneous across roles (Barley and Kunda 2001), I found that within a highly institutionalized domain such as medical operations there is wide variety of work within and across each context and role. Specifically I used the Work Network perspective that builds on Pentland and Feldman's narrative network methodology to show concretely how work is done in each of the clinic and how different they were when we compare across roles and contexts. The Work Network perspective is especially useful as a conceptual and analytical lens as it not only sensitizes us to the different levels of work but also the interconnection among actors, artifacts and their actions. The Work Network perspective basically involves two steps of analysis. The first step of work analysis uses the narrative network method to

show how an organizational actor and their attending artifacts are connected in the course of carrying out its specific set of routines. The second step of analysis folds the first step up to a network level and trace how different actors and artifacts (e.g. paper chart) are related in carrying out key clinical processes within its unique context.

This is important as this set of analyses surfaces the existing organizational actors and artifacts as well as the current patterns of interrelating that occur in its context and through the process of work. In this chapter, I focused my Work Network and narrative network analyses on two key operational processes: the scheduling, registration and rooming of patients (WN1) and the patient communication (WN2) and the attending narrative networks that each role plays within the respective Work Network.

I observed that the two Work Networks and narrative networks are products of the work context such that each clinic has its own unique Work Network. I found that despite using similar organizational titles (e.g. medical assistants) and doing what was considered “standard” work (e.g. vitalizing of patients) each clinic’s role had its own unique narrative networks. Finally I also show that while the Work Network may be tailored to the clinic’s context, operational issues exist due to issues relating to organizational culture, human resource changes, infrastructural shortcomings, patient population and institutional factors. Just as the existing Work Network had to evolve and adjust to each clinic’s context, so would the new EMR system and its idealized Work Network configurations go through the process whereby it contends and adapts to the real working environment. I discuss this process in the next chapter on Tensions and Fitting work.

Chapter 7: Tensions, Fitting and Change

Introduction

This is the last chapter detailing the key findings of the dissertation. It covers how the new EMR system was received by the three clinics, specifically looking at the tensions that arose after the system was put in place and the fitting work that emerge in reaction to those tensions. Before I proceed to discuss the tensions and fitting of the EMR system, I first review the final EMR system configurations that had been decided during the DBV and RBV processes. I apply the narrative network as well as the Work Network analysis to these configuration – focusing on the two key processes that had been discussed in chapter 6 regarding scheduling, registration and rooming of patients and patient communications. The second section proceeds to discuss the tensions that arose as the “idealized” EMR configuration for these two processes replaced existing processes (W*N1 and W*N2). The third section captures the fitting work that emerged in reaction to the tensions within each of the site and the eventual Work Network and its attending narrative networks of each role. Finally I review the different organizational changes and outcomes in the three clinics that occurred after the EMR implementation.

Configurations of EMR

Using information from MATH’s “new” operations manual as well as the EMR project Visio documentation, I re-analyzed the configurations for the EMR as well as the workflow from a narrative network perspective. As there are a wide range of workflows and configurations, I chose to focus on the two key processes – the scheduling, registration and rooming of patients and the patient communication process. I first collated the information and rearranged them according to their narrative fragments/nodes. I then input them into the UCINet software to visualize the new narrative network. Next, I fold up the individual role’s narrative network into the Work Network to

show how these roles connect as production nodes. I discuss also some of the changes that are introduced by these new narratives.

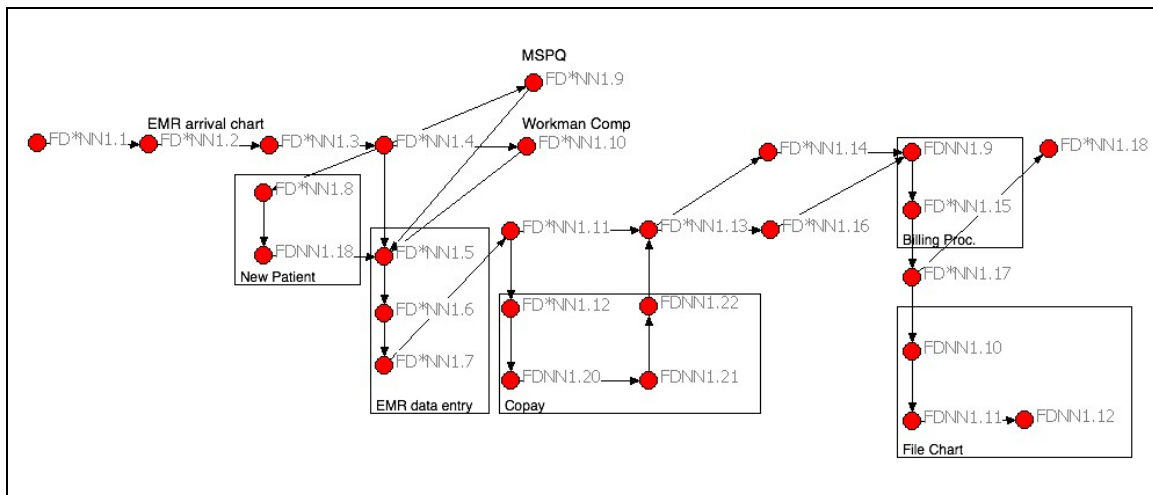
Redesigned Scheduling, Registration, and Rooming of patients (W*N1): The new EMR system had major impact on the way the Work Network for scheduling, registration and rooming of patients or WNN1. I shall refer to the new Work Network for scheduling, registration and rooming of patients as W*N1. First, I consider the new FD narrative (FD*NN1) and how that is changed in the EMR system. As shown by the figure below, the nodes without asterix are existing narrative nodes in the FDNN1 while the nodes with asterix depict new configurations within the EMR. The first change is the use of the EMR arrival chart to determine which patient to call from the sign in sheet (FD*NN1.2). The next change is that after the FD staff verifies the patient’s demographics, patients whose status requires additional information such as the Workman compensation or Medicare Secondary Payor Questionnaire (MSPQ) will have to be processed before moving to the next step. FD staff will be required to capture more information in the next few steps (FD*NN1.5-1.7) if the patient’s data is incomplete. The final change is the new printing and billing procedure where instead of encounter forms that are sent to the providers, only a billing facesheet will be printed (FD*NN1.16). Labels containing pertinent patient information will also print (FD*NN1.14). The FD staff has to collate the facesheet, labels and insurance card copy for billing reconciliation. The patient chart is still used to signal the patient’s arrival as well as a means to convey any other paperwork that were completed in the registration e.g. HIPAA forms, consent to treatment forms and labels.

Table 26. Narrative Nodes of New EMR Check-in (FD*NN1)

Node	Description of Narrative Node
FD*NN1.1	Patient arrives at clinic and signs the sign in sheet.
FD*NN1.2	FD uses the Department Appointment Report (DAR) to locate the patient.
FD*NN1.3	FD Staff calls patient forward to check in according to appointment time.
FD*NN1.4	FD will verify and update demographics.
FD*NN1.5	FD will verify and update insurance. Take copy of insurance card.
FD*NN1.6	Complete Encounter Info fields.

FD*NN1.7	Click Continue Check In, choose Patient Class and create HAR.
FD*NN1.11	Fill all fields required in EMR before patient can be given the status of arrived.
FD*NN1.12	Collect co-payment as appropriate. Refer to co-payment collection process.
FDNN1.20	FD writes up a receipt from receipt book for patient reflecting copay
FDNN1.21	FD collects copay from patient and swipe credit card at credit card terminal at FD 1
FDNN1.22	FD hands over receipt to patient
FD*NN1.13	Arrive the patient in EMR.
FD*NN1.14	One label will print.
FD*NN1.15	Place a label on the copy of the insurance card.
FD*NN1.16	The Billing Face Sheet will print.
FDNN1.9	FD collects Face Sheet from printer (behind their desks)
FD*NN1.17	Staple Face Sheet to the copy of the insurance card and place in the appropriate provider bin.
FDNN1.10	FD picks up paper medical record of patient from trolley (behind their desks)
FDNN1.11	FD files label and forms into paper medical record
FDNN1.12	FD places paper medical record in provider's rack (on a table behind their desks)
FD*NN1.8	If applicable, have patient sign a HIPPA form.
FDNN1.18	FD collects forms back from patient & document it in EMR
FD*NN1.9	Complete MSPQ for Medicare patients if applicable.
FD*NN1.10	Complete Workman's Compensation or Auto Accident information if applicable.
FD*NN1.18	Ask the patient to please have a seat and someone will be right with them.

Figure 28: Front-Desk Check-in Narrative Network (FD*NN1)



The next node that I consider in the newly designed Work Network is the Scheduling Node. In the current scheduling workflow, a phone operator gathers four key patient data: name, date of birth, social security number and gender to identify whether a patient is an existing or new patient. If the patient is new, these four data is used to create a new patient account and the phone operator proceeds to gather the appointment information i.e. reason for visit, visit type, provider to be seen.

Next the phone operator provides the patient with available appointment slots and completes the scheduling process when an agreed appointment date and time is set. This is depicted on the top figure (Figure 28).

In the new scheduling workflow, the phone operator is expected to do registration in addition to the existing scheduling work. This registration workflow consists of three levels: patient information, guarantor, and insurance coverages. According to the EMR project documentation, the patient information has four major components – patient demographics, employer, emergency contacts, and additional information. The guarantor information captures who the ultimate party is responsible for the patient’s bill and the insurance coverage captures the type of insurance coverage as well as other insurance related information. The patient information has about 22 fields for the demographics section, 16 fields for the employer section, 11 fields for emergency contact, and 8 fields for additional information. The guarantor section has 2 key input fields while the insurance coverage has four sub-sections each about 10-15 fields each. These narrative nodes are captured as PR*NN1.4-7. The other new inputs within the new system is PR*NN1.8 that replaces PRNN1.10 in that instead of a telephone encounter form that was filled up and sent to the medical records for a chart pull, the telephone operator has to send two separate electronic messages via the EMR. One is to the MA for triage and the other is to the medical records for chart pull. These details are captured in the right columns of Table 27 and Figure 29.

Table 27. Narrative Nodes for Existing and New Scheduling (PRNN1 & PR*NN1)

Existing		Configured	
Node	Description	Node	Description
PRNN1.1	Patient calls, PO take call	PR*NN1.1	Patient calls, PO take call
PRNN1.2	PO asks patient for name, DOB	PR*NN1.2	PO asks patient for name, DOB
PRNN1.3	PO verifies address, phone no., insurance	PR*NN1.3	PO creates new patient: name, DOB, SSN, gender, if it is a new patient
PRNN1.4	PO creates new patient: name, DOB, SSN, gender, if it is a new	PR*NN1.4	PO verifies and/or enters patient information

	patient		
PRNN1.5	PO asks for nature of complaint and provider	PR*NN1.5	PO verifies and/or enters guarantor information
PRNN1.6	PO asks if patient wants different provider if requested provider is not available	PR*NN1.6	PO verifies and/or enters insurance coverages
PRNN1.7	PO requests patient to call back later to request for appointment	PR*NN1.7	PO creates Hospital Account Record (HAR)
PRNN1.8	PO selects appointment time and date	PRNN1.5	PO asks for nature of complaint and provider
PRNN1.9	PO confirms appointment with patient and end calls	PRNN1.6	PO asks if patient wants different provider if requested provider is not available
PRNN1.10	PO writes TEF if patient has urgent needs and place it for MR	PRNN1.7	PO requests patient to call back later to request for appointment
		PRNN1.8	PO selects appointment time and date
		PRNN1.9	PO confirms appointment with patient and end calls
		PR*NN1.8	PO writes staff message and sends to MA if patient has urgent needs

Figure 29: Existing phone room operation narrative network for scheduling (PRNN1)

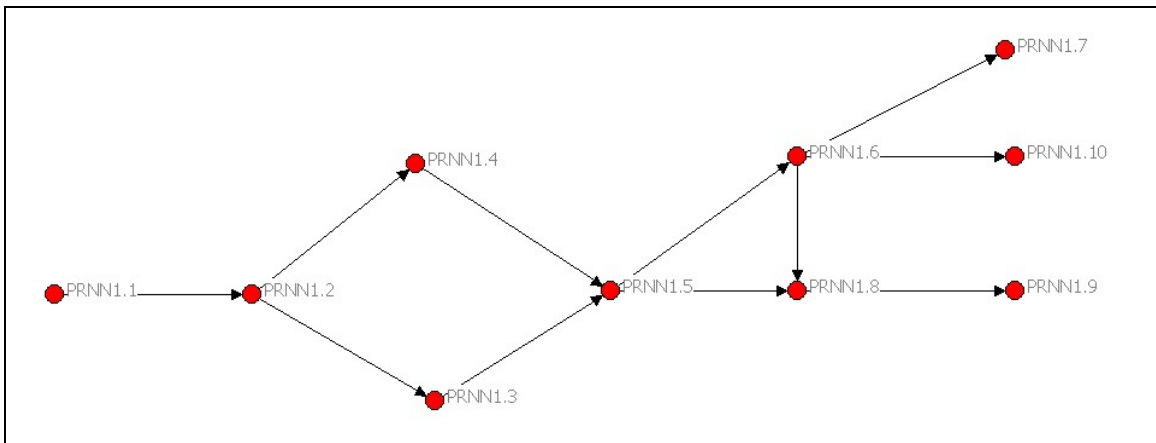
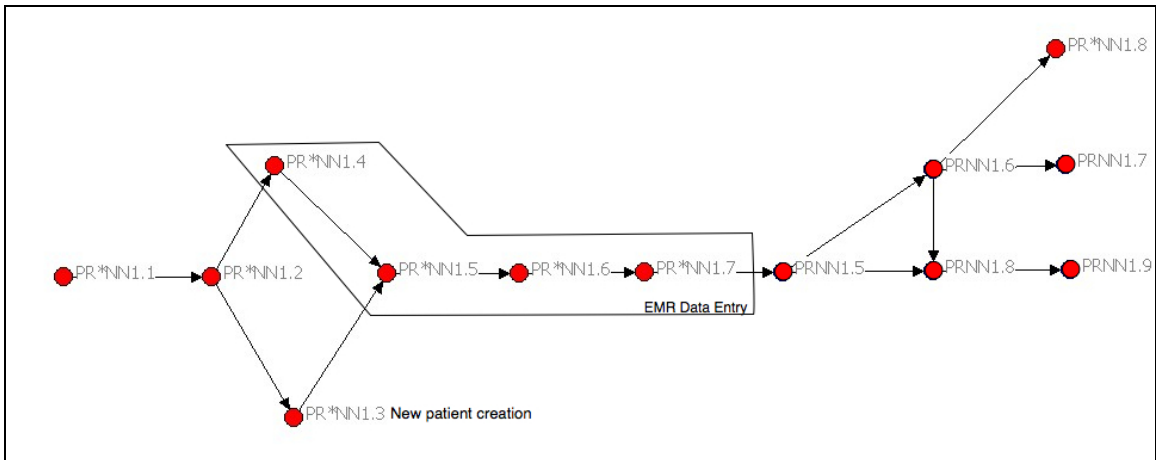


Figure 30: Ideal phone room operation narrative network for scheduling (PR*NN1)



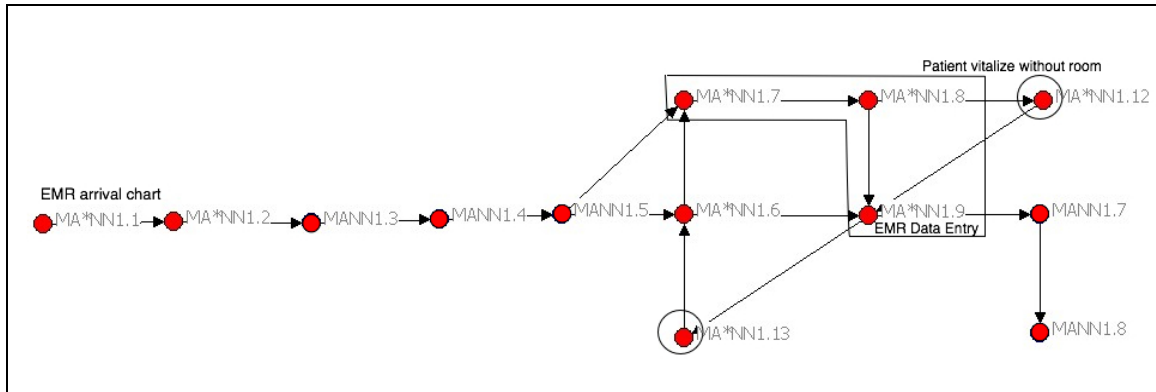
Finally, I consider the MA rooming node in the new configuration. From the Figure 30 I note that there is now the option for MA to vitalize patient information and capture that when rooms are not available. The main change of course is the use of EMR to document all vitals, chief complaints, and test results. But a minor but important subtle change is also the way in which MA are supposed to be alerted of a patient’s status. That is, they are supposed to check against the department schedule view rather than depend on the physical signal of a paper chart in the front-desk. They are also expected to prep for the patients based on available patient information within the EMR and anticipate some of the minor tests that can be conducted and completed prior to provider’s examination.

Table 28. Narrative Nodes of MA’s New vitalizing/rooming (MA*NN1)

Node	Description of Narrative Node
MA*NN1.1	MA/LPN will verify the patient status via the department schedule view within EMR -- arrived
MA*NN1.2	Review patient’s problem list in the EMR
MANN1.3	Gets patient's paper chart/paper from stack in FD
MANN1.4	Calls and escorts patient from Front Desk to Vital Station
MANN1.5	Vitalizes patient -- weight, height at the Vitals Station; get thermometer and blood pressure devices
MANN1.6	Rooms patient

MA*NN1.7	Log into EMR and bring up current patient; enter vitals and chief complaints
MA*NN1.8	Orders Point of care tests: takes and enters blood pressure, temperature in enter/edit results (incl. finger stick)
MA*NN1.9	Secure workstation
MANN1.7	Leaves room -- places paper chart on door shelf
MANN1.8	Updates Whiteboard with Patient's Initials against room number
MA*NN1.12	If room not available, put yellow dot against pt name
MA*NN1.13	Escort patient back to waiting room and brought back when room available

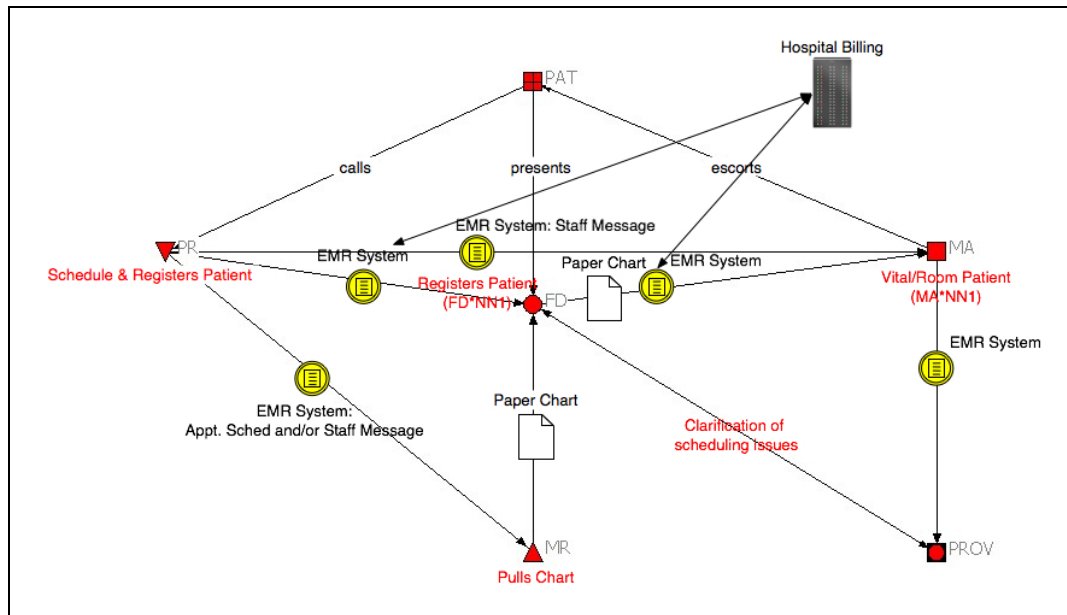
Figure 31: MA vitalizing/rooming Narrative Network (MA*NN1)



Putting these three changed narrative nodes together, the new Work Network for the scheduling, registration and rooming process becomes significantly altered (W*N1). The first main change in the W*N1 is the addition of another node – the hospital billing system. This addition is important since part of the design of the EMR is to integrate patient information across the various clinical locations of MATH. This addition accounts for the increase in data entry requirements in both the phone operator and front-desk narrative networks.

Another important change in the W*N1 is the replacement of artifacts linking the various nodes. In place of the paper chart and the old check-in system (CI system), we have the EMR system bridging all the communication, coordination and interaction between the nodes. I note however that the paper chart is still in use between the front-desk and the MA nodes. The linkage between the MA and the provider still relies on the whiteboard and/or verbal links but the EMR system plays also a large part in that communication.

Figure 32: New Work Network for Scheduling, Registering and Rooming Patients (W*N1)



Redesigned Patient Communications (W*N2): Similar to the scheduling, registration and rooming Work Network terminology, I shall refer to the new patient communications Work Network as W*N2. In the case of patient communications, I first consider how the phone operator and medical records narratives are changed for the different types of patient communications. For the phone operators all patient calls about enquiries about paperwork, prescription refills and medical issues used to be hand written on a paper form – the telephone encounter form. These are collated by the medical records staff (or equivalent in Beta clinic) and attached to patient charts. Correspondences from patients or other patient related entities (other providers, specialists or lawyers) go through the same process. Laboratory results that are faxed into the clinic are compiled in the same process. All these patient communication are then disseminated to the respective providers and MAs.

In the new EMR the process for correspondences remain unchanged but laboratory results are directly sent to the providers via electronic interfaces between the EMR and laboratory systems. Telephone encounter forms are now replaced by the staff messaging system (called the In-Basket⁹) and telephone operators have to enter all messages as specific staff message templates. These are found in the new W*N2 as PR*NN2. Telephone operators have to also send out a parallel staff message to the medical records for chart pulls so that the MAs and providers will have the paper charts to deal with these enquiries. Front-desk staff also have to use the in-basket system to send out patient messages to the MAs and providers.

For the MAs and the providers their respective administrative duties narratives have now become intricately inter-connected as I shall elaborate below. They have also re-scoped and re-designated some of the work for the MAs and the providers. While there were various patient communication as depicted in Chapter 6, I found that paperwork review remained unchanged as they continue to be done apart from the EMR system (PROVNN3.1 and MANN3.18 and 3.5). What had significantly changed were the processes by which the laboratory results and prescription refills communication were conducted. (See Table 29 and Figure 32 for provider's new administrative duties and Table 30 and Figure 33 for MA's new administrative duties).

In terms of the laboratory results, providers no longer need to wait for in its paper format following the paper trail. They are now able to get it direct in their In-Basket folder, very much like an email message but limited to laboratory systems as senders and the providers who initiated the laboratory test as receivers. Like before they can choose call the patient directly or assign it to the MA to advise the patient about the results (PROV*NN3.7) or follow up on information (PROV*NN3.10).

⁹ See chapter 4 for discussion about this feature

They can also choose to set up an appointment (PROV*NN3.8). But instead of assigning that to the MAs, they need to assign that to the Schedulers as MA do not have access to the scheduling system. They can also choose to not act on it and simply “done” the message if no further action is required (PROV*NN3.18). However in this new EMR environment, they can also choose to use template letters to send a letter based on the results and assign it to the MA to mail it out via the In-Basket. In the case of PROV*NN3.7 and PROV*NN3.10, providers are dependent on the MAs to gather and document the information in the quick-note or results notes before the encounter and “done” it on their end before the providers can “done” the encounter.

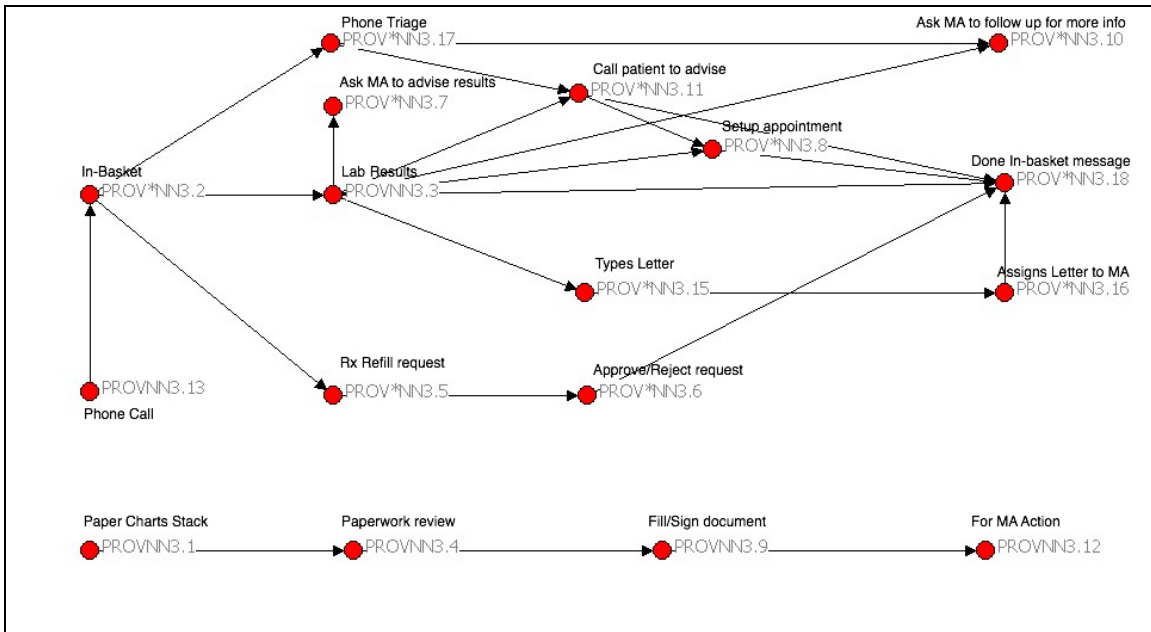
Table 29. Narrative Nodes of Providers’ New Administrative Duties (PROV*NN3)

Node	Description of Narrative Node
PROVNN3.1	Review PMR stack from medical records
PROV*NN3.2	Review In-Basket messages
PROVNN3.3	If Results: review results
PROVNN3.4	If Paperwork: review document
PROV*NN3.5	IF Rx Refill: review chart; enter Rx if errors or amendments
PROV*NN3.6	Approve prescription refill (or reject) via In-Basket
PROV*NN3.7	Assign MA to inform patient of results via In-Basket
PROV*NN3.8	Ask Scheduler to setup appointment via In-Basket
PROVNN3.9	Sign document
PROV*NN3.10	Assign MA to request for more information via In-Basket
PROV*NN3.11	Call patient to advise; use Tel. Enc.
PROVNN3.12	Leave paper chart on MA stack for action
PROVNN3.13	Phone Call or MA verbal communications
PROV*NN3.15	Types letter
PROV*NN3.16	Assign MA to send letter via In-Basket
PROV*NN3.17	If Tel. Enc.: review message
PROV*NN3.18	“Done” Result message

In terms of the prescription refills the request no longer go direct to the providers to review but routes to the MAs first as staff messages. MAs have to convert the staff messages into telephone/refill encounters and review the patient medical record to see if the request is valid (MA*NN3.3-3.5). If it is not in the patient’s EMR, the MAs has to call the patient to see if they would like to schedule an appointment and if so, they will transfer the patient to the schedulers (MA*NN3.10). If the requests are valid, the MAs are to tee-up the reorders, select the pharmacies

and send it as a in-basket message to the providers which initiates PROV*NN3.5.

Figure 33: Narrative Network of Providers' New Administrative Duties (PROV*NN3)



When dealing with prescription refills, they have to take an extra care when approving the requests (PROV*NN3.6). Given the new requirement that scripts sent to pharmacy with patients have to be on tamper proof paper, providers have to check if the prescriptions are for fax/phone-in or for pickup. Fax prescriptions are printed on standard paper while pickup prescriptions are printed on tamper proof paper. Providers have to sign these prescriptions and pass it on to the MAs (who would be notified via the in-basket) (MA*NN3.6).

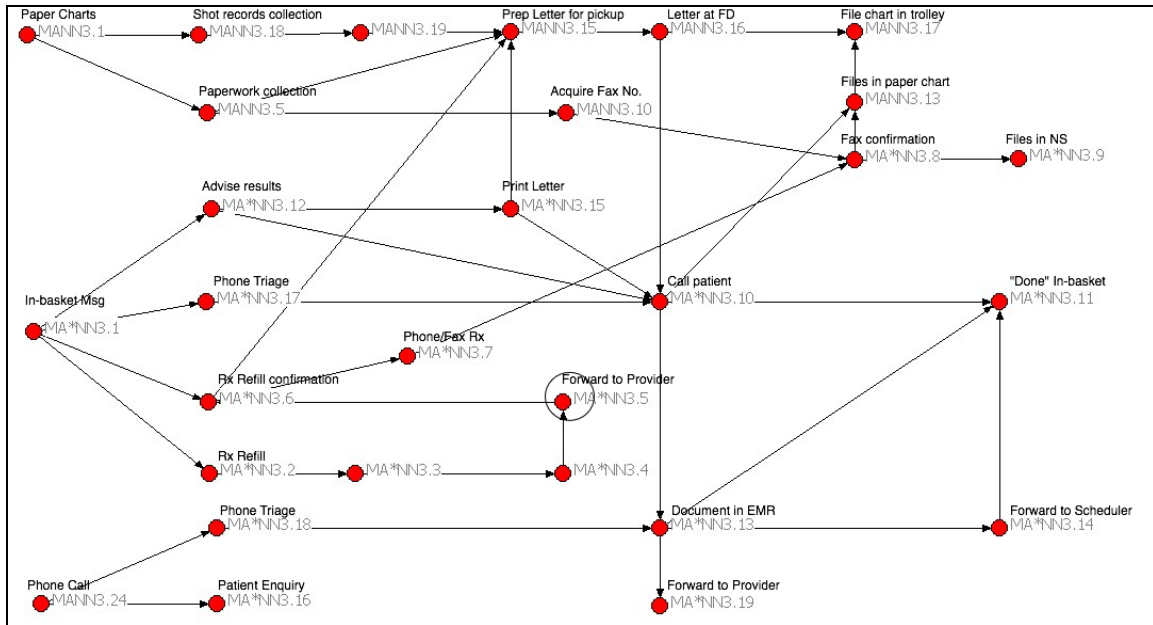
From the MAs' perspective handling laboratory results also require more work as it does not simply mean calling the patient but also having the additional duty of printing letters and prepping them for pickup. It also includes an extra step where they forward to the schedulers patients who require to schedule an appointment (either as a result of the laboratory result or in the case of phone triage – MA*NN3.18). Also from Figure 33 below, one can see that the MAs have to attend to not

just the paper charts and telephone calls coming in from the operators, they have to also attend to the EMR system's In-basket messaging as another "source" of administrative work.

Table 30. Narrative Nodes of MAs' New Administrative Duties (MA*NN3)

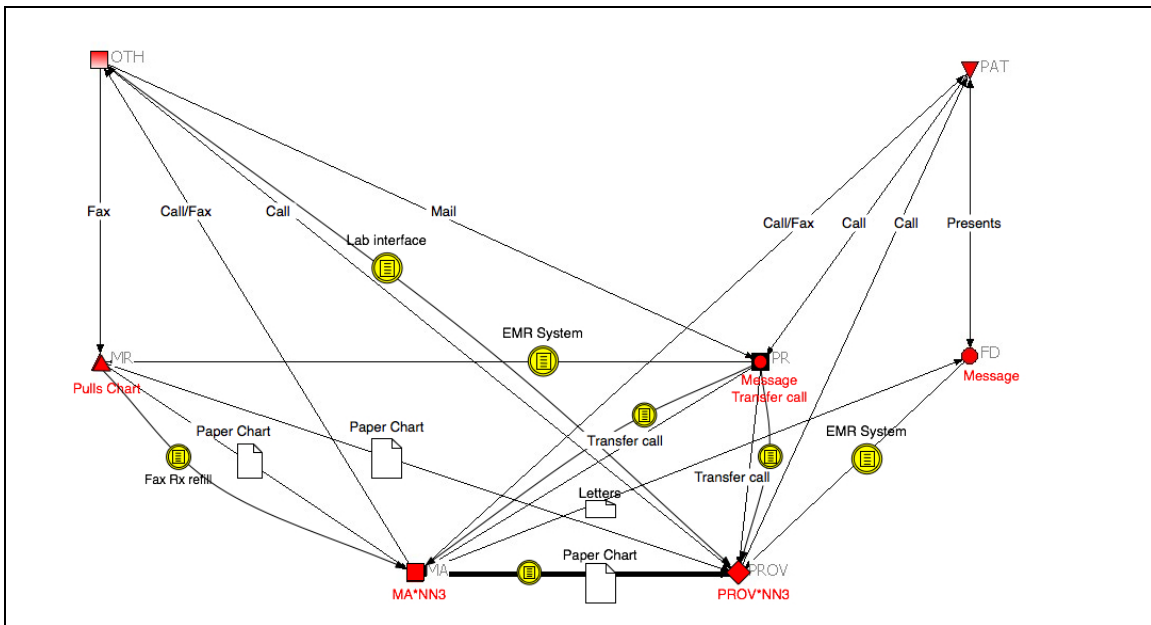
Node	Description of Narrative Node
MA*NN3.1	Review In-Basket messages
MA*NN3.2	If Rx Refill: convert staff message to telephone encounter
MA*NN3.3	Review patient chart
MA*NN3.4	Tee up Rx and fill up information
MA*NN3.5	Send in-basket Rx refill request to provider
MA*NN3.6	If Rx Refill approval: get printed scripts from provider
MA*NN3.7	Fax/Phone in Rx
MA*NN3.8	Collect confirmation of fax
MA*NN3.9	File confirmation with Rx printout at nurse station
MA*NN3.10	Call patient for pickup or follow-up or advise
MA*NN3.11	Done In-basket message
MANN3.13	Files into paper chart
MANN3.15	Prep letter (paperwork, controlled Rx, results) for patient pickup
MANN3.16	Leave letter at FD for pickup
MANN3.17	File paper chart into trolley/MR
MANN3.5	If Paperwork: Call patient to inform of collection
MANN3.10	Paperwork: if patient request fax; then acquire fax no. & fax
MA*NN3.12	If Results: Review provider's instructions
MA*NN3.13	Document information in quicknote/results
MA*NN3.14	Forward In-basket message to schedulers to setup appointment
MA*NN3.15	Print provider's result letter
MA*NN3.16	If Call-in Enquiry: take phone call and find chart or lookup information
MA*NN3.17	If Triage/TEF: converts staff message to telephone encounter
MA*NN3.18	If Call-in Triage: take phone call and start telephone encounter
MA*NN3.19	Forward In-basket to provider for decision
MANN3.18	If Shot records: fill it up
MANN3.19	Request for provider signature
MANN3.24	Phone Call
MANN3.1	Check PMR stack from provider or as prompted by provider

Figure 34: Narrative Network of MA's New Administrative Duties (MA*NN3)



When I put the new nodes together and consider the W*N2 we find that the network has increased in terms of the directions by which different nodes are connected. For example, as mentioned above the OTH viz. laboratories now have a direct connection to the providers and can bypass the MR totally. This allows the providers to act on the laboratory test results in a more timely fashion. Also the MA and providers also have a direct connection to the schedulers in the phone room apart from verbal communications. In this new Work Network, the MAs are restricted from the appointment/scheduling section and hence both parties have to forward in-basket messages to the schedulers to assist them in this work. Phone operators also do not need to send messages via the paper chart and can directly connect to either MAs or providers via the in-basket messages. More importantly, the link between the MAs and the providers is significantly stronger and complex as described above. This link is now supported by both paper charts and the EMR system's in-basket messages.

Figure 35: New Work Network for Patient Communication (W*N2)



Tensions in Alpha clinic

Tensions in W*N1: The main tensions concerned the phone operators and front-desk but also spilled over to the MA and providers' work.

Phone Operators: Phone operators/schedulers in Alpha clinic faced significant tensions when the redesigned W*N1 was introduced. In chapter 5, I had presented the process by which this design was introduced, negotiated and decided upon. The imperative from the management was to streamline the front-desk registration process such that required registration information would

have been captured prior to patient-front-desk encounter. The vision was to create a short and quick check-in at the front-desk. The way that would be done was to capture that information during the phone encounters when patients were scheduling their appointment with the provider. The vendor had claimed that it does not significantly increase the workflow for users and that it is a best practice that other clients have adopted. The reality for Alpha clinic is that prior to the new EMR system, the amount of information handled by the phone operators was minimal. The integration between the EMR and other legacy systems such as the hospital billing system had significantly increased the amount of data required for patient records.

As discussed above, the number of fields that a scheduler had to deal with increased from less than ten to around a hundred fields; the number of screens jumped from one-two to at least eight. The amount of time required for the additional narrative nodes (PR*NN1.4-1.7) was significantly higher than what the vendor and project team had considered. From my structured content observations, the duration of each appointment call increased from two minutes to six minutes during the first and second months after implementation (N=36). Together with the change in workflow Alpha clinic management and the project team had also implemented a highly reduced provider schedule for the first few months after go-live (i.e. number of available slots were reduced to 50 percent in the first month and 75 percent in the second month). This strategy was to allow for the staff, especially the providers, to get comfortable with the new system and workflows.

When one put together the increase in the work by the EMR design with high volume of patient calls as well as a reduced appointment schedule, the result was an aggravation of the existing operational issues faced in Alpha clinic's phone operators (see chapter 6's discussion about pre-existing problems of volume of phone calls and issues of patient access to appointments). The issue with the new narratives for the phone operators was not just with the additional steps that the phone operators had to take, it was a problem on the patient or callers' side as well. The new

narrative implicitly assumed that a patient would have access to all the demographics and insurance information when they are on the phone making their appointments. However this assumption turned out to be faulty since many of the callers did not have access or had difficulty accessing the insurance information (FN Alpha #22, #31). Other problematic situations include patient whose condition did not allow them to provide the details, wary patients unwilling to provide sensitive personal information such as social security number or insurance number to the schedulers, callers who were not primary insurance account holders and callers who were from other doctor's office making an appointment on behalf of their patients. In sum the reality of the patient-scheduler interaction and the above in practice issues create challenges for the schedulers to stick to the new narratives. The failure to follow the new narratives in turn "flowed" through to the front-desk narratives within the context of the new W*N1.

Front-desk: In the re-designed check-in narrative, there are 26 nodes as compared to Alpha clinic's actual 25 nodes. The shortest case involved 18 nodes or 17 steps. In this new FD*NN1, however, it is assumed that there would not be a need to search for charts and to verify the insurance. This was based on the design of using schedulers to get the information that will generate an insurance verification workqueue. A front-desk staff will clear the insurance verification workqueue prior to the patient's arrival. Moreover, FD*NN1.4-7 are designed such that they are mainly for verification and minor updates since these information have been collected earlier by the schedulers or are available in the hospital billing systems.

Because of the challenges faced by the phone operators/schedulers, there were many cases of patient data that were not completed at the scheduling stage. The system was configured with a limited number of "hard-stops" such that phone operators can continue to navigate through the scheduling encounter without having completed the data fields. This design was inscribed as both the EMR project team and vendor acknowledge that there may be cases where not information were

available (albeit the training curriculum tried to enforce the policy of completing a full registration). When information are not complete, the system generate a workqueue that the front-desk staff have to complete. At this stage, those incomplete data fields are made mandatory or “hard-stops” and it is the job of the front-desk staff to complete them. The end-result is that the FD*NN1.4-7 became a more data-intensive process than what had been previously designed.

Moreover due to a staff shortage, Alpha clinic did not “work” their insurance verification workqueue as planned (FD#54). Besides the shortage of staff, Alpha clinic management saw the workqueue as double work since many of their patients were on Medicaid plans that require same-day verification (CM#27, DS#32). Therefore the existing verification workflow (FDNN1.23 and 24) had to be incorporated to this new narrative network. New workflows were also included in the EMR whereby MSPQ and Workman Compensation cases had to be corrected into the system as the respective questionnaires or screens would appear once those patients were registered (FD 071023). This was unlike the old CI system that did not “force” the input of these data. Finally, I observed that the new EMR did not remove the need for patient chart at the front-desk as patient forms and labels are still “conveyed” via the paper charts to the back office.

The end-result is as one front-desk staff put it, “there is (sic) more steps, more to everything, more to check in, more to register.... The way it is now, we are just getting by above water and we know what to do. With the new system two, three steps are now seven, eight steps and more. It is supposed to help us be more efficient but I think it helps the backend – to help the billing and all” (FD 071023). From my observations, prior to the new EMR the average check-in and registration took Alpha clinic’s front-desk staff four minutes (N=174) to complete. After the EMR system, the average check-in and registration took seven minutes (N=131). Moreover, prior to the EMR system about 30 percent of the check in took more than five minutes, after the new system that figure jumped to more than 60 percent. Anecdotally one front-desk staff confirmed that by her own

estimating she needs at least five minutes to complete a new patient registration (FD #54). I observed many cases where the verification process adds up to ten minutes to the entire check in process (FN #37 080109). This does not account for the fact that the issue of missing charts still continues to create problems for the front-desk as well as the rippling effect on the MAs and providers since they also depend on partly on the paper charts (FN Alpha #24, #25, #31, #37).

MA/Provider: While the issues upfront do not directly affect the two nodes, they noticed that the system has not helped them in their patient flow. One provider commented “the registration step still takes a lot of time” (Dr G#55). In fact the provider personally felt that the registration “should be a lot faster” and wondered “why it is still taking forever for patients to come in.” They explained that because of the slowdown upfront the providers and MAs are being “pushed behind in their schedule” (Dr G#36). The overall effect is that the slow-down upfront created a backlog at the clinical side that together led to patients spending a longer time in the clinic. The laboratory assistant said, “By the time they (patients) reach me, they are ready to cuss me out.” (FD 080303).

Tensions in W*N2: While there is an increased tension for the scheduling, registration and rooming patients, the handling of patient communication also faced new challenges in the Alpha clinic. Specifically, there were issues arose concerning the prescription refills requests flows at both the front-end as well as the backend.

Telephone Operator/Medical Records: In the existing process, all prescription refill requests are sent via the fax and processed by the medical records staff (i.e. compiling them with the medical chart) who will then send it directly to the providers for approval. Telephone operators do not take prescription refill requests in the existing system (PR 080303). With the new system telephone operators are able to use the EMR to put a prescription refill request message and send it to the medical assistants. Medical records on the other hand have to key into the EMR In-basket system

the faxed-in requests before pulling the charts and sending them to the MAs. The situation in Alpha clinic is that the medical records staff have been struggling with missing chart issues as well as dealing with daily chart pulls for same-day patients. They also continue to under management's scrutiny with respect to their work attitude and efficiency (CM#27). In fact, according to the management patients have complained that their refill requests do not get done in a timely fashion (DS#32, Dr G#55). The lead provider mentioned that faxed requests use to "sit" in the medical records room and he may only see the requests weeks after it was sent (Dr W#31). Because these requests were not attended to in a timely fashion there were cases where a pharmacy sent five requests for three medicines. The other negative consequence was that some providers deal with these requests without the charts. That also creates problems with the pharmacies as the providers might have unintentionally refilled a prescription multiple times since they did not have the chart to refer to the history of prescription refills (Dr S#26).

The effect of enabling the telephone operators to send off prescription refills requests in this situation was a shift of prescription refill requests from the fax to the phones. According to the telephone operators, this started when patients called up to check on their prescriptions requests and found out that they could get their requests in by phone. Since phone messages were put directly to the clinicians, patients had their prescriptions refill completed earlier and they stopped calling their pharmacies for refills (PR 080303). Phone operators claim that they now handle a significant number of messages requesting for medication refills.

MA/Provider: For the MAs the main tension came from the route by which messages, especially prescription refill requests, were communicated to them. Previously, messages only come to the MAs twice a day – when the medical records person delivers the collated charts and messages. The MAs, who are attached to different providers each month, monitors the stack of charts in their particular provider. They usually work in their administrative duties in between vitalizing patients

and carrying out orders for their providers. In the case of prescription refills, the MAs do not have to deal with that unless the provider has reviewed it, wrote out the prescription on a pad and left it on their stack of charts. Their job was to either prep the prescription for pickup or to fax it out to the pharmacy (MANN3.2).

In this new narrative access to the patient's "electronic medical chart" is limited such that only clinical staff can add, edit or remove data from the patient's record. A telephone encounter and other prescription messages are considered part of this electronic medical chart as they are automatically added into the patient's record. As a result telephone operators and medical records staff do not have access to the chart and can only create staff messages concerning patient-related communication. In the DBV as well as the RBV¹⁰, it was decided that the MA would be in charge of converting that staff message into a prescription refill request and forward that to the provider (MA*NN3.2). This meant an increase in work for the MAs in this particular process. Not only so, the MAs have to continue to monitor their In Basket to see if the provider has approved or denied the refill requests so that they can act on it further. This continual monitoring of the In Basket in addition to working with existing stacks of paper charts (correspondences are still coming through the existing route) means that administrative work no longer comes to the MAs as it were in a "batched mode". As one MA points out,

"You don't have enough time to keep up with the messages. Not in this office, this office is too much, to read and write, and respond to those messages. Patient load is very high, with EMR, [there is] a lot of more stuff to do for one patient. Also with the EMR the messages are constantly send. Where do you find the time to take care of them? When you don't take

¹⁰ See chapter 4's discussion on In Basket design

care of these messages, they will become a work queue. And when that takes too long, we get into trouble. The work queue doesn't care about work done on the floor” (MA 071023).

The tension expressed by this MA is that of maintaining the balance between their clinical duties that are determined by the flow of patients and providers’ orders and their administrative duties. When it was based on the paper chart trail, the pressure on the MAs was not as intense as the flow was managed by the medical records routine. With the EMR, the administrative messages not only come through the medical records but through the phone operators as well – which may seem to them like an endless stream of work. This clashes with the demand of the constant stream of patients in Alpha clinic. Also the demands on the MAs with respect to the messaging are especially heavy as they are pooled and rotated among the five providers every month¹¹. There are also times when MAs are absent or on leave and as such MAs may cover for one provider today and switch back to their own on the next. The pooled MA structure in the new EMR created some confusion among the MAs as to how they would be able to keep track and handle messages for different providers (Interviews MA 071023, 071024). In the paper chart world, MAs were able to keep track of their work by simply taking the charts with them. As one provider points out, “when you have the chart you own it” (Dr G#22). In fact there were cases where one MA started working on a message and another MA came in and worked on the same message as well and that resulted in the encounter being left open without knowing that two MAs had been working on the same case (SC #28). As one senior MA reflected, “there’s a whole lot of messaging from one person to another to send something from here to there. You just go crazy” (FN Alpha #33). The bottom-line was that there was an overload of In Basket messages for MAs to handle.

¹¹ See Chapter 4 on the background of each clinic.

The tension around the prescription refills as well as the In Basket in general was not restricted to the MAs but the providers as well. Because the MAs were unsure with the In Basket messaging system, provider were sometimes encountering two to three In Basket messages requesting refills of medication for the same patient (Dr S#64 FN Alpha #28 071119). Moreover, some of the prescription requests were not completed correctly or had been abstracted incorrectly. Providers found themselves spending time to abstract and correct the prescription refills from the charts. As one frustrated provider point out, they have become a “glorified clerk” (Dr Ev#24). This is especially problematic when providers are still in the clinic trying to close their In Basket message while the MAs have gone home – unlike the paper charts world they depend on the MAs to close on certain messages before they can close their encounters (e.g. PROV*NN3.7). And like their MAs, providers also found themselves keeping an eye out on the In Basket trying to make sure that they are not behind on the messages (Dr Ev#39 Dr S#26). In fact, during my observations, it was not uncommon for providers to compare with each other how many uncompleted In Basket messages they have in their In Basket and making comments like “your box is worse than mine” (FN Alpha #24, #26) or for MAs to overlook arrived patients as they are caught up with clearing the In Basket messages (FN Alpha #31 071126).

Table 31. Summary of Tensions in Alpha Clinic

WN/NN		Specifics of tension
1	W*N1 at PR*NN1	<ul style="list-style-type: none"> - Increased workload (PR*NN1.4-1.7) - Unable to gather information - Increased phone access problems (longer call durations)
2	W*N1 at FD*NN1	<ul style="list-style-type: none"> - Insurance information not available due to PR*NN1 - Increased workload as missing information are hard-stops at FD (FD*NN1.4-7) - Longer registration duration
3	W*N2 at PR	<ul style="list-style-type: none"> - Shift of Rx refills request from fax to phones due to slow down at MR
4	W*N2 at MA*NN3	<ul style="list-style-type: none"> - Prescription refills requests now comes directly from PR and MR via In Basket - MA*NN3.2 requires them to convert staff messages to tel. encounters i.e. additional steps - Constant pressure to monitor In Basket as well as clinical duties - Complicated In Basket monitoring process due to overlapping

		work with different providers over the months
5	W*N2 at PROV*NN3	<ul style="list-style-type: none"> - Increased dependence on MA to close encounters (PROV*NN3.7) - Increased work to verify abstracted prescription requests - Constant pressure to monitor In Basket as well as clinical duties

Tensions in Beta clinic

Tensions in W*N1: The tensions in the new Work Network 1 for Beta clinic revolved around the phone operators and front-desk, similar to Alpha clinic’s experience.

Phone Operators: The front-desk staff that are doubling up as phone operators in Beta clinic did not face as much challenge as their counterparts in Alpha clinic albeit they had experienced a slight increase in the duration taken for appointment calls (around 1-2 minutes more per call) and faced similar resistance by patients to provide information over the phone (FN Beta #13). This is due to changes in the original EMR scheduling narrative network that had been introduced in Alpha clinic. I shall discuss the “fitting” work that took place with respect to the scheduling narrative in the “Fitting work” section below. [Note emergent change from Beta clinic schedulers FN Beta #13]

Front-desk: As discussed above the new check-in narrative had 26 nodes with an additional 2 nodes for insurance verification. For Beta clinic’s check-in narrative, they only had 17 nodes and their normal check-in took only 9 steps (or 10 nodes). The new check-in doubled Beta clinic’s current practice (FN Beta #13). It is no surprise that the average check-in and registration in Beta clinic increased from three minutes to five minutes (Nprior = 51, Npost = 35). Not only did the new narrative include more steps that require data verification and entry, the new narrative also changed one of Beta clinic’s practices where patient’s billing encounter form and patient labels were printed prior to the registration. Now the front-desk staff prints the billing face sheet and labels at point of registration (FD*NN1.14, FD*NN1.15, and FD*NN1.16) – these necessarily add time to the registration process.

In addition to the scheduling and registration, the new EMR also adds a new narrative for Beta clinic's front-desk staff – the narrative of checking-out with the After-visit summary. As discussed in chapter 6, Beta clinic did not practice any checkout at their front-desk. This allowed their staff to have the ability to double-up as medical records as well as phone operators. Now the front-desk staff not only continue to carry out those duties, they also have to keep track of checkouts. Patients who have been coming regularly to Beta clinic were also not used to this fact. Beta clinic's front-desk staff who works mainly on the medical records and the phones said, "Time management is going to be a big thing as there is just a lot more to add like seeing every patient out while I have to pull and file charts, answer calls, and open mail" (TR #42).

Further, the new "fitted" scheduling narrative has shifted the insurance registration to the front-desk as well as the insurance verification workqueue. In Beta clinic's this was something new since they did not have to call to verify any of patients' insurances unlike Alpha clinic's practice (TR #42, JM #47). Like the checkout narrative and other new things, the verification workqueue and insurance registration imposed greater load and scope on the front-desk. With the phones still ringing in the background and two calls put on hold, a Beta clinic phone operator told me "it's going to be like that from now on. There's just too much things to do" (FN Beta #13). The effect of Beta clinic's W*N1 therefore reduced the efficiency at the front-desk like Alpha clinic even though they did not have the high patient volume. Their main tension came from the organizational structure that placed multiple roles on a set of personnel.

Tensions in W*N2: While tension in Alpha clinic's over the new patient communication work arose from the shift of requests from medical records to phone and from provider/MA (mis)communication, the tension in Beta clinic formed around existing "positive" practices and the breakdown of working interfaces.

Visibility of work: The EMR In Basket messaging system was designed to replace the paper messaging system currently in place. Beta clinic's practice manager saw the EMR In Basket as a way to "make sure we have detailed documentation, make sure that communication flow smoothly, so there's not a chance for a message to be dropped" (SL#33). The management's view is that the front-desk operators' job is only to "take a correct message, gather the bare bones information and send it to the person it should go to" (SL#33). While it is true that the new W*N2 created a new infrastructure for messages to be communicated between the phone operators/front-desk staff and the clinical staff, it also imposed specific barriers among these roles such that work and information did not flow as freely as before. According the Beta clinic's staff the existing practice was that phone operators were able to assist the clinicians in some patient enquiries such as whether a patient's refill request had been filled. This was possible since Beta clinicians documented their prescription refills in the charts and the front-desk staff had access to the patient's medical records (FN Beta #14, SO#58, JM#61). Beta clinic front-desk staff complained that with the In Basket messaging, they would not know "what happened to their message that is, what the provider said or what the MA is doing with it" (FN Beta #14).

The issue is complicated by how MA's read and "done" their messages. The flow of message is that once a MA reviews the staff message for a prescription refills, they tee it up and sends it to the provider for review. MAs can "done" the staff message once they reviewed it even though they may not have tee-ed up the request or that the provider has not approved the request (FN Beta #14, #19). There were cases where the phone operators attempted to assist the clinicians by advising the

patients according to the status of their staff messages – but they found later that in fact the refills had not been completed. The result was some unhappy patients and more work for the phone operators who had to counter-check the messages with the MAs (FN Beta #14). As one frustrated front-desk puts it – “done is not done” in the EMR In Basket system (TR#60).

The flip side of the communication and coordination issue in the new work was also true. For example, now that clinicians do not have access to the scheduling system they have to depend on the front-desk for all patient related demographics and appointment work. Clinicians now complain that they do not have a feedback on their requests for patient scheduling or even demographics change. In comparison to the paper chart practice, clinicians can at least see if the message is received by the presence or absence of the paper chart on the front desk tray (Dr P#51, #69).

The barriers to the visibility of work is not limited to barriers between front-desk and the clinicians, they also limit visibility between front-desk staff. From observations, there were several cases where one front-desk staff would take call from a patient and fail to assist with the patient enquiries as they could not see the messages taken by other staff (FN Beta #16, #19). The front-desk staff had to verbally communicate with each other on those cases or follow up with the practice manager who had access to the staff In Baskets. A workaround that emerged from this situation was that phone operators resorted to putting the other phone operators on the cc list of each staff message they create. This allows the other phone operators to “know what each other had dealt with so that we can cover for each other” (TR#60).

Therefore while the initial idea of the EMR In Basket system was to better the clinic’s communication flows, Beta clinic’s lead (sole) provider saw that the result proved to otherwise. He commented:

“The way that the practice was run (previously) was pretty efficient. I think we had enough

time to spend with the patients and we can get our work done efficiently. And we could easily access information – the front could access it – so it saved the physicians as it kept (us) efficient for the most part ... With the new system only certain people have access to certain parts and it makes it difficult for cross activity. The EMR helps places that are disorganized but does not help a private practice that is running efficiently. In fact it adds burden to them.” (Dr P#69).

Not only did the system made it challenging for the staff in Beta clinic to view and assist each other’s work, it also created new bottlenecks at the MA and provider nodes. For instance, the phone operators now forward all enquiries to the MAs via the In Basket staff message or by phone transfer. But just as the Alpha clinic MAs had difficulty to toggle between clinical work that was at hand and administrative work that piled up in the In Basket, the MA in Beta clinic experienced the same dilemma. The end result was increased patient dissatisfaction due to reduced patient communication (FN Beta #19). Beta clinic’s MA explains:

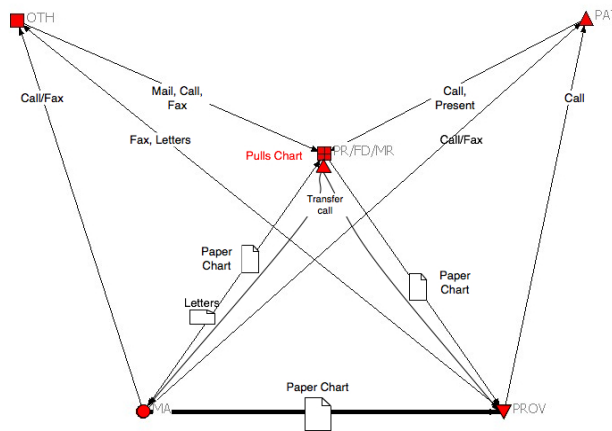
“Well, they (patients) do get frustrated because they say, ‘Well, how come you didn't call me back?’ I say, ‘Well, sir, I was suppose to call you back but I was kinda of busy with the other patients and I have other prescriptions on the phones too’” (SO#58).

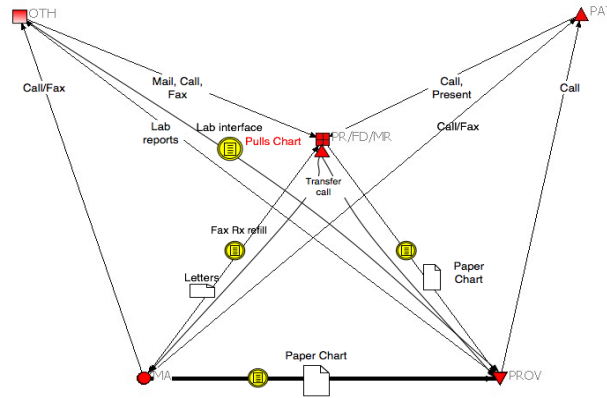
Laboratory Results Interface Issues: Beta clinic also faced unique issues with the new automated link between the external laboratories and the provider’s In Basket. Unlike Alpha clinic that worked almost exclusively with one laboratory provider, Beta clinic sent their patients to two large laboratories. This structure required the EMR to be interfaced to both laboratory’s result systems. The initial interface setup in Alpha clinic had experience little hiccups and the EMR project team believed that the second interface work had progressed equally well. However after Beta clinic’s February go-live, Beta clinic’s provider began experiencing problems with the lab result messages. Specifically, he found that the different lab tests ordered for one patient returns as separate

messages in his In Basket (FN Beta #14). Not only that, he found that some messages lagged others so for a patient that has four tests, he may get three results first followed by the last one several days later (Dr P#51).

Although this was surfaced to the EMR project team, this problem persisted all the way through my period of observations (three months post go-live). The provider complained that this reduced his ability to provide patient care since he could have provided patients with incomplete advice and information given the way results were coming back to him. He gave me an example where three of the results had returned normal but the last test came back abnormal. If he had acted on the first three, the patient would have had cause for concern when a second call comes from the clinic about the last abnormal test result (Dr P#51). He also found that the direct messages are not faster than the paper results that he gets via the fax. As a result, Beta clinic continues to rely on paper results that come from the labs in addition to the direct result messages (FN #19).

Figure 36: Beta clinic's WN2 vs. its final W*N2





Others: Although the communication between the MA and provider changed with the new In Basket communication and workflow, the one-to-one assignment allowed the clinical team to develop a set of tacit understanding to deal with the questions arising from the various messages. For example, the MA said that in certain routine cases, she goes ahead and advice patients directly and inform the provider verbally concerning the advice as well as document that directly into the chart. This reduces a series of staff messages concerning such cases (SO#58). On the front-desk end they found that while their previous work of pulling charts has reduced significantly due to the ability to put in messages directly in the system, they have new workload of typing faxed-in prescription requests.

Table 32. Summary of Tensions in Beta Clinic

WN/NN		Specifics of tension
1	W*N1 at PR*NN1	- Unable to gather information (not insurance information due to fitting work) - Faced similar longer call durations
2	W*N1 at FD*NN1	- Increased workload as missing information and insurance info. are hard-stops at FD (FD*NN1.4-7) - Longer registration duration - Changed patient's billing encounter and labels print-out (FD*NN1.14-16)
3	Checkout	- New work narrative
4	W*N2 at PR*NN1 & MA*NN3	- Rx refills requests and messages now sent directly from PR via In Basket (PR*NN1) - PR and MA do not have visibility of completed Rx (MA*NN3.6) - Constant pressure to monitor In Basket as well as clinical duties (for MA*NN3)
5	W*N2 at PROV*NN3	- Lagged individual lab result messages create confusion

		(PROVNN3.3) - Additional steps needed log in & sign-in - Constant pressure to monitor In Basket as well as clinical duties
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Tensions in Gamma clinic

Tensions in the W*N1: Unlike the other two clinics, Gamma clinic has only one staff performing both the phone operator and front-desk roles. The changes that were introduced with the new W*N1 significantly increased the workload and scope for that single staff. Like Beta clinic, Gamma clinic enjoyed some of the fitting-work that had taken place after Alpha clinic but because there is one only staff the tensions introduced by the new narrative are inescapable when the clinic is running full-steam. As the front-staff puts it:

“It gets a little long when I am busy. For example I am checking in and checking out, verify insurance, I get setback at times. Like the other day, I have had an incident where three docs were in, the phone was ringing off the hook, and I was checking in and checking out. It was just crazy” (AD #59).

As documented in chapter 6 Gamma clinic operate as a highly “informal” environment where patients and clinical staff have cordial relationships and where staff frequently do favors for patients. I have described how the front-staff is able to recognize patients by face and check them in with less or no wait-time. One observer mentioned that in this clinic “the patients drive their workflow” (FN Gamma #15). While Gamma clinic verify all insurance prior to visits, patients who have Medicare are used to the fact that they don’t have to present their insurance card each time they come for their appointment (FN Gamma #13, #22). They also do not conduct the MSPQ as required by the Medicare and Medicaid rules. Finally Gamma clinic like Beta clinic had usually prepared their billing encounter forms prior to patient visit, now they have to both print that when a patient checks in as well as the patient label (FD*NN1.14 and 16). The fact that they have to all

these additional steps e.g. make a copy of the insurance card (FD*NN1.5), print labels and forms, and conduct the MSPQ (FD*NN1.9) as part of the new Work Network necessarily makes the check-in and registration longer than before. From my structured observations I found that pre-EMR check-in averaged around 1 min while post-EMR check-in averaged 4 min (Nprior=15, Npost=40). A point of note concerning the increase in Gamma's check-in time is that they continued to collect any co-payment from the patients (FD*NN12, FDNN20-22) during checkout and not during the check-in (FN Gamma #16). If I were to add that to the average time duration, Gamma's check-in time would average around Beta's five minutes.

Apart from the occasional slow-down during registration and scheduling the informal culture that has been ingrained in Gamma clinic also created tensions for patients who were used to dropping by for laboratory tests. Apparently, during the early period after the EMR go-live patients had come in to Gamma clinic for blood work or shots and went directly to the MAs. They left after that was done but their visits were not captured in the EMR (FN Gamma #14, #15). The management "discovered" the "gap" in the workflow and had issued directives to ensure that the lab-only registration narrative process is reinforced with the clinic staff and the front-desk staff. The management also discovered that Gamma clinician conduct blood pressure checks for elderly patients who frequent the senior center (Gamma clinic is housed with a senior center) (FN Gamma #14). Again the management asked that this process be reigned-in under the new EMR check-in workflow. Finally, Gamma clinic's main patient base are geriatric patients and they found that executing the specific questionnaires like MSPQ and capturing pertinent registration information to be challenging as well (FN Gamma #16). Patients also expressed unhappiness over the new requirements for check-in and registration for procedures (FN Gamma #16).

Tensions in the W*N2: The main bottleneck in Gamma clinic, however, was with provider documentation and the In Basket messaging (viz. prescription refills). Although this tension

superficially resembles Alpha clinic's tension, the source of the tension resides more with the providers' rather than the MAs. While Alpha clinic saw MAs juggling between clinical and administrative duties, Gamma clinic's schedule allowed MAs to have sufficient time to deal with their administrative (FN Gamma #19). Furthermore, Gamma clinic's providers prefer to handle most of their own patient communication (letters) and this also reduces the amount of administrative work (MANN3.24, MA*NN3.17, MA*NN3.12 etc.).

Providers and MAs: The providers however were negatively affected in their work after the EMR implementation. First, according to the providers, their patients being more elderly also suffer from more chronic conditions and therefore require more time for examination. As one provider put it, "it's impossible for me to see a patient that's older in 15 minutes, even without the computer. But now with the computer it's really impossible" (Dr A#73). Second, the system demands that each order that a provider gives has to be associated with a diagnosis as recommended during the DBV and RBV. While this may be easily executed for patients with normal ailments, Gamma clinic patients are "complex" and usually have several ailments that require several medications (FN Gamma #26). According to the Gamma clinic provider they feel like they have to "take 15 steps to do one prescription" and "they have to put one in and then go back and associate another one and put that in" (PD #70). So what used to take the provider five minutes to do now takes 15 minutes (PD#70, Dr A#73) and a normal 15-minute appointment may even take up to 45 minutes (Dr A#73). "It is a lot more involved, a lot more work" (PD#70). Finally, the providers feel that as a result of being overwhelmed by the system, their patient care quality has suffered. The lead provider sees themselves as "hooked to the computer, just taking notes, just feeding it into the system without communicating with the patient" so much so he wonders "when he can fit in the patient exam" (Dr M#74).

Because the providers are backed up with their own patient exam documentation, it leaves them

little time to get to the In Basket messages for prescription refills and phone triages (FN Gamma #26). One MA reflected that now it takes “20 times longer to get a patient’s medication refill” and the messages with the doctors are “falling to the wayside” (MA#72). They now have to “hound the doctors” to tell them to do their messages, to clean out their In Basket and get all the scripts, otherwise the providers only attend to them at the end of the day (FN Gamma #26). They compared the current system to the previous paper chart process – whereas previously they brought the paper requests to the providers’ desk and it would be completed by the end of the day, now they have to reconcile prescription refill requests with the EMR history (and follow up with paper chart if there are discrepancies) then tee it up for providers but not be able to get that approval till two to three days later. For the lead provider, the issue with prescription refills is even more salient as he is only at the clinic for three days a week and not always available to sign off on the prescriptions (FN Gamma#22). Like their Alpha clinic counterparts, Gamma clinic providers spent significant time abstracting medication information into the EMR, which adds on to the total time (FN Gamma #26).

Infrastructure Breakdowns: Another contributing factor to Gamma clinic’s slowdown is also its aging infrastructure. Prior to EMR implementation, Gamma clinic’s network and workstations have been unstable (FN Gamma #1, #12). While it was an inconvenience it did not directly impact the day-to-day clinical work. Post EMR implementation Gamma clinic’s infrastructure remained unstable despite attempts to upgrade the wireless LAN and workstations. In this phase the unstable infrastructure was no longer just an inconvenience; it posed a major challenge for work to be done with the EMR. For reasons to be discovered workstations were slowing down so much so that users were forced to continually reboot their system (FN Gamma #16, #23, #20, AD#59). Without working workstations Gamma clinic staff were forced to wait for the system to come on line before carrying out the orders and other In Basket messaging.

Table 33. Summary of Tensions in Gamma Clinic

WN/NN		Specifics of tension
1	W*N1 at FD*NN1	<ul style="list-style-type: none"> - Insurance cards not available at registration - Increased workload as missing information are hard-stops at FD (FD*NN1.4-7) - Changed patient's billing encounter and labels print-out (FD*NN1.14-16) - MSPQ requirement (FD*NN1.9) - Longer registration duration
2	W*N1 at FD*NN1 (lab only)	<ul style="list-style-type: none"> - Patients not accustomed to registration and visits not captured in system
3	W*N2 at MA*NN3	<ul style="list-style-type: none"> - MA*NN3.2 requires them to convert staff messages to tel. encounters i.e. additional steps - Constant pressure to monitor In Basket as well as clinical duties
4	W*N2 at PRO*NN3	<ul style="list-style-type: none"> - EMR documentation increases duration of examination given complex medical conditions - Increased work to create, abstract and verify prescription requests; slowdown in completion of requests - Constant pressure to monitor In Basket as well as clinical duties

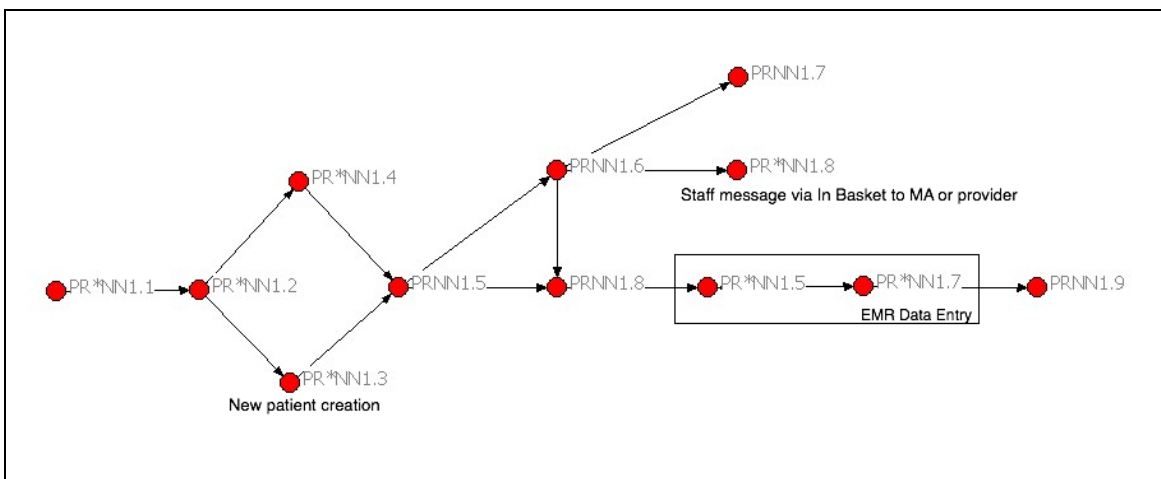
Fitting Work

For every action there is a reaction, so goes one of physics' classical laws. In the three clinics and the MATH organization I observed the same phenomenon in that there were a series of reactions at individual and organizational levels to the tensions created by the new Work Networks. In the IS literature, Gasser (1986) discusses the notion of "fitting" to describe these reactions. Fitting refers to an organizational adaptation process and is defined as "activity of changing computing or changing the structure of work to accommodate for computing misfit" (pg. 214). It is similar to what organizational literature refer to as "improvisations" (Weick, 1993, Orlikowski 1996, Ciborra 1997) where they are described as "emergent, ongoing and continuous" and are "situated accommodations and adaptations" (Orlikowski 1996, pg. 66). However, I chose to use fitting as my vocabulary to describe the reactions as it is more specific in describing what the organization does and it also captures the roles of the actors and artifacts while improvisations focuses more on the agency of the actor and is more vague as to what exactly is changed. I discuss below the main fitting

work that were observed with respect to some of the tensions mentioned earlier.

Fitting the scheduler in W*N1: It became apparent very quickly to the users that the design of full registration at the point of scheduling was untenable in Alpha clinic (CM#21). During the first two weeks the phone operators had made an effort, under the guidance of the EMR project team, to stick to the proposed operational procedures. But when more exceptions occurred (e.g. patients not willing or able to provide the required information), the phone operators began to skip through the insurance steps (PR*NN1.5 and 1.6) (FN Alpha #31, #39). Phone operators also realized that the design flow where registration occurred before scheduling is problematic. There were cases where a scheduler had gone through the entire registration process with the patient and found that there were no available appointment slots (FN Alpha #31). This led to a revised narrative where schedulers went to the old steps first (PRNN1.5-1.8) and then attend to the data entry later (FN Alpha #24). In short, the individual schedulers began to “fit” the new narrative network to the patients as well as the system. They attempted to fit to the patient by removing (avoiding) nodes that did not apply and to reorder the nodes to provide the patient with the output they needed.

Figure 37: Revised phone operator’s scheduling (PR*NN1)



The management also slowly realized that the tensions surrounding the scheduling node had to be managed as the lines were backed up and patient dissatisfaction was growing (JR#65, DS#66).

They acknowledged that they had to compromise the new design flow (DS#32) and drop the need to gather insurance information (CM#57). However, the management continues to see this as a “best practice” that “they ultimately want to be” but will require “more staff, more practice and getting used to” (FN Gamma #14, JR#65). This new “policy” went into effect for Alpha, Beta and Gamma clinics and allowed the schedulers to execute a shorter narrative network (See Figure 36 above for the narrative network of new policy). The management at MATH also began to re-look at the number of compulsory data fields required for the demographics section (FN Gamma #14) as some of that is relevant for the hospital setting and not pertinent for the ambulatory clinics (Minutes research meeting 071129). This observation captured the process by which individual users “fitting” work become instituted at the organizational level as senior management also engaged in “fitting” work at their level.

In terms of the order of scheduling, it remained idiosyncratic to some Alpha schedulers as management did not take note of this practice and it did not create enough attention for the local management to surface it as an issue. However in the Beta clinic roll out, the Beta clinic schedulers had very quickly decided to switch the flow of scheduling by using a previously unused function – “walk-in” registration (FN Beta #13). This function allows a scheduler to start the registration process from the provider’s schedule screen rather than the patient demographics screen. But the schedulers in Beta clinic were used to work from the schedule screen in the old CI system and had asked the EMR project team for that particular function. Although the EMR project team member provided that information, they did it reluctantly and cautioned the Beta clinic schedulers against this flow. Their main concern was that schedulers may avoid the demographics and other data entry section totally and create more work-queues for the registration flow. When this was raised as an issue with the local and MATH management, MATH management reacted surprisingly positively to this “emergent” workflow. After observing the Beta clinic scheduler at work, the MATH management team considered documenting this new workflow in the Standard Operating Manual

as it allows patient to have their appointment slots first while the schedulers gather other patient information (EMR Project Documentation EOD 080211). This was however agreed upon after the EMR project team decided to build compulsory links between the appointment section and the patient information sections (FN Beta#15).

The “fitting” work in this case was not so much tension among production nodes as tension between existing practices and the new practice within a user/node. Here fitting work involved surfacing new functions within the artifact as well as changes made to both organizational practices (Manual) and EMR system (EMR project team’s tweaks). I also observe in this case of how individual fitting work evolves into an organizational routine when management is made aware of and agreeable with this fitting work.

Fitting the front-desk staff in W*N1: The consequence of “fitting work” for schedulers i.e. to remove the need for full insurance registration is that this work is shifted to the registrars/front-desk staff. In the case of Alpha and Beta clinics, this meant that front-desk staff has to process the insurance information when patients present and conduct the verification as needed when it falls into the verification work-queues. This is what the EMR project team was referring to when they say it is a “pay now or pay later” scenario (Minutes Walkthrough Meeting 070822). For Alpha clinic front-desk staff, they continued with the new narrative network with the additional verification and insurance information gathering nodes. They also ignored the insurance verification workqueues as there was not enough staff to work them. The result was longer registration time as noted above. (See Figure 37). Beta and Gamma clinic’s front-desk staff followed the same “strategy” as Alpha clinic during the early part of the EMR implementation. But after some time, they realized they could capture some of the patient information simply by referring to the existing patient charts and update those portions when patients presents (FN Beta #24, TR#60, JM#61 FN Gamma #18, #22, #24). (See Figure 39 for Beta clinic’s new registration

narrative network). This enabled both Beta and Gamma front-desk staff to reduce their check-in duration.

On its part, the Alpha clinic management also enforced new operational policies that attempted to reduce the tension at the front-desk. One of these policies was the decision to send the paper charts from the medical records directly to the nursing stations instead of the front-desk (FD Alpha #40, #41). According to Alpha clinic's practice manager there was no longer a need to have the chart in the front-desk since patient arrival is visible on the EMR's department schedule. Furthermore, neither the billing facesheets nor the patient labels are required by the clinical staff which means that the front-desk does not need to convey any paperwork via the paper chart. The exceptions were for new patients when they need to send back a new chart with signed forms. In the new Work Network, front-desk staff no longer need to concern themselves with paper chart and therefore remove the narrative nodes of searching or calling for missing charts. Alpha clinic management hopes that the result of this "fitting" work will be "less the steps for the front – where they had to get up and put the chart and also forces the nurse to look at the provider schedule in the system and not wait for a paper chart to come up so patients aren't left out in the waiting room when they don't see a piece of paper waiting for them" (CM#57). See Alpha clinic's final W*N1 in Figure 38.

Figure 38: Revised Alpha clinic's front-desk registration (FD*NN1)

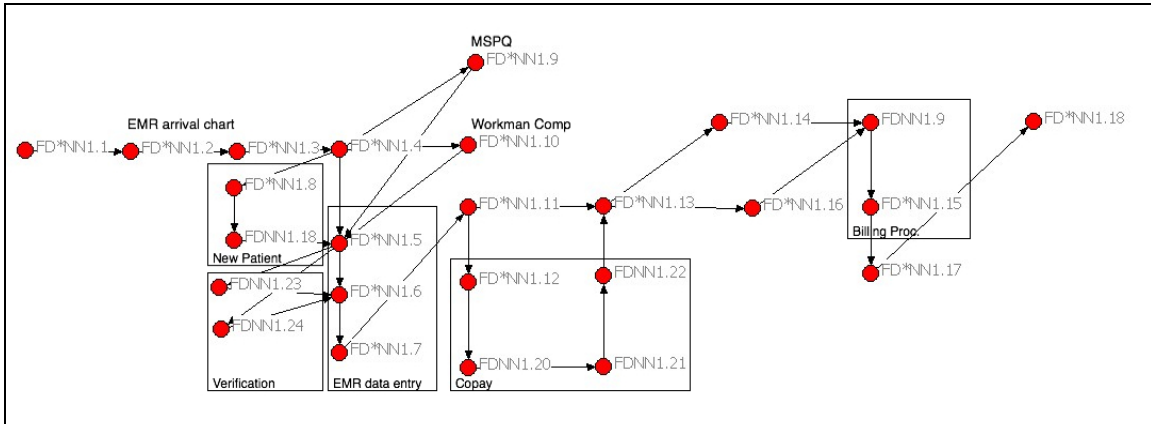
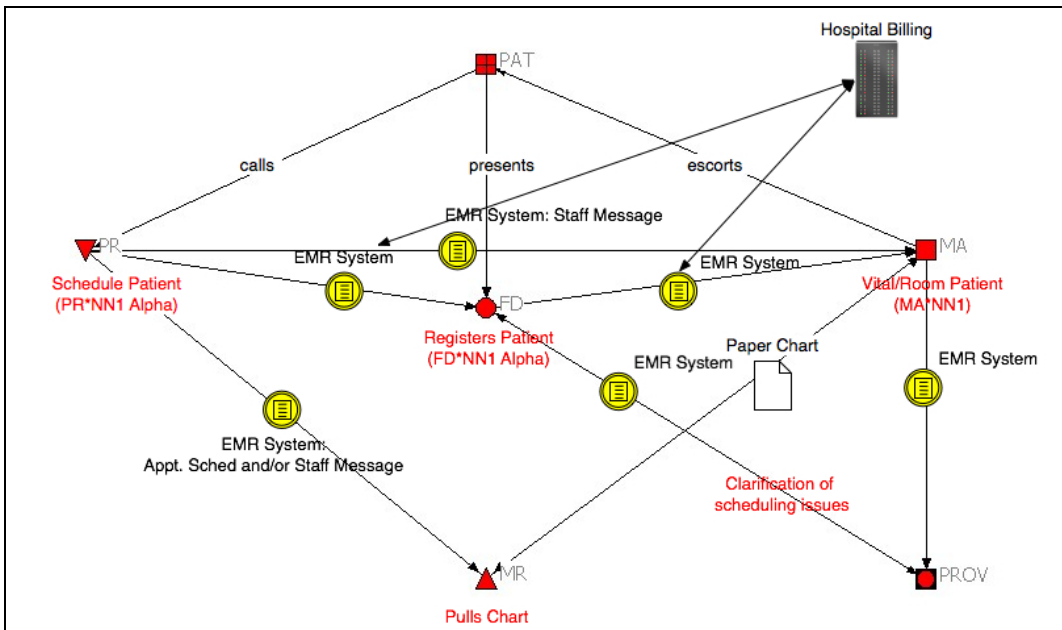
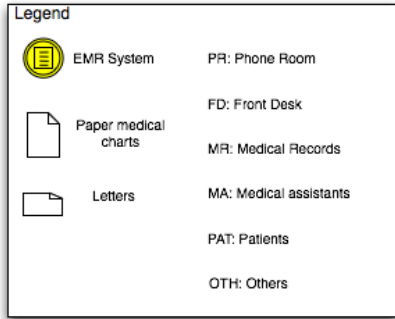


Figure 39: Alpha clinic's final W*N1





In contrast to this formal “fitting” work in Alpha clinic, Gamma clinic’s front-desk staff was found to engage in informal “fitting” work (see Figure 40). Specifically, I observed that when she executes the MSPQ node (FD*NN1.9), she would enter the answers to the questionnaire without referring to the patient (FN Gamma #16, #18). When I asked her about this, she explained that a) MSPQ is common step for her as Gamma clinic has a significant number of geriatric patients on Medicare, b) she found that only two questions really matter – whether the patient is over 65 or qualifies for disability, c) patients usually are unable to answer the rest of the other questions (AD#59). Given her experience, she has adapted it such that she “asks the questions I need and save my time ... if I know they are over 90 something years old, I am not asking if they are entitled to Medicare” (AD#59).

Figure 40: Revised Beta clinic’s front-desk registration (FD*NN1)

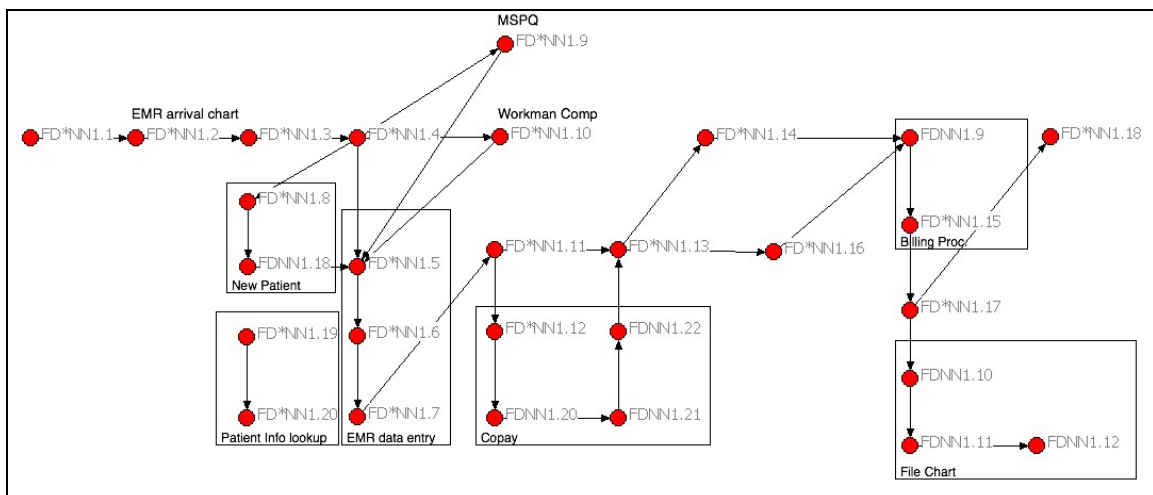
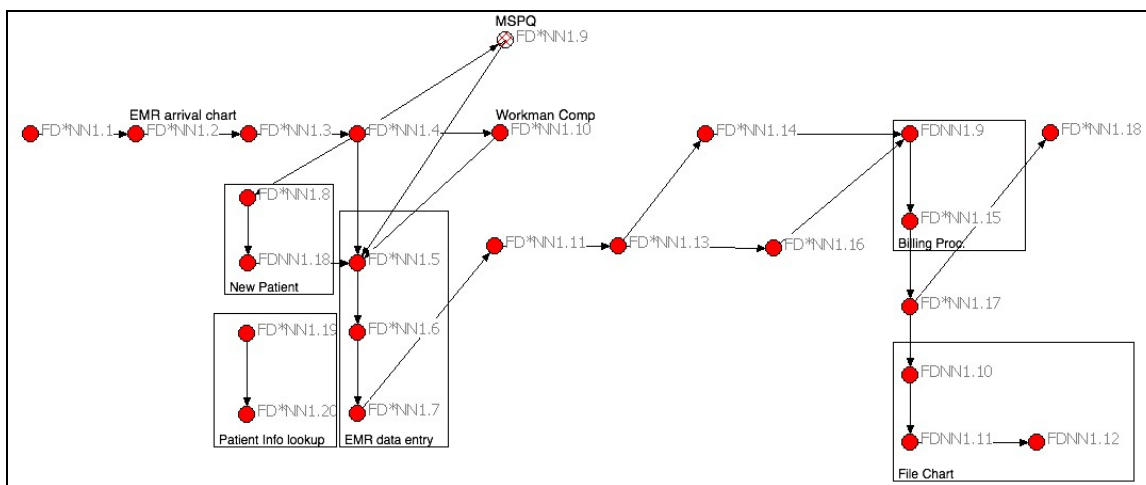


Figure 41: Revised Gamma clinic's front-desk registration (FD*NN1)



All the fitting work – both formal and informal – typifies workarounds or articulating work that assists to make the main narratives flow smoothly. The inclusion of additional work e.g. insurance verification and updating of information from charts, the removing of additional steps e.g. moving paper charts out of front-desk, and the creation of short-cuts e.g. entering MSPQ based on personal knowledge of patients are all important fitting work that arose from the tensions at the front-desk.

Fitting the medical records staff in W*N2: Given the problems associated with Alpha clinic's medical records role in the new Work Network for patient communication, Alpha clinic's management decided that it made operational sense for all prescription refills (via phone and fax) to be consolidated at the MA's end. The logic behind this new "fitted" network is a) it reduces one step in the flow of faxed prescription refill requests (goes direct from fax to MA without going via the staff message route), b) it removes the bottleneck of the medical records data entry and lessens the load on the medical records node, and c) it potentially removes duplicate requests that might have come via a patient's phone call and via the fax from the pharmacy (on behalf of that same patient) (FN Alpha #40). This new operational flow however is idiosyncratic to Alpha clinic and I did not observe the standardization of this practice across the other two clinics (See Figure 41 for

Alpha clinic's final W*N2). The reason could be that the medical records and phone operator roles overlap in both Beta and Gamma clinics and hence it makes less sense there to consolidate the fax at the MA when it is consolidated at the Phone Operator node.

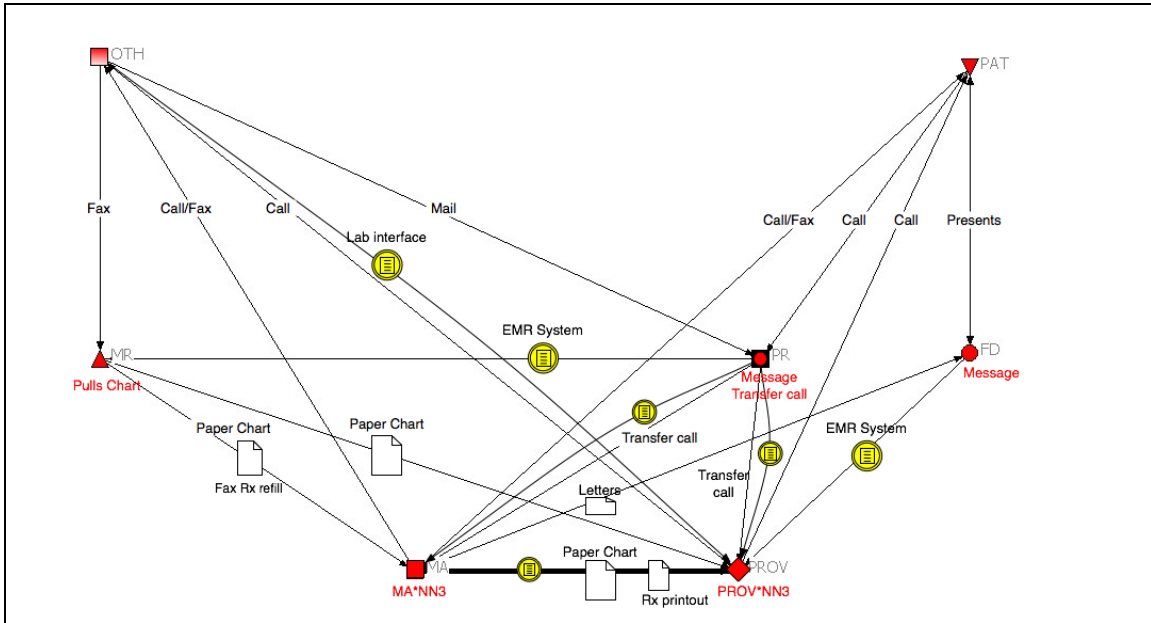
Fitting the MA-Provider in W*N2: The confusion among providers and MAs over the flow of In Basket messages concerning prescription refills and orders was partly resolved by “fitting” work that was enabled through the EMR system. According to the medical director and Alpha clinic's lead provider, the high number of In Basket messages was partly due to a partial understanding of how the workflows worked in the new EMR system (Dr S#26 Dr W#31). Once the providers and the MAs understood when they should close a chart and when they need to co-sign a chart. Providers and MAs also developed verbal communication with respect to the In Basket messages coordination so that each party knows when to get to the In Basket messages, what are the priority of messages, what messages require specific In Basket actions (Interviews Dr G#36, Dr EV#39, YV#55). An “extreme” example of this coordination work was the case of Alpha clinic's lead provider who decided that he would not send an In Basket message to his MA after he approves a prescription refills requests. Instead he will close that requests, print the approved refills, sign it and physically hand it to his MA (FN Alpha #32, #33, Dr W#31). He claims that this helps reduce his MA's In Basket clutter and at the same time reduce one step for his own workflow (see figure above where MA-Provider nodes are also inter-linked by prescription printouts). In Gamma clinic's case, the MAs have adopted the role to push the providers to be timely in their prescription refills.

Besides working closer with each other and developing a work style that took into account the new dependency between the MA and the provider, Alpha clinic management realized that they could strengthen that by implementing a new MA and provider arrangement. According to the staff, the management decided that it would replace the pool MA structure where MAs rotated among

providers on a monthly basis to a fixed MA and provider structure – akin to Beta clinic’s structure (FN Alpha #37). This new structure was welcomed by most of the staff, especially the providers (Dr G#, FN Alpha #38). The providers and MAs both claimed that this structure allowed them to develop a better rapport so that they can anticipate and coordinate the Provider-MA administrative and clinical work (Dr G# 55, YV#55). In other words, the fitting work here concerns the tacit and explicit coordination and communication between the MA and provider and organizational structure that facilitate the development of that tacit and explicit coordination. (See Figure 41 where MA and provider nodes are linked by a thick black line).

Providers also have to engage in fitting work to meet the requirements of the EMR system. Specifically, providers had to readjust the way they document and exam patients. In the paper chart system, providers typically follow the S-O-A-P i.e. they document the (S) ubjective, (O) bjective aspects of the exam and then document their (A)ssessment and (P)lan (or orders). They found that in order to discharge the patient and initiate the MA order flow, they are constrained to document their assessment and plan before documenting the subjective/objective exams (Dr W#31, Dr EV#39). Some providers decided to only document skeleton notes of their diagnosis and examination and complete their electronic documentation after the patient leaves (Dr P#51).

Figure 42: Alpha clinic's final W*N2



Finally, one other fitting work concerns an EMR function –the prescription reprint function.

According to Alpha clinic staff this function was designed such that a MA can initiate the reprinting of a previously approved prescription. The logic behind this function was so that MAs can provide patients with these reprints in cases where patients misplaced or lost their prescriptions. It helps streamline the administrative process since MAs do not need to go through the entire process of tee-ing up the prescription for approval. The process was secured by the fact that providers have to co-sign these reprint instructions (MA 080306). MATH management on reviewing this process considered this function to be a compliance risk and decided to remove that function totally.

Instead, the new policy is that all prescriptions from the system (be it new or refills) need to be filed by the MA for seven days. During this period, any requests for reprints of prescriptions will be given the paper prescriptions in the file. Requests made after the seven days had to be placed into the system as a new prescription refill request (CM#57). This rejection of this system based fitting work created unhappiness among Alpha clinic MAs as they now have to keep more paper and do

redundant In Basket messages. Clinical staff in Beta and Gamma clinics were not provided with the reprint function/button after this policy was implemented. They similarly complained of the redundant steps required for lost prescriptions and orders (Dr P#69).

Table 34. Summary of Fitting Work in all three clinics

	Tension	Fitting the Work Network	Fitting the Org./Tech.
Alpha clinic			
1	Scheduling pressures	Avoided PR*NN1.5-6 Sequence reversed (PRNN1.5-8 moved in front of EMR entry)	Revised policy on full registration; Reviewed compulsory fields
2	Front-desk registration and workqueues	FD*NN1.4-7 more data intensive; Ignored insurance verification queues; Lab only removed	Removed paper chart flow from FD
3	Phone operator and MR prescription refill work	MR sends all fax Rx refills to MA	N.A.
4	MA administrative duties	N.A.	Verbal comm. and knowledge of EMR functions; Rx reprint function (later removed)
5	MAs and Providers interactions	PROV*NN3.18 avoided (use Rx printout to signal close)	Dedicated 1-1 MA-Provider assignment; Changed documentation style
Beta clinic			
6	Scheduling pressures	Adopted new PR*NN1 as per Alpha clinic	Used “walk-in” function; Compulsory links for function
7	Front-desk registration and workqueues	Ignored insurance verification queues	Use existing paper chart information to complete workqueues
8	Checkout	N.A.	Reminders to patient of check-out; new staff hired
9	Accountability and visibility of work in W*N2	N.A.	FD use cc field to provide access to staff messages; FD forwards all calls and enquiries to MA
10	MAs and Providers interactions	MA advises patient and close enc. (skips MA*NN3.19)	Revert to paper lab results
Gamma clinic			
11	Front-desk tension	MSPQ (FD*NN1.9) short-cut; Copay (FD*NN1.20-22) shifted to check-out	Notices and letters to remind patients of new policy
12	Providers’ documentation	N.A.	MA constant verbal reminders to provider on Rx requests; Use of new whiteboards for additional communication between MA-Provider

Organizational Changes and Outcomes

Planned changes

Information access and flow: Based on the DBV and RBV notes, two of the key aims of the EMR system was to provide “a seamless access to clinical information” and promote transparent flow of patient information across the MATH organization¹². I found that in general there was across the board consensus that the EMR system had improved patient information access for providers and MATH management. The medical director for the three clinics listed the following improved documentation access and how they impact on the quality of patient care: a) legibility of documentation – it improves not only provider access to their own notes but more importantly enables their colleagues who covering for them to also read their notes, b) access to patient messages and lab results – previously only very urgent messages or patient results were attended to but now providers via Virtual Private Network (VPN) connections can access and attend to all messages and react to them from home or other clinical sites, and c) referral process – referral orders are now associated with provider diagnosis such that referral coordinators are more efficient in processing referrals with little or no clarification with providers (Dr S#64). Other providers in Alpha clinic echoed these observations albeit providers in Beta and Gamma clinics were more reserved concerning these “improvements” (Dr W#31, Dr G#36).

The more significant improvement in terms of information access and flow is the “availability” of patient charts for the three clinics, especially for Alpha clinic. Unlike previous situations where the absence of paper charts create problems for provider-patient exams, current ability to access the electronic version of the patient chart have more or less ameliorated this problem of missing charts. Especially with repeat patients, most providers do not need to rely on the paper charts for their

¹² Refer to chapter 5 for more details.

examinations (Dr W#53, Dr S#64, Dr P#69). This ability to rely more on the electronic patient chart has also provided some operational efficiency since staff report that they now spend less time searching for charts (e.g. MB#52, Dr EV#52, CM#57).

Other staff also claim that the EMR system has improved their ability to document and retrieve patient information. MAs in Alpha clinics were impressed by the immunization documentation tools in the EMR. A senior Alpha clinic MA said, “In the past when patients wanted their shot records I had to check the paper charts, find the paper records and copy out all the relevant dates. Now I simply go into immunization records in the electronic patient chart and print it” (MB#52). Others found the access to laboratory results to be equally helpful (YV#55) while some found that the telephone message templates improved the quality of phone messages (Dr S#26)

Improved accountability: In addition to information access and flow, the management had also envisioned the EMR initiative to standardize workflows across its different clinics and improve the patient experience. These principles translate to creating a standard set of operational policies and increasing the clinics’ efficiency and accountability. Alpha clinic’s lead provider saw the EMR program as a subtle way to change the “culture of inefficiency and promote consistency”. As he puts it: “It is hard to turn the Titanic but since the Titanic is turning we can use that momentum to make a more efficient office” (Dr W#19). Indeed, most of the staff found that the EMR system’s In Basket messaging system increased each other’s accountability. The management in Alpha clinic tracks the efficiency of the medical records staff and MAs through the In Basket messages (Dr W#31, DS#32). The MATH operational team had set down the policy that all In Basket messages (except for request for paperwork and prescription refills) should be cleared by the end of the work-day (DS#32). MAs and the Front-Desk staff report that they can now hold the provider accountable to the messages using the same In Basket system (MB#52, YV#55). On the flipside, providers have better awareness of their message and therefore able to respond in a timely manner

(Dr S#64). Other users in Beta and Gamma clinics also reported the increased accountability via the EMR's In Basket system (AD#59, TY#67, MA#72).

Interestingly, the practice managers also reported that the In Basket messages allow them to hold patients and internal staff accountable (CM#57, SL#68). For example, Alpha clinic practice manager says, "When patients call I can go right to the records to see what happened. It cuts down on running around looking for charts, for a note" (CM#57). Practice managers can now easily run reports as well as get In Basket messages when providers do not close their encounters – this allows them to keep constant tabs on the billing process within the clinics (CM#57, PD#44). In sum, the EMR system has brought in a whole set of tools to allow the clinics to monitor their work and for the management to hold the staff accountable – a first step towards enforcing standardization and drive efficiency in the system.

Emergent changes

While some aspects of the clinic operations changed as planned, I observed one key emergent change in the clinic – that is the shift in work from one part of the Work Network to another.

Specifically, the most salient shift of work was from both the front-desk and the providers to the MAs. As discussed earlier, the EMR effectively enforced barriers between the front-desk/phone staff and the clinical domains such that these staff no longer have access to any clinical data. The effect is that front-desk and phone staff transfer patient calls to MAs instead of directly assisting the patients. However MAs usually have to juggle these calls with the clinical work as well as other administrative duties. One of Alpha clinic's MA expresses her frustration, "Now the front-desk staff just asks the MA, 'Is the Rx done?' But by the time I get to the patient on the phone the patient is mad 'cause they have been put on hold for long while" (MA 080306). This situation was not limited to just Alpha clinic – I observed the same issue across all three clinics (e.g. FN Alpha #35,

Beta #17, Gamma #22).

Provider work has also been shifted to MAs especially with respect to the prescription refill process. Gamma clinic's practice manager observed that "there is a lot more work on the MAs with prescriptions as our older patients require a lot of prescriptions ... it really stretches them" (PD#70). So in addition to more calls to deal with enquiries about prescriptions and other results, MAs have to work on more steps to process prescription refills.

The other shift of work occurred in the front-desk/scheduling. As discussed earlier due to the real pressures of scheduling as well as the constraints set by patients and callers, it forced the management to compromise on the design of the scheduling and registration workflows. The net effect of this shift is that patients experience longer durations for both scheduling and registration processes. To reduce that front-desk staff and schedulers in Beta and Gamma clinics engage in additional fitting work. This was not observed in Alpha clinic given that they operate medical records separately from the scheduling and registration operations and that the medical records deals with a larger patient base.

Other key emergent changes are those captured under the "fitting" sections – such as the restructuring of MA-Provider in Alpha clinic, short cuts in check-in in Gamma clinic, and the use of paper lab results in Beta clinic.

Outcomes

While I had attempted to understand how the EMR system affected the financial aspects of the three clinics, the management in MATH and the three clinics were reluctant to provide concrete details and reports. They cited the fact that they had reduced the schedule for the three clinics during the first few months after the implementation so as to allow the providers and staff to

acclimatize to the new working environment. The medical director did go on record to say that they had actually lost less revenue for both Alpha and Beta clinics than what they had budgeted for. He is hopeful that when they are actively using the EMR system at full steam that they will see improvements in their bottom line (Dr S#64). The Network director commented that by virtue of the reduced schedule they definitely had lower volumes for the clinics but the revenue captured from the lower volume was higher and that made up for some of the anticipated loss. She believes that in the long run they should have a positive impact as the EMR system allows for faster turnaround in terms of pending claims and posting of bills to the system (DS#66). A key caveat is that Alpha clinic was at the sixth month after its EMR go-live while Beta and Gamma clinics were at their fourth and third month after going live on the EMR system.

In terms of other metrics such as paperwork turnaround – the clinics have different perspective on how the EMR had affected them. Alpha clinic believes that their paperwork turnaround has improved with the increased access to the messages and charts as well as accountability (Dr W#31). Beta clinic considered themselves to be efficient prior to the EMR system and that they have remained efficient despite the EMR system creating more work in the paperwork process (Dr P#51). Finally Gamma clinic definitely considers themselves to have dropped in their paperwork turnaround capability (PD#70).

Finally, in terms of operational efficiency I found that the front-desk operations have indeed slowed-down. From the Figures 42 and 43, we see that the time taken for check-in and registration has increased for all three clinics after EMR and the time taken for MAs to room patients has also increased. The latter metric reflects not so much handover issues but more of the overall slow-down in the flow of patients through the clinic as MAs may have increased the wait-time to room patients due to increased provider documentation and examination time as well as increased administrative work. What is interesting for Alpha clinic is that their wait-time i.e. the time patients wait between

signing-in and registration has reduced. One main reason for this is the reduced need to search for charts, which translated to increased front-desk coverage as well as the visibility of patient arrival in the EMR system. This is less of an issue for Beta and Gamma clinics as their charts are usually prepped prior to visits.

Table 35. N of observations for the Front-Desk Metrics

Clinic\Metric	Prior to EMR			Post EMR*		
	Check-in	Wait-time	FD/MA H/O	Check-in	Wait-time	FD/MA H/O
Alpha	174	100	70	131	85	49
Beta	51	37	32	76	59	47
Gamma	15	7	14	84	79	50

*Alpha clinic was sixth month while Beta and Gamma clinics were fourth and third month post EMR

Figure 43: Front-Desk Metrics (Prior to EMR)

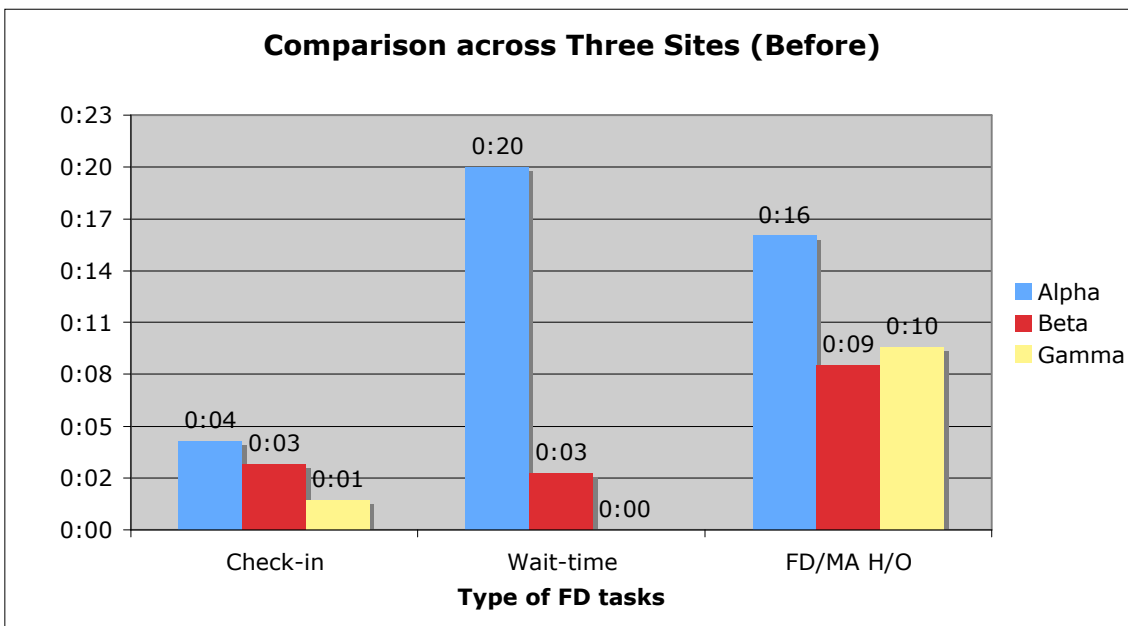
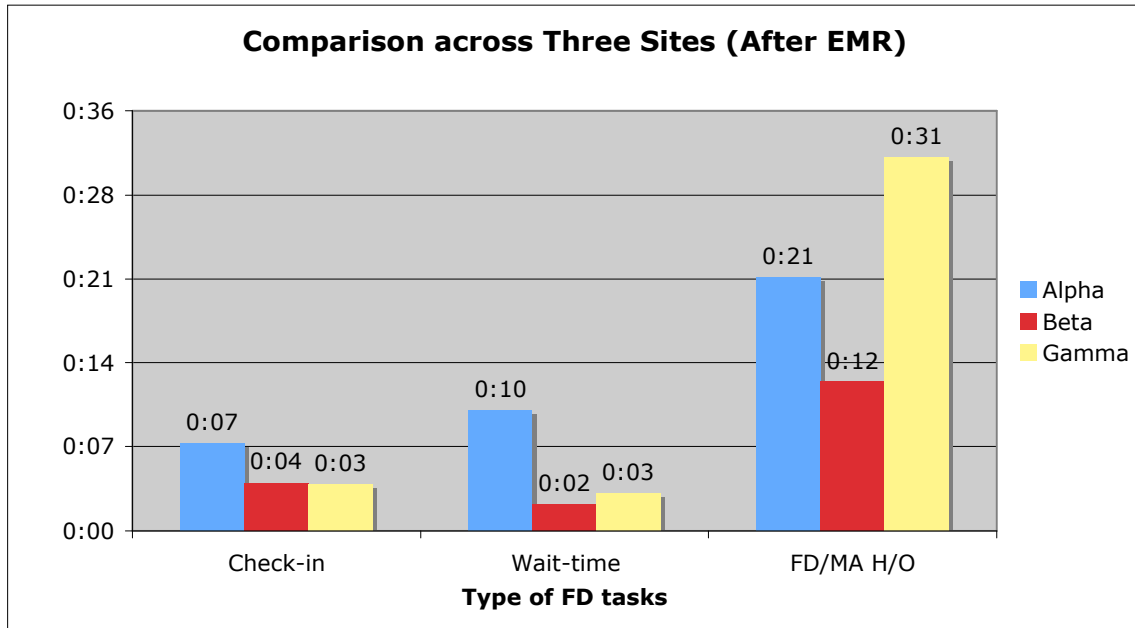


Figure 44: Front-Desk Metrics (Post EMR)



In terms of the clinical aspect of the clinic, I found that they also have increased albeit less than the front-desk metrics. MA now take slightly more time to take patient vitals and administers provider orders (See Figures 44 and 45). Providers also take more time for examination – especially in the case of Gamma clinic providers (see above-mentioned issues). The wait-time between rooming and examination has mixed results where some clinics such as Alpha clinic has a significant decrease while Beta clinic remains the same and Gamma clinic increasing by half. This again is a proxy for the overall flow of patients through the clinic. It seems that Alpha clinic now have better flow between MA and providers while Gamma clinic is experiencing slow-down in patient flow from the front-desk to the clinical areas.

Table 36. N of observations for the Clinical Station Metrics

Clinic\Metric	Prior to EMR				Post EMR*			
	Vitals	Exam	Orders	Wait-time	Vitals	Exam	Orders	Wait-time
Alpha	72	75	19	63	145	138	49	124
Beta	76	68	9	61	90	82	8	79
Gamma	42	45	22	32	78	73	19	62

Figure 45: Clinical Station Metrics (Prior to EMR)

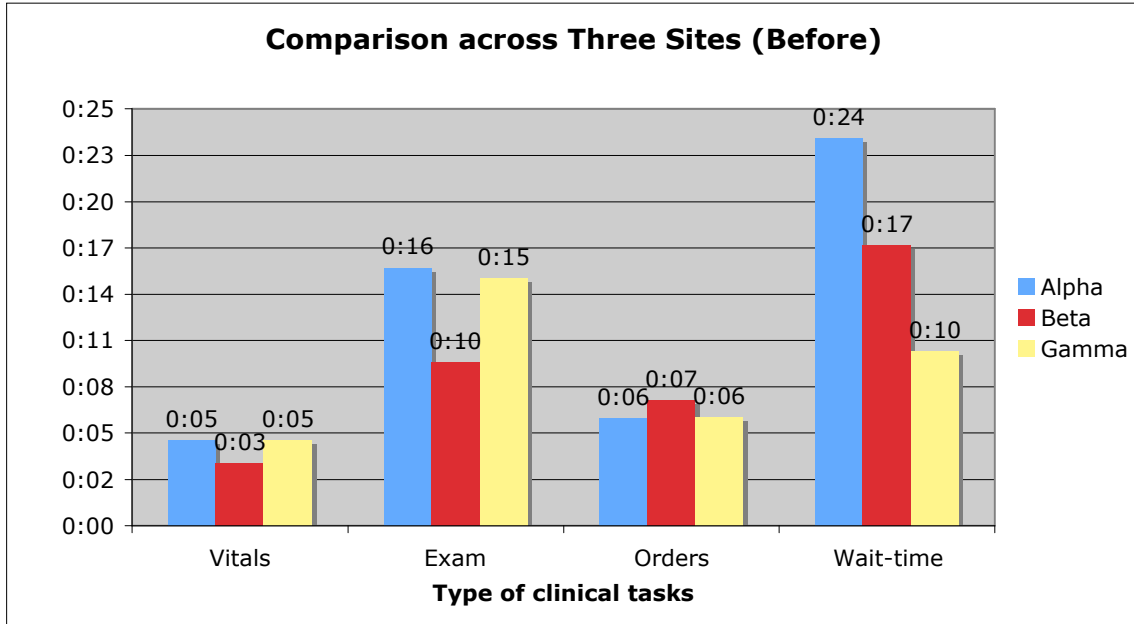
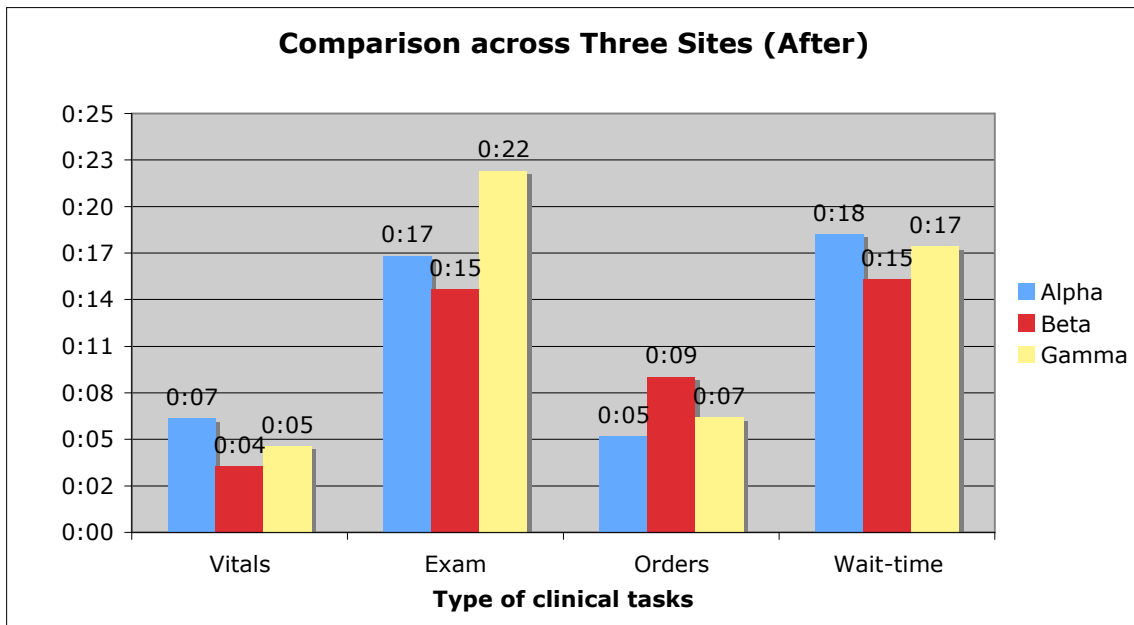


Figure 46: Clinical Station Metrics (Post EMR)



Summary

This chapter sums up the findings in the research study of the three sites with respect to the process

of change in the three clinical sites after the EMR system was implemented. The first section applies the Work Network and narrative network analysis on the same set of operational processes (WN1 and WN2) that have been decided through the configuration process (in chapter 5) and inscribed in the EMR system. I show how the inscribed processes differ from the existing work practices found in the three clinics (as described in chapter 6). The second section describes the tensions that arose in each site with respect to the two new operational processes (W*N1 and W*N2). This is followed by a description of the fitting work that emerged in reaction to the tensions within each of the site. Here I use the final Work Network and its attending narrative networks of each role to show how the new EMR system has changed and been change in through the process. Finally I review the different organizational changes and outcomes in the three clinics that occurred after the EMR implementation. I discuss next the theoretical model that ties together all the findings in chapters 5 through 7 and show how the factors and Work Network explains the process of change that emerge from the introduction of the new EMR system in these three clinics.

Chapter 8: Bringing it together: The Work Network Model

“The question is not whether technology causes change: it does; or whether various social changes cause technology: they do. The only interesting question is: Which changes under what circumstances?” (Moore 1972 pg. 23-24) quoted in (McLoughlin and Badham 2005 pg. 839)

This dissertation begins by arguing that research on technology-based change requires a more nuanced understanding of the technological artifact and the process by which the technological artifact is configured for use within the organization. Recent research has begun to re-assert the role of the technology’s materiality in the change process and some has gone so far to propose that the historicity of the technology’s materiality has more to offer in illuminating how change occur (Kallinikos 2004).

This research bridges this gap by examining the process by which an EMR system is configured, implemented and used in three family clinics. The findings presented in chapter 5 show how various stakeholders at different levels interacted to determine what is and what is not configured in the EMR system. In chapter 6, I uncover how different contextual factors influence the current work practices at the three clinics and in chapter 7, I discuss how the existing work practices clash with idealized work practices in the EMR system to produce tensions and fitting work. The configuration process, tension and fitting work combine to produce varying changes in the three organizations studied.

Chapter 8 builds on the findings described in earlier chapters and extant theories of organizational routines, organizational change and social construction of technology to develop a midrange process theory of technology-based change. I call this process theory the Work Network model because at the core of my explanation of how change occurs with new technology is the concept of Work Network. I shall first define the concept of Work Network, and then discuss the different

components of the process – namely the process of configuring the Ideal Work Network, the factors influencing the Actual Work Network and the tensions and fitting events, which combine to create changes to the organization and technological artifact.

Definition of Work Network

The “Work Network” and its attending concept “narrative network” have been briefly introduced in chapter 6 as I analyze the work that has been done at the research sites. Here I attempt to provide a more comprehensive and formal definition to this concept and discuss its function in my theory of technology-based change. The basic premise behind the Work Network can be traced to several existing concepts such as Kling and Scacchi’s (1982) “production lattice”, Barley’s (1986) “role network” and Berg’s (1999) “heterogeneous entity”. More recently, Pentland and Feldman (2007) proposed that the “narrative network” as a novel way to tie together actors, actions and artifacts, which has proven to be a useful language to represent organizational change.

In their seminal work on the “web of computing” model, Kling and Scacchi (1982) proposed the idea of production lattice as a lens to think through computing design¹³. They define it as “the way in which a user of computer based services receives critical computing-related resources from others or different groups locations provide different elements which contribute to some final product” (pg. 75). They argue that computing design needs to take into account the work that actors engage in and the structure or the “lattice” that emerge as these lines of work interact and converge (see also Gasser’s (1986) empirical work on task chain and lattice).

Barley (1986) on the other hand focused on the roles each actor plays within an organization and

¹³ Orlikowski and Iacono’s (2001) “ensemble view” is based on Kling and Scacchi’s web model

how these roles are linked to each other. Using Nadel's (1957) dichotomy of relational and non-relational roles, Barley (1986) traced how technology change reverberate via non-relational and then relational roles to effect organizational change. Unlike Kling and Scacchi's view, the technological artifact in Barley's analysis is not embedded in the links between actors.

Marc Berg, a noted researcher of medical work and technologies, suggested the notion of heterogeneous entities as an analytical building block to study how medical practices and technologies are shaped in the course of medical work (1999). This "heterogeneous entity" is based on Latour's (1987) actor-network theory to refer to networks of medical actors and technological artifact linked together to handle complex medical tasks. While it is similar to Kling and Scacchi's notion that the artifact is part of the network, Berg places equal emphasis on both the actors and the artifact within the network. He argues that medical work is completed as a joint effort of both actors and artifact at the level of the network.

These concepts provide me with three key principles as I attempt to theorize about technology-based change based on the data I have collected: a) the work that takes place in an organization, especially in a medical context, exists at the individual as well as a the network or mezzo levels, b) the network can be conceived as different nodes or roles and that they are linked by relational roles i.e. communication, coordination or simply transfer of input/outputs, and c) the technological artifact is an integral component of the network.

Hence the concept of "Work Network" draws on these three key principles to describe how technological artifact, actors and actions are bound together within organizations. Formally, I define the "Work Network" as a heterogeneous network of actors and technologies with a common purpose, notably to carry out the work that an organization is engaged in, where each of the actors and technologies play a role and are linked by their task interactions or resource exchange.

While it is in essence a sociotechnical ensemble or system (Bostrom and Heinen 1977; Emery and Trist 1960), I propose that the concept of Work Network is a specific and concrete manifestation of the sociotechnical that puts “work” at its core (Barley and Kunda 2001). The focus on organizational work enables us to capture the elements of work, people, and technology and make explicit the sources as well as the connections among all the elements. Therefore Work Network provides a conceptual bridge that captures the agency of organizational actors and the technological artifact and situates both in the larger context of organizational work at the network level. I shall discuss more of its theoretical implications in the chapter 9.

Application of Work Network

The Work Network can be applied for an organization that captures all the work that is done within that organization. However this manner of application makes the analysis overly complicated and hard for analysis since there are many possible layers of Work Network overlaid on each other. In my analysis I have applied it on specific organizational work processes such as scheduling-registration of patient. By slicing it along each organizational process the Work Network provides a clearer and logical view of the organization. And while the Work Network is focused mainly on organizational work the Work Network itself does not have to strictly follow the organizational boundaries. Instead the boundary of the Work Network is determined by the observed actors that have interactions and interdependencies with the organization and can include as I have done in my analysis external actors such as patients, laboratory systems.

Since the Work Network also includes the relational and non-relational roles each actor plays, the Work Network essentially captures both the micro and meso structures. However the notion of role can be widely interpreted and includes formal duties, expectations, skills and tasks (Barley, 1986). In my conceptualization of Work Network, I have adopted Pentland and Feldman’s (2007, pg. 787)

“narrative network” to concretely capture the notion of individual roles.

According to Pentland and Feldman (2007, pg. 787) narrative network is a method for “representing and visualizing patterns of technology in use”. It allows researchers to build “actual and potential narratives that can be created within some sphere of activity” (pg. 789). At the center of the method is surfacing the actor, artifacts and the actions that connect them as a narrative fragment. Work then could be described as narrative fragments connected by the sequence in which they occur. The relationship between the narrative fragments does not only capture the chronology but also a coherent story (pg. 789). The examples of narrative fragments given include “I turn on the computer”, “I log into website” etc. They proposed that narrative networks should be studied from specific vantage points with an emphasis on the agent’s purposeful actions.

Compared to other existing tools e.g. flow chart for work processes, narrative network is more flexible as it is not simply focused on the decisions points and the work that the actor does (Pentland and Feldman 2007, pg. 790). The narrative network allows us to capture the process by which work is currently done and how it can be potentially done. It also allows us to explicitly capture the actors, artifacts and actions whereas other methods place less emphasis on either actors or artifacts and focus more on the actions. Theoretically, the narrative network is similar to my conceptualization of work as a network rather than a deterministic process akin to Taylor’s concept of a production line. It is also especially appropriate for assisting researchers to describe organizational change and design – both of which are key goals in my research.

In the Work Network analysis, I have taken a two-step approach. The first step involves using the narrative network to describe and visualize the work that each role is engaged in. This narrative network uses the task and the agent as its focal points. For example, I created a narrative network of the front-desk staff and their check-in task or the MA and their vital/rooming task. In each narrative

network there are “connecting” narrative nodes that joins each of the role with each other. For example the front-desk staff’s FDNN1.25 connects its role to the MA’s role as that narrative node describes the handover from front-desk to the MA. Detecting these points moves my analysis to the second step that is to build the Work Network.

In the second step I focus on the Work Network that each of the individual roles/tasks are part of. So the front-desk check-in and MA vitals/rooming are part of the overall Work Network of checking-in and prepping a patient for examination. To describe this Work Network, I use the connecting narrative nodes found in step one to link the different roles and artifacts. In a sense the narrative networks are now “rolled up” as part of the nodes of the Work Network¹⁴.

There may be some confusion between the use of two networks and I would like to make a point of clarification here. Specifically, the Work Network is my conceptual tool to conceptualize work and technological change. In the Work Network, the nodes are roles and artifacts and the links are the communication, coordination and exchange of resources. On the other hand, the narrative network is a methodological device to visualize the tasks done by each node and to assist in building and understanding the Work Network. The nodes in the narrative network are narrative fragments (a short narrative that contains at least two actants and some of kind of action linking them) and the links are the sequence of the narratives.

Applying the Work Network in this way therefore allows me to make explicit description of how artifacts interact with the actors in the course of doing work, as artifacts are located in each of the

¹⁴ See Narduzzo et al. (2000) for similar description of two levels of work in their study on the emergence of routines and capabilities. They referred to the lower level of work as punctuated routines and the higher level of work as “patterns of action” that contains various combinations of the punctuated routines.

narrative fragments as well as the Work Network links. This in turn allows me to trace the microstructures and the meso structures over time as the new EMR technology is introduced at the three sites.

In conclusion, the Work Network concept is in essence a network or an ensemble where organizational performative work gets done. It is built up of the different roles, actors, actions, technological artifact and the links that connect them. The work performed by each role or artifact and the interconnecting links are analyzed by the narrative network methodology.

Work Network Model of Technology-Based Change

The goal of this dissertation is to provide a process model on technology-based change that explains how IT systems are linked to various changes in an organization. At the core of the model is the Work Network that captures the actors, artifacts and their actions in the course of performing work and in the process follows the two key phases of introducing a new IT system: configuration/development and use (Leonardi 2005; Leonardi and Barley 2008). The configuration/development phase covers the time period when the organization is involved with implementation activities such as negotiating and contesting the new IT system's designs and configurations. The use phase covers the time period beginning with the introduction of the new IT system in the organizational context and its subsequent use by organizational actors. Refer to Figure 46 on page ?.

The model follows the notion that Barley (1990) introduced from linguistic studies with regards to understanding technology and organizational change i.e. the idea of synchronic and diachronic analysis. Diachronic analysis refers mainly to understanding the change over time so as to capture the how and why; the tracing of change across configuration/development and use phases in the

model follows this analysis. Synchronic view refers to understanding the change at the same phase but across different context and activities. Unlike Barley's original conception of synchronic which is focused only on understanding how different technologies engender change in the same context, the model captures two different aspects of synchronic analysis: one, the synchronic analysis in the configuration phase attempts to understand how activities and issues in one domain i.e. the actual pilot sites and organizations influence the activities in the development of the system; two, the synchronic analysis in the use phase captures how use activities across three pilot sites generate different changes as well as how the same use activities influence the technological artifact itself. Hence my model of change while drawing on the basic premise of synchronic and diachronic analysis extends it to consider how the technological and organizational domains co-evolve and mutually constitute each other (Leonardi, 2005).

Configuration/Development Phase

Within the configuration/development I find that a multi-level process of political contests involving various stakeholders influences the development of the set of "Ideal Work Networks" that are inscribed into the new EMR system as well as influences the existing set of institutional environment and infrastructure that enables and constrains the Ideal Work Networks.

Key Terms: I build on Kling and Scacchi's (1982) notion of infrastructure where they proposed that technologies are seen to be embedded in "a larger matrix of social and economic relations and is dependent upon a local infrastructure" (pg. 69). Infrastructure therefore refers to "resources which help support the provision of a given service or product and it includes resources such as skilled staff and good operations procedures, as well as physical systems such as reliable clean energy and low-noise communication lines" (pg. 74). There are in a sense different levels of infrastructure as we consider specific levels of the political process. For the local process, the infrastructure refers to the staffs within the clinics as well as the telecommunication and billing system links while

organizational level infrastructure refers to MATH's various billing and clinical platforms. Institutional environment on the other hand refers to institutional pressure and constraints imposed by parent organizations and other entities in its macro-institutional context (Davidson and Chismar 2007; Kling and Scacchi 1982; Orlikowski and Barley 2001). Like infrastructure the institutional environment spans the organization to the enterprise and down to the local. Unlike the infrastructure notion where each infrastructure may be discrete albeit interconnected, institutional environment is flexible as it may cover multiple levels or be specific to one level. Specific examples from my study include MATH's organizational policies that apply to all MATH clinics, or Medicare policies, JCHAO and physician guidelines that cover the entire enterprise, or Alpha clinic policies or its patient base that pertain only to Alpha clinic.

Political Contest – Organizational Level findings: Based on my findings, I propose that there are multiple levels of political contests that involve negotiations among relevant stakeholders at each level. There may be more or less levels as depicted in my model but I propose that in general one can observe these three levels of negotiations. At the highest level – the organizational level – I have observed how important organizational actors such as the CEO and CIOs negotiate over the overall vision of the system and the general direction for technical development. On one hand, existing institutional and infrastructure factors influence the negotiations (e.g. MATH vs. CPI/SOM institutional mandates or CPI's existing billing infrastructure) among these stakeholders. On the other hand, the unresolved high-level disagreements influence the institutional and infrastructure factors surrounding the development of the new EMR system and the Ideal Work Networks. Specifically the integration between the new EMR system and the existing billing system managed by CPI is dissolved due to the political impasse between the two actors. This affects the infrastructure for the new EMR as it means that it has no direct billing information flow with the CPI system. In terms of the institutional environment, the decision by CPI to withdraw from the scheduling/registration development leads indirectly to a breakdown in the PatAccG's

ability to develop a common workflow policy for the entire organization. The ramification of the political conflict also directly affects the configuration of specific EMR functions and by implication Work Network e.g. the failure to implement the LOS calculator due to lack of billing integration.

Enterprise Level findings: At the enterprise level of negotiations (namely the DBVs and the advisory group levels), I have observed that existing institutional factors play a significant role in the negotiation process. This is unsurprising from the Institutional theory perspective where institutions are typically viewed as stabilizing forces against change (Scott 2001). Specifically the enterprise level stakeholders include senior physicians and hospital administrators each representing their particular domain of expertise e.g. Audit, IT, Operations, Clinical specialists. Each stakeholder draws extensively on existing institutional forces in their negotiations over the configuration and development of specific key functions and Ideal Work Network. Of note is the Compliance group that has gained considerable negotiating power by leveraging billing policies and audit practices as well as policies of government agencies and insurance companies to determine whether a function should be approved for use. Examples include the rejection of the “notorious” copy previous note function (in spite of interest from the physician community) and the reduced implementation of the LOS calculator. Compliance and its attending concerns are also influential in the design of the Work Network – for example when and where providers use the “Mark-as-reviewed button”. While the infrastructure’s role is less prominent at this level of negotiations, it is pertinent in some of the discussion revolving around the copy previous note issue where the Compliance group and the project group have to discuss about how to create the staffing, system and policies to monitor the abuse of the function.

Local Level findings: As illustrated earlier the political disagreements at the organizational level affect the enterprise level’s ability to function. And the decisions and outcomes at the

organizational and enterprise levels determine the scope and boundary for the negotiations at the local level. For example, the lack of billing integration, the use of Mark-as-read function, and copy previous note functions have been black-boxed and eliminated from local level discussions. The notion of “black-box” comes from social constructionist perspective (Bjiker 1995; Latour 1999) and refers to aspects of technology that are stabilized, almost taken for granted and therefore not open for further negotiations. It is as if the entire large EMR system has to be redrawn so that the local team has access to only a set of the functions that are pertinent and relevant to them. Workarounds that have to be created for those eliminated issues are taken-for-granted and form part of the infrastructure for the negotiations e.g. the use of paper printouts for billing instead of direct billing information flow. As such the local level negotiations – which involve mainly the management from the specific site e.g. Alpha clinic, the project team, and MATH’s operational management – focus mainly on validating approved functions and designing Ideal Work Networks and the negotiations mainly revolve around concerns derived from the existing Work Network and local infrastructure. As for institutional and infrastructure factors, they continue to influence at the local negotiations e.g. the requirement by CMS to print prescriptions on tamper proof paper or the implication of AVS printout on HIPAA regulations.

Besides being bounded by the “higher” levels of negotiations, another distinct aspect of the local level negotiations is the influence from actual Work Networks and the issues surrounding these networks. As discussed in chapter 6, Alpha clinic has significant operational issues surrounding its Work Network 1 (WN1) e.g. missing charts, slow turnaround of prescription refills, slow registration process. These concerns and issues have been channeled into the negotiations via Alpha clinic representatives (medical director, the network director, the practice manager) and have become part of the motivations for the new or ideal Work Networks such as the Scheduling/Registration Work Network (W*N1) and patient communications Work Network (W*N2) discussed in the later part of chapter 5 and depicted in the early part of chapter 7. However

as all political contests, the ability for local actors to push the agenda for the new workflows partly lies on the overarching scope provided by the institutional forces. The fact that the PatAccG fails to push for a clear standard for the patient access operations has allowed the local actors more leeway to push for their agenda. Ironically once the first local level negotiations (for Alpha clinic) are completed their decisions become constraints for the subsequent local level discussions (for Beta and Gamma clinics). It is only due to “new” issues such as the different specialties in Gamma clinic that the system’s black boxes are re-opened again.

Together the different levels of political contests in varying degrees determine the final set of ideal Work Networks that are configured into the new EMR system. The infrastructure and institutional environments also directly determine these ideal Work Networks to the extent they enable or constrain the different functionalities as mentioned above (e.g. the billing integration piece, the policies for standardized workflows). This part of the model therefore shows how the socio-political process of technical work together with the existing institutional, infrastructural and Work Networks in the organization mutually constitute the development and design of the final EMR system with its set of ideal Work Networks. This part of the model explains how the EMR system and its Work Network evolve and why specific functions and Work Network are present or absent – this answers the first research question of my dissertation. The next part of the model shows how the organization and technology actually have changed and the reasons for their changes.

Use Phase findings

In the use phase of the model, I have observed how the users in the three clinics put into action the ideal Work Network inscribed in the system. While the ideal Work Network (as described in chapter 7) exists as inscriptions in the operational handbook, training materials and systems, and even user-test scenarios and rules in the EMR system, it is only a potential idealized flow between

the roles specified and built on potential idealized narrative networks. As the saying goes “when the rubber hits the road”, actual users have to actively negotiate these ideal Work Network flows and ideal narrative networks with their actual Work Network practices, existing infrastructure and institutional environment. This is where the “tension” between the ideal Work Network and existing factors arise.

Tension: The notion of “tension” used here is similar to several notions that have been discussed in the literature yet differing in substantive ways that justifies its usage. First it is similar but not completely synonymous with the idea of “slippage” that Barley (1988) and Orlikowski (1996) have explored in the area of ongoing situated change. In their perspective slippage occurs unintentionally when actual daily events and social interactions shift what is expected based on institutional templates and what is experienced to create social innovations. Tension is similar to slippage in the sense that there is a disconnect between what is experienced and what is inscribed or prescribed. However tension here is not unintentional or occurs in an emergent manner – rather it is a constant force that exerts itself on the actors and artifacts within the Work Network that arises from that disconnect. Another concept that tension is similar to is the notion of “drift” used by Berg (1997) and Ciborra (1996) to describe the force experienced by actors who inhabit cross-secting networks of work. Tension is like drift in that different aspects of the work context create a gap between Work Networks and thereby lead to breakdowns and glitches. However in my analysis tension as a metaphor is more apt to describe the force that leads to the gap as it conjures the image of two opposing forces pulling away from the center than the metaphor of drift that seemingly imply a less forceful distancing of two objects.

Tension between Ideal Network and Institutional Environment: There are significant tensions between the EMR system’s new narratives and Work Network and the clinics’ institutional environment. For the WN1 and W*N1, I have observed several key institutional issues as sources

of tensions in the clinics. Alpha clinic's large Medicare and Medicaid patient population and its use of open access schedule to deal with their long-standing no-show issues lead to severe tension for the new scheduling narrative network where the demands for rapid phone call turnaround competes against the demand for more patient information collection. The Medicare and Medicaid patient population and Alpha clinic's open access policy also create tension in the check-in registration as they continue to verify insurances at the point of arrival. In Beta and Gamma clinics, we have the organizational structure of shared/non-dedicated phone operation that leads to tensions where front-desk staff has to balance the demands of the new scheduling with new phone messages and new check-in narratives. Gamma clinic's informal culture also creates tensions where patients who are accustomed to walk-in labs and blood-pressure checks have to undergo formal check-in and registrations. For WN2 and W*N2, institutional factors such as MA-provider relationship as well as their organizational arrangements are directly linked to observed tensions. The rotating pooled approach in Alpha clinic creates tensions in the new patient communication Work Network as MAs attempt to keep track of all their prior In Basket messages as well as the current day's In Basket messages. The informal culture in Gamma clinic becomes an obstacle to providers' quick response to In Basket messages. The providers continue to choose to rely on verbal and written communications and neglect the In Basket workflows unless reminded by the MAs.

Tension between Ideal Network and Infrastructure: The existing and new infrastructure (or lack thereof) exerts severe pressures on the new Work Networks. Alpha aging telephone system and its inability to intelligently route or hold calls add tension for the phone operator role in the new Work Network. The inefficient medical records staff is part of the local infrastructure that creates tensions in Alpha clinic's W*N2. In Beta clinic's experience, the laboratory interface issues in the new EMR system are a source of tensions as experienced by Beta clinic's sole provider. That breakdown and unreliability of the new infrastructure also ripple down to the MA and front-desk since they have to workaroud this tension. Infrastructure breakdown is also a key source of tension

in Gamma clinic given the history of unreliable network and workstations at the site. While previously these breakdowns do not directly impact the work they do, the new Work Network is fully dependent on the network and workstations. Their breakdowns therefore impose significant tensions on all the newly introduced Work Networks.

Tension between Ideal Network and Actual Work Network: The actual Work Network in the clinics captures the work as is done previously and as such represents the work practices that are developed *in situ* within the context of the clinic. While users grapple with the newly acquired Work Network instinctively they are also negotiating these new narratives and Work Network with their existing practices. Alpha clinic for example has relied on the paper medical chart as a documentation device but also a handover signal device between the front-desk and the MAs. The fact that a paper medical chart sits in a particular provider's rack signals that a patient for that provider has been registered by the front-desk and hence ready for vitalization and rooming. The new EMR system's department arrival schedule, with its ability to show not only the name and appointment details, is built to replace that since it also captures the status of the patient. MAs have to deal with the instinct to depend on the existing practice of checking for a paper chart at the front-desk against the new practice of checking on the department arrival schedule on the computer. Another example from Alpha clinic of this tension is the way MA deals with their administrative duties. The existing practice is to deal with the messages only when the medical records are delivered to their stations – twice a day. This allows them time to juggle the constant busy flow of patients and orders that is characteristic of Alpha clinic. The new practice where messages come directly from the telephone operator means that there is a constant stream of administrative work that competes against the demands of clinical work. In Beta clinic, the current practice is that staffs work together and cover for each other where possible e.g. front-desk dealing with patient enquiries about the status of lab results and prescription refills or clinical assisting patient with scheduling appointments. The imposition of security roles and decreased visibility of

messages and work make this practice of work challenging and in some cases impossible. Gamma clinic's providers also face substantial tension between the new EMR and their actual work practices. As discussed in detail in chapter 7, Gamma clinic's patients tend to be older and have more medical conditions that require a wide variety of medications. The documentation requirements in the EMR e.g. diagnosis and order association impose demands on the provider's time and competes against the demand to provide quality care for these patients. This is also true for the front-desk check in e.g. the MSPQ requirement is now formalized and made compulsory in the EMR system and that makes registration for older patients more cumbersome and challenging.

Fitting Work findings: As I have discussed in chapter 7, the notion of "fitting" is based on Gasser's (1986) work on how computers are integrated with organizational routines. Fitting refers to an organizational adaptation process and is defined as "activity of changing computing or changing the structure of work to accommodate for computing misfit" (Gasser 1986, pg. 214). It is similar to what organizational literature refer to as "improvisations" (Weick, 1993, Orlikowski 1996, Ciborra 1997) where these actions are described as "emergent, ongoing and continuous" and are "situated accommodations and adaptations" to the demands of technology (Orlikowski 1996, pg. 66).

Another similar notion to fitting is the idea of workaround – that is adaptations that rely on alternative ways of using the system for which it is unintended for or for using alternative ways of work. I propose to use the notion of "fitting work" to capture Gasser's notion of fitting, improvisation and workaround as my vocabulary to describe the reactions to tensions between the ideal Work Network and contextual factors.

The fitting work that has taken place changes the Ideal Work Network in the EMR system (technology) as well as the actual Work Network. I have documented those in detail in chapter 7. The theoretical aspect here is that the fitting work is focused mainly on the realigning the Work Networks and the EMR system and only somewhat on the infrastructure factors and institutional

factors. Specifically I have found many examples of fitting of the ideal Work Network and the EMR system and fitting of actual Work Networks. Examples of fitting of the “ideal” Work Network and the EMR system include the shift of the full registration from the phone scheduler to the front-desk, the removal of requirement to do the work-queues given the lack of staff, removing certain fields as hard-stops, enabling new scheduling flow while examples of fitting of actual Work Networks include the change in flow of medical charts, the change in Alpha clinic’s medical records role of refill data entry, the change in provider documentation. A key takeaway here is that I show that the artifact and the organization are mutually co-evolving during the fitting work process. Fitting to the institutional and infrastructure components is less in comparison e.g. the change in Alpha clinic provider and MA arrangement and improvement to the Gamma clinic’s wireless network as they are probably more challenging and less accessible to fitting work by the actors (e.g. Gamma clinic’s informal culture or Alpha clinic’s patient base and patient flow).

Fitting work also ranges between formal and informal. Examples of formal fitting work include the change in the phone scheduling narratives and the shift of work on the Work Network to the front-desk – both examples are stated as a formal management policy. The change in the provider and MA arrangement is also a formal policy and in both cases they require extensive coordination and “extensive justification” (Gasser 1986). The informal fitting work observed is mainly limited to individual narratives e.g. Gamma clinic’s front-desk shortcut for MSPQ questionnaire, Beta clinic’s entry of patient data using file data, and providers’ in Alpha and Beta clinic documentation style. Finally I also note that not all fitting work is approved or sanctioned – especially in the case of the system-based prescription refill reprint where not only is it reversed, additional work is imposed to ensure the gap is covered (i.e. printing and holding printed prescriptions for seven days and reverting the whole process of prescription refill after the seven days).

Process and Change

The Work Network model of technology-based change attempts to understand the change process in organizations resulting from the introduction of a new IT technology. The model traces the configuration/development of the new IT technology to its subsequent use. It also considers the activities and issues within the domains of technology and organization within each of the phases. Using the central concept of Work Network, the model explores first how the IT technology is inscribed or embedded with an ideal set of Work Network (Volkoff et al. 2007) through a series of inter-related political contests at various levels of the organization. The process of negotiations among the stakeholders as well as salient aspects of the organization (such as its institutional environment, the infrastructure and current work practices) drive the development of the ideal Work Networks and the IT system. This first part of the model provides the basic understanding behind the rationale of the ideal Work Networks found in the IT system.

The second phase considers how the ideal Work Network in the IT system interact with the actual user context – its institutional environment, infrastructure and work practices. By overlapping the ideal Work Network with actual work conditions and Work Network, I am able to tease apart their interactions to show where the tensions are and how fitting work takes place and where tensions persist. Organizational change is therefore understood from the process by which politically charged ideals inscribed in the EMR system and ideal Work Network align or conflict with existing infrastructure, institutional forces and Work Networks.

Drawing on this model, I am able to better understand the changes that occur at the three different clinics. For example, the positive aspects of improved information access and flow in Alpha clinic is enabled in part by the overhaul of its existing faulty Work Network for patient communication and charts through the new EMR Work Network design. Yet the political decision to integrate the scheduling and registration system with organization wide billing system and the local

management strategic choice to adopt a “best practice” approach towards scheduling lead to negative impact on operational efficiency across three clinics as it is unable to resolve the tension between the idealized Work Network and the onsite demands from institutional and infrastructure factors. Moreover the decision to enforce institutionally sanctioned security policies and adopt “best practice” of clinical message taking has created unintended consequence of shift of work from several nodes in the old Work Network to one specific node (i.e. the MAs) in the new Work Network that potentially may lead to a drop in patient care.

Finally by combining both the configuration/development and use phases in one model, I can also explicate why certain aspects of the organization remain unchanged. For example the political impasse at the organizational level of negotiations and its impact on the billing integration has led to huge design and configuration constraints for the scheduling and billing operations in the new EMR system. This is the reason why the three clinics continue to print out paper billing sheets and engage in the same manual process of encounter reconciliation despite using an “integrated” EMR system. This also accounts for why the referral process in all three clinics continues to generate paper referrals for patients instead of electronically refer patients to other MATH clinics.

Figure 47: Work Network Model of Technology-based Change

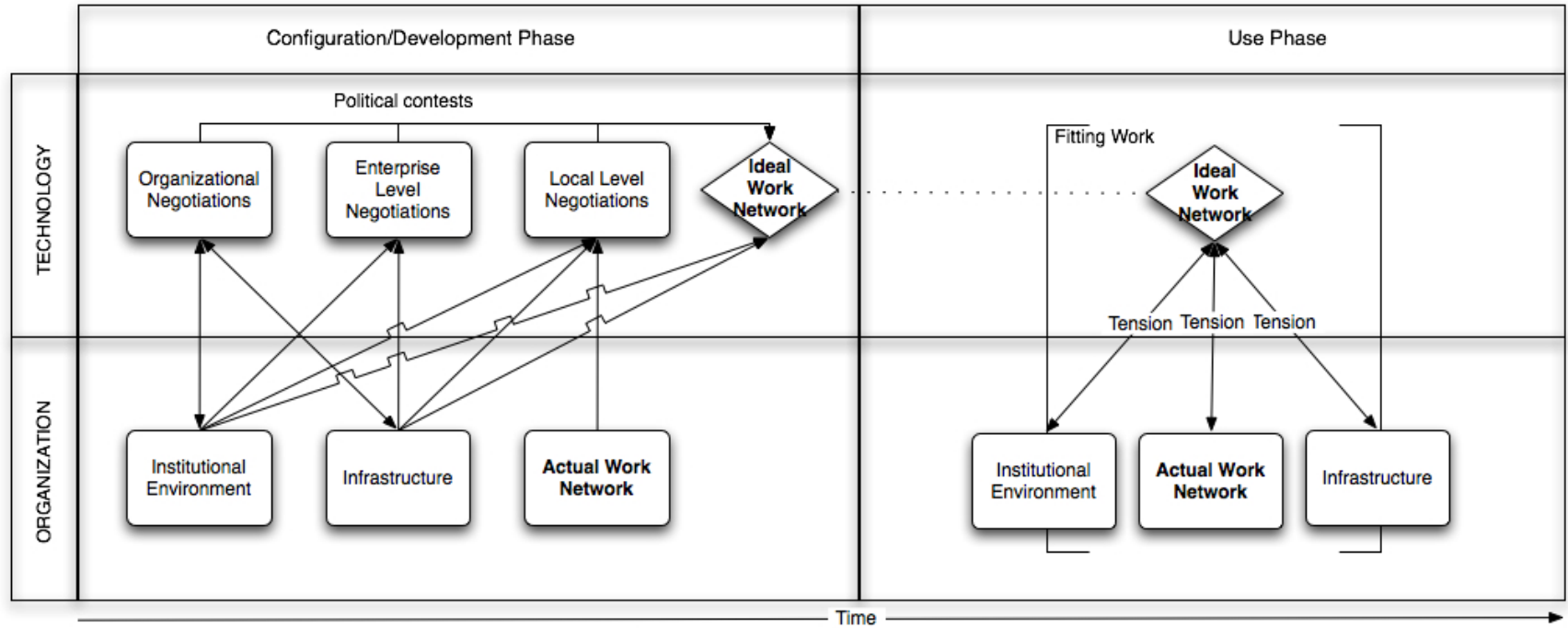


Table 37. Process of configuration

Configuration issues		Factors			Outcome	
Level: Organizational		Institutional Environment	Infrastructure	Existing Work Network	Ideal Work Network/NN	Missing functions
1	Integration between EMR and CPI's Billing system (IDX)	MATH & SOM/CPI conflict; MATH's vision of information flow & integrated registration	IDX and its upgrades	N.A.	W*N1 / FD*NN1.14-17, FDNN1.9	Referral scheduling & Benefits engine; LOS function
2	Integration between EMR and MATH's STAR system	MATH's vision of information flow & integrated registration	MATH's ACC project	N.A.	PR*NN1.4-7; FD*NN1.4	N.A.
3	Payor-plans master-files synchronization	MATH & SOM/CPI conflict; MATH's vision of integrated registration	EMPI system; STAR; IDX	N.A.	PR*NN1.4-7; FD*NN1.4	N.A.
Level: Enterprise						
4	Standardization of scheduling & registration processes	MATH & SOM/CPI conflict	Payor-plan master-files	N.A.	W*N1	Automatic verification system
5	After-visit summary (AVS)	Patient care; audit risk assessment	Print-groups on site	Provider & MA workflow	Check-out work	N.A.
6	LOS calculator	Compliance and audit policies; CMS guidelines	Lack of billing integration	Increase Providers' compliance	N.A.	LOS calculator (not turned on)
7	Copy-previous note	Other adopting institution's policies; Compliance & audit policies; insurance companies audit	EMR platform built-in function	To improve Provider's efficiency	Provider's documentation	Copy-previous note (not officially sanctioned)
8	Mark-as-reviewed	Billing policies, EMR policy and chart etiquette	N.A.	Provider's practices	Provider's documentation	N.A.
Level: Local						
9	Scheduling & registration workflow	Vendor "best practice" accepted during DBV; Existing clinic policies	Allocation of staff; EMR registration flow	Current staff & operational challenges	W*N1/ PR*NN1.4-7; FD*NN1	N.A.
10	In Basket workflow	Vendor "best practice" accepted during DBV; Existing clinic policy; CMS mandate	EMR core design; Printer configurations	MR staff issues	W*N2/ PROVNN3, MANN3	N.A.
11	Check-out workflow	Existing clinic policy; HIPAA	AVS	Provider's practices	Check-out work	N.A.

Table 38. Tensions and Fitting work (Alpha clinic)

		Tensions	Factors		Fitting work	
WN/NN		Specifics of tension	Institutional Environment	Infrastructure	Work Network	Org./Tech.
1	W*N1 at PR*NN1	<ul style="list-style-type: none"> - Increased workload (PR*NN1.4-1.7) - Unable to gather information - Increased phone access problems (longer call durations) 	Reduced provider schedule; Lack of access to relevant information; Patient unwilling to provide information	High volume of calls with old telephone system	<ul style="list-style-type: none"> Avoided PR*NN1.5-6 Sequence reversed (PRNN1.5-8 moved in front of EMR entry) 	<ul style="list-style-type: none"> Revised policy on full registration; Reviewed compulsory fields
2	W*N1 at FD*NN1	<ul style="list-style-type: none"> - Insurance information not available due to PR*NN1 - Increased workload as missing information are hard-stops at FD (FD*NN1.4-7) - Longer registration duration 	Payor-mix require same day insurance verification; Paper chart pull policy continues (with it the missing chart issue)	Lack of staff to work verification workqueues	<ul style="list-style-type: none"> FD*NN1.4-7 more data intensive; Ignored insurance verification queues; Lab only removed 	<ul style="list-style-type: none"> Removed paper chart flow from FD
3	W*N2 at PR	<ul style="list-style-type: none"> - Shift of Rx refills request from fax to phones due to slow down at MR 	Clinic policy of receiving only fax prescription requests changed	MR slow turnaround on faxed prescription requests	MR sends all fax Rx refills to MA	N.A.
4	W*N2 at MA*NN3	<ul style="list-style-type: none"> - Prescription refills requests now comes directly from PR and MR via In Basket - MA*NN3.2 requires them to convert staff messages to tel. encounters i.e. additional steps - Constant pressure to monitor In Basket as well as clinical duties - Complicated In Basket monitoring process due to overlapping work with different providers over the months 	Part of provider prescription refill documentation shifted to MA; Rotating assignment to providers; High patient volume	Charts and EMR both continue to circulate work	N.A.	<ul style="list-style-type: none"> Verbal comm. and knowledge of EMR functions; Rx reprint function (later removed)
5	W*N2 at PROV*NN3	<ul style="list-style-type: none"> - Increased dependence on MA to close encounters (PROV*NN3.7) - Increased work to verify abstracted prescription requests - Constant pressure to monitor In Basket as well as clinical duties 	Rotating assignment to providers; High patient volume High	Charts and EMR both continue to circulate work	PROV*NN3.18 avoided (use Rx printout to signal close)	<ul style="list-style-type: none"> Dedicated 1-1 MA-Provider assignment; Changed documentation style

Table 39. Tensions and Fitting work (Beta clinic)

		Tensions	Factors		Fitting work	
WN/NN		Specifics of tension	Institutional Environment	Infrastructure	Work Network	Org./Tech.
1	W*N1 at PR*NN1	- Unable to gather information (not insurance information due to fitting work) - Faced similar longer call durations	Reduced provider schedule; Lack of access to relevant information; Patient unwilling to provide information	N.A.	Adopted new PR*NN1 as per Alpha clinic	Used “walk-in” function; Compulsory links for function
2	W*N1 at FD*NN1	- Increased workload as missing information and insurance info. are hard-stops at FD (FD*NN1.4-7) - Longer registration duration - Changed patient’s billing encounter and labels print-out (FD*NN1.14-16)	New requirement to verify insurance (previously not done at Beta front-desk)	Lack of staff to work verification workqueues	Ignored insurance verification queues	Use existing paper chart information to complete workqueues
3	Checkout	- New work narrative	New requirement to checkout patients; Multiple work roles on front-desk staff	Lack of staff to work check-out in addition to existing work queue	N.A.	Reminders to patient of check-out; new staff hired
4	W*N2 at PR*NN1 & MA*NN3	- Rx refills requests and messages now sent directly from PR via In Basket (PR*NN1) - PR and MA do not have visibility of completed Rx (MA*NN3.6) - Constant pressure to monitor In Basket as well as clinical duties (for MA*NN3)	Part of provider prescription refill documentation shifted to MA; Close collaboration of work across FD and clinical	N.A.	N.A.	FD use cc field to provide access to staff messages; FD forwards all calls and enquiries to MA
5	W*N2 at PROV*NN3	- Lagged individual lab result messages create confusion (PROVNN3.3) - Additional steps needed log in & sign-in - Constant pressure to monitor In Basket as well as clinical duties	Paperwork turnaround policy	EMR and Laboratory systems interface issues	MA advises patient and close enc. (skips MA*NN3.19)	Revert to paper lab results

Table 40. Tensions and Fitting work (Gamma clinic)

		Tensions	Factors		Fitting work	
WN/NN		Specifics of tension	Institutional Environment	Infrastructure	Work Network	Org./Tech.
1	W*N1 at FD*NN1	<ul style="list-style-type: none"> - Insurance cards not available at registration - Increased workload as missing information are hard-stops at FD (FD*NN1.4-7) - Changed patient's billing encounter and labels print-out (FD*NN1.14-16) - MSPQ requirement (FD*NN1.9) - Longer registration duration 	Payor-mix require same day insurance verification; Patients accustomed to informal culture and processes; MSPQ formalized; Multiple work roles on front-desk staff	Lack of staff to work verification workqueues	MSPQ (FD*NN1.9) short-cut; Copay (FD*NN1.20-22) shifted to check-out	Notices and letters to remind patients of new policy
2	W*N1 at FD*NN1 (lab only)	<ul style="list-style-type: none"> - Patients not accustomed to registration and visits not captured in system 	Formalization of lab only visit registration	Ease of access to clinical office without having to go through FD	N.A.	Reminders to patients and MAs of new workflow
3	W*N2 at MA*NN3	<ul style="list-style-type: none"> - MA*NN3.2 requires them to convert staff messages to tel. encounters i.e. additional steps - Constant pressure to monitor In Basket as well as clinical duties 	Part of provider prescription refill documentation shifted to MA	Charts and EMR both continue to circulate work	N.A.	N.A.
4	W*N2 at PRO*NN3	<ul style="list-style-type: none"> - EMR documentation increases duration of examination given complex medical conditions - Increased work to create, abstract and verify prescription requests; slowdown in completion of requests - Constant pressure to monitor In Basket as well as clinical duties 	Chronic geriatric patient base; Provider schedule that spends only part-time onsite	Charts and EMR both continue to circulate work	N.A.	MA constant verbal reminders to provider on Rx requests; Use of new whiteboards for additional communication between MA-Provider

Chapter 9: Key Findings

Introduction

This chapter bridges the explanation of the Work Network model in chapter 8 and the discussion about the theoretical implications of this model in chapter 10 to discuss and review the key findings of the dissertation. The break-down of this chapter is as follows: first, I discuss concerning the research setting and its implication on the system design process; second, I describe the contributions of the Work Network and narrative network methods; and last, I review the substantive findings from the study derived from the Work Network and narrative network analysis and look at how they relate to my research questions.

Findings of the research setting

Like most clinical operations, all three sites face a certain degree of input uncertainty and a significant amount of patient load. This is especially true in a family clinic setting since the family clinician sees almost all types of patient and medical conditions – they may range from common ailments and allergies to chronic conditions such as diabetes and blood pressure issues. In a typical day, a clinician may be dealing with a pediatric examination in one time slot and then switch to a normal cough patient and back to treating a diabetic patient. A patient presenting in the clinic is often very different from the next. This therefore creates the high input uncertainty for the clinic's operations and clinician course of work. Among the three clinics observed, Alpha clinic has the most variety of patients as the five clinicians included pediatric specialist as well as OBGYN specialist. Gamma clinic has a relatively lower degree of input uncertainty as it limits its patient base to geriatric and adult patients. Beta clinic is in between Alpha and Gamma clinics since it covers pediatric and adult patients but see fewer patients with chronic conditions than Alpha clinics. Regardless, all three sites have a relatively higher level of input uncertainty compared to

specialist clinics in hospitals. The patient load adds to the variety mix to increase the complexity and dynamism at the clinics. Alpha clinic being the one with the larger number of clinicians has the largest volume compared to both Beta and Gamma clinics.

The challenge for clinical operations at the three sites is to be able to provide quality care in the face of the relatively high degree of uncertainty and load. This is vital since the consequences of failure may be fatal. Clinical operations at the three clinics handle this challenge by building a tight integration between the clinical work and the other support and clinical operations. Thus a key finding concerning the research setting is the significant overlap in work between the clinical and support staff. The provision of high quality care is therefore not just the purview of the clinicians but that of the clinical operations as well. This rich “ecosystem” of work that surrounded the clinicians includes phone operators, front-desk staff, medical records and medical assistants. For example, clinicians depend on schedulers at the phone room and front-desk to ensure that the “right” types of patient are scheduled in the appropriate timeslots. The rule at Alpha clinic is that no two patients who require physical examinations should be scheduled back-to-back as this would necessarily lead to a back up in the patient flow. MA and the front-desk staff need to coordinate closely to ensure that the correct patients are registered and vitalized according to the paper schedule so that clinicians have enough lead-time between patient examinations. In turn all these operations require that the medical records team provide the patient medical chart to each role when they are interacting with the patient e.g. front-desk during registration, MA during vitalization, and clinicians during examinations. The same work ecosystem is also observed in terms of patient-clinic communications where clinicians are dependent on their MA to communicate the pertinent medical information to the patient in a timely manner. Clinicians are also dependent on the medical records team and phone room operators to receive patient communication and act on them in a timely fashion.

However the coordination and communication that occur in these overlapping work between clinical and support staff is dependent on the availability and utilization of various artifacts. For example the appropriate patient scheduling is determined by the management and clinicians and communicated to schedulers via paper memos and handbook detailing the appropriate timeslots. These rules are also inscribed into the existing scheduling system as time blocks. The coordination between front-desk and MA depends on the physical provider rack and the presence of paper charts in those racks as well as printouts of patient schedules. The paper medical chart is an essential artifact that enables and follows the patient flow through the clinic. While its main duty is to capture all clinical notes pertaining to the patient, its application is wider in scope. Specifically, it acts as a conduit to transfer phone messages between patient and clinicians; it also acts as a signal of patient readiness to be roomed. In other words, the ecosystem of work in the clinics involves significant interconnection between work and the use of various artifacts. Hence, I observe that it is through the joint effort of this complex assemblage of actors and artifacts that each clinic is able to deal with the high input uncertainty and avoid being potentially fatal.

Put together these aspects of the clinics have important implications for the new EMR system design and implementation project and vice versa. On the one hand, from a technical view, the EMR system design has to take into account the features and ways by which various artifacts are used in the coordination and communication among the staff and to ensure continuity and if possible enable better performance than existing artifacts. On the other hand, from a process view, the EMR system design has deeper and subtler impact on the operations. This is because the EMR system's design is focused on integrating and standardizing clinical and support operations and as such it not only impacts each individual role but also radically changes the structure and dynamics of the tightly knitted team. However the team structure at each site and the way artifacts are enrolled as part of its network are different as they constantly react and evolve with the direct environment. So while the EMR system is designed with a goal of a "standard" system, the

consequences of introducing a “standard” EMR system into each environment are hard to predict from a set of priori factors. More importantly the clinical and operational teams can and will adjust to the new EMR system since these changes have significant consequences for the level of patient care they provide. Hence it is no wonder that medical informatics practitioners have difficulty classifying whether an EMR system is successful or not (Berg 2001).

Given these key findings, I provide in my dissertation an in-depth examination of the processes and infrastructure that support medical work in these clinics and how the process of designing and using the EMR system interacts with those existing processes of medical work. I suggest that the clinics’ medical work and more importantly the process by which technology-based changes emerges must be understood at the level of team or network of roles where the trajectory of patient care unfolds (Faraj and Xiao 2006; Strauss 1993). To facilitate this, I have developed a novel methodological approach – Work Network analysis.

Methodological Contribution and Approach contribution

The Work Network analysis is a key contribution of this dissertation as it is an attempt to a) capture patterns of work in clinical settings at the network and individual role levels, b) make explicit how human actors and artifacts combine to jointly carry out work as viable sociotechnical systems, and c) provide the basis for a new framework to tease out the influence of institutional factors, political factors and practices on changes to work and technology.

The Work Network analysis is based on the narrative networks that Pentland and Feldman (2007) proposed as a “device for representing patterns of ‘technology in use’”. They suggest that “the use of (technology) to accomplish organizational tasks and enact organizational forms can be conceptualized and empirically summarized as patterns of narrative fragments connected into networks (pg. 781). The narrative fragment/node focuses on how actors/users use technology and

serves as the foundational building block of organizing. Each narrative fragment succinctly captures the action, agency and artifact and shows how actors and systems are or can be interconnected in a single enactment. Interlinking a series of narrative nodes into a narrative network allows researchers to then capture the “potential and realized interconnections between actants and actions and the fluidity of these interconnections” (Pentland and Feldman 2007, pg. 781). While sociotechnical system idea is not novel there has been little attempt to empirically capture and describe such systems in today’s rapidly evolving organizational environment, especially with a view to describe how work is done with artifacts (Barley and Kunda 2001). The narrative network analysis therefore brings a new conceptual vocabulary to facilitate describing these sociotechnical systems in organizing and represents a change from existing research that has relied on rich descriptions of change (Orlikowski 2000) or structural proxies such as social network in organizations (Barley 1986, Leonardi 2007).

However work in organizations is not limited to one single narrative network of a single role but is rather a mish-mash of narrative networks of various overlapping roles. To depict all the overlap as a single narrative network would be cumbersome and unwieldy for analysis. The Work Network analysis extends the narrative network analysis by taking into account the networks beyond individual roles and provides a way to depict the interconnecting narrative networks in an organization. The Work Network analysis enables this by “aggregating” each role’s narrative network into a single node in the work network and depicting the interconnection between the different roles at the organizational level. Like the narrative network, it foregrounds the action and artifacts in organizing at the organizational level as the links between each role represent the communication or coordination among roles as well as the artifact involved.

By doing so, the Work Network analysis and its attending narrative network analysis of pertinent organizational roles make salient what other methods do not allow us to see. For example data or

workflow diagrams that system analysts employ typically show optimized or formal paths of information or work but do not attempt to capture both actual and potential flows like in the narrative network and Work Network analysis. These diagramming techniques also place relatively more emphasis on identifying either human or technical components. The Work Network on the other hand places equal emphasis on both human and technical components. Also existing workflow diagramming tends to be focused on a specific individual role and the decision points that it takes as it carries out its work. The narrative network also depicts the sequence of events albeit a broader range of possibilities that are beyond explicit decision points and the Work Network widens the view to include other roles in the organization.

Hence the Work Network and narrative network enable researchers to trace the sequence of specific changes in organizing and technology use from a holistic, sociotechnical and dynamic perspective. Because Work Network captures broad possibilities it allows us to understand how different outcomes occur when similar new technology is introduced. Further, by capturing explicitly the action and artifacts, it allows us to investigate how these action and artifacts are influenced by existing or new institutional factors, political factors and practices. This gives us a more nuanced and precise approach to understanding the process of change. This approach improves on past research that has typically paid lip service to the role of institutional factors, political factors and practices and left them in the background.

Substantive findings

I begin this research looking at how the process of technology-based change occurs in high reliability organizations such as the medical clinics. The key research questions being: “how do users and their current work practices interact with the configurations of new work processes implemented in the EMR system?” and “how do these interactions influence organizational outcomes?”. Using the Work Network analysis, I find that it is not just the existing work practices

and new technology-based processes that influence the emergent organizational changes but rather it is the institutional factors, infrastructure and design differences surrounding these practices and processes that lead to specific tensions where things cannot be reworked. Specifically, by super-imposing the existing Work Networks with the ideal or designed Work Networks, it becomes clear how and where the new EMR system significantly impact the role of support staff and clinicians, which in turn upsets the existing sociotechnical system that is in place in each clinic. For example when I compare the existing and ideal Work Network for registration and scheduling of patients, I find that the ability of the front-desk and the phone operator staff to cope with the high input uncertainty and high transaction volumes given existing infrastructure (human and technical) becomes upset by the new EMR system and new organizational policy. The tensions that emerge in this process are so significant in its impact that the new EMR system and organizational policies have to be significantly altered.

In relation to the third research question i.e. what configuration and user practices make one site more “successful” than another, my analysis shows that while one cannot directly predict success factors, one can potentially gain insights into where and what kind of tensions each site may face with a new EMR system by comparing existing Work Networks with ideal Work Network; these emergent tensions in turn influence the relative “success” of each implementation. As noted above, these comparisons need to take into account the institutional and infrastructure factors to provide a clearer understanding of the challenges and subsequent outcomes. For example the existing Work Networks for Alpha clinic is denser with more interconnections due to the high patient volume as well as the larger number of clinician. Comparing their existing Work Network with the relatively streamlined and formalized ideal Work Network shows that challenges would emerge as staff carry out the formalize network flow while reacting to the high volume and uncertainty.

Table 41. Cross-case comparison

	Alpha Clinic	Beta Clinic	Gamma Clinic
Institutional Factors	Patient reluctance to share information Payor-mix (same day verification) High patient volume Reduced provider schedule Paper chart continuity Rotating assignment to providers	Patient reluctance to share information Reduced provider schedule Paper chart continuity New requirement to do verification Multiple front-desk roles Close collaboration across staff Paperwork turnaround policy	Patient reluctance to share information Higher number of Chronic/Geriatric patients Payor-mix (same day verification) Reduced provider schedule Paper chart continuity MSPQ formalized Multiple front-desk roles Informal culture
Infrastructure Factors	Outdated telephone system Lack of front-desk and tel. operator staff Perceived inefficiencies in medical records Use of paper chart in parallel with EMR	Outdated telephone system Lack of front-desk and tel. operator staff Lab interface issues	Outdated telephone system Lack of front-desk and tel. operator staff Part-time providers Lab interface issues Ease of access to MA bypassing front-desk
Tensions	W*N1 at Phone Operator NN1, Front Desk NN1 W*N2 at Phone Operator NN1, MA NN3, Clinical NN3	W*N1 at Phone Operator NN1, Front Desk NN1, Checkout W*N2 at Phone Operator NN1, MA NN3, Clinical NN3	W*N1 at Phone Operator NN1 & Lab only, Front Desk NN1 W*N2 at MA NN3, Clinical NN3
Fitting Work	Amended Phone Operator NN Revised policy on registration Changed Paper chart flow Amended Front-desk verification Extensive verbal communications abt EMR MA wholly responsible for Rx refills Workarounds messaging protocol One-to-one provider-MA	Adopted Alpha clinic Phone Operator NN Adapted Walk-in function Used existing paper charts for data entry Front-desk's new checkout flow Workarounds messaging protocol MA wholly responsible for Rx enquiries Use of paper lab results MA takes responsibility for closing enc.	Retained existing checkout process Informal workaround for MSPQ registration Constant communication with patients of new workflows Use of whiteboards for comm.. between MA and providers MA actively engaging providers on EMR messaging
Outcomes	Increased duration for check-in but reduced check-in wait time Reduced patient flow speed from Front-Desk and MA Increased duration for vitalization and orders but improved patient flow in bet. exams	Increased duration for check-in Reduced patient flow speed from Front-Desk and MA Increased duration for vitalization and orders but improved patient flow in bet. exams	Increased duration for check-in and wait-time Significantly reduced patient flow speed from Front-Desk and MA Increased duration for orders but reduced patient flow in bet. exams

From the Work Network analysis, one can observe that each clinic's Work Network is different from the other and these differences reflect the organizing that has emerged *in situ* given existing

institutional and infrastructure conditions (See Table 1 above). It is no wonder that these Work Networks interact differently with the ideal Work Network design thereby leading to differing system success in each clinic. For example the eventual narrative networks for similar roles across the three clinics are different (see pg. 192-198) and the metrics of task durations vary from one site to another (see pg. 205).

Given these findings, I observe that standardization in clinics through the EMR implementation is limited since the “standard” configurations are usually not applicable when the system design does not take into account the context where poor infrastructure exists and where input uncertainty is high. Instead, the new EMR system very often creates more work in the form of “fitting work” for staff on the ground as they attempt to navigate around the issues of poor infrastructure, resource limitations and highly uncertain work conditions (see Table 1 above).

From this perspective, I argue that the Work Network analysis of the different clinics after work has stabilized shows that fitting work may be a natural outcome of this process and may in fact be important as it makes systems workable and crucial for system success. While this may not be true for a simple system, it is critical in complex systems. This argument is a departure from traditional IS’ negative view of workarounds where they are often portrayed as inefficient and problematic (McAfee 2003) and is in line with recent work to open up the black-box of “workarounds” in IS work (Azad and King 2008). Thus the fitting work as observed in the clinics is an important component of work that the staff on the ground engages in so as to adapt the ideal Work Network and narrative networks in the EMR system to the actual working conditions. As such, the notion of “fitting work” that each site engages in is also key to explaining the different success of the EMR system in the three sites.

Finally with regards to my first research question on how the implementation process of an EMR

system impacts its configurations and the work process in the ideal clinical operation, the Work Network method provides a direct method to pinpoint specifically how the socio-political process and the institutional context impact the design of the system. The key insight therefore is not so much that the system configuration process is socially constructed and politically charged, but that the Work Network allows us to explicitly trace and relate the material aspects of technology and work to these pertinent socio-political issues, which most studies have alluded to but have not discussed in great detail (Orlikowski 1999, Barley 1986, Davidson and Chismar 2006). In fact, my analysis of the process by which the ideal Work Network emerged as well as the documentation of the eventual ideal Work Network system show a more nuanced and richer perspective where the direct and indirect impacts of the political, institutional and infrastructure factors on the EMR system are discussed.

For example I detail clearly how the political impasse as well as infrastructure differences between the two key sponsors leads to the “non-integration” of the EMR system with the billing system. This significantly affects key aspects of billing work in the clinics, which are reflected in both the narrative network of front-desk staff and the Work Networks for scheduling patients. Other examples include the lack of standardization for clinical operations and the non-integrated referral and benefits calculation process.

From an organizational level, this analysis shows how the political process of system configuration compromises the design of the system – when different stakeholders actively work against each other due to their differences in agenda, motivation and priorities. From the project level, the Work Network analysis reveals that system configurations tend to be narrowly defined by powerful local level actors e.g. doctors and clinical management who may or may not be directly related to the daily operations of the sites. Examples include the best practice of full registration over the telephone and design of the In Basket workflow for providers and MAs. They focus on their

general clinical and operational concerns and give shrift to local practices and conditions resulting in tensions and problems as reflected in the Work Network analysis.

Finally, the Work Network analysis allows us to understand how institutional factors affect the design of the system and how they limit or enable the system effectiveness in each of the clinics. Institutional factors include the organizational goals, policies, external government policies etc. Specifically, the Work Network analysis shows clearly how the new roles and process connect with external institutional factors such as the hospital billing systems and that reflects the closer connection between the local practices and the larger organizational systems and policies. On the other hand, the absence of various artifacts and functions in the ideal Work Network shows how some institutional factors can limit the system effectiveness. Key examples are found in the Compliance advisory team's work that influences the removal of various efficiency enhancing functions from the EMR due to risk concerns (the most notable is the copy previous note function). Yet, I also observe positive impact of institutional factors on the project and EMR implementation. An example of the positive institutional influence is the availability of significant resources provided by the MATH organization to move forward the implementation of the EMR. These resources include large infrastructure investment (e.g. local area network upgrades, additional printers, fax, copiers and workstations), provision of extensive training and training facilities for users, and staffing in the three clinical sites. These are reflected in new artifacts built into the new Work Network and narrative networks.

Conclusion and summary

The clinical setting in my dissertation research involves high input uncertainty that requires a high degree of integration among different roles in the clinics as well as the use of various artifacts to provide quality patient care. The Work Network analysis provides a novel method to describe and analyze both the changes in an individual role and the flow of work among inter-connected roles

and artifacts. This goes beyond existing requirement fit analysis that may focus on a single role or task, which may not take into account the work at the network level.

With regards to my second and third research questions, the findings from the Work Network analysis show that it is important to understand the implementation of complex enterprise systems like EMR at the network level because when the nature of work changes at that level, new skills and new expectations are required of different users. These changes are often hard to anticipate for large-scale implementation since Work Networks evolve differently under different local institutional and infrastructural conditions and unintended consequences may result in significantly more work that might negatively impact the process of change. Work Network analysis of individual sites provides a step forward to potentially anticipate some of these challenges of technology-based change and explain the varied outcomes that emerged.

As regards to the first research question concerning the implementation process and its impact on system configuration, I find that the implementation of mandated systems in high input uncertainty and high reliability setting requires recognizing who the stakeholders are at each level and the institutional factors and infrastructure involved in the process across these levels. On the one hand, stakeholders and institutional factors enable and provide key resources to move the EMR project forward. On the other hand, when stakeholders do not represent the ground-level users or fail to take into account pertinent institutional factors it is not surprising that the new system design leads to workarounds. In this way, it is hard to classify if this type of system implementation is a success or failure. Instead it is more important to understand the process of change and the degree of workarounds that new systems create. It also challenges the degree of standardization a system like EMR can bring about in the clinical organization.

Chapter 10: Discussion and Conclusions

How does technological change relate to organizational change? Why do these interactions occur and when do they occur? These are the key questions that I attempt to answer through my dissertation research. While the literature and recent research has meandered from a technological deterministic approach (e.g. Leavitt and Whistler 1958) to an agentic approach (e.g. Orlikowski 1996) and more recently to a material-agentic approach (Orlikowski 2007). I offer that the core of change emerges from a deeper investigation of the notion of “work” itself. Although this theoretical stance may seem almost mundane and commonplace, I believe that my Work Network model provides a unique counterpoint to the varied swings and familiar debates that the stream of technology-based change research has been undergoing in recent years. I discuss briefly below the theoretical and empirical motivations that have guided me to this position and how this is a key contribution from my dissertation. I also provide my views on the other contributions of the dissertation and also how my model relate to four existing theoretical perspectives. I then conclude this chapter with the limitations of my dissertation as well as the implications of my findings for practice and future research.

Reflection on the Path of Theorizing

Lévi-Strauss (1967) used the notion of “bricolage” to explore a type of scientific knowledge that is built on “whatever is at hand”, that is, the process of building and problem-solving is contingent on the problem as well as the existing tools and materials that are available to the researcher. As I reflect on my own research journey, I find myself following in a path similar to that of a “bricoleur” and that the result of my work i.e. Work Network is a kind of “bricolage”.

In my dissertation proposal I have concluded that extant literature has failed to fully take into account the materiality as well as the active role that technology plays in organizational change.

Like many social constructivists before me, I have argued that this is important since the technological artifact is not a neutral medium; rather it is often vested with socio-political interests. Given this position I attempt to explore the process by which the technological artifact has been configured and developed and then placed into the work environment. I believe then that the affordance perspective of the artifact would provide a deeper understanding of the changes.

When I enter into fieldwork I see that the materiality of the technology is indeed salient. This can be seen in chapter 5 where I discuss how various functions are contested and finally included or excluded from the final EMR system. However as I engage more with the participants, the system and the data on site, I find that the discussion concerning the technological artifact materiality is tightly linked with the work that is done – so much so that the discussions on work and its flows turn out to be more critical for the people developing it and using it than simply the individual EMR functions. For example physicians have discussed how for the first time the system is making them think beyond their own individual work and consider how their work interconnect with each other and with others in the clinic (Dr K in Minutes PAG 071204). Administrators have reviewed how their work could be standardized (CIO in Minutes Research Meeting 071129) and individual support staff has reconsidered how their work should be coordinated (SC #28). So like Lévi-Strauss's "bricoleur" I go back to "interrogate" the literature on work, organizational change and technology. Several key writings have become important mental markers as I begin to consider deeper along this direction of research.

The first conceptual marker comes from Kling and Scacchi's (1982) "web of computing" model. I have discussed this work in chapter 8 and I will not repeat it here. However I want to highlight again its impact on my own theorizing. First, their emphasis on IT design and work resonates with my data collection where the EMR system design is not just about individual sets of functionalities but how these functionalities embed and are embedded in individual work as well as collective

work. Second the fact that they see IT systems as embedded in a larger social and political context has assisted me to begin framing the conditions and issues that emerge to influence the design and use of the system. While Kling and Scacchi's (1982) has sensitized me to how computer design and use are intricately intertwined with the work the people do, their research is highly descriptive and as they have admitted "analytically cumbersome". Scacchi (2004) points to this lack and has proposed that researchers should consider various means to "visualize, represent, or depict" the web of computing itself so as to communicate its form or dynamics.

The next conceptual marker comes from Barley and Kunda's (2001) impassionate call to bring "work studies" back into organizational theorizing. They argue that organizing and work are interdependent such that changes in the nature of work naturally lead to changes in organizing and organizational structure. Therefore to understand new organizational structures, researchers have to return to uncover and update images of work itself. They argue that current bias towards abstraction and environmentalism i.e. the reliance on external factors to explain for new organizational structures fails to take into account the important intermediary steps – work activities – that "mediate the effects of environmental change" on organizations (pg. 79). Specifically with respect to technology-based change, they argue it is the way "the technology is designed, the way it is deployed, and how it is used and interpreted in a specific organizational context" that determine the technologies' impact (pg. 79). In this way, they argue, researchers can better account for the link between environmental change and change in nature of work.

Just as Kling and Scacchi have made the connection between technology and work, Barley and Kunda have made the connection between organizational change and work. The two key points that I derive from Barley and Kunda's essay are: a) it affirms the need to shift my view of the organization and change from an agent-artifact dichotomy to the work perspective, and b) the nature of technological-change in organizations requires a set of "specific, verifiable" image of

work. Another side point that impresses me is their short discussion on how “work studies” could reinvigorate taken-for-granted notions such as roles. They have broadly discussed how roles when viewed from a work perspective could refocus organizational understanding of roles as dynamic and rooted in action and interactions. They suggest that this work conception of role might be linked to social network analysis to understand how changes in work change organizations (pg. 89).

The third and last conceptual marker that builds on the previous two is Pentland and Feldman’s (2007) “narrative network” paper. Again because I have elaborated on this concept in chapter 3, I will not repeat it here. However, I do want to point out the theoretical foundations for the narrative network and how that supports and extends Kling and Scacchi (1982) and Barley and Kunda (2001) ideas. Pentland and Feldman’s goal for the narrative network is to be a tool to make sense of new info-communication technologies (ICT). This notion grows partly from Pentland’s own research program on organizational routines as grammatical models and partly from existing constructivist theories such as technologies-in-practice theory (Orlikowski, 2000) and actor-network theory (Latour, 1999). Narrative network therefore puts action at the foreground by capturing patterns of action that “retains possibilities and alternatives” (pg. 787). In a more succinct form, they propose that narrative network captures how *people use tools to do tasks* (pg. 781, emphasis in original work). The narrative network becomes the methodological linchpin that ties both Kling and Scacchi (1982) and Barley and Kunda’s (2001) ideas and provides the practical way forward in developing my model. On the one hand, the narrative network provides a concrete way to explore Barley and Kunda’s call for a “specific, verifiable” image of work while on the other hand it naturally lends itself as building blocks for visualizing Kling and Scacchi’s production lattice.

Work Network Model as a Counterpoint

Building on these three key papers as well as a slew of computer-supported cooperative work (CSCW) studies in the medical informatics stream of research (e.g. Berg 1999), the dissertation’s

main contribution is a new mid-range process theory – called the “Work Network Model of Technology-Based Change” that seeks to explain technology-based change using work and network as its focal concepts (Gregor 2006). I argue that the Work Network represents a counterpoint to current swings between views that privilege agency (Boudreau and Robey 2005; Orlikowski 2000) and views that emphasize the technologies’ materiality (Leonardi 2007; Volkoff et al. 2007). It serves as a counterpoint because the Work Network model a) includes both agency and materiality and b) shifts the perspective of technology-based change to the Work Network level.

With regards to the former, Leonardi and Barley (2008) argued that to build a better theory about the role of materiality in the process of organizing, researchers should “integrate materiality with a more voluntaristic stance” (pg. 164) and tease out the role of the material and social. Work Network model represents an attempt in this direction in that it speaks to the agency perspective by documenting the actual and potential practices in the individual narratives and the Work Network as well as the material perspective by explicating how the technology is embedded in each narrative as well as within the overall Work Network. It captures individual agency in that it shows how individuals are enabled by the technology so that they can manipulate their narratives of work but are also constrained by the technology as their individual narratives are interlinked to other narratives and artifacts. With regards to the latter, Work Network model captures materiality of technology in the way the “ideal Work Network” describes how politically negotiated data, routines and roles are inscribed into the EMR system (Volkoff et al. 2007). Materiality is also captured in the actual accounts of how EMR system is utilized in the narratives and embedded in the Work Networks.

More importantly it is a counterpoint because the Work Network model argues that it is neither the agency nor materiality of technology that drives change. This is analogous to Barley’s (1986)

relational/non-relational role perspective where he argues that only changes that ripple from non-relational to relational aspect of a role lead to social and organizational change. Likewise by analyzing changes solely from an agent's use of a technology (e.g. a MA's choice to use a comment field in the EMR) or a new function that embeds new data (e.g. EMR capturing religion of a patient) may not provide us with insights to organizational change. Instead the Work Network model analyzes change at the level of network from an organization work's perspective where the agent's use of a function is contextualized in the organization's work and linked with other agents and technology in their courses of "work". Volkoff et al.'s (2007) second level analysis, which discusses how the enterprise system embeds the relationships "among routines in the form of work sequences" and its consequences, captures part of this argument. But they left their analysis at the point where the system embodied these relationships and do not discuss in detail how that impacts the work practices. In contrast, the Work Network model puts "work practices" at its focal point and uses these practices to show "the specific ways in which features of particular artifacts become entangled in the social practices of people's work (Leonardi and Barley 2008 pg. 164)" so as to acquire a fuller account of the change process.

Other contributions

While it is important to shift our level of analysis of change from the individual user and from the individual system functionalities to that of work and its network, the other important contribution of the Work Network model is the widening of the scope of change analysis from only the post-implementation use phase to include the pre-implementation or the configuration/development phase. As I have shown in my model, the configuration/development phase analysis shows the situated political process by which the final assemblage of actors, actions, and artifact is "created". Unlike most change theories, I do not assume that the process of configuring is unproblematic as most studies have (e.g. Boudreau and Robey 2005; Volkoff et al. 2007). This is because science and technology studies (Bjiker 1995) as well as some IT research

(Davidson 2002; Markus 1983) have shown that IT systems are influenced by and are the results of socio-political negotiations. Kling and his associates (Kling 1980) have also shown that IT developments are shaped by institutional structures, historical commitments and parochial interests and perspectives. By reintroducing and adopting a critical view of the configuration/development activities surrounding a IT system, I have chosen to ignore the unspoken theoretical blinkers (Leonardi 2005; Leonardi and Barley 2008) and theorize concerning the processes and factors that assist us to understand how and why specific uses and functions of the IT system come about (Kallinikos 2004; Orlikowski and Robey 1991). This understanding and the outcome of the process (viz. Ideal Work Network) inform and provide basis for the tensions observed. Therefore, on the one hand, this theorizing extends science and technology studies research as their work on innovations usually assumes that the political process ends when a technology is designed and adopted whereas the Work Network model views that as an intermediate step in the process of organizational and technological change. On the other hand, the Work Network model surfaces the sources of tensions and is a way to track and trace the reasons why users may want to change an aspect of the technology or why they are able to adapt to the technology.

A sidebar to studying the change process from the configuration/development phase is the surfacing of “missing” artifacts and its impact on organizational change. While most research on development has mainly focused on why certain artifact exist or succeed, not much research has touched on the reason why certain artifact fail or do not exist since it is challenging to collect data on failed artifacts. There are exceptions, of course, e.g. Bruno Latour’s (1996) study of the failed French automotive system. Recently, researchers in the field of organization studies have also begun exploring the traces of failure, specifically failed organizations, using artifacts left *in situ* of these organizations (Neff and Kirsch 2007). I reflect on the fact that the multi-level political contests provide the traces of some EMR functionalities that have been excluded from the implementation at my three research sites. These “excluded” functionalities include the billing

integration functionality, the LOS calculator, and the copy previous note. What is interesting about the EMR artifacts that are excluded is the potential explanation they provide for why certain aspects of the organization remain unchanged (Gallie 1994). For example the lack of billing integration resulted in having the process of generating billing face sheets and its manual reconciliation – which meant that the billing processes remain the same for the organization. The lack of copy previous note function (which is excluded by policy but not physically removed from the system) means that providers will continue to document each encounters from scratch as currently practiced on the paper medical chart. While not directly linked to the model, the traces of the political contests over potential functions provide an interesting direction for future work on organizational (un)change.

The Work Network model also takes into account the context of change in a more concrete and explicit manner by considering the infrastructural and institutional environment factors. Specifically the Work Network model shows how both contextual factors are brought to bear both during the configuration/development and use phases. As discussed in the findings as well as the theory chapters, institutional factors such as the organizational rules of MATH and external agencies such as Medicaid/Medicare have been important in the designing and configuring the Work Network in the EMR system (e.g. printing of tamper-proof prescription requirements from CMS). They are also important sources of tensions during the use phase of the EMR system. The inclusion of these factors is in line with recent calls by IS researchers to take into account the institutional influences on IT use and development (Agarwal and Lucas 2005; Chiasson and Davidson 2005; Orlikowski and Barley 2001). It also adds to the emerging stream of research that focuses on the institutional triggers of technological and organizational change (Davidson and Chismar 2007). However, more work is needed to consider the various types of institutional forces e.g. local versus global and when and how their impact is effected.

The notion of infrastructure is also another important element of the context that has to be taken into account, as the introduction of a complex EMR system is inherently an infrastructural change. According to Star and Ruhleder (1996) an infrastructure is characterized as “embedded into other structures, social arrangements and technologies” therefore it is usually “built on an installed base” and interfaced through standards and existing practices so that it usually has a reach and scope beyond single site or event (pg. 113). In the Work Network model I show that the design of the EMR system is dependent on the installed infrastructure (be it human staff or wireless networks) as Star and Ruhleder have pointed out in their paper. When that installed infrastructure interface is not successful negotiated (as in the case of the billing interface) there is significant ramification for other aspects of the EMR system as they are all interconnected within the EMR infrastructure. The other key consideration of infrastructure is that existing aspects of installed infrastructure may “lag” behind the developments of the focal infrastructure; these potentially become focal points of tension and factors behind emergent changes (Ciborra and Hanseth 1998; Hughes 1983).

Finally, the Work Network model provides a concrete way to describe, formalize and trace change. As pointed out above there have been propositions by other researchers to visually represent social-technical networks and/or organizational work as social networks so as to account for the structure and dynamics of work and organizational change. The Work Network model uses the narrative network methodology as a starting point to derive the work narratives of key roles within the organization and then connect these roles with each other based on handover points described in those individual narratives. As Pentland and Feldman (2007) suggested, researchers can enter both of the levels of the network model into existing social network analytical tools such as UCINet for visualization and further analysis. Other researchers have also used social network tools to depict and analyze socio-technical relationships e.g. Kane and Alavi’s (2008) multi-modal network that examines knowledge networks in organization and incorporates both actors and the IT artifact. Applying the Work Network model researchers can examine and describe how work and

technology exist and how potential work and technology may exist as inscribed in design documents and in the systems. By capturing the different Work Networks within and across organizations over time, as I have done in my dissertation, researchers can pinpoint what has changed at both the role and network levels and theorize about the change by comparing them across sites.

Alternative Theories

In chapter 2 I discuss three main theories that IS researchers have used to explain technology-based change – viz. structuration theory, practice-view of technology and social construction of technology. This section explores how these theories might explain the research findings and I compare the Work Network model with their explanations? In addition to these three theories, I also discuss about the material aspects of IT and traditional enterprise system development perspective as alternative lens to view my findings.

From a structuration perspective, one might explain that EMR introduces change in the clinics by embodying a different set of norms, resources and interpretation to clinical and non-clinical work such that users' actions are changed. It might explain that change occurs in the scheduling and registration process because the users choose to enact a different set of norms and draw on a different set of resources in the EMR system so that the full registration institutional structure is not enacted. But apart from explaining the change from user's agency and actions, it does not account fully why only the phone operators "revolt" the institutional norms while the MAs enact the new norms of patient communications? Is the discrepancy between the phone operator's interpretive scheme and the EMR institutional scheme larger than the MAs' interpretive discrepancy?

The practice-view of technology extends the structuration arguments by taking a more deeply situated view of those enactments and premising that IT is not structure per se – only the rules and

resources that are enacted are structures. The practice-view of technology allows us to take account of the situation as well as the actor's own interpretive schemas and goals. Applying that to the phone operator case would sensitize us to the current practices and conditions that phone operators' face. However while this view allows us to focus on each individual or role, it fails to take into account why similar conditions would create issues in one context and not in another. For example the registration of patients in Alpha presents a more challenging context and requires more enactments as compared to Beta and Gamma's registration. Practice-view only describes what enactments and technology-in-practice are present but is unable to account for why those technology-in-practice occur. Work Network model in contrast takes into account the context, situation and surface the inter-connectedness of artifacts and practices (Bourdieu 1977). This is in line with the current trend of pushing for a more sociomaterial perspective of how organizational life and practices are assembled and produced (Orlikowski 2007). In this way, the Work Network model enriches the practice view of technology.

From a social construction of technology (SCOT) perspective, one would explain the changes observed as the outcome of discrepancies among stakeholders' technological frame. For example one might posit that the discrepancy between the management's technological frame and the support staff technological frame has created the problems in the two processes observed (Davidson 2002). However, SCOT assumes implicitly that while stakeholders may vary in terms of power and resources there are viable forums where negotiations and debate are made with respect to the technology. In reality the opportunities for the exercise of power in negotiations are limited to specific segments of the organization and the application of SCOT becomes less effective in such circumstances. Specifically, the ability to dominate and exercise power over the final framing of the technology can lead to a strong management imperative for the use of the new technology so that technological frames of actual users do not have a significant impact on actual use and the changes that evolved (McLoughlin et al. 2000).

As concerning the materiality of the artifact, I have mentioned above how the emerging stream of research of IT artifact and change has contributed to our understanding of the IT artifact's role. While I believe that the material view of IT is theoretically important as it speaks towards the gap that structuration and practice-view have created, the empirical studies fail to capture the complexity of work and the intricate relationship that links the material aspects of IT and work. In other words, it is not enough to just discuss about the IT features (e.g. embedded data, routines, and roles or IT's informational capability) but to relate that to organization and the act of organizing. As Zammuto et al. (2007 pg. 753) pointed out "theories are needed that elaborate on the affordances that arise when [IT and organizational features] are woven together. Understanding these affordances requires that the features of both IT and organization be considered simultaneously." In this way, the Work Network model provides a step forward in theorizing the affordance of IT and organization by considering the artifact and the work that organizations are engaged in.

Along this line of argument, Orlikowski and associates (2007, 2008) proposed that it is no longer sufficient to recognize the impact of technical on social or their mutual interactions. Instead they (2008) argue from a "sociomaterial" perspective that the technical and social are intrinsically meshed and interpenetrated so that it is not just "discrete entities of people and technology" but "composite and shifting assemblages" of people and technology (pg. 455). The concept of Work Network speaks directly to this reformulation of practice as it is inherently a sociotechnical or sociomaterial concept that foregrounds the patterns or networks in organizations as well as captures the set of relevant composite of actors and artifacts in the course of performing a specific organizational process. The Work Network model's notions of Framing, Tension and Fitting Work also resonate with the active and dynamic nature of such "assemblages" and the processes by which they emerge and are "made to work" (Orlikowski and Scott 2008 pg. 464). By surfacing the sociotechnical or sociomaterial networks within organizational work, the Work Network model

answers to Orlikowski and Scott's (2008) proposal for more effective ways to "examine the specific forms of sociomateriality that are entailed in performing everyday work" (pg. 467).

Finally, how should one make sense of the findings from a traditional software implementation view? Early research on the implementation of package software has recommended that organizations do a complete assessment of the fit between technology design and user requirements as one strategy for successful system implementation (Lucas 1981; Lucas et al. 1988). Others have explored this further in the context of ERP and clinical systems using the "misfit" lens (Heeks 2006; Soh et al. 2000). Drawing on that stream of work, recent IS researchers have proposed the Critical Success Factor (CSF) framework to examine what are necessary and sufficient conditions for successful implementations (Holland and Light 1999; Kim and Pan 2006; Williams and Ramaprasad 1996). Some of the CSFs include building customer acceptance and strategic visions, user participation, and garnering champion and management commitment. From this traditional IS implementation view the changes can be partly attributed to the presence and lack of champions and buy-in among the users (Alpha clinic has strong user champion and user participation). It can also be attributed to the "fit" and misfit between the design and the requirements. However these individual factors are usually understood as separate variables impinging on the implementation process. As one paper puts it, they are only a list of "ingredients" and not a recipe for success (Kim and Pan 2006 pg. 59). Berg's (2001) analysis of various health IS implementations shows that health IS projects are inherently complex and unpredictable because of its technical complexity and because its impact touches a large number of stakeholders whose reactions are hard to predict. As such, he argues "determining a definite list of success or failure factors is impossible because what has worked in one case might not be relevant in another" (pg. 146). The Work Network model avoids these weaknesses of the traditional view by taking a process approach to surface pertinent "critical success factors" and positioning them in a way that allows us to better understand their roles within the context of technological artifact, work and actors.

Limitations and Future Research

The system implementation project I have discussed here involves a large and complex enterprise system. IT systems and artifacts that are smaller in scope and less complex e.g. individual word processing packages may not face the issues or involve the process studied in this research. Moreover systems such as virtual platforms or community-based web applications also may not be amenable to the Work Network model. This is because virtual or community-based web applications projects tend to have a diffuse and distributed development process that makes it hard to discern both the exact period of configuration and the events and decisions that transpired during that phase. The work that users engage in are also unclear and the boundaries of work tend to be dynamic.

The project is also unique as the system is deployed and used in family practices but the project is driven from the management of a hospital system. Small family practices may not engage in as many levels of negotiations as a hospital system where the organizational structure is more complex. System use in hospital settings would be more specialized and would cater to a more select set of patient client unlike the ambulatory setting found in family practices. Hence the degree of complexity of the IT system, the type of medical setting as well as the organizational structure of the adopting organization may be important distinctions in evaluating the applicability of the findings to other projects.

The roles that are studied in the Work Network analysis (MA, front-desk and providers) form the representative and critical aspects of the clinical operations where the EMR system is implemented. However there are other roles that are not covered in depth in the Work Network analysis that could be important for other settings and projects. For example the role of residents that are present in Gamma clinic and the role of referral coordinators in the three clinics as well as other roles that may

be pertinent in hospital settings (e.g. registered nurses). Future research could explore surfacing these medical roles and their Work Network to tease out further details of the change process.

Besides applying the Work Network model to the medical context, I believe the Work Network model is applicable to other enterprise level IT system implementation projects such as Enterprise Resource Planning (ERP) systems or Customer Relationship Management (CRM) systems. This is because changes to organizational practices and work are inherent in such enterprise IT projects and the Work Network model is designed to understand that change process.

Future research should also explore and understand the institutional and infrastructural factors. As I have briefly pointed out, with respect to the focal organization, there are internal and external institutional and infrastructure issues and that they influence at different levels and at different stages of the change process. Researchers could develop taxonomy of these issues and trace their impact. Apart from these factors more research concerning the relationship between tensions and fitting needs to be conducted. I have shown that while some tensions are relieved through fitting of the work and/or the artifact, other tensions persist. More analysis is required to understand why some tensions are “removable” and why some are not and in turn what are their consequences.

Implications for Practice

In terms of practice, the Work Network analysis provides an alternative method of visualizing and understanding an organization’s workflow as well as imagining the impact of potential workflows. This form of analysis is complementary to the use of case methodology currently practiced by some ERP vendors whereby the goal of the exercise is to have a more holistic view of a system’s impact. This is especially important in the health context as healthcare work is highly knowledge-intensive, professional and inter-connected (Berg 2001). A more holistic view that takes into account the complexity of healthcare work is therefore even more salient as compared to the traditional

manufacturing context where ERP systems are commonly deployed.

The Work Network model also sensitizes the organization and the project team to the impact of what are traditionally considered external influences e.g. the clientele (patient base) and the infrastructure (both physical and human). The model brings these factors out from the background and highlights their impact on the design and use phases.

This dissertation research therefore suggests that the study of technology-based change in organizations requires a radical shift in both the scope and level of analysis of the change process. First the Work Network model suggests shifting the level of analysis of change from actors or artifacts to the level of Work Network. The notions of work and network to provide a more nuanced understanding of how organizational actors, actions and artifacts interact in the change process. Second the Work Network suggests a shift to the scope of analysis by adopting a more critical and holistic understanding of change. The model expands the scope by taking into account both the configuration and use phases of the new IT system. Third, it also shows how contextual factors i.e. institutional and infrastructure influence the Work Network design and use. Finally, the Work Network model not only answers the call to theorize about how the two different strands of technological and organizational features combine to form new organizations and ways of organizing, the Work Network and narrative network visualization method also provides a concrete way to specify and convey the outcomes of this combination over time.

Conclusions

I begin this dissertation by highlighting the gap that persists in our understanding of the relationship between organization and technological change. This gap is especially pertinent in the medical informatics domain as the push for increased IT applications within clinical work and operations has been met with a high degree of skepticism and frustrations despite the commonly subscribed

idea that IT does “benefit” healthcare. Based on my extensive literature review and consideration of extant empirical work on this area, I argue that this gap can be traced to the lack of attention given to the technological artifact and how the artifact and the organization are interrelated. This argument resonates with the views of leading scholars in the organizational and IS fields who have recently published editorials on this apparent paradox (Orlikowski and Scott 2008; Zammuto et al. 2007). Therefore my dissertation begins with the premise that the IT artifact is central to the process of technology-based change and that it is important therefore to understand how the IT artifact is introduced into the organization and subsequently how that IT artifact is intertwined with the organization.

In order to study this relationship from this premise, I have conducted a field study of an EMR implementation project over a period of 11 months (July 2007 to May 2008). I have not only covered the actual implementation and use of the EMR system as traditional organizational change research has done but also focused on the process of system configuration prior to the EMR implementation at the research sites. My research sites include the EMR project team from the sponsoring institution (MATH) and the three family clinics – Alpha, Beta and Gamma – where the EMR system is to be used. I have collected archival, interview and observation data from these sites and have used grounded theory methods to code and analyze the data.

From my findings, I propose the Work Network Model of technology-based change that highlights how organizational actors, actions and artifacts are mutually inter-related as Work Network in the course of carrying out organizational work. The model specifically takes into account the institutional, infrastructural, and work practices that influence the political processes by which ideal formulation of Work Networks are inscribed into the technological artifact. This serves to explain the process by which the technological artifact is configured and also forms the background to understand why specific changes occur when the ideal Work Networks are introduced into actual

organizational contexts. Here the tensions and fitting work that emerged as a result of the introduction of these ideal Work Networks embedded in the IT artifact show the process by which both organization and technological artifact co-evolve. The socio-political configuration process together with the practical fitting-work via the Work Network conceptual lens therefore provides a fresh perspective on the issue of technology-related change.

Scholars have called for research to “move beyond separating technology from people, work, and organizations” (Orlikowski and Scott 2008, pg. 466), and to “bring work back” into theorizing of organizations and change (Barley and Kunda 2001). I believe that my contribution of the Work Network model is a step towards developing research that answers these calls to extend our understanding of contemporary organizations, especially with its extensive reliance on new technologies such as the EMR. I believe that the Work Network model suggests a promising way to not only examine technology, work and actors but also reframe them and their interactions as part of the larger organizational context where institutions and other existing technological and human infrastructure are located. This dissertation therefore contributes empirically and conceptually to our understanding of the nexus between technology and organization.

Appendix A. History of the EMR

The first recorded use of computers for medical documentation was in 1959 when the Texas Institute for Rehabilitation and Research in Houston developed a system to document nurses' notes, lab reports, physiological test data (Collen 1995). Separately, in 1959, Ledley and Lusted had described a hypothetical computing system for clinical problems. These events sparked off a slew of computerization projects throughout the 1960s with major projects and developments in various research and private hospital systems notably, the Massachusetts General Hospital, Kaiser Permanente, and Latter Day Saints (LDS) Hospital (Collen 1995). Although most began from the clinical research domain, it quickly spread to hospital management. Key components for the modern day EMR were developed during this period for e.g. database management system (e.g. MUMPS), adoption of important clinical codes for coding of notes (e.g. Standard Nomenclature of Diseases and Operations or SNDO and later the ICD), medical orders, admission, discharge and transfer (ADT) and lab systems etc. By the end of the decade, computers have been deployed extensively among key hospitals to support medical research and patient care.

The seventies saw the creation of key companies that had spun-off from those major projects; COSTAR was formed from the Massachusetts General Hospital project and developed the current industry standard database language for medical system (MUMPS) and Health Evaluation Logical Proc (HELP) from the LDS project which was a industry standard for decision support system. Technically, the electronic medical record system had also migrated from main frame systems to a distributed system of minicomputer connected by Local Area Networks (LANs). There were also advances made in data input e.g. use of light pens, television terminals. The architecture of the EMR had also migrated to a modular approach (The Medical Record system or TMR as developed by Duke University). Even as the EMR became more powerful and its functionalities extended from simple documentation to more "intelligent" tasks, proponents of medical protocols within the

medical community saw the potential of using EMR to support their medical protocols. Medical protocols had been developed from the clinical research groups. Their proponents argued that adhering to medical protocols allowed physicians to practice evidenced based medicine which in their view is a more systematic and “scientific” form of medical care. Evidence based medicine, the proponents argued, would increase the quality of health care. As the protocol proponents intertwined their agenda with the development of the EMR, other stakeholders such as the government, insurance companies and hospital administrators joined the EMR/Protocol bandwagon as they attempted to push their own agenda for health care work through these systems.

As a result of the push for medical protocol, there was an overall bias towards building more artificial intelligence into the EMR to support expert based systems and decision support systems (Berg 1999; Gregory 2000). Functionalities like alert and reminders appeared in the market. More standards appeared in the market as well, for e.g. the HL7 group was formed in 1987, CPT-4 for reimbursement in 1989, Unified Medical Language System (UMLS) in 1989 to support the use of AI based systems. However, this push towards AI in the community almost led to the medical informatics’ demise as well as a general neglect of the core EMR (Berg 1999; Gregory 2000).

Between the nineties and into the early 21st Century, the medical informatics community focused its energy on standards to integrate diverse systems and codes (example, a unified controlled medical vocabulary), automatic data input and extraction, and comprehensive decision support systems (Shortliffe 1999; Sittig 1994). There were also attempts to leverage the Internet to integrate the diverse and splintered EMR systems (Kohane et al. 1996). During this same period, the Institute of Medicine commissioned a study into the patient medical record in 1989 and the report by Dick and Steen (1991) called “The Computer-Based Patient Record: An Essential Technology for Health Care” appeared in 1991. In that report, IOM called for the elimination of paper-based patient records within 10 years. This report was later revised and updated in 1997 to take into account the

new technologies that had emerged after the previous report namely, the Internet. The reports showed that significant gain in quality of care as well as increased efficiency and reduced cost (Institute of Medicine 2001). Parallel to the changes within the EMR and medical informatics field, there were huge changes in terms of health care system, health care practice and health care financing within the US itself.

While the benefits of EMR are clearly evident in all the reports and studies that have been done, the adoption of EMR systems in the US was slow and limited to large research and teaching hospitals. While figures differ depending on the survey used and the sample reached, in general the adoption is limited regardless of the sample or definitions employed. Specifically, the surveys and studies show that only 9.3 per cent of US physicians have adopted a complete EMR system, between 17 - 24 per cent of physicians in ambulatory care settings use EMR, around five per cent of hospitals had functioning CPOE systems (Blumenthal et al. 2006).

As a result of these conditions, in 2004, President Bush announced in his State of the Union Address his Health Information Technology Plan to rollout electronic health records for most Americans within the next ten years. The President then appointed a Health Information Technology Coordinator within the Department of Health and Human Services (HHS). HHS later released its own strategic report for realizing the President's framework and announced \$139 million worth of contracts for the adoption of health care technology. The momentum created by the government sparked a renewed interest in the medical and IT communities to re-look at the issues and barriers to the adoption and use of EMR in health care work. My current proposal is situated in part within this larger social context with a specific interest to understand how the EMR implementation affects the changes that a medical practice encounters.

Appendix B. Chronology of Project Events

Timeline	Key Events
2003	
Fall	New President and CEO of MATH appointed; brings new vision of EMR system
2004	
Spring	Discussion of clinical information systems by MATH, SOM and CPI for new ambulatory care center
Summer	New Senior VP and COO of Ambulatory Services joins
October	RFP for new EMR system issued by MATH, SOM and CPI
Late Fall	Demonstrations by three EMR systems vendors on MATH campus
2005	
January	Final review of three EMR vendors
May	Infrastructure assessment for EMR project. Interim project team from MATH sends project proposal to Maryland's Health Care Cost Commission (HCCC) for approval of Certificate of Need (CON)
September	EMR project approval pending HCCC approval of CON
December	Waiver of CON, EMR project to move ahead
2006	
January	Approval of EMR system vendor by Board of directors Physicians Design Team created to assist in EMR project
March	EMR system early adopter site assessment by MATH and consultants begins
April	Organizational structure for EMR project finalized Announcement of hiring of new CIO and EMR project director
May	New CIO for MATH officially joins Creation of EMR project Implementation Planning Committee (IPC); Kick-off meeting held Charting Tools Group formed under Physicians Design Team to build new EMR chart templates
June	EMR project team being assembled, trained and certified EMR project advisory groups being formed

	Consultants surveys Alpha, Beta and Gamma clinics
July	Consultant releases report of work flows of early adopter sites Early Planning for DBV by consultant and EMR vendor
August	Early adopter sites finalized DBV timeline more formalized (shifted from September to October) Discussion among senior management about system level decisions
September	New Dean of SOM appointed
October	DBV sessions begins (these sessions continued to March '07) EMR system hardware delivered to data center for installation
November	EMR system hardware installed
December	MATH and SOM formally announces the EMR project in its newsletter
2007	
January	Formal announcement of early adopter sites for EMR system
February	EMR project team begins system "build" activities after certification New CMIO is appointed for MATH Decision to implement a separate EMPI solution
March	DBV sessions being wrapped up Kick-off of integration work with EMPI solution vendor New HIM, Research and Compliance Advisory groups formed
April	Enterprise level workflow walkthrough sessions conducted CPI decides to refuse direct interface between EMR system and their billing system
May	EMR system production environment created
June	EMR project team initiate RBV sessions with Alpha clinic and GIM clinic
July	RBV sessions for Alpha and GIM clinics officially kick-off GIM clinic withdraw from early adopter sites; Beta and Gamma clinics tagged as early adopter

September	Go live preparations for Alpha clinic
October	Training for Alpha clinic staff
	Preparations for Beta and Gamma sites RBV kick-off
	EMR system for Alpha clinic goes live (30 th October)
November	EMR project team on-site support for Alpha clinic
	RBV for Beta and Gamma clinics begins
2008	
January	Go live preparations for Beta and Gamma clinics
February	EMR system for Beta clinic goes live (11 th February)
March	EMR system for Gamma clinic goes live (10 th March)

Appendix C. Interview Protocols

Configuration Phase

Senior Management Interview Protocol

“Grand Tour”

1. When did you join the organization? What is your background?
2. When did you join the project? Can you describe to me the history of the project?
3. From your perspective, what do you think is the vision of the project and of the technology?
4. How does that vision of the project compare with the EMRV system?

“Mini Tour”

5. From your perspective what specific issues emerge during the process of design and implementation that were significant with respect to your role?
6. For each of the issues you identified, can you provide me the details:
 - a. What are the problems or issues?
 - b. Who are/were involved?
 - c. Were there key events that took place for that issue to surface?
 - d. When did it occur and what happened after that key event?
 - e. What is the status of the issue now?
 - f. How did it reach the status that it is now? Was there escalation of issue?

EMR Project Team Interview Protocol

“Grand Tour”

1. When did you join the organization? What is your background?
2. When did you join the project? Can you describe to me the history of the project?
3. From your perspective, what do you think is the vision of the project and of the technology?
4. What is your specific role in the project? What aspect of the system are you involved in?
5. How do you go about accomplishing your tasks?

“Mini Tour”

6. In your particular area in the project, can you tell me what the key challenges are?
7. For each of the challenges you have identified, can you provide me the details of those challenges i.e.
 - g. What are the problems or issues?
 - h. Who are/were involved?
 - i. Were there key events that took place for that issue to surface?
 - j. When did it occur and what happened after that key event?
 - k. What is the status of the issue now?
 - l. How did it reach the status that it is now?

Clinical Site Participants Interview Protocol

“Grand Tour”

1. When did you join the organization? What is your background?
2. Describe to me the things that you do in a typical day at your work? Tell me about what you do, who you interact with, what things you would use etc.
3. What is your perception of the EMR system? What do you think is the role of the system?

“Mini Tour”

4. What are your thoughts/perceptions of technology?

5. What aspects of technology are most helpful? Why? Least helpful? Why?
6. What issues in training will be problematic in the future?
7. What important aspects of clinic are captured or not in the EMR?
8. Do you think that the system or project is needed?

Use Phase

MATH Management Interview Protocol

1. Given what you know of the project, do you think that the project will be a success?
2. In your view, what do you think may be barriers to success?
3. Knowing now what you know, how would you have done differently in the project?
4. Has your vision and perception of the EMR system changed? If so, how?
5. Do you think there was some input that should have been taken into account and was not?
6. How would those inputs have impacted the project?
7. Do you think there are issues in the training and implementation that will be problematic in the subsequent rollout? Why?
8. Do you think this project was necessary?

EMR Project Team Interview Protocol

1. Given what you know of the project, do you think that the project will be a success?
2. In your view, what do you think may be barriers to success?
3. Knowing now what you know, how would you have done differently in the project?
4. Do you think there was some input that should have been taken into account and was not?
5. How would those inputs have impacted the project?
6. Do you think there are issues in the training and implementation that will be problematic in the subsequent rollout? Why?
7. What is your role going forward from this point in the project?
8. What are the issues, in your view, will come back to “haunt” the project and the system?

Clinical Site Participants Interview Protocol

1. From your current exposure and use of the system, can you describe
 - m. One or more incidents where the EMR system behaved in a way that was unexpected?
 - n. One or more incidents where the EMR system failed to meet your expectations?
 - o. For each of the incidents above, why do you think it happened?
 - p. What were the implications for the incidents?
2. Has your work change after the EMR system was implemented? If so how?
3. Has the clinical operations changed after the EMR system was implemented? If so, what are the 3 main changes you see in the clinic today and who do you see it impacts most?
4. Do you think there was some input that should have been taken into account and was not?
5. How would those inputs have impacted the project?

Appendix D. List of Key Groups at Research Site

Group	Description
MATH management	They refer to staff that has been appointed to develop organizational policies and manage the processes to support those policies. They are the most powerful actors in the context as they have both the power and resources. They are made up of two distinct groups: the medical/clinical management and the administrative management.
- Medical Director	The medical director refers to a clinician involved in the management of specific hospital clinics. He/she is in charge of medical policies as well as overseeing the administrative practices that relate to clinical practices within the clinics. While they are hierarchically equivalent to administrators, they may in various contexts wield more power and authority than the administrator.
- Clinic/Hospital Management	The clinic/hospital management includes the actors involved in the overseeing of organizational policies and strategies related to all hospital clinics and departments.
Practice Managers	This group includes administrators in charge of specific clinics and are answerable to the clinic/hospital management but at the same time work closely with medical directors. They manage all the support staff within a clinic.
Providers	This group includes all the medically trained clinicians involved in carrying out medical care for patients. Physicians and registered nurses are the two main examples.
Support staff: Medical Assistants; Administrative Assistants	Support staff include the clinical and non-clinical. The clinical staff are medical assistants who are trained to support physicians in the course of providing medical care to patients. The non-clinical staff are personnel within a department or clinic who are charged with carrying out the administrative and organizational processes. They include front desk staff, phone operators, referral staff and medical records staff.
EMR project management	This group includes key personnel in charge of managing the overall project and work closely with the senior management to acquire resources and resolve issues related to the EMR project.
EMR project team	This group includes personnel of the IT team working on the implementation of the EMR system.

Glossary

ACC	Ambulatory Care Center
AVS	After-visit summary
CEO	Chief Executive Officer
CIO	Chief Information Officer
CMIO	Chief Medical Information Officer
CMS	Center for Medicare and Medicaid Services
CON	Certificate of Need
CPI	Clinical Physicians Inc.
CPOE	Computerized Physician Order Entry system
CRPN	Certified Registered Practitioner Nurse
DBV	Design-Build-Validate session – requirement analysis sessions conducted by EMR vendor for MATH and CPI
EMR	Electronic Medical Records
FD	Front-Desk
GIM	General Internal Medicine Clinic
HCCC	Maryland’s Health Care Cost Commission
HIM	Health Information Management
HIPAA	Health Insurance Portability and Accountability Act
IDX	CPI’s billing system
IPC	Implementation Planning Committee
ITG	MATH’s Information Technology Group
LOS	Level of service
MATH	Mid-Atlantic Teaching Hospital
MA	Medical Assistants
MSPQ	Medicare Secondary Payor Questionnaire
PAG	Physicians Advisory Group
PatAccG	Patient Access Advisory Group
PDT	Physician Design Team
PMR	Paper Medical Record (or Paper chart)
PR	Phone-Room Operators
Provider	Doctor or physician as well as other care giver such as a Certified Registered Practitioner Nurse or Physician Assistant (wider scope of clinical responsibility than CRPN) and is a short form for a clinical provider
RBV	Review-Build-Validate session – requirement analysis and validation meeting conducted by EMR project team with implementation site participants
RN	Registered Nurse
SCOT	Social construction of technology
SOM	School of Medicine
STAR	MATH’s hospital billing system
SVP	Senior Vice President
TEF	Telephone Encounter Form
WFWT	WorkFlow Walk Through

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