IT-based Revenue Cycle Management: An Action Research into Relational Coordination

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Abstract

Many US hospitals are finding it extremely challenging to maintain their financial health as they are operating with consistently thinning margins. Administrative inefficiencies in Revenue Cycle Management (RCM) diminish cash flow, reducing crucial capital investments urgently needed to improve health outcomes. Whereas IS research increasingly focuses on the promises and challenges of clinical IT, few studies have explored the role of IT in addressing the information sharing and coordination challenges related to RCM in hospitals. Motivated by this gap, we adopt relational coordination theory to analyze three successful IT-driven interventions into a hospital’s RCM. Our action research provides insights into how IT can help improve hospitals’ financial viability and it demonstrates how relational coordination theory can help understand IT-enabled process innovations. The findings are important to both practitioners and scholars interested in exploring how the nexus of work relationships and technology can improve organizational outcomes.

1. IT-based revenue cycle management

The US healthcare sector wastes between $107 billion and $389 billion annually, based on 2011 estimates [1]. Other estimates suggest that about 20% of not-for-profit hospitals consistently operate with negative margins and 63% operate only slightly above the breakeven point [2]. Revenue Cycle Management (RCM)—which refers to all activities related to delivering healthcare services to patients and receiving payment for those services [3]—is a major concern of hospital executives who continually seek new ways of improving cash flow. As shown in Figure 1, RCM includes functions such as patient scheduling, registration, clinical encounter with a physician and related documentation, medical charge coding, billing, payment posting and late revenue recovery [4]. Revenue cycle is a complex process requiring timely exchange of accurate information relating to these functions.

A typical revenue cycle exhibits multiple levels of complexity—both internal and external. At the internal level, it involves coordination between individuals in various functional departments, some that are directly associated with clinical decision making and patient care (such as physicians and nurses), and others that support care delivery to the patient (such as registration, billing, documentation, and coding personnel). To coordinate care for any patient, these individuals interact with each other and with other organizational units such as administration and finance. In doing so, they exchange complex information that relates directly or indirectly to patient care. To further add to revenue cycle complexity, each patient can have insurance coverage from a single or multiple payers and may suffer from a wide range (and often unpredictably evolving) set of symptoms that require different medications and clinical procedures. After each patient encounter, coding specialists must coordinate with the involved physicians and nurses to ensure appropriate documentation of services rendered to the patient and subsequently code the associated charges—based on a coding scheme consisting of nearly 70,000 items [5]. These tasks often suffer from lack of
communication and information sharing across the various RCM functions.

At the external level, various functional departments in a hospital interact with payers, clinical specialists, laboratories, collection agencies, and other entities. For example, registration clerks must seek pre-authorization from a patient’s insurance company before scheduling certain tests and clinical procedures. The billing specialists interact with insurance payers to discuss reasons of denial (or underpayment) of specific claims. Further, for each payer, a separate contract prescribes payments for each documented charge item for a patient, thereby making the process of revenue reconciliation and collection error-prone and labor-intensive. It is therefore not surprising that errors in RCM functions—and consequent claim denials and revenue loss—frequently occur in hospitals.

As these examples suggest, the inherent complexity of revenue cycle may explain why many hospitals struggle to improve their operations. Overall, a variety of factors—such as the highly specialized and fragmented nature of healthcare delivery, diversity of payers, large volume of transactions, ever-changing coding and diagnostic standards, and the need to integrate new scientific evidence into daily practice—make the task of coordinating care-related information, and any attempts to improve RCM, extremely challenging [5].

To date, information systems (IS) researchers have paid little attention to hospital RCM, despite its relevance to the management of information. Hospitals are often perceived as highly complex organizations requiring IT-enabled automation to coordinate between the different tasks; however, past and current experience shows that interactions and information exchanges among people using the technology (and not the technology by itself) often determine its successful implementation and assimilation [6, 7]. In their extensive literature review of the contextual factors influencing RCM performance, Mindel and Mathiassen [4] report information exchange issues, together with workforce management challenges, to be the leading causes of poor RCM performance. To improve information flow in RCM, hospital leaders are often tempted to turn to enterprise-wide IS solutions. However, these large-scale managerial initiatives are typically costly, and yield only mixed results if we take into account the long period it takes to generate positive return on the initial and ongoing investments. In particular, many small urban and rural hospitals simply cannot afford such enterprise-wide IT systems. Moreover, the implementation of new RCM IT carries additional opportunity costs in the form of extensive training and coaxing reluctant staff to change their work routines. Even after costly and complex implementation efforts, it is often hard to get meaningful use and business value from RCM IT investments. While RCM can benefit from improved information exchange and employee engagement resulting from better coordination—and the practitioner literature has ample discussions about IT-enabled RCM—there is unfortunately a paucity of research on how IT can help to improve RCM performance in a cost effective way [4].

Considering RCM underperformance as a socio-technical problem that can be addressed by improved understanding of work relationships, IT, and coordination, we focused on IT-based interventions into the RCM of a small rural hospital in Georgia, USA, which was struggling with declining revenue and cash flow. To address this problem situation, we designed and implemented a simple, standalone IT artifact and used the existing electronic medical record (EMR) functionality to improve coordination of tasks, enhance information exchanges and interactions, and support individual level learning as well as shared knowledge. As a result, we observed substantial improvement in RCM performance (in terms of reduced errors in claims submitted to payers) and in eventual financial performance.

2. Relational coordination theory

To make sense of the problem situation related to RCM underperformance as well as our chosen interventions and their outcomes, we adopt relational coordination theory [8-10]. This theory emphasizes the role of individual actors and their mutual relationships in determining organizational outcomes. It focuses on the “humanistic process underlying the technical process of coordination, arguing that coordination encompasses not only the management of interdependence between tasks but also between the people who perform those tasks” [11]. It explains how formal organizational structures can support relational forms of coordination, rather than suggesting that such structures are necessarily substitutes or impediments to relational coordination [11]. Organizational coordination is not just a catchphrase; it is the result of countless continuous interpersonal interactions between individual actors. Relational coordination refers to a "mutually reinforcing process of interaction between communication and relationships carried out for the purpose of task integration" [9]. It seeks to move beyond the traditional notions of functional specialization in firms by empirically illustrating how role-to-role coordination—which relies on frequent, timely communication and relationships based on shared knowledge, shared goals, and mutual respect—can be crucial for service-oriented firms like hospitals. Specialization can be a sensible
strategy for goods-producing firms that operate in relatively stable business environments characterized by long-term contracts, organizational hierarchy, and routines. However, it can become a point of weakness for service-oriented firms that rely on functional expertise as well as relational competence, which refers to the ability to interact with others to accomplish common goals [9]. Relational forms of coordination influence quality and efficiency outcomes, and this influence is weaker or stronger depending upon the nature of the work [11].

The antecedents of relational coordination include reciprocal interdependence, uncertainty, and time constraints. These antecedents characterize the healthcare sector and other service industries as well; resulting in undesired organizational outcomes, including compartmentalization of tasks and unproductive work relationships [12]. A series of studies at multiple hospitals emphasize this point, demonstrating that surgical units characterized by a higher level of relational coordination significantly outperformed units lacking it [12]. Both communication ties and relationship ties constitute relational coordination [9] as mindful information exchanges strengthen existing relationships further to improve interactions, and subsequently mitigating uncertainties and pressures caused by time constraints. Table 1 presents the main concepts of relational coordination theory, and the corresponding empirical questions reflecting them.

<table>
<thead>
<tr>
<th>Focus</th>
<th>Concepts</th>
<th>Empirical question</th>
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<tbody>
<tr>
<td>Communication ties</td>
<td>Frequent communication</td>
<td>How frequently do actors share information about problems across RCM functions?</td>
</tr>
<tr>
<td></td>
<td>Timely communication</td>
<td>How do actors share information about problems across RCM functions in a timely manner?</td>
</tr>
<tr>
<td></td>
<td>Accurate communication</td>
<td>How accurate is the information that actors share about problems across RCM functions?</td>
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<tr>
<td></td>
<td>Problem solving communication</td>
<td>How do actors solve problems across RCM functions?</td>
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<tr>
<td>Relationship ties</td>
<td>Shared goals</td>
<td>How do actors share goals across RCM functions?</td>
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<td></td>
<td>Shared knowledge</td>
<td>How do actors share knowledge across RCM functions?</td>
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<td></td>
<td>Mutual respect</td>
<td>How do actors show respect</td>
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Based on these foundational concepts, the relational coordination theory focuses on the interactions between people that enable coordination rather than on the complexity of the IT applications or the supporting infrastructure. Based on relational coordination thinking, one may measure the cost effectiveness of IT by examining its impact on work relationships. Therefore, even low-cost IT-based improvements can cause a substantial impact if they focus on improving interactions and cross-functional information exchanges. Following this logic, we investigate the following research question: *How can IT support relational coordination in RCM in a hospital setting?*

The challenge of RCM-related coordination in hospitals comes from the high degree of fragmentation across administrative departments as well as from a somewhat artificial divide between the administrative and clinical sides of operations. This fragmentation and compartmentalization reduces mutual respect among staff working across functional boundaries, making it harder to share knowledge or work toward achieving a common goal—whether to provide quality patient care or to receive appropriate reimbursements for the services delivered. To lower these barriers created over the years between administrative staff working on the different parts of RCM process, we designed low-cost IT-based interventions—using a free and open source software tool accompanied by minor configuration changes in existing EMR system—seeking to improve working relationships and coordination among RCM staff as well as overall organizational performance.

### 3. Action research design

To examine how IT can support relational coordination to improve RCM performance, we selected action research [13-15] as research method. Many studies have successfully adopted and applied action research to study and implement IT-enabled organizational change [16-21]. Action research has also proven useful in investigating complex issues related to healthcare, and specifically the implementation and consequences of health IT [22-25]. Whereas healthcare executives often discuss how to improve RCM performance, their efforts mostly rely on industry trends and are atheoretical. Action research is a collaborative, theory generating, situational methodology that is particularly well suited for bridging theory and practice in organizational settings [26]. Relying on the systematic interaction between the problem-solving cycle aimed at addressing RCM issues and the
research cycle aimed at developing new knowledge [27, 28], we designed and enacted three IT-based interventions to improve overall performance in RCM at EMC Hospital (a pseudonym). Through a subsequent longitudinal, qualitative analysis [29] of data from this experience, we advance new empirical and theoretical knowledge on IT-enabled relational coordination in RCM and lay the foundation for its application in other organizational settings [30].

Data collection started in March 2008, when we held the initial workshop with revenue cycle stakeholders at EMC. In April 2008, EMC’s chief financial officer invited us to visit the hospital. During the visit, we conducted interviews with the chief financial officer, the director of the business office, the director of coding and documentation, the billing supervisor, a nurse manager, and the IT manager. These early interactions resulted in a deeper engagement with the hospital. After initial communication of our diagnosis of RCM problems at EMC, we began a formal engagement that lasted over the next two years. Two researchers visited EMC about once every month for full-day sessions, in which we reviewed progress of various interventions with the steering committee (the chief financial officer, the director of the business office, the director of coding and documentation, and the two researchers), interviewed other stakeholders, and planned for subsequent interventions. In addition, one researcher visited EMC almost every other week to collect data and help EMC actors engaged in improving RCM. Besides collecting data, the purpose of these visits was to facilitate and manage interventions, provide training to revenue cycle staff, and coordinate technical issues with EMC’s IT team.

Following Miles and Huberman [29], we collected evidence from multiple sources to enhance data quality and support the research cycle. In all, we conducted over 125 semi-structured in-person interviews at EMC. We prepared a protocol to structure the interview process and to collect appropriate information. Typically, each interview lasted between 30 minutes and two hours, and the two researchers took separate notes. We recorded all interviews, except those that discussed specific patient cases or when requested by an interviewee. We transcribed most interviews and all workshops. We conducted direct observations of how different revenue cycle stakeholders conducted their day-to-day work, what technologies they used, how they consumed and produced information, what problems they faced, and which opportunities for improvement they saw. Apart from face-to-face interviews and direct observations, we also interacted through e-mail and phone to clarify issues raised in interviews and to collect additional documents. In particular, we requested and received weekly data updates for key interventions. The research team also reviewed secondary data sources such as technical specifications of the EMR system, internal presentations, minutes of monthly staff meetings, e-mails, and other written materials.

The research team triangulated between the different empirical materials, perspectives, and observations [29, 31]. During the problem-solving cycle, we used a diagnostic mapping technique [32] to analyze the qualitative data from workshops, meetings, and field-observations, and quantitative data from EMR reports, questionnaires, and other sources with the goal of diagnosing RCM problems. Overall, we followed data analysis procedures suggested by Miles and Huberman [29] with three concurrent flows of activity—data reduction, data display, and conclusion drawing and verification—with these activities occurring iteratively.

4. Empirical analysis

4.1 Need for relational coordination

Based on diagnostic mapping and working closely with revenue cycle managers and staff, we realized that EMC faced several challenges related to RCM, the chief among them being loss of revenue due to rejection of a large number of claims by third-party payers. Further, we learned that the hospital’s billing department was spending about 80% of its time handling problems created upstream in the revenue cycle (cf. Figure 1). As the billing manager told us, they saw the same problems occurring all the time. For example, incorrect insurance payer information and missing pre-authorizations were among the top problems each month. Apparently, there was little individual level learning or shared knowledge across the revenue cycle functions.

Often, the billing department could not submit “clean” claims (i.e., without any error) in a timely manner because it waited on information from staff members in registration, clinical encounter, documentation, and medical charge coding departments (cf. Figure 1). If the claim submission occurred more than 60 days after a patient visit, some payers refused reimbursement for services already delivered. The billing staff blamed registration staff for the majority of these problems, and the registration staff cited the challenge of handling a large amount of patient information in a narrow time window (about 10 minutes). Since some data was unavailable at times (for example, a valid identification card), the registration staff was often uncertain about accuracy of the information collected during registration. Similarly, the coding department often waited for complete and accurate information from the clinical encounter team (physicians and
nurses) before they could send claims to the billing department. In summary, most of the RCM problems related to uncertainty, interdependence, and time constraints before and after a patient visit. To address these problems, the research team embarked on several cycles of interventions in collaboration with key stakeholders at the hospital.

4.2 Interventions

**Intervention A: Daily problem report.** The immediate focus area of this intervention was the patient registration function of the revenue cycle (cf. Figure 1) because incorrect information entered into the EMR system during registration was a major cause of problems observed during billing. In October 2009, our analysis of RCM data suggested that more than half (67 out of 120) of all problems reported during that month originated during the registration function. The situation in December 2009 was no different, when the total number of problems had reduced, but registration related problems still accounted for a major share (42 out of 80). We identified over 30 types of problems relating to patient registration, including incorrect payer information, incorrect primary insurance subscriber information, and missing pre-authorizations (from commercial insurance companies) and medical necessity certifications (from Medicare). Often, these errors escaped notice during billing review and ultimately resulted in delays and denials of claims by the insurance payers. Although EMC maintained account information of all unpaid claims, it had no estimate of the number (or amount) of claims rejected for a specific reason (for example, missing pre-authorizations). This made it difficult to understand the scope of the problem and to identify appropriate solutions.

Working with the registration supervisor, we identified an existing report (Registration Census Quality Report) in the EMR system that showed registration-related problems based on nine pre-configured parameters (for example, incomplete or missing address information of the insurance subscriber). In November 2008, we set up a process by which each registration clerk would run this report on their computers at the end of their shift and clear any problems that showed up (by correcting relevant data for a particular patient account). We tracked the total number of outstanding problems that showed up on the report at the end of the month (Figure 2). Once this process was set up, we reviewed the trends with the registration supervisor and the steering committee during monthly meetings and discussed opportunities for training and feedback to registration clerks.

**Intervention B: IT-enabled problem management.** To address the pressing issue of problems across various functions of EMC’s revenue cycle, we built a simple software tool to track, manage, and resolve problems created during the health delivery transaction between the patient and the hospital. This intranet-based tool did not integrate with the EMR or other IT systems, and was based on an open-source application available freely. Once this software tool was ready and approved by the steering committee, we prepared a user-training plan, and conducted training for the revenue cycle staff in small groups. In April 2009, we gradually rolled out the application (Figure 3), starting with registration and billing departments. Initially, one of the researchers maintained and configured the application in response to requests from users (for example, to add new categories of problems). A few months later, the director of the business office took responsibility for the ongoing configuration, and EMC’s IT department took responsibility for the application’s back-end maintenance. The researchers obtained remote access to the application (via a secure, virtual private network application), which allowed us to track data on a regular basis. During our monthly visits to EMC, we discussed training needs for the staff based on trends and individual usage statistics from the problem management system. We conducted additional training sessions as needed.

**Intervention C: Re-allocation of responsibilities.** In 2008, a major problem was that EMC’s billing department was spending about 80% of its time handling problems created elsewhere in the revenue cycle, which left little time to follow-up with payers for denied claims. As the billing manager told us, they saw the same problems occurring all the time. For example, incorrect insurance payer information was among the top problems each month. Therefore, once the problem management system was functioning, we initiated a process of re-allocation of...
responsibility for problems found in any department to the department where the problem originated. In the new work arrangement, for example, upon finding incorrect payer information during review, a billing specialist would create a ticket in the problem management system, enter brief information about the error, and assign it to the relevant person (in this example, the registration clerk who created that patient account). This activity of creating a ticket took less than a minute. Upon submitting the ticket, the IT system sent an automated e-mail to the assignee. Once the assignee cleared the ticket (by providing requested information), another automated e-mail informed the sender.

Initially, many users hesitated to use the system to re-allocate problems to other departments, fearing that the new process would delay submission of claims. Moreover, as one billing specialist told us, they were concerned that other departments may not like the pushback from billing department, which may lead to inter-personal (and inter-departmental) issues. During training, we emphasized that the principle of accountability was critical to improving RCM as it facilitated learning from one’s mistakes and would help to reduce errors that occurred repeatedly. The chief financial officer and steering committee members supported this initiative and sent out frequent communications to all users, encouraging them to use the new system.

4.3 Relational coordination effects

Next, we draw on the key concepts of relational coordination theory to present evidence for IT-enabled relational coordination effects of our interventions. Table 2 summarizes these results.

<table>
<thead>
<tr>
<th>Relational coordination concept</th>
<th>Case evidence</th>
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<tr>
<td><strong>Shared goals</strong></td>
<td>The interventions produced a sense of shared goal (e.g., submitting clean claims to payers and receiving appropriate reimbursements) and increased personal accountability (e.g., assigning tickets based on the principle of “one who spills it, cleans it”)</td>
</tr>
<tr>
<td><strong>Shared knowledge</strong></td>
<td>The interventions facilitated learning from failure (e.g., by reviewing trends related to tickets assigned to specific individuals), creating a body of shared knowledge (e.g., readily available reports about various kinds of problems and how individual problems manifested over time)</td>
</tr>
<tr>
<td><strong>Mutual respect</strong></td>
<td>The interventions reduced inter-personal barriers (as the problem management system did not require direct emails or phone messages to specific individuals), improved mutual understanding and respect across RCM functions (“now they [registration folks] can see what we [in billing] have to deal with”)</td>
</tr>
<tr>
<td><strong>Frequent communications</strong></td>
<td>The interventions increased the rate of information exchange across RCM functions (most</td>
</tr>
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4.4 Improved RCM performance

Intervention A helped to reduce the number of problems during registration. As Figure 2 shows, the number of open (i.e., unresolved) problems at the end of each month dropped significantly after the intervention in November 2008 (from an average of nearly 70 per month to less than 10 per month). The outcomes suggested a continuous process of learning among the registration staff. The minor upward blip in May 2009 resulted from a training issue, which highlighted the importance of ongoing training. During our final follow-up visit in June 2011, we met a new registration supervisor. She noted that her team still ran the Registration Census Quality Report at the end of each shift, and the problems generated during the registration function had been consistently few. In a related discussion, the business office director (to whom both the registration and billing departments reported) informed us that EMC had engaged the EMR vendor to create alerts for all common registration errors. During our discussions in early 2010, we had often discussed such functionality.

During the follow-up visit in June 2011, we found that the revenue cycle staff was still using the problem management system (Intervention B). However, the usage was mostly by the registration, billing, and utilization review departments. The director of the business office had added several new categories of problems. The turn-around time for fixing any problem was typically less than a day. In response to our comment that it was remarkable that the process was still being followed, the registration supervisor joked, “I threatened to break their fingers if they don’t use it.”

As Figure 4 shows, Intervention C (re-allocation of responsibilities) improved RCM performance over time, as fewer problems surfaced during billing reviews. During the follow-up visit in June 2011, the business office director noted that the billing staff processed about 1800 claims per month, and of these, more than 80% were now clean (i.e., without any error). This was a marked improvement over his estimate of 50–60% clean claims in 2008.
systems and must rely on portfolios of IT systems and available in-house IT solutions with limited integration between them.

The presented findings support current literature that cross-functional organizational structures can strengthen relational coordination [9, 10, 33]. Moreover, a large body of IS research into technology adoption inside and outside of the healthcare context illustrates that human factors play significant roles in IT adoption and assimilation [24, 34-37]. Our selection of relational coordination as a theoretical framework adds to this focus, while emphasizing the value of already available and low-cost IT artifacts in day-to-day organizational work.

At EMC Hospital, our IT based interventions allowed more accurate and efficient information exchanges among various actors, increased accountability of involved actors, improved interpersonal relationships (by reducing direct communication when reporting problems), engendered a sense of shared goals, facilitated learning from failure, created a body of shared knowledge, and improved mutual understanding and respect. The interventions also improved transparency of problem handling in the RCM process. Further, the interventions enabled autonomy and learning at the individual level (by empowering employees to proactively find and fix their own errors) and shared learning at the team levels. Overall, the interventions led to improved relational coordination, and eventually helped RCM actors move towards their common goal of improving organizational performance of the rural hospital.

Considering alternative interpretations of the action research into RCM at EMC, there is a longstanding and rich tradition for studying the relationship between IT and coordination in organizational contexts. Most notably, this includes the extensive literature on Computer Supported Collaborative Work (CSCW) [38-40] and Malone and Crowston’s widely cited work related to coordination theory [41-43]. For several decades, CSCW research has focused on investigating how technology in various forms can support collaboration between organizational actors as an antidote to traditional use of technology aimed at streamlining and automating work processes. By enabling awareness (of group member’s activities) and articulation of work (i.e., partitioning work into units, distributing it amongst group members and, after the work is performed, reintegrating it) coupled with individual- and group-level technology appropriation (i.e., adaptation of a technology to a particular situation), CSCW thinking has provided a useful perspective on technology-enabled coordination [39, 44, 45].

While relational coordination theory, like CSCW studies, is focused on enabling collaboration and knowledge sharing between organizational actors as a means to improve performance, it differentiates itself from the CSCW tradition by accepting as a premise that work is typically functionally specialized and formally organized. Hence, the challenge is not to develop a different perspective on IT and coordination, but rather to find ways to complement or compensate for the drawbacks of traditional work arrangements in ways that afford better work experiences and create higher performance at the same time. Similarly, the strength of Malone and Crowston’s work is its solid anchoring in coordination ideas across multiple scientific disciplines leading to a rich and well-grounded set of intellectual tools for investigating the relationship between technology and coordination. In comparison, the vocabulary of relational coordination theory is simpler, but it has the advantage of effectively zooming in on normative propositions for how managers can enable better coordination and higher performance in contexts where traditional formal work arrangements dominate. Thus, although CSCW as well as Malone and Crowston’s coordination theory each could offer additional insights based on our action research at EMC, we found that relational coordination theory with its specific concepts and set of assumptions offered a particularly relevant perspective on how IT may effectively enable significant improvement in RCM without large-scale investments and efforts.

5.2 Relational coordination in process innovation

Our research also contributes to information systems research by demonstrating the value of relational coordination theory as an important perspective on IT-enabled process innovation. The theory helped us understand how the IT based interventions at EMC provided a sense of shared goals to the RCM staff, increased personal accountability, facilitated learning from failure, created a body of shared knowledge, reduced interpersonal barriers, allowed more accurate and efficient information exchanges, and improved mutual understanding and respect across RCM function. These mechanisms led to improved relational coordination, and eventually to improved performance of RCM at the rural hospital. In Figure 5, we adapt Gittell’s relational coordination theory [8-11] to summarize how we applied it to make sense of our IT-based process innovations at EMC.
Based on this model and combining our empirical findings with extant theory, we propose the following:

- **Proposition 1:** Relational coordination will more likely contribute to positive outcomes in IT-based process innovation when processes are characterized by uncertainties, reciprocal interdependencies, and time constraints.

- **Proposition 2:** IT-based process innovations will more likely support relational coordination when they focus on cross-functional interventions.

- **Proposition 3:** IT-based process innovations will more likely support relational coordination when technological interventions complement changes in work arrangements.

- **Proposition 4:** IT-based process innovations will more likely lead to improved performance when they strengthen communication ties as well as relationship ties across functions.

By emphasizing, in this way, the important role of relational coordination in process innovation and how it relates to IT-based interventions, we hope that our research will inspire IS practitioners and researchers to further explore how low-cost IT interventions can stimulate cross-functional collaboration, reduce inefficiencies and improve overall quality of outcomes in business process innovation efforts.

In conclusion, our study has some limitations that require further research. First, our interventions evolved over a two-year period and made use of a given set of IT interventions. The results could be different if researchers focused on other aspects of RCM or applied other interventions. In addition, the involved actors fine-tuned their EMR use and practices over time; these may have happened even if the researchers were not involved. Furthermore, our findings rely on the development of specific IT interventions in a small, resource-constrained rural hospital. Further studies may determine how the findings compare with findings from other health settings. Finally, readers should be aware that researchers from a positivist or other research traditions (such as design science) might be able to develop different and complementary results.

### 6. References


