META-COORDINATION ACTIVITIES: EXPLORING ARTICULATION WORK IN HOSPITALS

A Dissertation in
Information Sciences and Technology
by
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ABSTRACT

Coordination of distributed activities is central to organizational work. The effective functioning of organizations hinges on their ability to manage interdependencies both within (intra-) and between (inter-) various departments. However, more than just the management of these individual dependencies is required for smooth coordination in organizations. Organizations must also manage the interactions between intra- and inter-departmental coordination activities. In this thesis, I investigate a certain set of interactions which I refer to as negative cross-level interactions. These interactions often result in poor performance, increased errors and higher coordination costs. Consequently, in order to achieve organizational goals, workers must perform a certain type of articulation work - meta-coordination activities - to manage and mitigate the effects of these negative cross-level interactions.

To examine negative cross-level interactions and how they are dealt with in an organizational setting, I conducted a year-long qualitative research study of the patient transfer process at a large academic hospital in the Northeastern United States. Patient transfers are particularly appropriate to study because they require both intra- and inter-departmental coordination activities to be successful. I focused on the patient transfer activities between two clinical departments (emergency department and neurosciences department) and the role of a non-clinical department (inpatient access department) in facilitating the patient transfer process. I utilized standard qualitative methods including observations, shadowing and interviews. Through this study, I provide a detailed understanding of patient transfer process, with a particular emphasis on (a) the challenges that lead to negative cross-level interactions and its effect on both inter-departmental coordination and on overall hospital workflow, and (b) the meta-coordination activities that are performed to mitigate the effects of these negative cross-level interactions, and (c) the relationship between meta-coordination activities and articulation work.
The findings from this study will make contributions to research in the fields of Computer Supported Cooperative Work (CSCW) and Medical Informatics (MI). The main contributions to the CSCW field include (a) *examining a unique set of coordination challenges* - negative cross-level interactions that occur at the intersection of intra- and inter-departmental coordination activities; (b) *uncovering a particular type of work activities* - meta-coordination activities - that are performed to mitigate the effects of negative cross-level interactions; (c) *developing a conceptual and empirical understanding of meta-coordination activities*; (d) *identifying meta-coordination activities as a type of articulation work* focused on fixing breakdowns that occur when intra- and inter-departmental coordination activities affect each other; (e) *providing deeper insights on organizational articulation work* across multiple levels; (f) *developing a framework of inter-departmental coordination work* that highlights the relationship between the concepts of negative cross-level interactions and meta-coordination activities.

The main contributions to the MI field include (a) *drawing attention to the role of non-clinical staff* during patient transfers; (b) *providing detailed understanding about an inter-departmental workflow* (e.g. patient transfer) that depends on the coordination between clinical and non-clinical departments; and (c) *informing the design of systems* that can support inter-departmental workflows.
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Chapter 1

Introduction

This chapter introduces the problem and research motivation of the thesis. I also present the research objectives and questions that I answer through this thesis. Furthermore, the research approach that is adopted to address my research objectives is briefly described. Finally, an outline of the dissertation is highlighted.

Problem Motivation

Hospital environments are highly dynamic in nature, characterized by rapidly changing information needs, time-pressured decision making, distributed activities and functionally diverse teams. The vignette provided below captures some of the coordination challenges during patient transfers that take place in most hospitals in the U.S. This vignette illustrates a transfer process of a trauma patient from the emergency department (ED) to the operation room (OR).

The ED has reached its critical capacity of seventy one patients. The ED staff is overwhelmed with the constant influx of patients. During this chaos, a trauma patient is brought to the ED. The ED attending, based on his evaluation of the patient, decides that the patient needs to undergo a surgery sometime that day. After consulting with the OR attending (on OR schedule and staff availability), the patient is directly sent to the OR from the ED.

Later that evening, the admissions department staff responsible for bed placement gets a phone call from the charge nurse of the OR requesting an ICU (intensive care unit) bed for the trauma patient. Since the admissions staff member was not notified of the prior transfer sequence of this patient, she had no updates regarding the status
or the physical location of this patient. Because the hospital was at critical capacity, the admissions staff member was unable to immediately locate an available ICU bed for the patient. This consequently created bed assignment delays and other bottlenecks in patient flow which in turn had a detrimental effect on the goals of the hospital.

As the vignette highlights, coordination is a prominent aspect of collaborative work in organizations [1], [2], [3]. Organizational work is characterized by interactions between individuals and teams in different departments that result in the need for coordination of their activities to ensure seamless and efficient work processes. Effective organizational coordination results in streamlined work processes, increased performance and effectiveness, higher productivity, and effective resource management [4].

The smooth functioning of an organization hinges on its ability to manage the coordination of distributed activities both within (intra-) and between (inter-) the various departments. The seamless management of organizational work requires intra- and inter-departmental coordination activities to be synchronized with each other. This requires the management of coordination activities (at intra- and inter-departmental levels) in such a way that they do not have a detrimental effect on each other. However, organizations find it extremely difficult to balance these intra- and inter-departmental coordination activities. This is because often times intra-departmental activities negatively influence the inter-departmental coordination activities and vice versa. As a result, conflicts arise at the intersection of intra- and inter-departmental coordination activities (where intra- and inter-departmental coordination activities interact with each other) which impact the overall workflow, consequently disrupting the organizational performance and success. Failure to address these conflicts and breakdowns in coordination activities can potentially result in poor performance, increased errors and higher coordination costs.
In healthcare, hospitals are a prime example of large-scale organizations that have to deal with these types of coordination breakdowns on a daily basis. They have wide number of functionally diverse departments that support a variety of related patient care activities. Consequently, characteristics such as increased complexity and uncertainty of work, hierarchical and distributed organizational structures, heterogeneous teams, distributed decision making, uncertainty of patient conditions, and dispersed information makes hospitals susceptible to a variety of intra- and inter-departmental coordination breakdowns. Hospitals have to deal with these breakdowns in a timely manner because they can become detrimental to patient safety, sometimes even resulting in the death of patients. For example in the vignette above, coordination breakdowns occurred when decisions made to facilitate one type of coordination activity within a department negatively impacted other types of coordination activities between departments.

- The ED staff failed to notify the admissions staff about the transfer (ED to OR) due to the chaotic and time-pressed nature of the ED environment. They decided to send the patient to the OR to temporarily solve the crowding crisis within the ED, thereby achieving the coordination of care and patient flow activities within the ED at the expense of inter-departmental coordination activities between the OR and IPA.

- The lack of notification about the patient transfer from ED to OR (i.e. inter-departmental coordination activities) affected the intra-departmental activities of the IPA department, i.e., bed management.

The major consequence of this type of coordination breakdown that occurs at the intersection of intra- and inter-departmental coordination activities is the use of additional resources such as the time and effort required by the IPA departmental staff to switch patients around to find an appropriate bed, to contact physicians in the ED and OR requesting them to enter admit and transfer orders of the ED trauma patient, to cancel a hospital transfer of a patient
who was pre-assigned the last ICU bed and also to try to convince the PACU (post-anesthesia care unit) CN to accommodate and temporarily board an OR patient.

Thus the vignette raises some interesting issues about coordination activities in organizations: the breakdowns that arise at the intersection of intra- and inter-departmental levels, the factors contributing to these breakdowns, the effects of these coordination breakdowns on organizational goals, and finally, the mechanisms to mitigate the effects of the breakdowns in order to maintain the smooth coordination of the organization. Understanding these issues can help address the breakdowns, thus leading to better coordination support in organizations such as hospitals.

**Research Motivation**

Coordination has been a prominent topic of research in a variety of domains including maritime operations and software development [5], civil work [6], electronic commerce [4], and healthcare [7]. Coordination has been studied at various levels including team [8], departmental [9] and organizational levels [10]. Studies of organizational coordination have examined both intra-departmental and inter-departmental coordination practices. While intra-departmental coordination studies investigate the local departmental work practices; specifically focusing on the interdependencies between teams within a department [7], [11], [12], inter-departmental coordination studies examine the global organizational work practices; specifically focusing on the interdependencies between teams from different departments [13], [14], [15], [16], [17], [18]. Although coordination has been the focus of much research [1], [2], [3], researchers have not examined the effects of intra- and inter-departmental coordination practices on each other.

Furthermore, most of these studies have investigated how the seamless integration of distributed work activities results in significant problems affecting coordination. They highlight
that some problems are caused by the specialization and decomposition of activities [19], [20], while other problems arise due to the presence of interdependencies among activities and the need to integrate and align these interdependencies to achieve organizational goals [2], [21].

Especially, within the healthcare domain, [22], researchers have investigated the coordination problems of clinical departments. Some of the coordination problems that are investigated in healthcare are related to information breakdowns [23], [24], process bottlenecks [25], and patient handoff [26] challenges that result in medical errors and poor quality of care. However, these problems are specifically related to coordination of patient care activities of clinical staff in clinical departments. Although the coordination of non-patient care activities (i.e. organizational activities such as hospital resource management) has an effect on clinical outcomes, there is still a lack of research that examines the challenges that affect the seamless coordination of activities between staff from clinical and non-clinical departments.

Besides, despite the vast amount of research on coordination problems in a variety of domains, there is still a lack of understanding of the coordination challenges that occur when intra- and inter-departmental coordination activities negatively affect each other. To address these coordination problems in organizations, researchers have investigated the role of several coordination strategies and mechanisms [21], [24], [27]. One particular approach that has received much attention is articulation work. Central to articulation work is the need to manage interdependencies among various coordination activities and their related consequences. As an “informal” mechanism for sustaining coordination and the continuity of work, researchers have been focusing a great deal of attention on articulation work [28]. CSCW (Computer Supported Cooperative Work) researchers have interpreted this particular aspect of coordination in different ways. For example, Strauss [29] defines articulation work as “the coordination of lines of work”. Star et al. [30] describe articulation as the work that “gets things back on track in face of unexpected contingencies”. However, these perspectives do not highlight the specific
characteristics of the articulation work that is done to manage the negative effects of the coordination challenges that arise at the intersection of intra- and inter-departmental coordination activities.

Moreover, despite the research examining the role of articulation work in managing the consequences of coordinated work in variety of settings [31], [32], there is limited knowledge on articulation work in the healthcare setting [33], [34]. Besides, these studies in the healthcare setting are primarily focused on articulation work done by clinical departments to maintain the continuity of clinical work; it fails to identify the articulation work of non-clinical departments which play a vital role in maintaining hospital coordination. Consequently the overall body of knowledge in this research space is considerably limited.

I have identified three important gaps in coordination research that need to be addressed:

a) There is limited research on the coordination problems that occur at the intersection of intra- and inter-departmental coordination activities. Although researchers have identified various challenges to organizational coordination, the conflicts that occur when intra- and inter-departmental coordination activities affect each other is an important issue that needs to be examined in greater detail.

b) There is little empirical understanding about coordination mechanisms used to mitigate the coordination problems that occur when intra- and inter-departmental coordination activities affect each other. Researchers have investigated a number of coordination mechanisms that help mitigate coordination breakdowns. However, it is important to understand what types of mechanisms can be used to mitigate the coordination problems that occur at the intersection of intra- and inter-departmental coordination activities.

c) There is a lack of understanding about the nature of articulation work done to alleviate the coordination problems that occur when intra- and inter-departmental
coordination activities affect each other. Researchers have investigated the role of articulation work in different domains. In particular they have explored the nature of articulation work used to alleviate consequences of distributed collaborative work. It is also important to examine the unique nature and type of articulation work used to mitigate the coordination challenges that occur at the intersection of intra- and inter-departmental coordination activities.

**Research Approach**

To address these gaps in research, I investigated the patient transfer process in a hospital. Hospitals are a natural site for investigating coordination activities because there are a wide variety of activities that requires seamless coordination between individuals, teams, and departments to maintain continuity of care. A patient transfer process is a paradigmatic example of a coordination activity for a number of reasons. First, it requires ad-hoc collaboration among hospital departments because of the dynamic and rapid nature of events. Second, its success depends on effective management of both intra-departmental and inter-departmental coordination activities. Third, patient transfers involve both clinical and non-clinical departments that have varied and constantly changing coordination needs and goals. Finally, effective patient transfers is instrumental in realizing organizational goals such as improving access to care, minimizing the length of patient stay and reducing the wait times for patients [35].

To examine the coordination practices during patient transfers, I conducted a year long qualitative research study at the Penn State Milton S. Hershey Medical Center. These methods allowed for a situated in-depth evaluation of the healthcare practices by focusing our attention on the interaction of people, information technologies, and organizational structures. In particular, I investigated the conflicts that occur when intra- and inter-departmental coordination activities
affect each other which I label as “negative cross-level interactions” and also the activities that are performed to mitigate their effects, which I label as “meta-coordination activities”. To collect this data, I focused on patient transfer activities between two clinical departments (emergency department and neurosciences department) and investigated the role of a non-clinical department (inpatient access department) in managing these activities. The three departments were selected because of the large number of patient transfers that take place between the ED and NSD and the prominent role played by IPA in facilitating hospital transfers. I used standard ethnographic methods such as general observations, patient transfer activity shadowing, formal and informal interviews, and artifact identification & collection to gather data. These methods have been widely used in computer supported cooperative work [36] and the medical informatics domains [37] to gain meaningful insights on the nuances and complexities of work practices. For instance, these methods can help identify and provide a detailed understanding of complex interactions of technical and organizational issues. I adopted a grounded theory approach [38] and the concept of articulation work [28] to analyze the data.

**Research Objectives and Questions**

The three main research objectives of this dissertation study are (a) to explore negative cross-level interactions that occur between intra- and inter-departmental coordination activities; (b) to develop a conceptual and empirical understanding of the nature of meta-coordination activities; (c) to provide insights on the relationship between meta-coordination activities and articulation work (Table 1-1).

The three main research questions that will help address the research objectives of the study include:

**RQ 1: How do negative cross-level interactions affect organizational workflow?**
• What are negative cross-level interactions?
• What are the challenges that lead to negative cross-level interactions?

RQ 2: **What are the meta-coordination activities employed by organizational staff to alleviate the effects of negative cross-level interactions?**
• What are the unique features of meta-coordination activities?
• How does meta-coordination manifest itself in hospital work?

RQ 3: **How is meta-coordination activity an aspect of articulation work?**

Answering RQ 1 will help achieve the first research objective, (a) of the study. The second and third objectives, (b) and (c) will be addressed by answering RQ 2 and RQ 3.
Table 1-1. Mapping the Research Gap to the Research Objectives and Questions

<table>
<thead>
<tr>
<th>RESEARCH GAP</th>
<th>RESEARCH OBJECTIVE</th>
<th>RESEARCH QUESTIONS</th>
</tr>
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<tbody>
<tr>
<td>Limited research on the coordination problems that occur at the intersection of intra- and inter-departmental coordination activities</td>
<td>To explore negative cross-level interactions that occur between intra- and inter-departmental coordination activities</td>
<td>How do negative cross-level interactions affect organizational workflow?</td>
</tr>
<tr>
<td>Little empirical understanding on coordination mechanisms used to mitigate the coordination problems that occur when intra- and inter-departmental coordination activities affect each other</td>
<td>To develop a conceptual and empirical understanding of the nature of meta-coordination activities</td>
<td>What are the meta-coordination activities employed by organizational staff to alleviate the effects of negative cross-level interactions?</td>
</tr>
<tr>
<td>Lack of understanding on the nature of articulation work done to alleviate the coordination problems that occur when intra- and inter-departmental coordination activities affect each other</td>
<td>To provide insights on the relationship between meta-coordination activities and articulation work</td>
<td>How is meta-coordination activity an aspect of articulation work?</td>
</tr>
</tbody>
</table>

RQ 1 investigates the various challenges that lead to negative cross-level interactions that are caused by the interplay of coordination activities both within and across departments.

Answering RQ 1 will also provide insights on how negative cross-level interactions affect organizational coordination goals.

RQ 2 explores the meta-coordination activities employed that will mitigate the effects of negative cross-level interactions. Answering RQ 2 will contribute to a stronger understanding on meta-coordination activities including its basic nature, features and characteristics. This understanding will provide a broader perspective on the role of meta-coordination activities in organizational work. Subsequently, this understanding will be instrumental in the design of healthcare information systems that can support meta-coordination activities.
RQ 3 describes the aspects of meta-coordination activities that allow it to be categorized under articulation work. Addressing this question will help identify a particular type of articulation work that mitigates coordination challenges that occur at the intersection of intra- and inter-departmental coordination activities which has been little explored.

By answering these research questions, I provide a detailed understanding of (a) how interdependencies among activities within and between departments (clinical and non-clinical departments) are managed in order to achieve organizational goals; (b) the challenges caused when intra-departmental activities and inter-departmental coordination activities negatively affect each other; and (c) a type of articulation work used to mitigate the effects of the coordination challenges that arise when intra-departmental and inter-departmental activities negatively affect each other.

**Dissertation Overview**

The structure of the dissertation is as follows:

- **Chapter 2 Background** – This chapter presents a review of coordination research including the coordination theories and models, coordination problems, strategies and mechanisms and modes of coordination. It also highlights prior research on patient flows and transfers.

- **Chapter 3 Study Design and Methodology** – This chapter provides an overview of the research methodology, specifically focusing on the data collection and analysis methods.

- **Chapter 4 Organizational Background** – This chapter describes the research setting and participants involved in the patient transfer process.
• **Chapter 5 Findings: Patient Transfer Work** – This chapter presents the main findings on coordination of patient transfers: sequence of steps in the patient transfer process and the types of interdependencies in patient transfer work.

• **Chapter 6 Findings: Coordination Challenges during Patient Transfers** – This chapter highlights the coordination challenges that lead to negative cross-level interactions. A variety of examples, vignettes and quotations from the field data are used to highlight the negative cross-level interactions.

• **Chapter 7 Discussion: Negative Cross-level Interactions** – This chapter describes the various levels of factors that lead to negative cross-level interactions; specifically focusing on the organizational issues that create challenges for effective management of interdependencies resulting in coordination challenges which in turn lead to negative cross-level interactions. In addition, the consequences of the negative cross-level interactions on two important hospital goals: effective patient flow and effective patient colocalization are also discussed.

• **Chapter 8 Discussion: Meta-Coordination Activities** – This chapter presents the different meta-coordination activities used to mitigate the effects of negative cross-level interactions in patient transfers. It also describes the relationship between meta-coordination activities and articulation work. In particular, I highlight how the concept of meta-coordination activities help improve our understanding of articulation work by (a) identifying the nature and characteristics of a type of articulation work that aims at mitigating the challenges at the intersection of intra- and inter-departmental coordination activities and (b) examining organizational articulation work in complex settings.
• **Chapter 9 Discussion: Informing Design** – This chapter first highlights a framework of inter-departmental coordination work that ties the concept of negative cross-level interactions and meta-coordination activities. Then, I discuss the socio-technical design issues that need to be considered when designing informatics tools to support effective inter-departmental coordination based on the analysis drawn from Chapter 5 and 6.

• **Chapter 10 Conclusion** – This chapter discusses the major contributions of this dissertation, future research directions and some final concluding remarks on the dissertation.
Chapter 2

Background

I draw on three streams of research on coordination from the fields of Information Systems (IS), Computer Supported Cooperative Work (CSCW), and Medical Informatics (MI). This chapter is divided into three main sections. The first section describes prior research on coordination - coordination models, coordination problems, mechanisms, strategies and modes. In this section, I also examine the departmental coordination studies in various domains. The second section presents related research on the concept of articulation work. In the final section, I present studies investigating workflows in hospital organizations, with a particular emphasis on patient transfer workflow studies.

Coordination Research

Coordination focuses on achieving concerted action that requires seamless integration of different parts of an organization to accomplish a set of tasks. Coordination has been a prominent topic of research in a variety of organizational settings including maritime operations and software development [5] civil work [6], electronic commerce [4], and healthcare [7]. Effective organizational coordination results in streamlined work processes, increased performance and effectiveness, higher productivity, and effective resource management (e.g. [39], [40], [41]). Therefore, coordination is a central aspect of work in organizations [1], [2], [3].

Organizational coordination have been defined in different ways: (a) the mutual influencing of working processes of two or more organizational actors to attain a certain objective [42], (b) the search for coherence between the goals for which an organization exists, the people that do the work, and the patterns of division of labor and inter-unit coordination [43], (c)
provision of everybody with insight into everybody else’s behavior, so that every individual is capable of making the right decisions [44], and (d) achieving integration among different parts of an organization, through information processes, to pursue common goals [45]. Despite the varying definitions on organizational coordination, the central theme across these definitions is the alignment of work that is required among different organizational units to achieve the success of a particular shared activity.

Coordination research can be classified into two main themes: first, research on models and theories that describe how coordination is achieved and second, research that investigates the problems that arise because of the lack of coordination and the various coordination mechanisms that are employed to alleviate these problems.

**Coordination Models**

Coordination models provide an explanatory understanding of coordination work and processes. Researchers have described a number of models of coordination in various domains including computer science, distributed artificial intelligence, biology and sociology [46], [47], [48]. These models are developed mainly to provide a framework when designing tools and technologies to support coordination [49]. Some examples of these coordination models include Malone and Crowston’s coordination theory model [21], Mintzberg’s model [50], Linda model of coordination [51] and the workflow reference model [52]. Malone and Crowston [21] in their model identify four unique components of coordination including actor, activities, goals and interdependencies. They define coordination as “the act of managing the interdependencies between activities to achieve a shared goal”. Mintzberg [50] develops a coordination model that explores five coordination mechanisms used by organizations including mutual adjustment, direct supervision, standardization of work processes, standardization of work outputs and
standardization of worker skills. These coordination mechanisms follow a specific complexity pattern. As complexity increases, people shift from mutual adjustment to direct supervision to standardization and revert back to mutual adjustment. The Linda coordination model [51] is built on the notion that coordination can be explicitly performed between agents by incorporating a separate language such as Linda to support it. The workflow reference model [52] takes the view that a workflow can be modeled as a graph consisting of nodes that represent the various activities and transitions between the nodes that represent the dependencies between the activities. While Malone and Crowston’s coordination theory and the Mintzberg’s model support an organizational perspective, Linda model of coordination and workflow reference models are based on perspectives in computer science and artificial intelligence. Consequently, the latter models are computational in nature and therefore cannot adequately model organizational coordination.

Since this thesis deals with coordination practices in an hospital organization, I describe the two models that take an organizational perspective - Malone and Crowston’s interdisciplinary theory of coordination [53] and Mintzberg’s coordination model [50]. While Malone and Crowston’s model is a descriptive framework for understanding how people work together, Mintzberg’s model provides a description of the five basic components of organizations and the coordination mechanisms used by organizations.

**Interdisciplinary Theory of Coordination**

Malone and Crowston [53] developed an interdisciplinary theory of coordination to help explain how people work together. The theory draws on different disciplines such as computer science, psychology, linguistics, organization theory, management sciences among others. The theory defines coordination as “the act of managing the interdependencies across activities to
achieve a shared goal”. Malone and Crowston [53] argue that actors perform interdependent tasks that might require or create resources of various types. The four basic components (Table 2-1) highlighted in the theory are goals, activities, actors and interdependencies. While the first three components (i.e., goals, activities and actors) are part of most work processes, the fourth component (interdependencies between activities) is unique to coordination. The presence of interdependencies highlights the need for coordination. Thus a proper understanding of interdependencies is important to improve coordination practices. Developing this understanding will help in the design of coordination technologies.

Table 2-1: Components of Coordination [53]

<table>
<thead>
<tr>
<th>Components of Coordination</th>
<th>Associated Coordination Processes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goals</td>
<td>Identifying goals</td>
</tr>
<tr>
<td>Activities</td>
<td>Mapping goals to activities</td>
</tr>
<tr>
<td>Actors</td>
<td>Selecting actors, assigning activities to actors</td>
</tr>
<tr>
<td>Interdependencies</td>
<td>Managing interdependencies</td>
</tr>
</tbody>
</table>

The fundamental types of interdependencies described are prerequisite, shared resource and simultaneity. A prerequisite interdependency exists when the output of an activity is required by the following activity. Shared resource interdependency exists when multiple activities share resources. Simultaneity interdependency exists when multiple activities are synchronized at a single time.

Malone and Crowston [53] further note that coordination mechanisms need to be used to manage the problems that arise from the different interdependencies. The authors also highlight that these coordination mechanisms depend on other group processes such as decision making, communication and collective sense-making [54].
Since Malone and Crowston’s theory is not specific to any particular domain, researchers have reformulated it for specific domains. For example, Herbsleb et al. [55] presented a theory of coordination in software engineering to develop a unified view on coordination in the domain. In the software engineering domain, breakdowns in design occur when the past, present and future decisions are not considered in the technical decision making process. The coordination theory helped in achieving the coordination of these decisions.

**Mintzberg’s Coordination Model**

Mintzberg [50] formulated a coordination model highlighting five basic components of organizations. At the pinnacle, is the strategic apex that consists of decision makers of the organization. The middle line comprises of managers who implement the organizational decisions by supervising the work of their subordinates and reporting to the higher authorities. At the base of the organization is the operating core where the actual work is done. Technostructure is where the work done is analyzed and organized. The support staff includes workers that perform ancillary work such as cafeteria services.
Figure 2-1: Structure of Organizations [50]

The five different coordination mechanisms used by organizations is also explained by the model. The mechanisms include mutual adjustment, direct supervision, standardization of work processes, standardization of work outputs and standardization of worker skills. He argues that the choice of the coordination mechanisms used should be based on the structure the organization follows. For instance, mutual adjustment is the most suitable coordination mechanism when an organization follows an adhocracy organizational structure that is based on decentralization and specialization. Direct supervision is most suitable if the organizational structure follows a simple structure based on centralization. These coordination mechanisms follow a specific sequence over time. In other words, as complexity of coordination increases, people shift from mutual adjustment to direct supervision to standardization and return back to mutual adjustment. This coordination approach is suitable for organizations that follow specific structures.

Although the model serves as an overarching framework for achieving coordination in organizations, it does not explain the nuances of conflicts that occur at the intersection of intra- and inter-departmental coordination activities. In addition, this model does not fully address the
coordination practices in dynamic environments. This has been a major criticism that the model has received from other researchers. For example, in a research study, Melin et al. [56] evaluated the coordination mechanisms put forth by Mintzberg [50] for understanding the use of information systems and organizational coordination. The authors argued that these mechanisms did not fully address the use of information systems and coordination practices in dynamic environments. Coordination history, external influences, emergent processes, concurrency variation and communication of interactive organizations are some of the dynamic aspects of coordination that are not addressed by the Mintzberg model. The authors also highlighted the importance of the process of coordination including the principles and patterns of coordination and relationship to external actors to understand information system use.

Thus, after closely examining how these models help explain hospital coordination, I found that neither of the two models pays enough attention to coordination activities both within and across departments that is central to organizational work. Although Malone and Crowston’s interdisciplinary coordination theory highlights the importance of managing interdependencies to achieve coordination among actors, it narrowly focuses on the interdependencies between activities. The theory fails to examine the various information and role interdependencies and consequently pays less attention to actors and their goals. In the Mintzberg’s model, the coordination mechanism depends on the organizational structure and is not easily interchangeable [49]. Furthermore, while Malone and Crowston’s model describes a micro-level (e.g. group) coordination of activities, Mintzberg’s model focuses at high-level coordination processes. Consequently, both these coordination models do not explicitly address the challenges that occur at the intersection of intra- and inter-departmental coordination activities. Furthermore, they do not examine the coordination strategies that are used to alleviate these challenges. In the next section, I highlight the different kinds of coordination challenges that have received attention in
coordination research. I also describe the coordination strategies and mechanisms used to alleviate them.

**Coordination Problems, Strategies, Mechanisms and Modes**

The successful completion of work in organizations is achieved by a division of labor among staff members specializing in different aspects of work [19], [57]. Although the work is spread across different task experts, its completion requires the integration and coordination of these sub-components. The seamless integration of these sub-components can result in significant problems. Some problems are caused by the specialization and decomposition of activities [19], [20] whereas other problems arise due to the presence of interdependencies among activities and the need to integrate these interdependencies to achieve organizational goals [2], [21]. For example, Eastman et al., [58] described the coordination practices of design and planning decisions in multi-organizational projects such as architectural projects. They found that coordination problems were mainly caused by contractual relationships and working familiarity between the team members. They examined specific factors affecting coordination between different organizations during the architectural project. The factors include shared visibility of certain work and responsibilities, privacy issues, coordination using shared artifacts, tentativeness of commitments, process knowledge as a basic aspect of professional expertise, technological and procedural heterogeneity, adaptive process and meta-level discussions, professional trust, and face-face interactions.
Coordination Strategies and Mechanisms

Researchers have noted that some of the coordination problems in organizations can be resolved by employing coordination strategies and mechanisms [21]. While a coordination strategy is defined as a logic through which coordination is exercised, a coordination mechanism is a technique used to achieve coordinated action within organizations [59]. Studies have focused on two main categories of coordination strategies: organic and mechanistic.

Organic Coordination Strategy

Organic coordination is characterized by informal, cooperative and decentralized strategies [60]. For example, coordination by mutual adjustment [2], [50] is a widely used mechanism of coordination that falls under this category. This type requires constant communication to ensure that coordination requirements (and expectations) are clear and that activities are performed in an effective and efficient manner. Mutual adjustment is the most costly form of coordination because it is mainly used in situations where other coordination mechanisms such as planning, organizing, standardizations cannot be used and therefore is inappropriate in dynamic environments such as hospitals where tasks are uncertain and unpredictable [2].

Other coordination mechanisms in this category are implicit coordination processes [61], [62], instrumental coordination [60], relational coordination [63], [64], communicative coordination [60], and coordination achieved using shared knowledge [65], [66]. Instrumental coordination [60] is achieved by observing actions performed by the other individuals. Relational coordination is primarily based on informal-relationship building [64], [63] and social networks [67], [68] that focus on the informal interactions among individuals. For example, Kapucu [67] studied the effect of inter-organizational networks on coordination of emergency response activities. He found that well-coordinated networks between the private, public and non-profit organizations led to effective response. On the other hand, communicative coordination as the
name suggests is the coordination of activity achieved through communication and semiotic actions such as signs. And finally, coordination based on shared knowledge depends primarily on the construction of shared perspectives of knowledge among collaborators [65] such as mental models [66] and common ground [69].

Mechanistic Coordination Strategy

Mechanistic coordination is characterized by formal, non-cooperative and centralized strategies [70], [71]. The main types of coordination mechanisms in this category are explicit coordination structures [72], coordination by standardization [50], coordination using plans [2], and scripts [64]. Explicit coordination occurs when team members use communication channels and messages to coordinate their activities. Coordination by standardization involves established rules and routines for achieving coordination [64]. For example, Mintzberg [50] describes three types of standardizations that support coordination including standardization of work processes, standardization of work outputs and standardization of worker skills. Coordination by plan depends on a plan that is followed for coordinating the task. On the other hand, scripted coordination is achieved through a common script that is used by all the actors to specify the protocols of the interaction. Rules, division of labor, protocols, plans are all examples of information that can be present in a script. In addition to these formal mechanisms, the involvement of coordination mediators such as individuals (with integrator roles) and groups who are primarily responsible for ensuring coordination and integration of work [73], [64] belong to this category.

In addition to these coordination mechanisms, articulation work [22] is also another widely utilized mechanism to deal with some of the coordination challenges in collaborative work. Since my thesis is mainly focused on articulation work, I describe prior research on articulation work in the next section.
**Modes of Coordination**

The manner in which coordination is achieved depends on the mode of coordination. Researchers have described two primary modes of coordination: oral and artifact-based coordination. Carstensen et al. [5] examined the basic characteristics of oral and artifact-based modes of coordination within the context of maritime operations and software engineering respectively. Oral mode of coordination is primarily based on protocols or rules that govern the interactions, while artifact-based coordination is based on artifacts. The information contained in the artifacts can be made visible to other actors and is therefore persistent unlike oral coordination where the information is distributed and temporary in nature, therefore cannot be accessed later. The differences between the oral and artifact-based coordination modes were discussed in relation to features such as persistency, dedicated and non-exclusive coordination support, degree of automation, direct and indirect referencing, dynamic and static states, coupling and detachment, flexibility and reduction of coordination workload. Therefore, understanding these similarities and differences between oral and artifact-based coordination can help in the design of collaborative technologies.

Oral-based coordination relies on mutual adjustment, interactions and communication among actors and therefore is most suitable to support the coordination of co-located activities [74], [75], [76]. Conversely, artifact-based coordination is focused on the use of an artifact to support coordination and therefore is mostly used to coordinate activities among distributed actors. Researchers have examined two types of artifact-based coordination mechanisms: non-technology-based and technology-based mechanisms. Studies that investigate non-technology-based artifact coordination mechanisms focus mainly on the role of paper. For example, Berndtsson et al. [77] explored the role of paper flight strips as a coordination artifact in air traffic control. Though paper strips are flexible and rich in information, it affects coordination. The
authors point to some of the main drawbacks of paper strips that affected coordination such as increase in amount of time required for coordination and complexity involved in maintaining its functions. They also highlighted four main points that are important to the design of coordination systems. First, the system should distribute a team member’s information with the rest of the team so that everyone can align their work accordingly. Second, the system should support features such as visualization of current state of work. Third, pre-defined structured messages should be incorporated into the system that can be used when coordination issues arise. Fourth, the system should allow the user to specify the degree of obtrusiveness of messages.

Researchers have paid a great deal of attention on investigating the role of technology-based artifacts in coordination. For example, Rogers [6] studied the coordination of computer-mediated work in civil engineering practices where she focused on the effect of information technology (IT) on work practices. She argued that the coordinative functions of IT can be exploited if there is a good support structure to resolve the technical issues that affect the social work practices. The paper highlighted the importance of maintaining a balance between supporting socially distributed and technology-mediated coordination.

Furthermore, they have also discussed incorporating various features into technological artifacts to support coordination [64]. Some interesting examples of these features include awareness [78], communication [79], and semi-structured messages [80]. Most research studies on coordination mechanism have highlighted the importance of incorporating awareness features into coordination systems (e.g. [81], [82]). For example, Dourish et al. [78] investigated the important role played by content awareness in collaborative writing systems. They argue that most existing collaborative writing tools provide high level awareness of group activities and collaborator roles and do not provide any kind of low-level content awareness. A case study of a multi-user text editor, ShrEdit was conducted to explore how content awareness was supported using shared feedback. The shared feedback feature allows group members to negotiate and adapt
the content and character of their work activities with respect to the context of group activities, thus achieving better coordination. A similar study by Nomura et al. [83] discusses the role of activity awareness in coordination among users in a workspace. They developed a prototype, Interlocus which helps in providing activity awareness. Interlocus supports activity awareness by preserving both current and past activities.

Additional features such as communication and use of semi-structured messages are also needed to support technology-based artifact coordination. For example, Agostini et al., [79] developed a coordination prototype, UTUCS (User-To-User Communication Support) system to support groups that switch between dispersed vs. non dispersed or synchronous vs. asynchronous communication modes. The system supports coordination by integrating the information created/used during and when groups switch between these communication modes, thus improving the effectiveness of work processes. Malone et al. [80] investigated the potential role of semi-structured messages in facilitating computer-supported communication and coordination. The feature of semi-structured messages is incorporated into Information Lens, an information sharing system in organizations. The use of semi-structured messages in applications such as conferencing, task tracking, and calendar and project management allowed both rigidity and flexibility of information. It helped formulate information that needs to be communicated, automatically select, classify and prioritize information, automatically respond to certain kinds of information and also suggest actions that people need to take.

Furthermore, besides these studies that highlight the important role of technology-based artifacts in coordination, researchers have also evaluated the effects of these technology artifacts on coordination [84], [85]. For example, Shin [86] investigated the relationship between IT (information technology) and coordination costs. The author empirically confirmed that IT helps minimize the coordination costs in addition to contributing to higher firm productivity. In a similar study, Cordella et al. [87] examined the effects of IT on transaction and coordination cost.
The authors suggested a new interpretation of IT’s role in improving coordination cost efficiency and reducing transaction cost. They argue that IT’s effect is enhanced when it is viewed as a tool to minimize coordination need and information overload and as organizational structure that can improve its growth.

Hengst et al., [88] investigated the effect of ICT (information and communication technology) on inter-organizational coordination. The paper highlighted some guidelines that help predict the impact of IT on inter-organizational coordination structures. The authors found that ICT have the potential to change the coordination structure from an authoritative hierarchical organizational structure to a free market-like structure that allows all organizations to be autonomous. In addition to the ICT, the authors argue that there are other influential factors affecting inter-organizational coordination that include homogeneity, specificity, time pressure, value, frequency and uncertainty.

**Departmental Studies on Coordination**

Coordination has been studied at various levels including team [8], departmental [9] and organizational levels [10], [58]. In this section, I first define the terms, intra- and inter-departmental coordination before reviewing the studies related to them.

In this research, I define intra-departmental coordination as coordination practices within a department. Intra-departmental coordination studies focus either on intra- or inter-team coordination work where teams belonging to the same department need to coordinate their activities to achieve a departmental goal. For example, Mentzas [11] explored the coordination practices of multiple groups and the issues that arise during large-scale decision support projects. A coordination model was developed to support multi-group decision making processes. The author used a concept of “job which is a tree-structured application with the different resources..."
engaged in the coordination process organized according to precedence relationships. Besides this study, most studies on intra-departmental coordination activities are conducted within the healthcare domain. The prominence of intra-departmental coordination studies in healthcare practice can be attributed to the fairly compartmentalized nature of medical practice, i.e., the functional diversity among the departments that cater to different medical conditions require specific expertise. For example, a neurosciences department in a hospital that attends to all patients with neurological disorders would require different functional expertise than a cardiology department. Each of these departments has several patient care teams with different functional responsibilities such as physicians, nurses, pharmacists, support staff, and administrators.

On the other hand, in this research, I define inter-departmental coordination as coordination practices within an organization. Inter-departmental coordination studies focus on inter-team coordination work where teams belonging to different departments in the organization need to coordinate their activities to achieve an organizational goal. For example, Hoegl et al., [89] examined the coordination practices between different departments in managing large-scale projects. The authors conducted a multi-informant longitudinal research design on a product development project in a European automotive industry to investigate variables such as inter-team coordination, project commitment and teamwork quality. They found that these three variables are important factors that affected team performance and success of an organization. Therefore, the authors also argue that intra- and inter-team collaboration processes need to be monitored in a regular manner during the entire phase of the project.

Bechky [15] conducted an ethnographic study in a semiconductor equipment manufacturing facility where she focused on how teams belonging to different departments within the organization produced a new product. The main teams she observed are the manufacturing technician, assembly and design engineering teams. She describes how coordination across these departmental boundaries is achieved using two features: common ground and organizational
accountability. Common ground [90] is built on shared understanding about a joint activity while organizational accountability is built on how actions are made explicit and recognizable to others within the organization [91]. The author found that common ground was viewed as a reactive practice which is based on mutual knowledge. Whereas organizational accountability was more of a preventive mechanism to coordination which was based on standardized practices such as formalized rules and schedules. Therefore, common ground helped in preventing some of the unexpected coordination problems while organizational accountability helped in preventing some of the routine coordination problems. Kim [16] examined how departments and groups depended on each other to achieve organizational goals. He discussed about how the lack of coordination at either of these levels resulted in a transition gap which can affect the performance and coordination costs. A coordination modeling method is developed for linking inter- and intra-organizational coordination in electronic commerce design. Also, the study highlighted the effect of inter-departmental, inter-personal and personal interdependencies on intra-organizational coordination. However this model does not address the interplay between intra- and inter-departmental interdependencies and its effect on intra-organizational coordination.

Cataldo et al. [17] investigated the role of task interdependencies in coordination of dynamic work activities involving the development of software systems. They gathered data from a large software development project that involved eight different teams distributed across three R&D laboratories in a company. They described a technique to measure these task interdependencies among individuals. They also developed a concept of congruence that evaluates the fit between the task interdependencies and the coordination activities performed by individuals. They found that better the fit between task interdependencies and coordination activities, shorter is the amount of time needed to perform the tasks.

Cuel et al. [18] examined the role of ontologies as coordination tools within an organization. The authors investigated the three main coordination processes (standardization,
plan and mutual adaptation) discussed by Thompson [2] from a knowledge management perspective. For example, coordination by standardization involves the use of a formal ontology that consists of agreed upon terms which define the organizational setting in which the department is working in. Coordination by plan refers to coordination achieved using shared concepts that are specified. Coordination by mutual adaptation for example, takes place when different departments communicate in informal settings and negotiate concepts of meanings. They argued that these coordination processes are employed depending on the type of technology used within the organization. They also emphasized that the design of knowledge management systems must consider ways to incorporate these three processes to sustain coordination.

A number of researchers have investigated the coordination practices within the employment and training services, specifically focusing on coordination of workforce development system [92], [93], [94]. The effective functioning of a workforce development system depends on coordination between job seekers, students and employers to ensure access to job information, labor statistics, training programs and other ancillary employment-related services. Researchers have highlighted a number of benefits in maintaining service coordination including expansion of features offered to clientele, additional job resources, increased communication between agencies, serving different job seekers. However, researchers have identified a number of significant barriers that can affect the seamless coordination of services. For instance, bureaucratic barriers and turf protection [94], differences in missions, performance measures, eligibility criteria, and incompatible management information systems [92]. As a result, the lack of coordination of these services has been a concern for policy makers and agency administrators; consequently researchers are examining the factors that can foster effective coordination in the service domain.

To summarize, although coordination has been focus of much research, there is still a lack of understanding of the coordination problems that occur at the intersection of intra- and
inter-departmental coordination activities. Moreover, despite the enormous research on coordination mechanisms, it is still unclear how these mechanisms or what kinds of mechanisms might mitigate the coordination problems that arise from the negative interactions between intra- and inter-departmental coordination activities. In the next section, I provide a review of coordination studies in the healthcare domain.

**Healthcare Coordination Studies**

A number of researchers have investigated coordination practices in hospitals [95], [96], [97], [98]. These coordination studies have been conducted mostly at team and departmental levels. Furthermore, researchers have examined coordination practices both within-departments (intra-departmental coordination), and between-departments (inter-departmental coordination).

**Intra-departmental Coordination Studies**

Studies of coordination within departments investigate local work practices of department staff. The intra-departmental coordination studies mainly focus on examining patient care activities of clinical teams that include care providers such as physicians, nurses, and pharmacists within a department [99], [100], [12], [7]. For example, Reddy et al. [12] investigated the role of rhythms in temporal coordination of information and work of patient care teams in a SICU (Surgical Intensive Care Unit). The authors argued that these temporal rhythms serve as resource during information seeking and management activities. They discussed incorporating temporal information into technologies. This temporal information on current and past patterns of activity will provide an idea about future activities.
In a similar study, Bardram [7] investigated the coordination activities among actors within a patient care team in a SICU and found that actors synchronized their work based on time. He used concepts of activity theory to describe four temporal constraints related to surgical work in the department. The temporal constraints include changes to operation schedules and schedule of surgeons, artifact that need to be used within a particular time frame such as operating rooms, and division of activity among actors. In addition to these four constraints, other organizational temporal constraints such as organizational specialization, temporal segmentation, temporal inflexibility, and the problem of bad and fair schedules are discussed. The author developed a prototype, Patient Scheduler based on temporal aspects of coordination to schedule treatment tasks within the SICU. Patient scheduler consists of 6 basic components such as organizational unit, an appointment, a resource, a template, a program and a note. These components help support three specific coordination tasks including coordination through scheduling, temporal coordination through synchronization and temporal coordination through allocation. Coordination through scheduling is supported by juxtaposing the schedules of actors and other temporal constraints such as a medication requires to be administered at a particular time before the surgery. Coordination through synchronization is based on a computerized operation schedule that allows actors to synchronize their activities with each other. Finally, coordination through allocation is supported by allowing the owner of a resource to allocate it to others in the hospital.

Argote [101] examined how organizations can work-around the uncertainty to achieve increased coordination. She identifies the sources of uncertainty in an emergency department and examines how uncertainty relates to coordination. The author recommends that programmed means of coordination is best suitable in emergency departments with lower levels of uncertainty while non-programmed means of coordination is appropriate in emergency departments with higher levels of uncertainty.
Ellingsen [102] described a study that focuses on coordination of clinical work in the department of rehabilitation. He examined the use of a global WHO based classification system ICF (International Classification of Functioning, Disability and Health) as a mechanism to support the coordination of highly specialized work between health care professionals within the local department. Although the tool is intended to support categorization of patient’s conditions at the global level, it helps organize work at the local level. The author argued that the global tool can be useful if it is adapted within the local context.

Coordination Problems and Strategies

Researchers have investigated the problems that are caused by the lack of coordination of patient care teams. Some of the coordination problems that are investigated in healthcare are related to information breakdowns [23], [24], process bottlenecks [25], and patient handoff challenges [26] that result in medical errors and poor quality of care.

To overcome these problems, healthcare researchers have described the use of organic coordination strategies such as trajectory awareness, organizational learning [24], redundancy [27] and adaptive coordination mechanisms [99]. Ren et al. [24] described a coordination study that was conducted in a hospital operating room environment. They investigated how coordination among multiple groups including patients, physicians, nurses and other staff resulted in breakdowns in their work. They identified two important factors including trajectory awareness and organizational learning that played a role in dynamic coordination. The authors also discuss technological implications in relation to the two factors. Trajectory awareness can be supported by incorporating distributed, interactive eWhiteboards and context-aware systems that can facilitate a dynamic communication without interfering with other trajectories. Organizational learning can be supported by fostering collaborative culture of the multiple groups using workplace structure and culture.
Cabitza et al. [27] examined the role of redundancy in coordination in a hospital ward. The authors discussed how three forms of redundancy (e.g., of data, of effort and of functions) were caused by the lack of coordination. The authors also investigated the potential role a technology can play in eliminating the bad redundancies such as data inconsistencies and support good redundancies such as incorporating extra practitioners in each department that will help when there is a shortage in practitioners. They found that technologies can reduce the amount of duplication work involved in storing the same data in multiple artifacts. In addition, it can also relieve workers of the redundant effort of different actors from writing the same data twice in order to improve awareness of work activities to promote coordination. Manser et al., [99] examined another type of coordination mechanism, adaptive coordination used by medical teams in complex work situations. Teams adapt to coordinate their processes based on the contextual requirements. In this paper, the authors examine adaptation patterns in the coordination behavior of operating room teams. The authors found that teams adapt both coordination processes and structures to meet the changing task requirements.

Furthermore, besides, these organic coordination strategies described, Xiao et al. [103] have highlighted four different types of coordination mechanisms including coordination by following protocols, coordination through monitoring of leader, coordination through anticipation and coordination through activity monitoring. They argued that breakdowns in coordination generally were caused because of poor implicit communication strategies. Hence, the authors emphasized that explicit communication channels and formal work processes need to be incorporated to improve coordination. There are a number of coordination studies that highlight the role of artifacts as mechanistic coordination strategies. The interactions of patient care teams with artifacts such as whiteboards, pagers, and other information technologies such as electronic medical records and computerized physician order entry systems that support intra-departmental coordination have been studied. Researchers have found that the use of artifacts did not always
support intra-departmental coordination. For example, Reddy et al. [9] described the role of an information system in coordination of activities of a patient care team. The authors used the concept of common information spaces (CIS) to investigate the use of EMR in SICU coordination and found that the information should be separated from its representation to achieve effective coordination.

In a similar study, Berg [98] investigated the role of information technology (IT) in an intensive care unit (ICU). He highlighted the embedded nature of IT in medical work and examined how IT supported the coordination of work activities within the ICU. He specifically focuses on how order forms in relation to reading and writing activities of care providers support the accumulation of inscriptions and coordination of other inter-related activities. The author highlights two main points central to coordination. First, the physical presence of the order form at a specific location and its structured format supported the coordination of inter-related activities. Second, the order form served as a mediator between activities that are supported by it, where it either constrains or transforms the inter-related activities.

In another study, Hartswood et al. [104] explored the role of EMR (electronic medical record) in a toxicology ward that supports multiple services such as medical and psychiatric care. They found discrepancies between the formal, intended purpose of the EMR in achieving coordination of the various services and the actual information sharing practices of healthcare workers and coordination practices. Additionally, they found that the EMR provided minimal support for coordination and cooperation between these multiple services.

Bardram et al. [105] conducted a field study in a hospital ward that focused on the material characteristics and role of interrelated non-digital artifacts such as whiteboards, work schedules, care records in coordination of activities. They found that the artifacts provided structure to work and hence, suggest that designers of coordination systems should tailor the information to meet the needs of medical personnel, tasks, and context. A study that investigated
the coordination challenges in operating room (OR) management [106] described the information practices that impact the intra-departmental coordination activities. Three sources of information were examined including information systems and documents, direct observation, and social networks. The authors argued that information systems provided only limited information necessary for coordination of the OR schedule and were not accurate sources of information. As a result, the dynamic coordination was facilitated by acquiring information from team members in addition to the information contained in the information systems.

**Inter-departmental Coordination Studies**

Inter-departmental coordination studies in healthcare mainly investigate how interdependencies between clinical departments and their activities are managed to ensure continuity of care. For example, Symon et al. [13] examined how a radiology department coordinates its activities with other departments within the hospital. To study this, they investigated the use of a radiological request form to schedule radiology examinations for the entire hospital. They found that the radiological request form did not serve as an effective coordination tool because the form contained very little information. The authors highlighted some of the main factors that affected inter-departmental coordination including status influences, social and political uses of information, conflicts between goals and between motivations for coordinating activities and the role of formal and informal practices in coordination.

In another study, Reddy et al. [107] examined the inter-team coordination practices between ED and EMS (emergency medical services) teams during a crisis situation. They described three prominent challenges that affected the coordination between these teams including ineffectiveness of information and communication technologies, lack of common ground, and breakdowns in information flow. They also highlighted the importance of designing
socio-technical systems that incorporate features such as awareness, context and workflow in order to address these challenges.

Shen et al. [108] conducted a study on the inter-departmental coordination of information between the ED and laboratory of a medical center. The authors were specifically interested in examining the causes of sample errors and delays in lab testing. They highlighted that the differences in temporal patterns of the two departments as a cause for coordination problems between them. To work-around these differences, staff used workarounds that consequently led to errors and delays in lab work. They argued that design of work procedures need to enhance greater awareness and understanding of the temporal arrangements between the ED and laboratory.

Besides, the studies that are described above, there are limited studies that investigate inter-departmental coordination practices because most of the research in healthcare domain has been focused on small teams [109], [97]. Also, there are very limited studies that have explored the inter-departmental coordination practices between clinical and non-clinical departments. For example, a study that investigated inter-departmental coordination focuses on the information sharing challenges between clinical and non-clinical departments [23]. The authors highlighted three main factors affecting information sharing practices between these functionally diverse departments. The factors examined are lack of awareness, prioritization of local clinical work, and status differences between the departments. They also discussed how workarounds are used to alleviate some of the effects of these information sharing challenges. Furthermore, despite the research highlighted above on intra- and inter-departmental coordination, there are limited studies that highlight the interaction between intra-departmental and inter-departmental coordination activities – the problems that occur when intra- and inter-departmental coordination affect each other and the mechanisms used to alleviate these coordination problems.
In the next section, I describe the studies on articulation work to examine how it can be used to overcome some of the coordination problems that occur at the intersection of intra- and inter-departmental coordination activities.

Articulation Work

Besides the coordination models described above, an alternative perspective that examines how coordination activities can be managed is articulation work. In this section, a detailed description of relevant research on articulation work is provided.

Perspectives on Articulation Work

Articulation work [22], [28] focuses on maintaining the continuity of distributed work and thus is an integral part of organizational activities. Gerson and Star [110] highlight the importance of understanding articulation work in order to capture the real work experiences. They argue that without acknowledging and capturing articulation work, we can only obtain an ideal representation of work. This concept was first formulated by Strauss [28] to understand how actors cooperate and get their work done. He defines it as the “specifics of putting together tasks, task sequences, task clusters – even aligning larger units such as lines of work and subprojects in the service of the work flow” [22]. Strauss [28] adds that it involves the meshing of tasks, meshing of efforts of actors, and meshing of actors and their work. Therefore, articulation work is viewed as “a kind of supra-type of work in any division of labor, done by various actors” [22].

Over time, there have been different interpretations of articulation work. While Strauss’ definition for articulation work remains an overarching concept, different researchers have refined articulation work to explore the specific aspects of work. For example, Sawyer et al. [111]
define articulation work as the “work that enables other work”. Other researchers view articulation as “work of pulling together everything that is needed to carry out production tasks: planning, organizing, monitoring, evaluating, adjusting, coordinating and integrating activities” [112], as “work that is often invisible or unnoticed work in everyday activities” that aim at interrelating parts [113], and as “the orderly accomplishment of cooperative work” [114]. Despite these multiple conceptualizations of articulation work, the common thread central to managing the continuity of work is that it involves “additional work” that is either performed at an individual or collective level. At an individual level, articulation work is the extra work that is done by an individual to maintain his/her ongoing work. The need to restock paper in the printer in order to print a document is an example of this kind of articulation work. At the collective level, articulation work is the extra work that is done by a group of individuals to sustain the continuity of shared work. The need to combine the various distributed tasks of a team working on an information seeking activity is an example of articulation work at this level. The team can either collaborate face to face or be distributed spatially and temporally.

Irrespective of the level of analysis, a few researchers view articulation work as being performed as part of the “routine workflow” [28] while other researchers view articulation work as being performed in response to “routine exceptions” [115]. On one hand, articulation work is part of routine workflow when it is the “planned” additional work that is done to regulate, integrate, align and mesh the individual tasks (who does what, when, where, how, with which quality, until when) to complete a specific activity.

On the other hand, it is performed in response to breakdowns in the routine workflow activities. During these routine exceptions, articulation work is the “unplanned” additional work done to manage the consequences of work – either at an individual or a collective level. For example, at the collective level, articulation work aims at managing the consequences of coordinated work. For instance, some of the consequences of distributed work highlighted by
software development researchers include changes in workplace and work structure, differences in skill, lack of knowledge, cognitive limitations, misfit of resources, equipment malfunctions and conflicting information [116].

Although, this division of labor and the management of interdependencies between tasks sound similar to “coordination”, articulation work is different from coordination in that it governs and mitigates the consequences of distributed work [115] while coordination refers to the management of the distributed nature of work.

Properties of Articulation Work

Researchers have highlighted some properties unique to articulation work. Some of the main features of articulation work discussed include openness to modification [117], invisible within rational models of work, making invisible activities that are not part of the formal rationalized model of practice visible, coordination of tasks, goals, beliefs and standards, the presence of a high level end goal [118], the presence of unmet articulation needs in organizations, and the cumulative nature of articulation work [111]. Researchers have also highlighted that articulation work is a recursive phenomenon [119], and consists of elements of self-organization and integration into formal models of work distribution [117]. However, there is still a limited understanding on the properties of the type of articulation work performed that mitigates the problems occurring at the intersection of intra- and inter-departmental coordination activities.

Domains of Interest

The concept of articulation work is used to analyze formal work practices in various contexts such as software development [116], agency content management [120], interactive
customer services [121], criminal justice [111], information infrastructure building [113] and healthcare [122].

In the software development domain [123], there is a great deal of articulation work performed to manage the coordination breakdowns in development and restore to normalcy. Mi et al. [116] have described the various breakdowns that occur during software development process. The breakdowns occur when some activities are left unfinished, use of other resources than allocated, unnecessary activities have been done, developers get different resources than they expect, cannot use assigned resources that are begun used by others, resources are unavailable when needed. The authors have also highlighted three articulation activities that help with coordination breakdowns in software development: diagnosing breakdowns, searching for solutions, and implementing a suggested solution.

Eschenfelder [118] highlights the importance of articulation work in agency content management work. Content management work involves review and approval of web content to ensure content availability and quality. She examined articulation strategies that were used to support content management work including use of paper, physical contact, not allowing new content to be added on existing websites, ignoring certain reviews, truth based exemptions, system surveillance, and addition of new approval mechanisms.

In the healthcare domain, studies have explored the role of articulation work in managing contingencies in healthcare work. Articulation work is crucial because of the coordination challenges that constantly arise owing to its dynamic hospital environment. Coordination and communication are highly complex in hospitals [124], [125], [126]. A number of researchers have studied the role of articulation work in maintaining departmental coordination [105], [125], [126], [34]. For example, Bossen et al. [33] study the use of shared interactive displays at a surgical ward. They mainly focus on identifying the effects of shared interactive displays on three main aspects of collaborative work including coordination, articulation and context-awareness. Several
features of the display (AwareMedia) to support surgical collaboration such as on-line, updated surgery schedules, video-feeds, RFID tags, chat and mobile phone capabilities helped improve coordination and context-awareness among the surgical team members and also reduced the amount of articulation work that is caused by the need to align different work trajectories in distributed collaboration. Despite its prominent role in healthcare work, articulation work remains largely invisible in organizational process flowcharts.

Besides the studies described above, there are limited studies investigating the significance of articulation work in the healthcare domain. There is still a need to understand how articulation work can help and be used to work-around some of the problems that arise from lack of coordination in dynamic environments. There are very few studies that investigate how these unique characteristics of the organizational environment affect articulation work employed by organizational actors. For example, time has a great impact on articulation work. As time decreases, importance of articulation work increases [121]. Furthermore, the healthcare studies focus on clinical coordination practices. These studies are focused on articulation work done to manage the consequences of coordination between clinical departments; it fails to identify the non-clinical departments which are key to maintain hospital coordination. For example, Faergemann et al. [34] examined the role of articulation work in supporting the collaboration and communication activities of heterogeneous teams belonging to different units. The authors laid out three important characteristics of articulation work performed across units. First, it involves a process of orientation; second, it requires access to an overview of state of affairs and lastly, articulation depends on the integration of different perspectives on relevant situations. They argued that articulation work exhibits a dual nature where articulation work to support cooperative work needs to be done at a local level (i.e. within local work arrangements) and at a global level (i.e. between the different local work arrangements). However, they did not examine the articulation work needed to overcome the challenges that occur at the intersection of intra-
and inter-departmental coordination activities. To the best of my knowledge, there are no studies that examine the details of articulation work that is performed to mitigate the negative effects of intra-departmental and inter-departmental coordination activities on each other. The different types of articulation work that have been highlighted in prior research are described in the following sub-section.

**Types of Articulation Work**

The two main perspectives on articulation work are categorized based on the visibility of work done. Hampson et al. [121] mapped the basic types of articulation work into a four-cell matrix along four dimensions of routine/non-routine and invisible/visible work (Figure 2 below). Routine work is part of the regular activities that are repeated daily [29]. This type of work can either be visible based on the formalization of roles and services or invisible in the formalized model of work. *Cell 1* consists of routine, visible work. Schmidt et al. [32] discussed the role of formal mechanisms of interaction such as plans, protocols, procedures and other organizational structures in supporting articulation work. They argued that meshing of work is highly complex when there is a need to maintain social interactions and communications between multiple distributed actors.
Figure 2-2: Fundamental categories of articulation work [121]

Cell 2 consists of routine invisible work that is necessary to maintain the continuity of work [127]. For example, secretaries in research projects do a great amount of implicit articulation work [28] nameless secretaries, support staff, technicians, administrative and other help, editors, and other backstage workers [128], [129], [130]. Cell 3 consists of response mechanisms used to workaround the non-routine contingencies that are internal to the formal workflow [131]. Cell 4 consists of response mechanisms that requires actors to modify their actions and workaround to accommodate unexpected contingencies that are external to the normal workflow [132]. For example, internal contingencies are embedded in the work arrangements while external contingencies are caused by external factors such as technology, culture, and organization structure [29].

While cells 1 and 2 are straightforward mechanisms that focus on normal “routine activities” required to manage the continuity of work, cells 3 and 4 are informal mechanisms that focus on “response activities” to mitigate the problems resulting from unexpected contingencies in work. Hence, the “routine” articulation work depicted in cells 1 and 2 is referred to as upper
level articulation and “non-routine” articulation work depicted in cells 3 and 4 is referred to as lower level articulation [118].

The important roles of both the types of articulation work have been investigated by several researchers in various domains. A number of researchers have explored upper level articulation activities. Kriplean et al., [133] investigated the articulation work in online communities such as Wikipedia. They examined the additional effort taken by certain editors who add information to the knowledge of Wikipedia. This articulation work is often awarded barnstars as a token of appreciation and acknowledgement. The authors concluded that articulation work is highly contextualized and the value of articulation work is appreciated in the wiki community.

Timmermans et al., [130] discussed the articulation work performed by mothers in taking care of their chronically ill children. The authors highlighted the invisible work that needs to be carried out by mothers to follow the care regimen suggested by healthcare providers. The different articulation strategies mothers follow in the care taking process include monitoring of their children activities, preventing children activities that can be of potential harm to their health and treating their asthma by administering medications in a timely manner.

Alternatively, there is a separate stream of research that focuses on the lower level articulation activities that are performed to manage the consequences and contingencies of distributed work. These coordination contingencies are either caused by conflicts arising from the collaborative nature of work practice or by the use of technologies introduced into the normal organizational workflow to enhance cooperative work. For example, Hampson et al. [121] discussed the role of articulation work in managing situations of tensions in interactive customer service work. Work is articulated to mitigate the conflicts between requirements of the customer and management. The authors described three choices of articulation work that can be adopted by the customer service workers in these kinds of conflict situations. First, the customer service worker can follow a combination of routine and non-routine practices to achieve management
goals but at the cost of tension with the customer. A second response involves negotiation of demands of conflicting requirements requires mediation skills and emotional work. The third option for conflict management involves a routine mechanism that requires the use of a management protocol.

Perry [134] examined the role of articulation work in mobile work. The author refers to the articulation work used to address the challenges associated with mobility as mobilization work. He highlighted that similar to mobilization work, articulation work is nomadic in nature. Boden et al. [135] studied the coordination practices of small and medium enterprises that offshored their software development projects to vendors in Eastern Europe. They found that companies relied on formal coordination mechanisms such as instant messaging, bug tracking systems, databases, and also informal articulation work practices such as informal communication and discussion. The paper stressed the importance of supporting articulation work in cooperative software development.

Schmidt et al. [136] highlighted the gap between two design strategies for coordination systems that are in stark contrast with each other. On one hand, coordination systems are embedded with structural features that regulate the coordinated interactions, while on the other; coordination systems are designed with flexibility to support free-flowing interactions. To bridge the gap, the authors argued that two modalities of articulation work including ad hoc alignment and coordination protocols need to be seamlessly integrated.

Furthermore, within this stream of research on lower-level articulation activities, researchers have investigated the articulation work done to manage the consequences of information technologies when they do not fit well with the work practice [32, 137]. One of the biggest problems is related to the rigid structure of systems that is based on workflow of the organization. These systems do not take into account the peripheral activities that are carried about to sustain collaborative work. The COORDINATOR [138] is an example of such a system.
that led to breakdowns and conflicts in work. The system failed because it did not provide communication support for negotiation of task allocation and articulation [139]. Thoresen [137] reported on a study that was conducted at a telecommunications center in Norway. The paper investigated the role of articulation work in alleviating the challenges caused by the system. The author discussed how a material administration system introduced in the organization affected the current work practices. In other words, she highlighted the disparity between the workflow and the work practice that was caused by the use of the new system.

In addition to the articulation work that result from the detrimental effects of information systems on actual work practices, researchers have also examined the changes to current articulation work that is caused by the introduction of these systems [140]. Novak et al. [140] highlighted several articulation strategies that are used by nursing staffing response to the new bar-code administration system. The strategies to support nurses’ medication administration work include organization of meetings, communications and shift reports, problem resolution mechanisms and follow-up-rounding on live units.

Although research studies have described articulation work to overcome coordination problems in individual and collaborative work, it can sometimes lead to unintended consequences [111]. For example, in a hospital context, the additional work done by the patient’s surgeon to respond to unforeseen contingencies caused by inaccurate information on patient’s allergies interrupts the entire flow of activities during the surgical procedure. Irrespective of the type, articulation work in general does not follow the ideal model of work and consequently creates an unnecessary overhead in collaborative work [141]. To reduce some of these overheads, researchers have pointed out that it is important to build systems that can automate some of the articulation work [32], [142]. For example, GROVE [143] is a multi-user outline processor. It allows multiple users to cooperate when drafting a common text. People could talk about their
ongoing activities while drafting the text. This verbal communication was supported by means of a voice link.

**Mechanisms supporting Articulation Work**

Collective responses to resolve these problematic contingencies usually require articulation work such as thought, discussion and negotiation between the various coordinating actors. In addition to these standard methods of articulation work, there are other specific variations of articulation work that is performed to integrate information technology into work practices. They include fitting, augmenting, and working-around [127], [137]. While fitting refers to adjusting or changing the current work practice to accommodate the problematic contingencies, augmenting refers to performing additional tasks and work to accommodate the contingencies.

Working-around is defined as the intentional use of technologies “in ways for which it was not designed or avoiding its use and relying on alternative means for accomplishing work” [127]. Working-around involves the use of non-approved mechanisms [4] to get things back on track to address the unexpected contingencies [30] that influence the course of work activities. However, workarounds do not address the underlying causes of the problem since they are temporary fixes that are employed to resolve problematic contingencies. As a result, workarounds generally are not a permanent solution to the problem and are often abandoned once the problem is solved [131].

Furthermore, workarounds vary significantly between contexts. For example, Kobayashi et al. [132] characterize the nature of workarounds in dynamic work environments. Individuals use different workarounds depending on their role. Although workarounds are creative solutions [131], during a time-pressured situation, they primarily depend on tacit knowledge of other
individuals. Workarounds are also characterized by their cumulative nature and their dependence on principles of fairness [132]. The author also provides four implications for designing technologies that can support workarounds. For example, a training module consisting of a library of workarounds helps in the training of workaround use. A decision making module will allow users to predict the short-term and long-term effects of the workarounds. A memory module will allow users to keep a log which will list all the initiators of workarounds and on who did favors for whom. Finally, an awareness module that supports the mutual knowledge of availability of resources and staff during a non-routine situation.

**Components of Articulation Work**

The three main components of articulation work are arrangements, working things-out, and stance [120].

*Arrangements:* Arrangements are the operational specifics agreed upon by the different team members for executing a cooperative activity (for example, who does what? when? and how?). These arrangements are either tacit or explicit in nature. Also, they are generally a temporary and therefore, open for revision and modifications by the team through the working things out process.

*Working Things Out:* Working things out refers to the upper level articulation work through which the arrangements are maintained. They include negotiation, education, and even at times, coercion of team members.

*Stance:* A stance represents the respective positions taken and strategies adopted by the different team members during the “working things out” process.
Modes of Articulation Work

Similar to the two fundamental modes that support coordination, articulation work is supported by implicit and explicit modes of work. Implicit articulation work is mainly achieved by maintaining a mutual awareness between team members and their respective activities. The team members mainly exploit the signals and cues present in the field of work (that include the signals in the environment, behavior of team members, and how they conduct their joint cooperative activities).

Despite the environmental signals, team members rely on explicit modalities to facilitate articulation work. The explicit support can either be non-technological or technological in nature. Non-technological support generally relies on informal communication [123]. Technological support becomes a requirement especially when the non-technological medium does not provide adequate support for managing articulation of distributed work. Researchers have explored the incorporation of features such as explicit communication channels, awareness features into information systems (e.g. [144]). Some examples of technologies with articulation features include groupware applications [145] and awareness tools [124], [125], [146], [147]. Apart from these technological features, Federico et al., [148] developed a model, Torres that can support healthcare practitioners belonging to different groups articulate their work activities performed across boundaries. This model is based on their study exploring the use of socio-technical interface instead of paper-based forms to overcome information flow breakdowns thereby achieving effective continuity of care across the hospital. The non-functional requirements of the framework that help alleviate information breakdowns include completeness of information, essentiality, accuracy of data entered, timeliness, comprehensibility, transparency and commitment. The authors refer to the articulation work across borders as inter-articulation work. However, although this model incorporates articulation features to support global (inter-)
coordination activity such as information sharing between groups, this model does not examine the articulation features to mitigate the negative effects of global coordination activities and local activities on each other. However, despite these features and tools, the use of both modalities require adaptability by users [136]. Furthermore, as highlighted above, since articulation work can be supported both by implicit conventions and explicit support, it is characterized by a “continuum of interactional modalities” [136].

Hospital Workflow and Coordination

In this section, I review studies that investigate workflows mainly because coordination of activities is an important aspect inherent to any type of workflow. An organizational workflow concerns how an organization completes the set of tasks required to accomplish a given goal.

Researchers especially in the medical informatics domain are interested in investigating hospital workflows and the different factors affecting these workflows such as information sharing, coordination, communication. For example, Buffone et al.[149] highlighted the importance of workflow in enabling hospitals to coordinate the resources for diagnosis, treatment and clinical management. Although these coordination activities are crucial to achieve better patient safety and quality of care, only a few studies have examined their effects on workflows. Reddy et al. [150] examined the coordination practices between ED and EMS (emergency medical services) teams during a crisis situation. They described some challenges that affected the coordination between these teams including ineffectiveness of information and communication technologies, lack of common ground, and breakdowns in information flow. They also highlighted the importance of designing socio-technical systems that incorporate features such as awareness, context and workflow in order to address these challenges.
Most workflow studies have examined workflows within a single department [151], [152]. For example, Brixey et al. [151] investigated the interruptions that affect the workflow of nurses in an emergency department of a level one trauma center. They argued that workflow studies that investigate interruptions should take into account the physical layout of the workplace and work practices within the particular department. Horsky et al. [152] mapped the workflow, decision-making, and cognitive processes of physicians within an emergency department. Using qualitative data analysis, they described the workflow processes and identified areas of work duplication and errors. They found that many delays and errors were caused by failure of interaction between the humans and systems, specifically due to the lack of proper integration of health information technology with the work practice. Despite the importance of maintaining workflows in hospitals, there are very few medical informatics studies that investigate workflow activities spanning multiple departments that are critical to hospital functioning. Patient transfer is an example of a critical activity that depends on the workflow activities between multiple departments. I examine the current research on patient transfer workflows in the following subsection.

**Patient Transfer Workflow**

Patient transfer involves the movement of patients and their respective information between various departments. Patient transfer is an important aspect of hospital workflow for a variety of reasons. Patient transfers are common in hospitals; on average 40% to 70% of patients in inpatient departments of U.S. hospitals are transferred each day [153]. Currently, many hospitals function at over 100% patient capacity. Therefore, ensuring that patients are transferred efficiently and quickly is crucial to achieve effective patient flow within the hospital [154]. Furthermore, the patient transfer process impacts whether appropriate care is delivered in a timely
and effective manner. For instance, patients with complex care requirements need to be moved between clinical departments that provide the services and care appropriate for those patients. Consequently, patient transfer is a critical hospital activity that impacts both organizational and clinical goals.

When medical informatics researchers have examined patient transfers, they have focused primarily on the clinical aspects of the patient transfer process. For example, researchers have examined coordination of “care” activities between healthcare professionals [155], [156] with an emphasis on transitions of care during patient handoffs [26], [157] and its respective challenges such as adverse drug events and medical errors [158]. A number of researchers have highlighted the effects of ineffective patient transfers on clinical outcomes. For example, the results of a survey by Australian Council safety and quality in Health Care confirmed that “ineffective handover can lead to wrong treatment, delays in medical diagnosis, life threatening adverse events, patient complaints, increased health care expenditure, increased hospital length of stay and a range of other effects that impact on the health system” [159]. However, most of these studies have failed to pay attention to the organizational impacts of patient transfer activities.

Since the clinical aspects cannot be separated from the organizational aspects, we need to investigate patient transfer workflow as both an organizational and clinical activity.

The process of patient transfer involves multiple departments; hence patient transfer workflow depends not only on the activities within a single department but also on coordination of activities that take place between multiple departments. Therefore, the success of a patient transfer between clinical departments depends not only on the internal workflows of those departments but also the inter-departmental workflows of all the involved departments including clinical and non-clinical departments. Consequently, one of the key features for maintaining effective patient transfer workflow is developing seamless coordination between the various clinical and non-clinical departments involved in the process. However, most hospital workflow
studies besides paying attention to single departments, are focused on investigating only clinical departmental workflows [160], [161]. For example, Malhotra et al. [160] developed a model to represent the workflow of an intensive care unit (ICU). They highlighted the importance of such a workflow representation in managing medical errors. While some researchers have examined the various activities that affect departmental workflow such as information sharing and communication [162], others have focused on the effects of technology use such as EMR, CPOE and whiteboards on the departmental workflow [163], [164]. For instance, Eisenberg et al. [162] investigated the workflow process in an ED, examining the communication patterns and interactions among care providers. They contrasted an ideal ED workflow process with the actual ED workflow process. Based on this comparison, they highlighted several breakdowns that could change the workflow process such as annoyed patients in the waiting room due to their extensive wait delays, frustrated staff nurses under stress and hunger, and negotiating the significance of a condition between the nurse and patient. Cheng et al. [163] used observational methods to investigate the effect of a computerized patient order entry system on the ICU (intensive care unit) workflow. They found that the introduction of a CPOE did not provide the expected benefits for the ICU healthcare providers. Instead, it increased the coordination load and redundancy and served as a new source for errors because of issues such as interruptions caused by the location of the system. The authors provided some recommendations to reduce the errors and improve system acceptance.

There is limited research evidence on non-clinical departmental workflows and the coordination between clinical and non-clinical departments such as bed management and its effect on their inter-departmental workflows (e.g. [165], [166]). For example, Proudlove et al. [166] examined the potential of capacity planning and control of beds in an acute hospital in enhancing service delivery offered in the ED. The authors highlighted several hospital-wide initiatives that need to be taken to improve ED services including management of emergency
demand, management of elective demand, management of supply through discharge
management, and collection of bed status information. Consequently, one factor that is crucial to
effective patient transfers is the design of technologies that can support inter-departmental
coordination. Researchers have long been interested in the design of systems that can support
departmental workflows [163]. However, these systems often fail to adequately support
workflows that span multiple departments.

Furthermore, most current clinical technologies (e.g. electronic medical record and
computerized patient order entry systems) focus on clinical activities such as physician order
entry, medication administration, scheduling, and documentation of patient care summary and
progress notes [124], [167], [168], [169]. However, there is limited attention paid to systems that
are used to support both clinical and organizational activities. Mostly, researchers have
demonstrated the importance of the different healthcare systems including expert systems, clinical
decision support systems, natural language systems, evidence-based systems, computerized
physician order entry systems, and also bar code technologies in patient care [170], [171], [172],
[173], [174]. Unlike these types of patient care activities, patient transfers require both clinical
and non-clinical departmental staff to work closely together to ensure that patients get transferred
to appropriate departments. For example, non-clinical staff members in the admissions
department are often responsible for assigning beds for patients to be transferred between clinical
departments. Therefore, we need to design systems that can better support activities such as
patient transfers.

Besides these workflow studies examined in the medical informatics community,
researchers from systems engineering and other related fields have been examining the issue of
patient flow in hospitals. Researchers have examined different aspects of hospital work relevant
to patient flow such as ED overcrowding [175], [176], ED boarding issues [177], [178], [179],
and hospital bed management [153], [180]. Much of this research focuses on mechanisms and
technologies [153], [181] that will help reduce the bottlenecks affecting patient flow. For example in a book edited by Randolph Hall [35], systems engineering approaches for dealing with patient flow are described. Mechanisms to minimize the unnecessary wait times in the hospital system in order to improve patient outcomes, and meet patient demands are discussed. Some examples of these mechanisms are simulation modelling techniques, queuing theory, and patient flow project management tools. However, although patient transfer is also an important factor that affects hospital patient flow, there has been very limited attention paid to the details and complexities of inter-departmental coordination activities in patient transfers and its impact on maintaining overall flow in the hospital.

From the analysis of the research on workflow studies, I have identified three significant gaps: First, there is limited research on workflows that span multiple departments (i.e. inter-departmental workflows). Second there is limited research that examines the coordination of activities between clinical and non-clinical departments and its subsequent effects on managing inter-departmental workflows. Third, there is limited research that investigates organizational aspects of the patient transfer process. To address these gaps, this research study focuses on coordination of patient transfers and its effect on workflows.

**Chapter Summary**

Although prior research has highlighted and described the problems that arise from the lack of coordination, there is still a lack of understanding on the problems that occur at the intersection of intra- and inter-departmental coordination activities. I address this gap in research by answering my first research question (RQ1).

Developing a coherent understanding of coordination mechanisms used to alleviate challenges caused by the interactions between intra- and inter-departmental coordination
activities is central to organizational work in dynamic contexts. Although there have been proposed solutions to achieve effective coordination of activities such as coordination mechanisms [182], awareness mechanisms [139], communication strategies [183], tools that support various modalities [55], and models based on coordination requirements [75], there is still a need to investigate what mechanisms can effectively overcome the negative interactions between intra- and inter-departmental coordination activities by alleviating its effects on coordination. This lack of understanding will affect how dynamic organizations can rapidly respond to negative cross-level interactions. The answer to my second research question (RQ2) will help develop this understanding.

Lastly, I add to the body of research on articulation work by examining meta-coordination activities that mitigate the negative cross-level interactions between intra- and inter-departmental coordination activities and by elucidating the nature and characteristics of articulation work employed within the healthcare context. My third research question (RQ3) will be answered by this investigation.

Therefore, to closely examine negative cross-level interactions and develop the concept of meta-coordination as a response to these negative cross-level interactions, I conducted a research study examining coordination activities within and between three departments of a large academic hospital. In the next chapter, I describe the research methodology in greater depth.
Chapter 3

Data Collection and Analysis

In this chapter, I provide the details of the research methodology for the study. This includes the rationale for choosing qualitative methods, different methods of data collection and analysis techniques.

Use of Qualitative Methods

Qualitative methods are widely being used in various domains [37], [184], [185], [186]. These methods allow for a situated in-depth evaluation of the healthcare practices; focusing on the interaction of people, information technologies and organizational structures. In this study, I used qualitative methods for data collection for the following reasons [187], [188]:

a. The open-ended nature of my research topic and the absence of a-priori research hypotheses were the primary motivations for employing qualitative methods. Qualitative methods allowed for the identification of general themes in my research and then iteratively refine these to concrete theoretical ideas related to negative cross-level interactions between intra- and inter-departmental coordination activities that allowed me to explore the nature and characteristics of meta-coordination activities.

b. The naturalistic setting of the study played an important role in my method choice. Factors related to the intricate and dynamic nature of work in hospitals, organizational processes, and patterns of interaction behavior at a large scale which involves several interacting components such as people (from different departments), artifacts and organizational structures cannot be captured in controlled environments such as laboratory settings.
c. Qualitative methods allowed me to gain a deeper understanding of the specific details of the ongoing patient transfer process. It helped me understand how patient transfers actually occur in hospitals and also capture the interdependencies between multiple departments.

d. The tensions in work practices that are spread across the organization can often only be uncovered through qualitative methods. Since the interdependencies need to be understood in the context of patient transfer work, these methods helped develop a rich description of the environment, its users, their interactions and other hidden conflicts that arise due to the interactions between intra- and inter-departmental coordination activities that cannot be captured in controlled environments. For instance, issues such as socio-economic status differences, political issues and other interpersonal conflicts can best be gathered by observing the interactions unfolding in real time and through interviewing hospital workers. The use of quantitative methods such as surveys and questionnaires, although useful, do not provide as much in-depth and detailed data on the varying perspectives on coordination issues in the hospital. Moreover, it would be difficult to capture the normal behavior of participants in the context they are working in and the effects of their cooperative behavior and interactions in the context on their work by using quantitative methods alone.

**Immersion in the Field**

The use of ethnographic data collection methods requires an “immersion” in the field in order to understand the experiences and practices of the informants [189]. I faced a number of challenges in immersing myself into the field. One important challenge was getting access to the study setting. With the support of the chief information officer (CIO) of the hospital, I got unlimited access to the three departments involved in the study: emergency, neurosciences and inpatient access departments. The CIO introduced me to top-level administrators and directors in
the three departments who, in turn, introduced me to their departmental staff. Another important challenge was gaining the trust of participants. During the initial stages of my data collection, the staff felt uncomfortable with my note-taking, and recording details about their actions. They were under the impression that their work was being evaluated. Once I explained the purpose behind my observations, staff members were much more relaxed and open to my questions. In addition, to gain their trust, I provided them with access to my notes. After the first month, they started to involve me in most of their social activities. I also helped the hospital staff solve some of their computer and printer problems, find misplaced paper charts, fetch nurses when patients needed them, answer phone calls to tell people to hold when charge nurses were busy, help secretaries compile patient folders, and also inform the nurses when their patient alarms were triggered. These activities helped me gain their trust and also build a rapport with the hospital staff. Furthermore, having a research topic that focused on the challenges of coordinating patient transfers was an added advantage. This was because hospital staff from various parts of the organization struggled in supporting smooth and efficient patient transfer. By focusing on a relevant and current problem, I was able to get adequate support in a venture they strongly believed would improve their work practices.

Data Collection

I employed ethnographic techniques such as observations, shadowing, interviews, and artifact identification and collection to develop an understanding of work activities performed by the various departments involved in patient transfers in the hospital. Ethnography is a widely accepted method for data collection in the field of anthropology [190]. An ethnographer obtains a firsthand experience by immersing herself in the research setting for an extended period of time. This helps in gaining an understanding of the particular social and cultural practices of the setting.
Ethnographic methods are used in a variety of domains to gain meaningful insights on the nuances and complexities of work practices. In CSCW (Computer Supported Cooperative Work) [36], these methods help in investigating the collaborative practices of work and the effect of technologies on work in these practices. In the medical informatics domain [151, 164, 191], these methods are used to investigate the work practices in healthcare and the effect of technologies on medical work. It is also used in evaluation of medical systems to gather design requirements from users of information systems [192]. Through ethnographic methods, I gained a deeper understanding of the particular work activities in this setting.

Data were collected in three departments: Inpatient Access Department, Emergency Department and Neurosciences Department at the Penn State Milton S. Hershey Medical Center (Table 3 below). Chapter 4 provides greater details of the research setting and participants. In this chapter, I provide an overview of the data collection methods and analysis methods that were used.

The data collection was divided into two phases: In the first phase, preliminary data were collected to gain an understanding of the various dimensions of hospital work practices such as patient care activities, patient transfer activities and how they interact with each other. In the second phase, I focused on specific patient transfer activities within and across these departments, and also the use of artifacts in patient transfer activities.

Phase 1 of the data collection was conducted over a period of ten months; between February, 2007 and October, 2007, June, 2008 and July, 2008. And phase 2 of the data collection was conducted over a period of two months; between December, 2008 and January, 2009. The study was approved by the hospital’s Institutional Review Board. The data collection methods including general observations, interviews and artifact collection that were employed are detailed below (Table 3-1).
Table 3-1: Data Collection Activities

<table>
<thead>
<tr>
<th>Department</th>
<th>Data Collection Method</th>
<th>Number of Participants</th>
<th>Type of Participants</th>
<th>Data Collection Time (in hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Phase 1</td>
<td>Phase 2</td>
<td></td>
</tr>
<tr>
<td>Inpatient Access Department</td>
<td>Observation</td>
<td>Varied among sessions</td>
<td>Varied among sessions</td>
<td>Bed placement staff and IPA manager</td>
</tr>
<tr>
<td></td>
<td>Interviews</td>
<td>9</td>
<td>9</td>
<td>IPA staff, IPA manager and house managers</td>
</tr>
<tr>
<td>Emergency Department</td>
<td>Observation</td>
<td>Varied among sessions</td>
<td>Varied among sessions</td>
<td>Charge nurses, staff nurses, physicians, residents, consults, transport staff, emergency technicians, registration associates and patient advocates</td>
</tr>
<tr>
<td></td>
<td>Interviews</td>
<td>13</td>
<td>16</td>
<td>Charge nurses, staff nurses, physicians, residents, consults and interim nurse manager</td>
</tr>
<tr>
<td>Neurosciences Department</td>
<td>Observation</td>
<td>Varied among sessions</td>
<td>Varied among sessions</td>
<td>Charge nurses, staff nurses, physicians, transport staff, and unit secretaries</td>
</tr>
<tr>
<td></td>
<td>Interviews</td>
<td>15</td>
<td>10</td>
<td>Charge nurses, staff nurses and unit secretaries</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Total Data Collection Time</td>
</tr>
</tbody>
</table>

**General Observations**

General observations are useful for a variety of reasons: (1) to obtain first hand information on the work practices and processes, (2) to capture non-routine events and
unanticipated issues that arise during these work activities, and (3) to explore all other
surrounding activities that might be of potential value to the central topic of interest [186]. I used
observation techniques to understand the work practices tied to the patient transfer process.

General observations were employed to gain an understanding of the following:

a) details of coordination work within and between these various departments
b) processes participants followed to complete their tasks and their interaction with
   artifacts, the department’s information needs, mainly focusing on the critical
   information shared among them, the interdependencies among the departments
during a patient transfer process
c) sequence of steps in the patient transfer process
d) roles of the departments and their interdependencies
e) current information and patient flows related to patient transfers
f) bottlenecks in these flows
g) methods of coordination between the departments
h) role of artifacts in coordination activities within and across departments
i) routine and non-routine events that arise during patient transfer activities and
j) the peripheral activities surrounding patient transfers.

I conducted approximately 440 hours of observations of work practices in three
departments: inpatient access (IPA), emergency department (ED) and neurosciences department
(NSD). During my observation sessions, I situated myself at different locations in the three
departments such as central workstation, clinical head’s desk, secretary’s desk, outside patient
rooms, hallways, break rooms, and medical store rooms. Through my observations, I have gained
an understanding of how the various departments work, what kinds of patient care activities they
each perform, the main participants involved in a patient transfer process, information sharing
practices and also the challenges that they face during patient transfers. For example, one
interesting event that I observed which affected a patient’s transfer was when a NSD physician was arguing with an IPA staff about an off-service patient (a patient who does not meet the service criteria of the particular department) being transferred to the department. I also observed ED patients who were frustrated with consulting residents (residents belonging to other specialties who are consulted in the ED) who did not provide definite answers to the patient’s questions about bed availability.

Observations were conducted during different times of the day to ensure that I captured representative data. Data were also collected during a few night shifts to get a sense of different work activities occurring at night. Due to the low number of internal patient transfers at night, most of the preliminary data collection was performed during day-shifts. During night shifts, the IPA staff mainly focused on ensuring that the ED was not overcrowded by placing admitted ED patients who needed hospital beds immediately. I also attended six bed management meetings with charge nurses of different departments, nurse managers, house managers, IPA manager and IPA staff members. These meetings were especially interesting because they served as discussion venues where key decision makers such as IPA staff, charge nurses, and house manager discussed different bed assignment options that will help manage the hospital resources (current resource availability, projected use of resources, projected hospital census) in an optimal manner, both during routine and non-routine events. Based on the information regarding the different departmental status’ gathered during these meetings, the IPA staff were able to plan their bed assignments better.

**Shadowing**

Shadowing techniques involve a researcher closely following a participant over an extended period of time. Unlike general observations, shadowing is more focused on collecting
data about a single participant. The data obtained through shadowing are mainly related to the activities performed by the particular participant during that time. For example, a researcher can capture data on the artifacts used by the participant, the different locations the participant went, the amount of time the participant spent on each activity, and the names of people the participant speaks to or interacts with [193].

Unlike the standard shadowing process where a particular participant is followed, I shadowed the patient transfer process. This provided me with deeper insights on the nuances and minute details of work associated with patient transfers. 16 patient transfers that occurred between the ED and NSD were closely shadowed. Shadowing the patient transfer process involved observing the activities of all participants such as nurses, charge nurses, house manager, and other hospital ancillary staff that came in touch with this process. I also collected data on their specific micro-level tasks related to the different information sharing practices, communication mechanisms, coordination modes, and artifacts used during patient transfers. A pre-created task template was used to record the common patterns during patient transfer activities including the current tasks performed, artifacts used, location, additional work, challenges faced during the task execution, and workarounds employed to alleviate some of these challenges. Using this method, I was able to find breakdowns and cooperative interactions between the two departments as they unfold in real time. For example, by shadowing a transfer of a patient from the ED to the NSICU, I was able to gather specific data on the entire patient transfer and care trajectory. I recorded data on the various staff members from the different departments that got involved in this particular patient case, the steps performed by the IPA and ED departmental staff to ensure a timely patient transfer, the breakdowns in information sharing between the transport staff and the ED, the lack of patient report before transferring the patient to the NSICU and its effect on NSICU activities, and finally, the coordination mechanisms and strategies used to overcome these breakdowns.
To protect patient privacy, no identifying patient information was recorded during the shadowing process. However, all the tasks performed during the patient transfer process were recorded in detail in my notes. An example of the notes taken using the template is provided in Appendix A.

**Interviews**

Interviews are useful to obtain the perspectives of the different participants who play a role in the patient transfer process. The interviews can provide insights into some of the implicit work practices in the setting [188].

The formal interviews allowed me to obtain participants’ (insider) viewpoints on coordination of patient transfers and its respective challenges. The interview questions focused on two aspects of hospital coordination: (a) coordination activities within the department and (b) coordination activities across departments.

I conducted 72 formal interviews with various staff members including IPA staff, IPA department manager, charge nurses of clinical departments, staff nurses, transport manager, nurse managers of the various departments, house managers of the hospital and other clinical heads and administrative staff in the clinical departments. Each interview lasted between 20 to 30 minutes.

The formal interviews were semi-structured to allow participants to discuss issues they felt that were relevant to coordination of patient transfers. A few background questions were asked first, followed by questions relevant to coordination of patient transfers related to specific themes such as patient transfer activities, importance of physician orders, information sharing practices, role of artifacts, patient flow bottlenecks and challenges with inappropriate bed assignments (The sample questions used can be found in Appendix B). The interviews helped me better grasp of certain activities that were performed by the various staff in the three departments.
This improved my understanding on the rationale behind their specific tasks and activities. For example, during my observations of patient transfers, I identified a number of breakdowns in information flow between the departments involved in patient transfers although coordination technologies were used to ensure effective information sharing. But from my observations, I was unable to pinpoint to a particular reason or set of issues that lead to this information breakdown. Therefore, to improve my understanding on this particular coordination challenge, I incorporated a couple of questions on information sharing practices between the departments to my interview guide. For instance, in one of the interviews, I asked an ED charge nurse to describe some of the information sharing issues that affect the coordination of patient transfers. Her response was: “A lot of times the attending residents don’t know to put in medication or change orders, additional labs and if we are busy with other patients, we don’t have time to go to the computer and even though these screens help, they still don’t alleviate the problem”. She further added that: “I think basically they don’t understand how the emergency department works, how difficult it is to hold patients, I don’t think they understand the concept like I said we don’t have the ancillary staff and so they have this expectation of what the patient is going to be like when they come up, you know they are disheveled or haven’t had a bath or like you know they think that’s horrible”.

In addition, I provided short scenarios related to patient transfers to get their response on how they would react to such kind of situation in real-world. For example, one scenario focused on how the IPA staff kept admitting patients though the NSIMCU was short staffed. Some of the questions that followed the scenario were related to how they managed the situation, whether the staff could hold beds in the department, the role as a CN in this situation, whether they would still accept ED admitted patients to alleviate some of the overcrowding crisis in the ED. The formal interviews were audio recorded. Verbal permission was obtained for audio recording the interviews.
During my observation sessions, I also conducted informal interviews with IPA staff, admit nurses, physicians, physician consults, residents, charge nurses, staff nurses, transport staff, housekeeping aids and department secretaries to clarify some comments made on patient transfer activities and to promote my understanding about activities that I was observing. I conducted all my interviews at locations selected by the participants to ensure that they were comfortable to talk without being worried about other colleagues overhearing their conversation with me.

Artifact Identification and Collection

Artifact identification plays an important role in the data collection process. By identifying artifacts that are embedded in work practice, I can gain an understanding of the role the artifact plays in coordinating the work activities.

I identified various artifacts including non-electronic artifacts such as paper documents and whiteboard, and electronic artifacts such as information systems used by participants to carry-out their patient transfer activities. Some samples of documents used for coordination within departments and across departments such as paper charts, triage forms, patient transfer folder, and flow sheets were collected and examined. Online documents such as organizational policies, protocols, and white papers were also reviewed. Electronic version of the paper artifacts are attached in Appendix A. Pictures and screenshots of electronic artifacts used in patient transfer process such as plasma overhead display, electronic medical record, and bed board management system were also captured.
Data Analysis

Grounded theory [194] is a widely used qualitative method [195]. It is a research approach that aims to analyze the data and investigate processes using constant comparison where codes are compared in an iterative manner, thus leading to the development of a substantive theory. The three steps in the coding process include open coding, axial coding and selective coding. The first step in the coding process involves open-coding where a line-by-line analysis is performed to derive open codes from the data. Once the open codes are generated, axial coding is performed on the data to identify repeated patterns of events and relationships between core categories. The last step involves selective coding where the coding is iteratively performed around the core categories to develop an emerging phenomenon.

In this research, I used a grounded theory approach to analyze the data because of the exploratory nature of my study. Before doing the analysis, I transcribed the data I collected into an electronic text document. The analysis was performed by closely reviewing the transcripts of the individual interviews and observation notes using the steps explained in the previous paragraph. I first did a line-by-line analysis of the data we collected on the patient transfer activities and labeled the various activities into general open codes. Some examples of open codes that were developed include information needs, coordination goals, role of artifacts, collaborators, interdependencies, sequence of steps during patient transfer, various patient and information flows, examples of routine exceptions, information breakdowns, workarounds to alleviate the coordination problems encountered. We then reanalyzed the data to examine the relationships between the open codes and developed categories. Finally, I integrated the core categories to describe the patient transfer process, the coordination challenges between departments and the meta-coordination activities that will help answer my research questions.
followed a “constant comparison” method where the constructs were compared and grouped together based on their similarities and uniformities.

The coding was performed both manually and then using Atlas.ti™ software. Due to the voluminous nature of data that required analysis, I performed manual coding that helped me first develop an overview of the data and Atlas.ti™ coding that helped analyze recurrent themes and patterns of repeated behavior across the data recorded in multiple documents. Table 3-2 provides an example of codes that helped in answering one of the sub-questions of RQ1.

Table 3-2: Example of Codes developed using Grounded Theory Approach

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Unmet information needs and sharing practices, status differences, prioritization of local work practices</td>
<td>Intentional lack of information sharing</td>
<td>Ineffective clinical/non-clinical interactions</td>
<td></td>
</tr>
</tbody>
</table>

The data collection and analysis was performed in an iterative manner where the data collection sessions were alternated with the analysis. For example, during my analysis, when I encountered interesting quotes by participants that needed more clarification or when I had questions about some unusual event that I observed, I went back to the field to collect more data. In doing so, I was able to refine my analysis.

From the data analysis using the grounded theory approach, codes and themes related to meta-coordination activities were identified. I found that meta-coordination activities clearly fit well with the concept of articulation work that has been investigated in prior research [28]. For example, an IPA staff contacted a physician when she found that the physician’s orders were written on two different patient OOS (Occasion of Service) numbers (a number which identifies a
particular patient visit). This example demonstrates a type of articulation work - additional work that was not part of ideal model of work practice.

After identifying that meta-coordination activity is a type of articulation work, I reanalyzed the entire data set using articulation work as my theoretical lens. The use of this theoretical framework provided me with insights on how meta-coordination activities are a type of articulation work. Articulation work has been widely used as a framework for analyzing ethnographic research in collaborative work environments [33]. Furthermore, it allowed me to take a practice-based perspective which is particularly appropriate while analyzing both planned and ad-hoc coordination practices in dynamic environments such as hospitals [135]. In addition to paying attention to the additional work performed to maintain continuity of work, this theoretical lens helped to uncover and examine valued work [133] such as the patient transfer activity which is an invisible aspect of hospital work. Also, it enabled in identifying and highlighting the non-clinical staff work that is done to achieve both clinical and organizational outcomes. Finally and most important, it facilitated the understanding of how staff manage unintended consequences of collaborative work and bring “things back on track” [115] which is crucial in hospital work. Thus, articulation work helped me think about coordination mechanisms that bridge gaps between situated and ideal models of patient transfer work.

Some of the specific themes relevant to articulation work that I used to code the data include anticipated and unanticipated breakdowns disrupting the patient transfer process, additional work to bring things back on track (this work can fall under visible work, invisible work, routine work, non-routine work), work activities that are not part of the ideal work model, the relations between the formal organizational workflow and the actual work practices, coordination mechanisms used to overcome and accommodate the contingencies and breakdowns, individuals who do the additional work, and role of time in articulation work. Using
this approach, I was able to generate a theoretical and conceptual understanding of the constructs that are relevant to meta-coordination activities.

While grounded theory helped in my initial data analysis to identify fundamental concepts and categories related to patient transfer practices of the various departments, articulation work helped me focus my understanding on the different types of additional work performed by various hospital staff in order to maintain the continuity of the patient transfer process.

Validity and Reliability of Study

Validity and reliability are important criteria to evaluate the integrity of the findings.

Internal Validity: To strengthen the internal validity of the research findings, I need to ensure that my findings were credible. I performed both triangulation and member checking [188] of the data. The triangulation was performed by collecting data on the same research topic from multiple sources such as physicians, nurses, administrators and also by collecting data using multiple data collection methods such as observations, shadowing, interviews and artifact collection and analysis. For example, I observed several instances when transfer orders were not entered for patients that got transferred from the ED to OR (operation room). This observation was confirmed during my interviews with the IPA staff. Member checking was done to test the data collected or its analysis with members of those groups from whom the data were originally obtained [196]. Member checking of the observation data was also performed during my interviews with hospital workers where I summarized my understanding of the on-going activities in the department to ensure the internal validity of the findings. I also verified my interpretations and findings by providing updates on my analysis to the chief information officer of the hospital and IPA manager. During this checking process, I made some minor changes to my
interpretations of the data based on the input of two staff nurses. The confirmation of my interpretations of the data with the participants also ensured the accuracy and robustness of the data.

*External Validity:* To ensure external validity, the findings of the research should be generalized to other settings. I collected enough data to provide a thick description of the nuances of the hospital context and the assumptions of the research study [197]. Thorough details of the data collected and analysis will allow an individual to check for its appropriateness in other settings.

*Reliability:* The reliability of the research findings can be achieved when the data is consistent and findings are dependable and trustworthy [196]. Consistency of the data was maintained by closely analyzing the data [198] and also by corroborating the evidence from various data sources. The trustworthiness of the research was achieved by revealing the entire research process. For instance, I revealed all the changes that occurred in the hospital setting and how these changes affected my research findings. For example, the hospital recently introduced a triage officer role which was not created during my initial data collection in spring 2007. To reflect this change, I have included details about the role a triage officer plays in the patient transfer process in my thesis. Furthermore, I provided a number of examples and quotations from my data to support my analysis. The quotations used in the thesis document are representative of the patient transfer process and are presented verbatim to illustrate the participants’ perspective on the particular issue.
Chapter Summary

This chapter detailed the various aspects of the research study methodology. In the following chapter, I provide an overview of the research setting and participants employed in this dissertation study.
Chapter 4

Research Setting

This chapter provides an overview of the research sites and also highlights the role and use of information systems in the patient transfer process.

Research Site

The Penn State Milton S. Hershey Medical Center (HMC) is a major suburban academic hospital in northeast United States. The entire hospital consists of 504 beds and has nearly 50,000 Emergency Department visits per year.

The three departments in this study are the inpatient access (IPA), emergency department (ED) and neurosciences department (NSD). These three departments were selected for the study because of the large number of patient transfers that take place between the ED and NSD and the prominent role played by IPA in facilitating these and other hospital transfers. On an average, 40% of patients that present to the ED are admitted to the inpatient departments of the hospital. Also, the increasing patient volume to the hospital’s ED introduces different kinds of interdependencies that need to be managed by the IPA to ensure smooth coordination of the patient transfer process. The IPA department works closely with the ED to help them manage their increasing patient volume.
Inpatient Access Department (IPA)

The IPA is primarily responsible for the admissions, discharges and transfers both within the hospital and between hospitals. IPA is divided into three main teams: bed placement team, registration team and insurance verification team.

a. The bed placement team is primarily responsible for finding beds for admitted patients in the hospital.

b. The registration team manages the pre-registration of patients admitted to the hospital.

c. The insurance verification team is responsible for the processing of insurance certifications.

In this study, I focus on the bed placement team because of the prominent role they play in facilitating patient transfers. Finding open beds to assign patients is highly critical to ensure the smooth running of the hospital. The bed placement staff will be referred to as IPA in the rest of the thesis proposal. The IPA team consists of:

1. Non-clinical bed placement staff: There are 2 to 3 non-clinical staff members who assign patients to beds in the hospital. They serve as gatekeepers of the organization because of the roles they play in the hospital. They are involved in:

   a. Managing scarce bed resources for internal hospital patients: The hospital functions at over hundred-percent capacity, so ensuring that appropriate beds are available for patients admitted to the hospital is critical for patient care delivery. The IPA staff manages the flow of patients by rearranging patients across various departments to make the best use of the limited number of available beds.

   b. Controlling bed assignment for patients external to the hospital: Patients arrive to the hospital from four different locations: clinic, home, another hospital or
another hospital’s ED. In order to handle the patient influx to the hospital, the IPA staff controls the beds assigned to patients. For example, the IPA staff informs the referring physician (of another hospital) of the hospital’s status if she feels the admission process is going to be delayed.

c. Monitoring patient movement in and out of the hospital: The IPA staff keep a close watch on the admissions, transfers and discharge processes by monitoring the status of beds. For instance, if a patient’s bed pops up dirty although the discharge orders are not written yet, the IPA staff immediately contact the clinical head of the department to confirm whether the patient is still in the room.

2. Admit nurse: The admit nurse is responsible for urgent ED insurance pre-certifications and making bed reservations for inter-hospital transfers. For example, when a hospital operator receives a phone call from a referring physician at another hospital regarding a potential hospital patient transfer, she immediately connects the call to the admit nurse in the IPA department and the admitting physician in the hospital. The admit nurse takes demographic and patient care information from the referring physician in order to make a bed reservation. The admit nurse listens to the phone conversation between the referring and admitting physicians regarding the potential patient admission. During these types of conversations, she can provide suggestions regarding the appropriateness of certain patient admissions. For example, when the admitting and referring physicians discuss about the possibility of sending the patient to an ICU bed, the admit nurse can suggest that the particular patient may not actually meet the criteria for intensive care unit services. The admit nurse can also inform the admitting physician about the status of beds in a particular department before the admitting physician decides to accept the patient. The nurse also plays a major role in the bed assignment decisions. She provides input to the bed assignment decisions made by the non-clinical staff based on her experience and
clinical expertise. For example, when a non-clinical staff receives a request for a bed with a diagnosis that does not sound familiar, the nurse could explain the bed requirements of the patient based on the diagnosis and condition.

**Emergency Department (ED)**

The three main goals of a hospital’s ED include the stabilization of patients, immediate patient diagnosis and temporary pain management. ED environments unlike other inpatient departments have unique characteristics such as dynamic and rapid nature of events, time critical nature of work, the constant influx of different types of patients with different conditions, and uncertainty of patient conditions.

The ED contains a total of 36 beds which are assigned to 3 patient care teams, the red, white and blue teams based on the acuity level of patients. For instance, the most acute patients are assigned to the red team and the least acute patients are assigned to the blue team. During each shift, the ED team comprises of 1 charge nurse (chief nurse), 3 attending physicians (physicians in-charge) one for each team, 2 to 3 residents per team, 1 to 2 triage nurses, 13 to 17 staff nurses (4:1 patient-nurse ratio), 3 to 4 IPA registration staff and 1 to 2 housekeeping staff.

I chose the ED as a venue for data collection because it serves as a primary gateway to the hospital. A large number of patients admitted to the hospital are transferred via ED. On an average, there are twelve patients a day that are transferred from the ED to other departments in the hospital.

The ED staff members who play a role in the patient transfer process include the following:

1. Charge nurse (CN): The charge nurse is responsible for the coordination of patient care and patient flow activities which include tasks such as bed
assignments within the ED and nurse assignments for patients during the particular shift. To expedite patient flow within the department, the CN contacts the IPA staff to assign beds immediately for ED admitted patients. Once a bed is available for an ED patient who is admitted to the hospital, the IPA staff notifies the CN about the bed assignment. The CN then informs the patient’s nurse about the bed assignment.

2. **Staff nurse:** The staff nurse is responsible for the care delivery of patients during their stay in the ED. Nursing tasks include evaluation and physical assessments of patient, administrations of medications, completes tests and procedures based on physician orders, and lastly, updates patient and family on patient condition and progress. Before transferring a patient to a hospital bed, the staff nurse gives patient report (summary of patient case) to the receiving department nurse accepting the patient. In addition to the care delivery responsibilities, she prepares the patient for transfer. She also makes arrangements for transferring the patient such as contacting the transport department. Depending on the care order requirements, she may accompany her patients during the transfer. For example, if the patient has a monitor order, then the staff nurse accompanies the patient to the inpatient department.

3. **ED attending physician:** The attending physician is the primary physician assigned to the care when the patient is admitted to the ED. If she feels the patient is a potential admission based on her assessment and evaluation, she initiates the patient transfer process by contacting the consulting physicians. She makes the first consult request for the patient.

4. **ED resident physicians:** The resident physicians are physicians in medical training who work under the supervision of the attending physicians. However,
when the attending physician is absent, the resident can initiate the transfer process. For example, when the physician is unavailable to write orders (during emergencies), the resident can initiate the transfer based on the verbal orders and instructions provided by the attending physician.

5. ED consulting physicians: The consulting physicians are external physicians who are brought into the ED to provide specialized services to the admitted patients in the ED. Consulting physicians make the decision whether the patient requires the care provided by their particular service. In other words, the consults make the final call on whether to accept and transfer the patient to the respective department. The consults need to write patient admit and transfer orders to an inpatient department before the IPA staff can start working on finding a bed.

6. Registration staff: The registration staff obtains demographic information for ED admitted patients. The staff also compile patient chart that comprises of paper record, face sheet (demographic information) and informed consent form from the patient. This chart is sent along with the patient to the receiving department.

**Neurosciences Department (NSD)**

The neuroscience department specializes in diagnosis and treatment of disorders affecting the nervous system, specifically the brain, head and spinal cord. The neurosciences department provides care for patients with neurological disorders such as Parkinson’s disease that can be treated with medications and neurosurgical disorders that need interventional procedures such as brain tumors.

The NSD is divided into two units: the neuroscience intensive care unit (NSICU) and the neurosciences intermediate care unit (NSIMCU). The NSICU is a specialized unit that provides
care for patients with head and spinal cord injuries, craniotomy for tumor resection, complex stroke care, and other neurological patients. The NSICU is a 16 bed unit with 1 charge nurse, 8 staff nurses (2:1 patient-nurse ratio) and an ICU team comprising of a senior resident, a nurse surgery resident and a neurology attending and the patient’s attending.

The NSIMCU provides care for patients that do not require intensive care for diagnoses such as ENTs, brain seizures, heart alerts, traumas, and spinal injuries. On an average, the movement in and out of the NSIMCU is higher when compared to NSICU where patients have a longer length of stay and recuperation period before they get transferred to a lower-level care facility or get discharged to rehabilitation. The NSIMCU is a 15 bed unit consisting of a charge nurse and 5 staff nurses (3:1 patient-nurse ratio). Other staff members belonging to the NSD include the triage officer and the secretary.

The NSD consists of the following staff members:

1. Charge nurse (CN): The charge nurse is responsible for the coordination of patient care and patient flow activities which involves duties such as nurse assignments for patients and assisting nurses with patient care. In addition to CN responsibilities, she sometimes has to perform patient care activities. The CN notifies the nurse when a new transfer patient is being assigned to her or when one of her patients ready to be transferred to another department has an available bed.

2. Staff nurse: The staff nurse is responsible for patient care. Once she is notified about the patient transfer to the department, she prepares the room for the patient getting transferred into the department. She stocks the room with special pumps and tubes required for the patient.

3. Triage officer: The triage officer is a physician belonging to the department. He screens and monitors the types of patients that get admitted to the department.
For example, after the IPA staff pre-assigns a NSICU bed for an ED patient, the triage officer has the right to refuse the patient if he feels it is an inappropriate admission that does not meet the department’s medical criteria. This helps in eliminating some of the off-service (i.e. inappropriate) admissions to the department. Also, when the IPA staff experiences a shortage of NSD beds to assign incoming patients, the triage officer is contacted to triage patients that can be potentially transferred out of the department.

4. Secretary: The secretary compiles the patient folder. The folder comprises of flow sheets, plan of care sheets, progress reports, information manuals, physician report sheets and family satisfaction surveys. She also informs the charge nurse about patient transfers coming into the department by tracking patient pre-assignment information on the Bed Board (a detailed description is provided below). The department does not have a secretary during all shifts.

**Overview of Systems used in Patient Transfers**

In this section, I describe the two main systems that are used during a patient transfer process: electronic medical record (EMR) and bed board tracking system. Information systems play an important role in the patient transfer process. Before the physical patient transfer process can even begin, systems are used as information sharing tools to initiate the transfer process.
**Electronic Medical Record**

Penn State Hershey Medical Center use a number of computer clinical applications. The EMR application consists of two separate portals – FirstNet (used by the ED) and Power Chart (used by inpatient departments). The layout and structure of FirstNet and Power Chart are similar except for minimal modifications on FirstNet that helps the ED staff and care providers with their dynamic work practice. The primary goal of the hospital EMR system is to improve patient safety. The EMR system helps hospital staff to achieve patient safety goals by reducing the transcription errors on the orders entered and by eliminating inappropriate duplication of orders by automatic system alerts. The EMR provides an integrated view by combining information such as clinical documentation, order entry, pharmacy, lab reports and ancillary services [199].

The clinical departments use the EMR (Figure 4-1) to view the department’s daily task list, review patient history, physician notes, medication profile and triage notes, view past procedures performed and other patient details such as name, age, sex, chief complaints and contact information.

The main components of the EMR used by the nursing staff include patient access list (PAL), patient care summary, electronic medication administration record (E-MAR), and multi-patient task list. It also has a computerized physician order entry component (CPOE) integrated into it that is used by physicians to enter orders. The CPOE component is incorporated into the EMR not only to minimize the delays in order completion by allowing online order-entry, but also to eliminate errors related to handwriting, transcription and order duplications [200].

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1 The suite of clinical applications is known as Connected™.
In order to access a patient’s EMR, the care provider first opens the patient’s chart by clicking on the particular patient’s name in their PAL. Specific information on the patient can be viewed by clicking on the EMR menu list (Figure 4-2).

The EMR menu list is divided into tabs consisting various types of patient information including alerts, orders, E-MAR, intake/output (I/O), vital signs, patient care summary, task list, results, new results, clinical assessments, form browser, notes, E-MAR summary, medication list, medication profile, allergies, problems and diagnosis, patient education, patient information and schedule and overview. I will detail the main tabs used and their functions. The alerts tab contains
documented information such as code status, special needs such as no blood products to be given, latex precautions, sensory deficits, infectious concerns, clinical trials information and release of information and other confidentiality concerns. The orders tab lists the orders on the patient for the particular encounter (Figure 4-3).

Figure 4-3: Electronic Medical Record (Orders tab)

The E-MAR tab displays medications for the patient’s encounter (Figure 4-4).

Figure 4-4: Electronic Medical Record (E-MAR tab)
The I/O tab is meant to view and enter patient intake and output (Figure 4-5).

Figure 4-5: Electronic Medical Record (I/O tab)

Vital signs tab is used to chart or view vital signs that have been charted on a patient in a spreadsheet view. Patient care summary tab provides a synopsis of patient information such as demographics, vitals, I&O, lab reports and medications. In the patient transfer process, this tab helps the sending department nurses convey patient information to receiving department nurses during report. Task list tab shows the tasks that need to be completed on a patient before the end of the shift, and also displays actual order details. The results tab displays lab, radiology, and pathology documents in a flow sheet format. While the clinical assessment tab is mainly used by nurses to enter information on the assessment forms, the form browser tab lists all forms and their status along with the name of the person who entered the information.

The main difference between the two portals (FirstNet and PowerChart) is the addition of a customized ED interface in a spreadsheet like format (Figure 4-6) on FirstNet which displays the list of patients in the ED which can be viewed by ED staff. It is divided into multiple columns listing patient’s name, bed number, chief complaint, nurse and physician information (including names and phone numbers), events, lab work, comment section and length of stay in the ED. This
interface can be viewed by everyone in the ED. The care providers use this interface to coordinate patient care processes. For example, the CN can use the interface to view details on patients in the waiting room that are waiting for a bed in the ED to be evaluated by physicians.

Figure 4-6: FirstNet (ED list of patients)

Although the ED and inpatient departments have different portals to the EMR that allow customization of the system to meet the specific needs of the two types of services, the EMR is integrated across the entire hospital. During patient transfers, the EMR is primarily used as a clinical coordination tool. For example, when a patient is transferred from the ED to the ICU, the ED nurse uses the EMR to give patient report to the ICU nurse. The ICU nurse on the other hand, takes down meticulous notes from the patient’s EMR before the patient arrives in the unit.

FirstNet is also employed by non-clinical departments such as the IPA. The IPA staff obtain patient admission, discharge and transfer (ADT) orders entered by physicians on the multi-patient task list or tab of FirstNet (Figure 4-7). Also, the access to the ED system provides the IPA staff with an idea about potential inpatient admitted patients in the ED. This helps them plan their bed management activities to ensure smooth patient flow.
However, they do not have access to the clinical information contained in the EMR for two reasons. First, the staff members do not have any clinical training so therefore, would not understand patient medical information. Second, to protect patient privacy, the information can be accessed only by clinical staff.

### Bed Board Tracking System

The Bed board (or pre-admit) tracking system is available to clinical departments but is primarily used by the IPA staff to assign and manage beds within the hospital (Figure 4-8). This 50-inch Bed board screen speeds the patient placement process for the IPA staff. It provides an instant snapshot of the status of beds in the hospital including departmental information such as un/available beds, closed beds within each department, number of discharges within each department, pending discharges and transfers, inpatients, and also specific patient information such as name, sex, DOB, patient length of stay, admitting physician, and allergies.
Figure 4-8: Bed Board Tracking System Interface

The bed board tracking system contains multiple columns, each column representing each department in the hospital. The charge nurses (CNs) use it occasionally to locate clean and available beds in the hospital.

In addition to these functionalities, the system has a paging feature incorporated into it. The IPA department uses the paging feature of the bed board system to inform the sending department CN when a bed becomes available for a patient in their department and to inform the receiving department CN when a patient is getting admitted to their department.

Chapter Summary

Having described the research setting including the departments work practices, roles of participants and systems used in patient transfers, in the next chapter, I discuss the inter-departmental patient transfer work. I also highlight the different types of interdependencies that are created due to the need to align and coordinate between intra- and inter-departmental activities during the patient transfer process.
Chapter 5

Findings: Patient Transfer Work

In this chapter, I describe the inter-departmental patient transfer work. In the first section, I provide an example of a patient transfer process. The second section highlights the various types of interdependencies that occur during a patient transfer process.

Hospital Work: Coordination of Patient Transfers

Patient transfer is a critical but often invisible aspect of workflow in a hospital. Patient transfer is defined as the movement of a patient from location A to location B. The patient transfer process is not a mere movement of patients between physical locations but between care services. Therefore, this process depends on the flow of right information among the different departments to allocate the right resource for the patient. Various patient transfer activities such as finding a bed in the appropriate service, exchanging clinical information between the sending and receiving departments, arranging transport and housekeeping services before the actual physical movement of the patient must be coordinated to maintain the continuity of care and to ensure the safety of patients during their hospital stay.

To highlight the coordinative practices involved in patient transfer process in hospitals, I investigate the sequence of steps in an ideal patient transfer process between two clinical departments (Figure 5-1).
The main participants involved in patient transfer process include the IPA department, the sending and receiving departments. The transport and housekeeping departments also play a vital role in patient transfers.

Below, I describe a real scenario to illustrate a patient transfer from ED to NSICU. An accident patient with multiple traumas was wheeled into the ED by EMS (emergency medical services). The primary participants involved in the scenario are ED attending (EA), neuroscience service consulting resident (NR), IPA staff member (BM), NSICU charge nurse (NSICU CN), ED charge nurse (ED CN) and ED nurse (ED N) and NSIMCU nurse (NSIMCU N).

ED Attending, EA stabilizes the patient in the trauma bay (place where traumas are evaluated). After the attending enters medication orders, EA contacts the consult, NR
to discuss the patient’s potential admission including the plan of care. NR presents to the ED to evaluate the patient. After a joint discussion with EA, NR decides to transfer the patient to NSICU based on patient assessment. He enters the transfer order which then shows up on the EMR’s ADT (admission, discharge and transfer) task list used by BM. On getting the order, BM searches for open beds in the NSICU. In the meantime, the patient’s nurse in the ED, ED N prepares for the patient’s move by completing all the paper charts and updating the patient’s EMR by appending her nurse notes and verifying patient summary. When a bed that meets the order and diagnosis criteria becomes available, BM immediately pages the NSICU CN to inform about the potential move to their department. The information that gets paged to the NSICU (receiving department) CN include patient’s name, sending department, DOB, sex, age, MRN and chief complaint of multiple traumas. NSICU CN is given 15 to 20 minutes to contact BM if she encounters any problem with the potential move. BM confirms the assignment (after 15 minutes) and pages the ED CN (i.e. sending department) with the room number, 4125 and patient name. The ED CN immediately informs the patient’s nurse about the room assignment. In addition to the page, BM makes changes to the bed board system data to reflect the move. On the receiving end, the NSICU CN informs the nurse who is getting the new transfer patient and provides her with the information paged by BM. The ED N before transferring the patient calls the NSICU nurse, NSICU N to give report on the patient (which includes what is currently going on and what to expect with the patient).

After report, the ED N performs the following tasks: cleans the patient, assesses the patient one last time before the transfer to make sure that the patient is fit to be transferred to the NSICU, packs his belongings and arranges transport services to physically transfer the patient. In the meanwhile, the NSICU N does the initial preparation for the new admission including stocking the room with medical supplies and pumps based on the patient’s condition. The nurse compiles a patient folder which contains blank flow sheets, plan of care sheets, information manuals, physician report sheets, contact information sheet, and family satisfaction surveys for the new patient. Once the ED N and the transport aid moves the patient to the NSICU, the nurse hands over the ED chart to the NSICU N.
The scenario describes the patient transfer activities that closely reflect the ideal model of patient transfer process. In particular, it highlights the importance of intra- and inter-departmental coordination activities for successfully performing patient transfers between departments.

The intra-departmental activities in the scenario include:

a) Entry of transfer order on EMR by the consulting physician, NR
b) Searching for availability of NSICU beds on bed board by IPA staff, BM
c) Pre-assignment and confirmation of bed assignment on bed board by BM
d) ED CN and NSICU CN notifying their respective nurses about the transfer and bed assignment
e) Packing up patient before leaving the ED by ED nurse, ED N
f) Preparing the patient’s room by NSICU nurse, NSICU N

The inter-departmental coordination activities include:

a) CNs of clinical departments, NSICU and ED receiving bed availability information from the IPA staff, BM
b) ED N giving timely “patient report” to NSICU N
c) Physical transportation of patient by transport staff and ED N
d) Patient handoff by the ED N to the NSICU N

As highlighted in Figure 5-1, both intra- and inter-departmental coordination activities depend on effective information sharing either between staff within a single department or between multiple departments. Furthermore, these coordination activities rely on the effective inter-departmental interactions between clinical and non-clinical departments (e.g. for bed allocation), and between clinical departments (e.g. for clinical collaboration). Finally, the departments use two main artifacts such as EMR and bed board to achieve smooth patient transfers between them.
Consequently, the patient transfer process comprises of a number of interdependencies that need to be managed. The following section examines the various types of interdependencies in patient transfer activities.

**Interdependencies in Patient Transfer Work**

Work in large organizations is distributed among multiple people and artifacts. Coordination is characterized by interdependencies between participants [53]. Therefore, to achieve a smooth organizational workflow, the different interdependencies in work have to be effectively managed.

Similar to the interdependencies described in prior research [2], [201], [202], [203], I have identified four prominent types of activity interdependencies that need to be managed during patient transfers: information, task, role and artifact.

*Information interdependency* occurs when an activity in one department is dependent on the availability of information from another department. For example, IPA’s ability to arrange a patient transfer from ED to NSICU is dependent on receiving accurate and timely patient and nurse staffing information from the ED and NSICU. The IPA requires information such as patient name, age, sex, DOB, length of stay, admitting and referring physician names, admit type, and urgent or emergent request type before they can make an assignment for the patient.

*Task interdependency* occurs when the initiation of an activity in one department depends on the completion of a particular task or set of tasks by another department. For example, the physical transfer of patient from ED to NSICU requires the NSICU nurse to complete a set of tasks (or actions) such as taking patient report and setting up the room for receiving the patient. In another example, the sending department, ED requires the IPA staff to complete a set of tasks
such as confirming the assignment, paging the CN of the receiving department before initiating the transfer tasks in the ED.

*Rrole interdependency* occurs when one department’s work activities depend on the specific role and responsibilities unique to a particular staff member belonging to another department. Unlike task interdependency, role interdependency requires the tasks to be carried out by individuals with specific roles. For example, the ED’s patient transfer to a NSICU bed depends on the CN’s decision on whether she should accept the ED transfer or not. Similarly, the CN of NSICU can manage her staffing and departmental activities based on the number of anticipated ED transfer patients to the unit and patient flow management within ED by the CN and rate of disposition of patients performed by ED attending.

*Artifact interdependency* is created when an activity in one department depends on an action (i.e. modification) on an artifact by another department. For example, the bed assignment activities of IPA department depend on physician orders documented into the EMR by the sending department. Although artifact interdependency may sound similar to information interdependency, it requires the information to be recorded and archived on an artifact because artifacts are viewed as tools that embody a whole history of social practices in their design and physical shape [204]. Consequently, persistency is an inherent characteristic of artifact interdependency because the information is constant in the artifact. Furthermore, while artifact interdependency relies on formal storage medium, information interdependency can also rely on informal verbal communication in addition to other formal artifacts.

Despite the different types of interdependencies, there are some common features that need to be highlighted. First, the interdependencies are not mutually exclusive of each other – they can overlap with each other. For instance, information interdependencies can sometimes be between individuals with defined roles (i.e. overlap with role interdependencies). As a result, the patient transfer process depends on the management of more than a single interdependency.
Second, during the course of work, the interdependencies can affect each other. Next, the strength of these interdependencies within and between departments varies depending on the problem context. For instance, during non-routine activities, the interdependencies tend to be stronger when compared to interdependencies in routine activities. Finally, the interdependencies in hospital work are always dynamic in nature. For instance, when a non-routine problem occurs the structure of the interdependencies can change - new interdependencies are created, old interdependencies change.

Therefore, a central aspect common to these types of interdependencies is that one department’s action can change the status of another department. For instance, the NSD’s closure of beds can affect the patient transfer activities of the neurology admit patients in the ED. Consequently, the status of the ED changes from controlled and normal capacity to uncontrolled and surge capacity.

Through the course of work, these interdependencies lead to coordination challenges that cause them to deviate from the ideal model of the patient transfer process [21], [201]. For instance, information interdependencies between departments cause coordination challenges in information sharing. Task interdependencies, on the other hand, cause challenges in the ADT (admission, discharge and transfer) process because the initiation of transfer-in activities in one department depends on the completion of discharge tasks in another department. Role interdependencies cause challenges that affected the departmental interactions because of the specific roles of individuals in ensuring the patient flow process. Finally, artifact dependencies introduce coordination challenges related to the effective use of artifacts.

The coordination challenges arising out of these interdependencies, in turn result in negative cross-level interactions between intra- and inter-departmental coordination activities.
Chapter Summary

This chapter presented some findings on the coordinative practices of patient transfer process: sequence of steps and the different interdependencies in patient transfer process. In the following chapter, I describe how the mismanagement of the interdependencies leads to coordination challenges in the patient transfer process. I also discuss my findings on negative cross-level interactions between intra- and inter-departmental coordination activities during patient transfers in detail.
Chapter 6

Findings: Coordination Challenges in Patient Transfer Process

Patient transfer process is an integral but hidden part of hospital workflow. It consists of a clinical and an organizational component that need to be seamlessly integrated with each other to ensure effective and timely coordination of patient transfers. While the clinical component deals with the clinical decisions made regarding the appropriateness of the transfer, and the location where patients move to, the organizational component deals with the physical movement of patients between departments. However, the interdependencies between the departmental activities (highlighted in Chapter 5) can have a detrimental effect on the way the clinical and organizational components are managed, consequently leading to a variety of challenges to the coordination of patient transfers.

This chapter first describes how interdependencies in patient transfer work can lead to coordination challenges. I then investigate four prominent coordination challenges affecting patient transfer activities and also highlight how these coordination challenges consequently result in negative cross-level interactions.

Interdependencies and Coordination Challenges

The mismanagement of the interdependencies leads to coordination challenges in the patient transfer process (Table 6-1). The four prominent challenges affecting the coordination of patient transfer activities are inefficiencies in ADT process, ineffective information handoffs, ineffective interactions and ineffectiveness of artifacts.
Table 6-1: Challenges and Interdependencies

<table>
<thead>
<tr>
<th>Interdependencies</th>
<th>Challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task, Artifact</td>
<td>Admission, Discharge and Transfer (ADT) Process Inefficiencies</td>
</tr>
<tr>
<td>Information, Role</td>
<td>Ineffective Information Handoffs</td>
</tr>
<tr>
<td>Role, Information</td>
<td>Ineffective Interactions</td>
</tr>
<tr>
<td>Artifact, Information</td>
<td>Ineffectiveness of Artifacts</td>
</tr>
</tbody>
</table>

The first challenge - inefficiencies in the ADT process – is affected by both task and role interdependencies. For instance, the initiation of transfer activities in receiving department is influenced by incomplete clinical staff tasks such as order entry, taking patient report in sending department.

The second challenge - ineffective information handoff practices is affected by information and role interdependencies. For instance, the transfer-in activities of receiving department are influenced by the unavailability of information from the sending department.

The third challenge - ineffective interactions between the departments involved in patient transfers is affected by both role and information interdependencies. For instance, the receiving department’s work activities are influenced by inconsistent orders (that do not match the bed requirements) entered by physicians belonging to the sending department.

Finally, the last challenge - artifact ineffectiveness is affected by both artifact and information dependencies. For instance, the IPA decision based on information contained in the electronic artifacts is affected by the inconsistencies in the use of multiple artifacts by the sending department.
As depicted below in Figure 6-1, these challenges then lead to negative cross-level interactions that occur at the intersection of intra- and inter-departmental coordination activities.

![Diagram: Coordination of Patient Transfers](image)

Figure 6-1: Challenges to Coordination of Patient Transfers

In the following sub-sections, the four prominent challenges that affect patient transfers are described: ADT process inefficiencies, ineffective information handoffs, ineffective interactions and ineffectiveness of artifacts. Furthermore, I examine how these challenges then lead to negative cross-level interactions.
ADT Process Inefficiencies

The total number of patient admissions, discharges and transfers (ADT) between departments is a key factor that determines the capacity of the hospital. However, the ADT process faces a number of bottlenecks that result in process loss and related inefficiencies. The timeliness of ADTs are influenced by delays in (1) physician’ order entry, (2) sharing of patient report, and (3) actual movement of patient by transport staff.

Delays in Physician Order Entry

Physician order entry is a process of entering physician instructions to deliver care for his or her patients. The CPOE (computerized physician order entry) component of the hospital’s EMR system allows physicians to electronically enter and communicate their orders to other hospital staff. The different types of orders entered by physicians include admission, medication, lab, discharge, and transfer orders.

A typical transfer order contains the physician name, the sending and receiving locations, and service requirements that need to be considered for bed assignments. These orders direct the work of both clinical staff such as nurses, residents and consulting physicians, and non-clinical staff such as IPA staff. Consequently, these transfer orders are interpreted differently depending on their staff roles. For example, a transfer order of a patient transferred from the ED to NSIMCU can mean different depending on the role of the staff. For a clinical staff such as the patient’s nurse, a transfer order means that the patient is ready to be discharged immediately from the ED once a bed is available in the NSIMCU. For a non-clinical staff such as the IPA staff, it means that an ED patient who is getting admitted to the hospital is waiting for a NSIMCU bed. In other words, the clinical staff views the transfer order as an instruction that requires an immediate
action while the non-clinical staff perceives the transfer order as an initial step in the patient transfer process that needs to be weighed against other transfer requests before an action can be taken.

Once the physician enters discharge/transfer orders for a patient, the discharge/transfer process is initiated. However, there are two important issues that influenced the physicians’ order entry including time and order of physician rounds.

*Time of Rounds:* Although the time of rounds is a critical factor that influences the order entry process, physicians made rounds at their convenience, based on their work schedule (e.g., surgeries/scheduled procedures/clinic visits) for that particular day.

A NSIMCU patient who is ready to be discharged stays in the unit for a whole day without being discharged, waiting for the physician to make his department rounds. The NSIMCU nurse commented that delays in getting the discharge orders entered into the system introduced “a time lapse there, where I could have moved this patient quicker”. Another nurse noted that “Until physicians change orders, we can’t do anything”. Based on the pending discharge information of the patient received from the NSIMCU CN, an IPA staff already pre-assigns that particular bed for another scheduled surgery patient in the OR (operation room).

As the vignette illustrates, the delays caused by the time of the rounds within the NSIMCU created a *negative cross-level interaction* between the IPA and OR. The delayed rounds in the NSIMCU forced the IPA staff to immediately find an appropriate bed to place the OR patient. Because of the unique requirements of the patient’s condition, she was unable to assign the patient immediately. As a result, the patient transfer activities of the patient was delayed which made the OR staff unhappy with the IPA. The OR CN kept calling the IPA staff to ask her to find another open bed and also inform her that the OR would not be able to hold the patient for more than an hour.
Order of Rounds: The order of rounds between clinical departments created delays in order entry of patients in lower-care services. Most physicians commenced their daily rounds from higher-level care units such as ICUs (intensive care units) and IMCs (intermediate care units) and proceeded to the regular medical departments. As a result, discharges in these regular departments which provide lower-care services occurred towards the end of the shift (i.e. later in the day). An IPA staff argued that these delayed discharges in lower-care units created transfer delays across the entire hospital. This was because a large percentage of patients admitted to the hospital required beds in these lower-care units which could only become available when discharge orders of pending discharge patients in these lower-care beds were entered first before rounding higher care units where the bed turn-over rate is less. However, the order of rounds between clinical departments had a negative impact on intra-departmental coordination activities of the IPA, thus resulting in negative cross-level interactions.

The following vignette illustrates the problems caused by the manner in which the rounds were carried out between inpatient departments of the hospital and its negative effects on intra-departmental activities of the ED.

An ED attending informs the internal medicine resident on-call about an ED patient’s potential admission to the department and also provides details about the patient based on her assessment. Although she informs the resident about the urgency of the patient’s condition, the patient stays in the ED for approximately seven hours before getting evaluated by the internal medicine consults who present to the ED after rounding other departments.

A negative cross-level interaction occurred when the order of internal medicine physician between clinical departments affected the intra-departmental coordination activities within the ED. As the vignette highlights, there were delays in admitting patients from the ED to the internal medicine department because the patient had to wait for consulting service team to complete their
inpatient departmental rounds before presenting to the ED to evaluate and enter orders for potential ED admit patients.

Furthermore, not only did the order of rounds between clinical departments but also the order of rounds within each of these departments resulted in delays in order entry. The primary physician and his patient care team generally round the entire department first. Once the rounding is complete, they all sit down at a central workstation and enter the ADT orders for all their patients. For example, a neurosurgery physician, after completing her rounds of the entire department (discussing all her patients’ plan of care and disposition with her team) entered her orders on the computer. Once all the transfer and discharge orders were entered, the IPA department immediately pre-assigned those available beds to NSIMCU boarders (i.e. patients waiting in other departments for NSIMCU beds). Although the delayed order entry (due to the batch manner) did not have much effect on intra-departmental coordination of IPA activities, it sure disrupted inter-departmental coordination between the NSIMCU department on the receiving end and other sending departments. The NSIMCU would get 3 to 4 new transfer patients from different sending departments simultaneously which made it difficult for the department staff to keep up with the influx.

Consequently, these delays created a negative cross-level interaction because the delayed coordination of physician rounds with ADT activities within the NSIMCU disrupted the coordination activities between the ED and NSIMCU.

**Delays in Report Sharing**

Although physicians are the primary care providers, nurses also play a central role in the delivery of care. In the NSD, nurses are responsible for the care of 2 or 3 patients depending on the type of unit in the department. For example, in the NSIMCU, 3 patients are assigned to a
single staff nurse. When one of her patients is ready to be transferred, the nurse is required to complete a set of transfer-out tasks such as administering any last-minute medications, getting the patient cleaned before the transfer, updating the paper work, calling report, compiling transfer instructions, arranging transport services to pick up the patient, packing patient’s belongings, and answering queries of family members. However, the unavailability of nurses in the receiving departments is an important factor that affected the nurses’ ability to receive report of transfer patients in a timely manner although the bed may be ready for the new patient.

The nurse may not be physically present in the department because she may be taking her other patients for tests, thus delaying the transfer process. For example, an ED nurse was unable to give report to the NSIMCU nurse because the NSIMCU nurse was outside the unit accompanying one of her other patients to CAT scan. As a result of the unavailability of the NSIMCU nurse, the coordination of transfer activities between the ED and NSIMCU was affected. The NSIMCU nurse noted that: “It’s difficult when you travel with a patient to discharge another patient. For example, patient in room 65 had 4 different tests to go to today – a duplex, echo, MRI and CVIR. If these tests are coordinated, it wouldn’t take this long. It took me 8 hours to take the patient to these tests. If a patient has lateral view x-rays to be taken, it will take a lot of time to position the patient. Sometimes the technicians are not ready, then we have to wait in the hallway for 45 minutes. And I am all behind (in care delivery) for my other patients”.

As a result, nurses in sending departments experienced indefinite delays in giving patient report which subsequently delayed the actual patient transfer. For example, when ED nurses called to give report, nurses in receiving departments were not ready to take it.

Upon learning that a neuro floor bed is available for a patient in the ED, the patient’s nurse, EN contacts the neuro department nurse, NN receiving the patient to give
report before the physical transfer of the patient. NN informs EN that she cannot take report at that time because she is busy with her other patients in the department. NN asks EN to call her after 15 minutes. EN calls back after 15 minutes. However, NN still does not take report and promises to call back EN once she becomes available.

When asked how long it would typically take for a nurse to call back, EN responded that it would take “forever” for receiving department nurses to respond and this hampered the care delivery process in the ED.

The vignette illustrates the unavailability of the inpatient department nurse, NN had a detrimental effect on taking report from EN. An ED nurse manager remarked on the issue of nurses in inpatient departments refusing to take timely reports when ED nurses called: “a nurse not taking report is a mindset challenge. This ED provides 43 -45% of hospital admits, so we admit 20% of our ED census. If you think of us as everybody’s customer, we don’t like the services here, we decide to take our business elsewhere, this hospital will lose half their business. That’s a perspective that’s not looked at either- how much downstream revenue we create”.

Consequently, these delays in taking report led to negative cross-level interactions where the interdepartmental coordination activities between ED and NSD affected patient flow activities within the ED. In addition to these negative cross-level interactions, the delay in patient report had a detrimental effect on the quality and detail of the information handed off by the sending department nurse. In this example, when EN finally gave the report, she forgot to mention about an arterial-line in the patient because she had been busy in the meantime with her other activities while waiting to give the report. Thus the information may often be incomplete and in extreme cases, inaccurate, thereby risking patient safety.
Delays in Physical Transport

The ADT process depends heavily on the transport department staff for handling patient movements both external and internal to the hospital. For example, once a patient is ready to be discharged or transferred, the patient’s nurse contacts the transport department to transfer the patient. A nurse commented on the key role the transport department plays in transfers: “transport is that cog that holds everything together, so when they are backed up it really makes life difficult”. However, the timeliness of the actual transfer is affected by the large number of pending job requests of the transport department. For example, an ED patient had to wait in an ED trauma bed for a couple of hours after all the transfer formalities were completed by the ED and SICU nurses (such as giving patient report to the SICU nurse, packing the patient’s belongings, updating records, preparing transfer instructions, calling transport to move the patient to the SICU) because of the delays caused by the transport departmental staff. This created a negative cross-level interaction of coordination activities where the transport department activities affected the inter-departmental coordination between the ED and SICU.

In addition to the delay in transferring the patient to the SICU, the care activities of the SICU patient was hampered by the transport delays. This was often because the ED nurse did not follow the order instructions that were entered after calling patient report. The SICU nurse commented that “once report is given, they don’t do anything”. It’s left to the receiving department to take care of the patient even if the patient is not physically in the department as yet. As a result, the SICU nurse had to do additional work just to catch up with the patient orders.
As this section highlights, the inefficiencies in ADT process lead to **negative cross-level interactions** that have a significant impact on coordination of patient transfers. The factors affecting the ADT process including physician order entry, report sharing and physical transport of patients as summarized in Figure 6-2 are described in detail and how they consequently result in negative cross-level interactions in the patient transfer process is highlighted.

**Ineffective Information Handoffs**

As described earlier in chapter 5, information interdependencies play an important role in coordination of patient transfer activities.
The two major types of information important to hospital work are clinical information and organizational information. During patient transfers, clinical information is shared between sending and receiving departments. Clinical information includes diagnosis, chief complaint, procedures conducted, list of medications administered, allergies, triage notes, physician and nurse narratives. In the case of patient transfers, this information is generally shared by the sending department nurse when she gives report to the receiving department nurse to ensure the continuity of care. Organizational information is important to the IPA staff to process patient transfer orders. This includes information such as patient name, age, date of birth (DOB), sex, physician order, estimated length of stay, admitting physician name, isolation requirements, fall precautions and other patient restraints.

Although departments depended on each other for their information needs, they faced bottlenecks in information sharing. Information handoffs are affected by (a) the intentional lack of information sharing and (b) the unintentional lack of information sharing.

**Intentional Lack of Information Sharing**

The intentional lack of information sharing between departments surprisingly was a recurring occurrence in the hospital and led to *negative cross-level interactions*. In one example, the intentional lack of information sharing is related to internal transfers that take place between clinical departments without the IPA department’s knowledge. An IPA staff member describes the process of hidden transfers: “Sometimes the patients are transferred out of the bed (Unit
A) and they arrived in the other unit (Unit B) and we don’t know it. If the other unit (Unit B) would have accepted the patient and let us know that they received the patient, then the unit that sent the patient (Unit A) wouldn’t be able to hide their bed. The other unit (Unit A) is not going to tell us the patient left because then we are going to key in the bed dirty if it wasn’t already in”.

This allowed charge nurses and nurses to hide beds for a short span of time until the end of shift. There were three main factors that led to this behavior: First, the nurses wanted to avoid an hour’s worth of cumbersome work involved in transferring a patient (such as preparing paper charts, taking report and setting up the room) so close to shift change. Second, with a constant influx of patients, the nurses wanted to postpone the addition of another critical patient to their already existing workload. Finally, the nurses were apprehensive about getting off-service patients who get admitted to their department because of a shortage in appropriate beds. This would result in the nurses doing extra work in admitting a patient who is potentially going to stay in the department only for a short period of time until an appropriate bed could be found.

In the above example, the intentional lack of information sharing by the two units led to problems for IPA staff in planning and coordinating bed assignment activities. By not notifying the IPA, the CN in (A) can prevent an immediate assignment by the IPA. This “hiding” of beds often occurs near shift change. However, this intentional delay in sharing information affects the work activities of the IPA staff in two ways. First, the IPA staff tries to assign an available bed in (B) without realizing that the bed has already being used by a transfer patient from (A). Second, IPA staff do not assign any patient to the available bed (from where the transfer was made) in (A) based on the assumption that
the bed is currently being occupied. This leads to a critical resource such as a hospital bed being kept idle, thus creating a logjam in patient movement.

The vignette below illustrates another instance of this kind of lack of information sharing where charge nurses did not immediately notify the IPA staff about deceased patients.

A patient in the NSIMCU passes away around seven o’clock in the morning. After the patient’s family is given sometime to grieve their loss, the patient’s body is cleaned and taken to a funeral home. Though the bed becomes available around eleven o’clock, the NSIMCU CN, NCN does not inform the IPA staff about the deceased patient and that the bed is actually available.

As a result, the NSIMCU bed remained vacant for a 12 hour period.

During this time, the ED CN, ECN being overwhelmed with the constant influx of patients informs the IPA department about a patient, X who needs an immediate bed in the NSIMCU and about three other patients who may also need bed assignments in the NSIMCU in relatively short time. After referring to the bed board, the IPA departmental staff informs ECN that there are no open beds to place X and finds out whether ECN is willing to transfer X to another floor bed with secondary services to meet the immediate needs of the patient.

This intentional lack of information sharing between IPA and NSIMCU affected the patient flow activities in the ED. When the ED CN informed X’s attending physician about the bed unavailability, the attending physician decided to keep X in the ED till an appropriate bed becomes open. Because of limited long-term care facilities in the ED, the patient’s family members were upset about the poor quality of care the patient was receiving in the ED.
These two episodes of intentional lack of information sharing highlight how the activities of staff in one clinical department affected the coordination activities between IPA and other clinical departments waiting for open beds, thus creating a negative cross-level interaction.

Unintentional Lack of Information Sharing

The unintentional lack of information sharing between departments occurs when staff members accidentally do not provide the required information. One issue that causes this type of information sharing bottleneck is the varied clinical/non-clinical information requirements. This often makes it difficult for clinical staff to anticipate the needs of IPA staff and vice versa.

A patient is admitted to the ED at night after being screened by the triage nurse. After a quick assessment of the patient, the consulting physician and the ED attending jointly decide to admit the patient. Once the consulting physician enters a transfer order for a MICU (medical intensive care unit) bed, the IPA department staff starts working towards finding an appropriate bed for the patient. Next morning, the ED CN calls the IPA staff to inform her that the original transfer was cancelled and also requests the IPA staff to start looking for a NSD bed instead. The ED CN does not provide any other clinical information on the patient.

The ED CN felt that the IPA staff did not require the information on patient’s current health status for assigning a bed in the NSD. However, the limited information shared by the ED CN affected the coordination between IPA and NSD activities. The IPA staff was unable to furnish detailed information on the patient’s on-going health status when requested by the NSD CN before confirming the transfer. The NSD CN had to do
additional work at the last-minute to get a special bed when she learned from the ED nurse that the patient was overweight. Also, based on other information obtained directly from the ED CN such as patient’s monitor requirements, the NSD CN requested the IPA department staff to re-assign the patient to another room that is monitor-compatible. This additional work caused by the lack of information shared between IPA and ED damaged the reputation and perception formed by the NSD CN of the IPA department. For instance, a secretary in NSD commented that the IPA staff had “no clue about what they are doing”.

Another issue that affects this kind of information sharing is that each department’s staff defines the relevance of information and prioritizes information based on goals of their local work practices. The IPA staff defined their information needs based on their departmental goal focused on bed management. On the other hand, charge nurses, for example, in the ED managed their information needs for the purpose of achieving ED departmental goals focused on reducing the length of patient stay in the ED. The narrow focus on local information introduced challenges to coordination of patient transfers. For example, a NSD nurse commented that patient transfers from ED were becoming problematic because ED nurses tend to discount the importance of certain types of information that are irrelevant to their local ED work practice.

The vignette below illustrates an instance of unintentional lack of information sharing where the ED nurse fails to mention to the NSIMCU nurse about an A-line (arterial-line) that the transfer patient had during her stay in the ED.

A NSIMCU nurse, NM takes report on a patient who is being transferred from the ED. Based on patient information shared during report, NM prepares the room to
meet the specific requirements of the patient. Upon arrival of the patient, NM gets ready to transfer the patient from the hospital litter to the patient’s bed. While making sure that the IV lines are not disturbed during the transfer, she discovers that the patient has an arterial-line (A-line). NM gets upset with the ED nurse because she forgot to share this important piece of information with NM.

This created a delay in the transfer arrangements of the patient to the NSIMCU bed. During the patient handoff, the NSIMCU nurse was forced to make the ED nurse wait with the patient in the unit’s hallway while she was in the medical storage room picking up medical supplies specific for an A-line patient.

This example highlights a negative cross-level interaction where intra-departmental ED transfer activities affected the coordination of activities between the ED and NSIMCU. Similar episodes of information sharing were observed when the sending department nurse forgot to convey information about patients’ mental status (confused/not or suicidal/not) and physical status (whether on some kind of restraint that requires a 1 to 1 monitoring). A NSD nurse commented that these information sharing problems affected their workflow by adding another dimension to their current work. Nurse: “you don’t always find out that the patient is confused and needs a 1 to 1 or closer observation or that kind of thing until the patient shows up - ‘By the way, they are in restraint and need a 1 to 1’ ”. The lack of information introduced new problems that required extra work in addition to their already heavy load of work activities. For example, the nurse commented that due to lack of information sharing on 1 to 1 care order, “there have been times when there is no sitter available until 11:00, so the curtain (in patient room) has to be wide-open and you have to be watching them in addition to your other two patients”.
Despite these negative cross-level interactions caused by limited information, the hospital staff still had to continue with their work. For example, the IPA staff still had to make timely decisions based on the minimal information that they had. As a result of these decisions, issues such as inappropriate bed assignments, bottlenecks in patient transfers, patient tracking problems, and other inconsistencies in IPA work affected patient movements within the hospital.

Figure 6-3: Factors affecting Information Sharing

As this section highlights, ineffective information handoffs between departments lead to negative cross-level interactions that have a significant impact on coordination of patient transfers. The factors affecting information handoffs including intentional and unintentional lack of information sharing as summarized in Figure 6-3 are described in detail and how they consequently result in negative cross-level interactions in the patient transfer process is highlighted.
Ineffective Interactions

Interactions between the various departments play an important role in ensuring that patients are transferred to the right department. These interactions can take place face-to-face or over the phone. They either occur between clinical and non-clinical staff or between clinical staff from various clinical departments. Despite their importance in managing and maintaining the coordination of patient transfers, the interactions were affected by two main factors: (1) clinical/non-clinical departmental collaboration and (2) clinical/clinical departmental collaboration.

Clinical/Non-Clinical Departmental Collaboration

Patient transfers between clinical departments depend on the bed assignment decisions made by the IPA department, a non-clinical department. For instance, when a bed is immediately required, the IPA staff, based on the transfer orders, decide who gets transferred to the first available bed. However, I identified three issues that led to conflicts during their joint collaboration.

First, although the IPA department has the authority to make these decisions, the hierarchical power structure of the hospital affected the manner in which the clinical departments collaborated with the IPA. In a hospital, the clinical staff has the greatest amount of control in most patient care activities. However, in the case of patient transfers, the IPA’s non-clinical staff have complete authority over bed assignment decisions. Yet, the clinical staff, because of their “direct” involvement in patient care, believed that they had the ultimate authority in any issue dealing with patient care including patient transfer. For instance, a clinical staff member was resentful of the loss of this decision-making autonomy to the non-clinical staff of the IPA. She
stated: “We are at their (IPA) mercy. They decide when a patient can move”. A CN further noted that the “IPA have too much control”. This consequently created a negative cross-level interaction where the inter-departmental coordination between the IPA and the clinical departments affected the intra-departmental activities of the IPA. The clinical departments often found faults with the bed assignment decisions made by the IPA department which often resulted in conflicts between the clinical and IPA departments, especially because the clinical staff felt a loss of control regarding these decisions.

Second, the clinical staff thought that the IPA staff lacked the clinical knowledge to make appropriate bed management decisions which consequently affected their collaboration with clinical departments. For instance, physicians sometimes placed orders for higher-service beds just to improve the priority of their patients. Although these orders gave the physicians a sense of security because their patients will not only be assigned beds soon, but will also receive close clinical monitoring, it often led to inappropriate bed assignments. This frustrated the receiving department’s clinical staff because they viewed this as something that IPA staff should have prevented but could not because of their lack of clinical knowledge.

One of the house managers emphasized that inappropriate patient transfers slowed the overall patient flow of the hospital: “The patient gets to the NSD and once the nurse is done with the vitals, the patient is already downgraded -You are using up medical supplies, doing double reports, and then rooms need to be re-cleaned which slows the flow”. In this particular example, the IPA staff did not possess the clinical expertise to identify that the order was inconsistent with the patient diagnosis and care requirements which not only had a detrimental effect on patient safety but also created a negative cross-level interaction. The negative cross-level interaction was created where the inappropriate bed assignment activities of the IPA affected the inter-departmental activities between the ED and NSIMCU.
Finally, the reduced involvement of clinical staff in organizational activities such as patient flow affected the collaboration between the clinical departments and the IPA. In addition to the well-recognized role played by care providers such as physicians and nurses in patient care delivery, they are also an important component in the patient transfer process. However, these care providers still focus primarily on care delivery while paying less attention to patient transfers and its challenges. The physician’s role in the patient transfer process was situated around the task of order entry. Therefore, the direct involvement of the physician ends at this point. As a result, physicians were unaware of the consequences their orders might have on the entire patient transfer process. They either entered orders that were inconsistent with the patient diagnosis or patient acuity. The inconsistency of physician orders with patient diagnosis and bed requirements was an order entry issue that hampered patient transfers. For example, physicians entered orders for higher-service beds just to improve the priority of their patients. This often affected the inter-departmental coordination activities between the IPA and the receiving departments.

A physician places a transfer order for a NSIMCU bed for an ED patient with spine problems. Upon receipt of this order, the IPA staff detected a mismatch between the diagnosis of the patient and the order for a bed in a higher service area. After consulting with the IPA admit nurse about the diagnosis, the staff immediately contacts the physician to verify the bed request information.

Although this extra step (detecting and following-up on rectifying the problem) was needed for making an informed decision on bed assignment, this step was not followed for every patient case. There were times when IPA staff failed to notice this discrepancy between the order and bed requirements. The lack of experience of staff in the IPA had an impact in finding these mismatches. In the vignette above, if the IPA staff member had failed to detect the discrepancy between the order-bed requirements, she
might be looking for a bed in an inappropriate service (as previously requested). This results in a negative cross-level interaction where physician activities in the NSD affect the inter-departmental coordination activities between the IPA and NSD. A house manager emphasized that: “The physicians will write orders for a critical bed, and when the patient gets to the ICU/IMC, the patient will be a floor status and waving at us. There’s a great potential for that patient to decompensate but it undermines the trust between the departments. People feel used, you circumvented the system, they feel used, they feel someone was trying to pull a wool over their eyes”.

Another example of an inconsistent order entry is when physicians in ED always placed their orders under the “urgent” acuity category. An IPA staff commented on how they defined urgency as a matter of routine for all their patients. IPA senior staff: “the majority of ones especially from the ER are either urgent or you may see an emergent, but normally its urgent”.

Defining urgency for most of the ED patients irrespective of their condition helped in achieving rapid patient flow within ED, thereby helping in intra-departmental coordination of ED activities. However, a negative cross-level interaction is created when physician activities within the ED affected the inter-departmental coordination activities between ED and IPA, and also between IPA and receiving departments. The inappropriate transfer requests made by ED physicians required the IPA to unnecessarily make open beds by switching patients around, sometimes even to inappropriate locations in the hospital in order to accommodate the urgent patients in the ED. Consequently, these inappropriate transfers within the hospital distorted not only patient care activities
but also jeopardized the inter-departmental coordination between IPA and other clinical departments that are affected by the inappropriate transfer decisions.

**Clinical/Clinical Departmental Collaboration**

The effectiveness of both patient care and patient transfer activities depend heavily on the smooth collaboration between the clinical departments. I observed that the collaboration process among the clinical departments face relatively less problems when compared to the collaboration between the clinical/non-clinical departments. This could be to a certain extent because of the functional similarity in clinical training and background between the clinical departments.

However, there are two main issues that jeopardized the collaboration between clinical departments. First, the different workflows in their local departments affected their interactions with each other. Consequently, the approach towards patient care is starkly different in the ED and NSD. While the ED pays more attention to an expeditious diagnostic evaluation and steps for immediate pain relief, inpatient departments such as NSD focus on therapeutic care and longer-term treatment. An ED nurse manager stated that: “We are the only specialty that cares for all ages, so we can deliver your baby, resuscitate the baby, resuscitate the mom, take care of grandma, take care of grandpa’s chest pain and dad’s GI bleed- you know we care for all age groups and all medical conditions”. As a result, the patients’ increased length of stay in the NSD constrains the limited available resources. The patient flow bottlenecks created within the NSD forces the IPA to either temporarily “board” the ED patients in off-service departments or have the patients remain in the ED till a NSD bed becomes available. This created negative cross-level interactions where the intra-departmental activities of NSD affected the inter-departmental coordination activities between IPA and the ED or between the ED and the receiving departments that are willing to board the patients temporarily.
Second, the varying levels of interest in ensuring patient flow influenced the collaboration between the clinical departments. Although, the entire hospital aims at maximizing the number of patients getting care, there are characteristic differences between the ED and inpatient departments. For example, the ED has limited control on the patients coming in unlike inpatient departments that have a choice on the patients they accept. Consequently, the ED is forced to accept new patients in spite of the staff shortages. An ED manager stated that: “Inpatient departments might have an empty bed but short staffed so they wouldn’t be able to accept patients in their minds. But the argument for that is we most times work short too but we can’t stop patients coming. From the ER perspective, that’s not a good reason at all”.

While the ED is focused on achieving the optimum patient flow to accommodate the constant influx of new patients, the inpatient departments are not as committed to rapid patient flow because they do not have to deal with the same influx of new patients. An ED nurse manager stated that: “culturally, the mindset of inpatient departments is that we are creating work for them and they want to manage their day without the surprise of a new patient from the ED. I think they need to change their culture – its not a surprise that a new patient is coming- we know that we are going to fill up half the house, so they should plan. It shouldn’t be ‘oh, there is a patient in the ED waiting to come here’; instead it should be ‘oh they are a little late’. It’s going to take cultural changes and that’s going to be hard and painful”.

More often only a preliminary evaluation would be completed by the time the patient leaves the ED. For example, one of the concerns voiced by inpatient departments were that the transfer patients from the ED were not always well-kept and most of their laboratory work was incomplete. A NSD CN stated that: “Half the patients come to our unit from the ER and right away we have to turn right around, go downstairs for CAT scan, MRI and it will be really, really helpful if they could do all these when the patient is down there in the ER”. When asked about this, an ED CN stated that “But that’s not our job”. Another NSD CN added: “Also, sometimes
the nurses don’t do all their orders – they don’t do blood draws that were ordered 4 hours before, then we get stuck trying to catch up the last how many hours. Or else if they do give report and then wait to bring the patient up, then the time between report and bringing the patient up, anything ordered between that time, they’ll not do it. They will say ‘we already gave report’.”

Consequently this resulted in a negative cross-level interaction where the intra-departmental activities within the ED affected the inter-departmental coordination activities between the ED and the inpatient departments receiving patients from the ED.

As this section highlights, ineffective interactions between departments lead to negative cross-level interactions that have a significant impact on coordination of patient transfers. The factors affecting information handoffs including clinical/non-clinical and clinical/clinical departmental collaboration as summarized in Figure 6-4 are described in detail and how they
consequently result in negative cross-level interactions in the patient transfer process is highlighted.

**Ineffectiveness of Artifacts**

The hospital staff employ a wide variety of artifacts to support their work in the patient transfer process. The complexity of these artifacts varies from most fundamental non-electronic artifact such as paper chart to complex electronic artifacts such as the EMR and bed board. The patient chart consists of a face sheet (a demographics sheet filled by IPA staff when the patient is first admitted to the hospital), other patient reports (such as X-rays, CAT scans, MRIs) and prior lab work, physician narratives, and flow sheets (if any) from the departments the patient has been receiving care (A pdf copy of the patient chart is attached in Appendix A). The electronic artifacts employed in the patient transfer process are detailed in the methodology chapter (refer Chapter 4). One of the key requirements for these artefacts is the ability to simultaneously support both intra-departmental and inter-departmental coordination activities in the patient transfer process. But these artifacts are used for different purposes in the patient transfer process; while paper charts help achieve intra-departmental coordination, the EMR and bed board help ensure inter-departmental coordination activities. There were three important factors that affected the usefulness and effectiveness of the artifacts in the patient transfer process: (1) use of multiple artifacts, (2) organization of information system content, and (3) system privileges.

**Use of Multiple Artifacts**

The two types of artifacts were used in conjunction with each other to support the coordination activities during the patient transfer process. Although the entire hospital had fully
functional electronic artifacts that supported the work of clinical and non-clinical departments, the clinical departments also relied on non-electronic artifacts such as paper charts to coordinate their patient care activities of transfer patients. However, the simultaneous use of the different types of artifacts led to ineffectiveness of artifacts. I identified three issues that affected the use of multiple artifacts: transitioning between artifacts, maintaining consistency across artifacts and limited use of electronic artifacts.

**Transitioning between artifacts**: Paper charts are primarily used by physicians to record relevant medical information from the EMR such as triage notes, vitals, prior physician visit summaries, and medical history. They also use it to capture information from patients (during patient assessment) such as current medications, and other health complaints as well as to enter possible diagnosis and temporary plan of care. A paper chart is initially prepared by the department that sees the patient first. For instance, if the patient is first seen in the ED, the ED staff prepare the paper chart for the patient. During the patient transfer process, this paper chart gets passed-on to the next department receiving the patient. For example, during a patient transfer from ED to NSICU, the ED nurse handed over the patient chart to the NSICU nurse. Each department has its own paper forms that get appended to the original paper charts which are then filed into a common patient transfer folder. Thus the patient chart serves as the primary resource for initiating care in the receiving department since it contains a lot of hand-written information on the patient’s progress by the sending department nurse, in addition to the physician’s hand-written notes for each day, lab results, and patient inputs and outputs for each day. However, the transitions between paper and electronic artifacts created several problems for the effective use of multiple artifacts.

First, the inter-departmental coordination of care activities of transfer patients are affected when the content of the paper charts are not transferred to the EMR in a timely manner. This consequently results in the need to rely on their paper charts. The following vignette
illustrates the importance of paper chart created in the ED and its effect on inter-departmental coordination of patient transfer activities between the NSIMCU and the ED.

A nurse in the ED is preparing a patient to be transferred to the NSIMCU. Before the actual transfer, the nurse looks for the ED patient chart that needs to be handed over to the NSIMCU nurse. She gets really frustrated because after making all the necessary arrangements for the transfer, she realizes that the patient’s chart is misplaced and cannot be found in the file rack (where patient charts are placed). She spends around 25 minutes inquiring about the lost chart – she searches in the patient’s room, physician’s workstation and other areas in the ED but does not find it. She also realized that not all information on the paper chart is transferred to the EMR.

This resulted in negative cross-level interactions where the intra-departmental activities of the ED affected the inter-departmental coordination of transfer activities between the ED and NSIMCU. The search for the misplaced paper chart created delays in the physical transfer of the patient to the NSIMCU. The NSIMCU nurse waited for the new transfer patient to arrive before he could start an elaborate process of suctioning fluids on his other isolation patient. The nurse was waiting to complete the initial set-up activities on the transfer patient and get the care process started before taking care of the isolation patient that would take a while. A staff stated that this was because nurses generally preferred not to be disturbed while they are with isolation patients performing a procedure: “Once the nurses are in isolation rooms, they want to get done, before they come out”. The NSIMCU nurse after waiting for nearly 30 minutes decided to carry on with his care activities on the isolation patient. During the care delivery, the ED nurse arrives at the NSIMCU. She is then asked to wait until the NSIMCU nurse has completed the care activities of the isolation patient. This adds more delays to the inter-departmental coordination of transfer-in activities between the ED and NSIMCU.
In addition to the delays caused in treating the patient, it also created an information loss because there was no way to retrieve the information on patient medications obtained from the patient’s specialist that was attached to the paper chart. The patient is finally handed off to the NSIMCU nurse without the paper chart which disrupts the transfer-in activities. As the NSIMCU nurse stated: “The nurse (from ED) came up and had no paper work on him”.

**Maintaining Consistency across Artifacts:** The use of multiple artifacts requires the various departments to constantly update the information recorded across all the artifacts in order to maintain them in a consistent manner. However, maintaining consistency of information across these multiple artifacts therefore resulted in redundancy and duplication of information and work which involved extra time and effort in addition to their already existing workload. As a result, there were inconsistencies in the use of systems which consequently led to number of coordination breakdowns in patient transfers. For instance, to notify the ED and receiving departments about the bed availability for a transfer patient, the IPA are required to use the paging feature of the bed board system in addition to making changes to the comment column on the FirstNet (i.e. EMR used in the ED) but not all IPA staff do both. However, some IPA staff forget to page the ED CN but they record the bed information on FirstNet while others page but fail to record the changes to the bed status information on FirstNet.

This resulted in a negative cross-level interaction because the intra-departmental activities of the IPA affected inter-departmental coordination activities between the ED and the receiving departments. In preference to what is available on the system, the ED CNs place credence only on the bed information paged to them by the IPA resulting in them being unaware about the bed availability. This consequently delays the inter-departmental transfer activities between the departments. An ED nurse commented that the delay in initiating inter-departmental transfer activities make the receiving department nurses frustrated over the uncertainty about the arrival of the patient and also become frustrated because they had been waiting for the patient for
quite awhile. The ED nurse remarked that when she calls the receiving department nurse to give patient report, “they’ll say ‘the bed has been ready for hours’”. But, because of the inconsistencies in the systems used, she is unaware of the bed availability, she stated: “but I didn’t know, nobody told us”.

**Limited use of electronic artifacts:** The staff members heavily depend on the information on the electronic artifacts since the departments are spatially-distributed from each other. For example, the IPA heavily depends on the information available on the bed board and EMR systems for their bed assignment decisions. However, the limited use of the electronic artifacts by clinical departments affected the coordination of patient transfers. There were multiple instances when information was not recorded by clinical departments on the system. As a result, the system information available to the IPA staff was limited which hampered their bed assignment decisions. For instance, sometimes the information did not reflect the actual reality. Patients would have already been discharged but their names would still not be deleted from the EMR system. An IPA staff stated that this was a: “system-reality gap”. Consequently, the IPA department did not find the EMR to be useful as it should have been in coordinating bed assignment activities of transfer patients. An IPA staff stated that “The only thing we can see on the system is what people have documented”. The limited use of electronic artifacts by clinical departments led to negative cross-level interactions where bed assignments made by IPA, based on incomplete system information resulted in inter-departmental conflicts between IPA and clinical departments regarding the appropriateness of bed assignments. The vignette below highlights this issue of limited use of electronic artifacts by clinical departments.

The ED has reached its surge capacity, and is in frequent contact with the IPA to place admitted patients into inpatient beds. The IPA department gets multiple calls from the ED staff, house manager and patient’s case worker about placing a NSIMCU patient who has been sitting in the ED for a day. But, since the NSIMCU
CN does not update the system on the discharge of a patient that already happened in the morning, the IPA department is unaware of that bed availability.

This resulted in negative cross-level interactions where the intra-departmental activities in the NSIMCU affected the inter-departmental coordination activities between the IPA and ED. The IPA informed the ED that the NSIMCU was full and the patient will be placed once a NSIMCU bed becomes open. Although the IPA staff keeps a close watch on the bed board system to see whether beds are becoming available in the NSIMCU, unless the NSIMCU CN makes the change on the system, the ED has to still board the patient till a bed the IPA can find a available bed in the NSIMCU.

**Organization of Information System Content**

The organization of information on systems is another important factor that affected its effectiveness during patient transfers. For instance, organization of content in the EMR led to its ineffective use during patient transfers. The EMR used in the hospital is highly comprehensive with a range of functionalities to support both administrative and clinical tasks. In order to support these tasks, the EMR has different views (organized into tabs) with specific functional support (Refer Chapter 4). Although the tabbed interface of the EMR helped in organizing the patient information in a clearly defined and well-structured format, it affected the coordination of patient transfer activities both within and between departments in numerous ways.

It increased the possibility of critical pieces of information being “hidden” within functionally “organized bins”. For instance, there was no simple method to find whether new transfer orders were entered or whether transfer requests have been modified by simply glancing at the patient’s record. Although the “orders” tab helped the admitting physicians enter new transfer orders, it failed to adequately support the transfer activities of other care providers such
as nurses and charge nurses in the department. Below is a vignette that illustrates the challenge of using the EMR tabbed browsing feature.

Before taking an ED patient to MRI, the nurse updates her tasks on the nurses’ data entry sheet on the EMR. Because the nurse does not click on the orders tab, she does not realize that the neuro consults just entered admit orders on the patient. The IPA department staff immediately pages the ED CN with a bed assignment for the patient. But since the nurse is away at MRI, the patient does not get transferred immediately.

The compartmentalized layout of the EMR interface led to the fragmentation of information in the EMR that affected the coordination of patient transfers. There were several instances where nurses continued their normal care activities without realizing that transfer orders had been entered into the system. This happened often especially because staff nurses were responsible for the simultaneous care of 3 to 4 patients, which did not give them sufficient time to sit at a stationary computer to check for order changes on the EMR. Unless the nurses checked the status on orders of their patients which normally took 2 to 3 mouse clicks before they could actually see the actual order details (including time of order, who ordered it, monitor requirements, isolation orders), they found out about the transfer only when they were notified by their charge nurses that beds were available to move their admitted patients.

The vignette illustrates that the organization of the “order” tab created a significant lag in activities within the ED between when the physician entered transfer orders and when the nurse checked for order updates. This consequently led to a negative cross-level interaction where the intra-departmental coordination activities in the ED significantly disrupted the inter-departmental coordination activities between the ED and the NSD (i.e. receiving department). The subsequent patient transfer activities between the ED and NSD got delayed and bed was sitting idle for couple of hours without being used.
Furthermore, the organization of the EMR content affected its use during “patient report”. Both sending and receiving departmental nurses tend not to use the EMR during report because of the difficulty involved in retrieving and reviewing relevant information that requires constant switching between tabs to navigate through the information while talking on the phone. Instead the nurses preferred to rely on their memory and paper notes during report. A nurse commented on the EMR’s ineffectiveness during patient report: “I find FirstNet useless for report because it has too many tabs to look through, also it will take a while to go through the tabs, especially when it is slow”. However, this had a detrimental effect on the quality and detail of the information. Thus the information may often be incomplete and in extreme cases, inaccurate, thereby affecting patient safety. This information loss during report created negative cross-level interactions where the inter-departmental coordination of activities between sending and receiving departments during patient report affected the intra-departmental activities of the receiving department such as setting up the room for the patient, arranging service aid to provide 1:1 care.

**System Privileges**

Another important factor that led to the ineffectiveness of systems is the extent of privilege given to access the information on the systems. I use an example of the bed board management system to illustrate how the universal access to system affected the effectiveness of artifacts.

Although the bed board is primarily designed to help the IPA staff in their bed management activities, the clinical departments had universal access to the system. This allowed the clinical departmental staff to maintain an awareness of other clinical departments’ bed availability and also the IPA’s bed assignment decisions. Charge nurses used the bed board to
track the status of on-going and evolving activities in other departments (such as the number of open and closed beds, number of discharges and transfer requests especially to their department). Although the passive awareness afforded by the system helped with collaborative bed management activities, it created a number of problems that affected the coordination of patient transfers.

First, the awareness offered by the bed board system led to conflicts between the clinical departments and the IPA especially at times when the IPA staff made unfavorable bed assignment decisions for a particular clinical department. For example, a NSD CN was unhappy with the IPA staff when she found out from the bed board system that the bed assigned to her patient was cancelled because the IPA staff wanted it for another patient in the SICU. The NSD CN remarked that “the IPA assigns bed and now they take it away for another patient in the SICU”. An IPA staff stated that the reason for this kind of negative attitude was because “people (referring to charge nurses) are bothered about what is going on with others (departments)”. The vignette below highlights how this played out during a patient transfer.

A NSICU CN, upon learning that a patient in her department was not assigned an available floor bed (that has been sitting idle for hours) got frustrated with the IPA staff. Since she felt that the IPA staff were unfair to her department, later that day when she received a page regarding a transfer patient, the CN refused to accept the patient to her department. Based on the system information on bed availability in other appropriate departments, she asked the IPA staff to assign the transfer patient to the SICU which provided similar services as that of the NSICU.

This resulted in a negative cross-level interaction where the intra-departmental activities of the IPA affected the inter-departmental coordination activities between the IPA and NSICU.

Second, the universal access to system allowed the clinical departments to make decisions on the amount and extent of information shared with the IPA. For instance, the nurses
withheld information regarding open beds, refused to accept transfers when they knew about the status of other departments, and delayed discharges in order to avoid new admissions. This consequently created a *negative cross-level interaction* where the intra-departmental activities of the receiving department affected the inter-departmental coordination of patient transfer activities between the IPA and sending departments.

Third, another related issue caused by the universal access to the bed board was that clinical departments could bypass the IPA and make bed assignment decisions for their transfer patients. For example, some CNs transferred their patients without the knowledge of the IPA department and the consent of the receiving department. In one such instance, the PACU CN, based on bed availability information on bed board system, transferred a patient to the NSIMCU without giving prior notification of the transfer to NSIMCU and IPA. This particular incident made the NSIMCU department really upset because it affected their departmental workflow. The NSIMCU CN remarks on the incident: “*PACU brought a patient in today. We did not know about the patient. Since, she (PACU nurse) couldn’t find the patient’s nurse (covering the available room), they told another nurse that they were leaving the patient in the room. They can’t do that. But without report, it happens*”.

This resulted in a *negative cross-level interaction* where the unofficial transfer by the PACU affected the inter-departmental coordination of transfer activities between IPA and NSIMCU. The IPA had to take extra steps to ascertain the state of the patient transfer from the charge nurse of the PACU, cancel other immediate assignments to the NSIMCU and also identify beds in other departments that would be appropriate for this patient.

Furthermore, the access allowed care providers to manipulate the transfer orders based on the system information on available beds. Some physicians chose higher service beds for their patients, while others wrote transfer orders to just get the patient to a bed even though they are fully aware that the receiving department cannot provide the appropriate care for the patient. The
house manager commented on the inconsistency of orders entered: “There are physicians who will write orders because they know that there’s a particular available in one area, write orders for that area just to get the patient up”.

I observed several episodes where inappropriate patients were sent from the PACU to the NSICU. A NSIMCU nurse recollected a incident where a PACU physician entered a transfer order just to get rid of the patient: “I had a patient who was supposed to come to me- definitely ICU material but ICU didn’t have room and the PACU nurse was like ‘we need to get this patient to IMC’ and the doctor said ‘ok, I will make this IMC’. And when she started to give me report, I said ‘wait a minute, this patient is really critical and needs an airway. I don’t think the patient should be here’. I then called the doc and the doc says ‘I thought there is not much difference between ICU and IMC’”.

Consequently these types of decisions made by physicians especially in the PACU created negative cross-level interactions where intra-departmental activities in the PACU affected the inter-departmental coordination of care activities between the NSICU and PACU. The NSICU nurse had to call the PACU multiple times to clarify certain information on how to administer medications and IVs, how to remove a particular type of catheter that was used during the surgery.
As this section highlights, ineffectiveness of artifacts used by staff in various departments lead to negative cross-level interactions that have a significant impact on coordination of patient transfers. The factors affecting the effectiveness of artifacts including use of multiple artifacts, organization of information system content and system access privileges as summarized in Figure 6-5 are described in detail and how they consequently result in negative cross-level interactions in the patient transfer process is highlighted.

**Chapter Summary**

In this chapter, the four main challenges that contributed to negative cross-level interactions between intra- and inter-departmental coordination of patient transfer activities: ADT
process inefficiencies, lack of information sharing, ineffective interactions, and ineffectiveness of artifacts are described.

In the next chapter, the three underlying features of inter-departmental work that result in coordination challenges that in turn lead to negative cross-level interactions are discussed. Then, I also examine how negative cross-level interactions impact effective patient flow within the hospital and patient co-localization efforts.
Chapter 7

Discussion: Negative Cross-Level Interactions

The preceding chapter highlighted four prominent challenges to coordination of patient transfer activities that resulted in negative cross-level interactions. These negative cross-level interactions mainly occurred when intra- and inter-departmental coordination activities during patient transfers interfered with each other. In this chapter, I describe in detail three organizational issues that lead to negative cross-level interactions. In addition to this, I examine the effects of negative cross-level interactions on the coordination goals of the hospital.

Organizational Issues contributing to Negative Cross-Level Interactions

Based on the analysis of the different coordination challenges affecting patient transfers, I identified three issues that impact organizational work: (1) competing goals, (2) competing resources and (3) competing teams. These organizational issues affect the way the different interdependencies between departmental activities are managed. Consequently, the ineffective management of the interdependencies leads to coordination challenges, which in turn results in negative cross-level interactions (Figure 7-1).
Figure 7-1: Contributors to Negative Cross-level Interactions

**Competing Goals**

Although the hospital shares a common objective of high quality patient care and patient safety, the various individual departments are driven by their own functional goals and responsibilities. The smooth functioning of the organization requires the proper management of the goals at local and global levels. Goals at the intra-departmental level are local goals that need to be achieved by a specific department. Examples of local goals include coordinating the patient care activities such as drawing blood sample from patient, suctioning fluids, and cleaning the patient. On the other hand, goals at the inter-departmental level are global goals that need to be achieved by two or more departments coordinating with each other. Examples of global goals include patient flow management and patient co-localization.

Coordination challenges in patient transfers arise when the local intra-departmental goals of the different departments compete with the global inter-departmental goals between these
departments. In other words, competing goals occur when the intra- and inter-departmental goals are achieved at the expense of each other. For example, to achieve PACU patient flow goals, PACU attending physicians sometimes enter transfer orders for their patients in departments where beds are available even though the patient is not appropriate for the particular department. However, negative cross-level interactions occur when the intra-departmental goals of the PACU are achieved at the expense of inter-departmental goals between the IPA and receiving departments that accept inappropriate patient transfers. Although these negative cross-level interactions helped with the PACU activities, they affected the inter-departmental coordination of activities between the IPA and receiving departments. In this example, the inter-departmental coordination of patient transfer activities is affected when one department achieves its local goals at the expense of the inter-departmental goals.

The competing goals of PACU, IPA and receiving departments had a detrimental effect on the way in which information interdependencies were managed. Consequently, this led to the lack of information sharing between the departments. For example, in order to achieve a manageable ratio of patients-to-available staff nurses so that the department was not overwhelmed with too many critical patients, the NSICU CN may not share information with the IPA department on NSICU bed availability. Although this helped with patient care activities in the NSICU, it affects the inter-departmental coordination activities between the ED and IPA because the IPA department is unable to assign an ED patient waiting for a NSICU bed, thus creating a negative cross-level interaction.

**Competing Resources**

Resources are valuable products that are required to accomplish a particular goal. Hospital resources needed for patient care can be categorized into two main types: personnel and
non-personnel. Personnel resources are hospital staff members (including clinical and non-clinical staff). Non-personnel resources include medical equipment, hospital beds that are crucial components for care delivery. Hospitals nationwide are currently working at their maximum capacity. As a result available resources (care providers, ancillary staff, equipments, medical supplies, beds) are stretched to accommodate the needs of patients. Coordination challenges in patient transfers arise when intra-departmental resources are managed by external staff members who achieve inter-departmental coordination at the expense of intra-departmental resources. For example, to ensure the inter-departmental coordination needs between IPA and NSICU, the IPA staff member assigned a NSICU patient to the first available bed in the medical intensive care unit (MICU). Sending an off-service patient to a MICU bed (intra-departmental resource) resulted in non-colocalization and affected the care process in the MICU. Here, the IPA staff was concerned only about assigning a patient so that they had one less patient waiting for a bed assignment. At the same time, NSD too had one less patient to be responsible for. Additionally, these non-personnel departmental resources (e.g., beds) are managed by external IPA staff members who have minimal information on personnel resources within the department (e.g., care provider availability, staffing levels, current nurse to patient ratio, number of critical patients in the department, time of physician rounds). For example, the IPA staff pre-assigned a critical heart patient with multiple traumas from the ED to a NSIMCU nurse with two other sick patients. This transfer made the nurse very unhappy with the CN, which then forced the CN to contact the IPA staff to inform them about the need to reject the patient. A negative cross-level interaction occurred where the inter-departmental coordination of activities between the ED and IPA were achieved at the cost of overburdening an intra-departmental personnel resource in the NSIMCU such as the nurse with a heavy patient. This example illustrates how complex and difficult it is to manage the resources within departments while satisfying the competing resource needs between the various departments (i.e. inter-departmental needs).
These challenges are further magnified when the lack of critical resources such as staffed beds (i.e., beds that have staff nurses assigned to them) create competition among various clinical departments for their use. For example, the coordination challenges between ED and PACU (post anesthesia care unit) arise when they both try to convince the IPA staff to assign their particular patients to the first available private bed in the NSICU. The IPA department staff decided to assign the ED patient to the NSICU bed because the ED had reached its surge capacity. However, negative cross-level interactions occurred when the intra-departmental activities of IPA affected the inter-departmental coordination activities between the IPA and PACU. The competition between ED and PACU for a NSICU bed affected the way the departments viewed and used the bed availability information on the system.

The competing resources between the departments had a detrimental effect on the way in which artifact interdependencies were managed. Consequently, this led to the ineffectiveness of artifacts (e.g. ineffective use of the bed board tracking system). This was because the departments vying for resources had complete knowledge about the available beds and allocation decisions. In the above example, the PACU CN gets frustrated when she learns that the SICU bed was assigned to an ED patient. This subsequently affected the coordination activities between the PACU and IPA. The PACU CN instead of waiting for the IPA staff to assign another SICU bed when it becomes available bypassed the IPA staff and made use of the system information on bed board to transfer the PACU patient to an empty bed in the NSICU. Although this transfer helped with patient flow in the PACU, it was done at the expense of NSICU work activities because the PACU transfers an inappropriate post-op patient (who did not meet the care criteria) to the NSICU, thus creating a negative cross-level interaction.
Competing Teams

Coordination within and between diverse teams (e.g., clinical or non-clinical) are an important aspect of hospital work. Clinical teams comprise of personnel (e.g., physicians, nurses, pharmacists, physician assistants and medical technicians) who are directly involved in the patient care process. Non-clinical teams comprise of personnel (e.g., inpatient access, transportation staff, and housekeeping staff) who provide ancillary patient services. While clinical teams focus on quality and timeliness of patient care delivered, non-clinical teams focus on appropriate bed assignments, and ensure patient safety during transfers between clinical departments. Although it is important to ensure effective intra-and inter-departmental coordination, managing these functionally diverse teams belonging to different departments is difficult.

Coordination challenges in patient transfer arise when intra-and inter-departmental coordination tasks of functionally diverse teams are achieved at the expense of each other. For example, to achieve rapid patient flow between the ED and OR during emergent situations, the clinical teams in these departments often fail to inform the IPA (i.e., a non-clinical team) team about patient transfer to the OR. However, negative cross-level interactions occurred when inter-departmental coordination tasks between the ED and OR are achieved at the cost of the IPA intra-departmental tasks.

Furthermore, these clinical teams do not pay much attention to the non-clinical patient transfer activities because of their lack of awareness of the importance of the work activities of non-clinical teams. Finally, the nature of professional hierarchies ingrained within hospital work practices, differences in educational background and clinical training and most importantly the socio-economic status differences between clinical and non-clinical teams are important factors
that affect their mentalities. This in turn influenced the way the diverse teams perceived and behaved towards each other.

For example, some admitting physicians showed a negative attitude towards IPA staff when they questioned the appropriateness of physicians’ transfer orders. This was because of the physician’s mindset which led to a feeling of superiority during his interaction with non-clinical IPA staff. The house managers stated that: “There are physicians who don’t like IPA staff question their orders. There are also physicians who like when we question their orders because we are nurses”. They also added: “The doctors need to realize that when IPA calls them, they are not questioning their intelligence, they are asking an intelligent question themselves: ‘Is this what you really want for the patient? ; ‘Is it an appropriate place for the patient?’”.

The competing teams of the departments had a detrimental effect on the way in which role and task interdependencies were managed. Consequently, this led to ineffective interactions between the sending and receiving clinical departments and between clinical/non-clinical departments during patient transfer activities, thus leading to negative cross-level interactions.

Thus, it is important to examine these organizational issues in order to minimize the negative cross-level interactions. Based on the understanding of the organizational issues, we can discover opportunities for assessing and improving hospital performance and operation, thus resulting in smooth hospital functioning.

**Effects of Negative Cross-level Interactions**

The negative cross-level interactions had a detrimental impact on two primary goals of the organization: patient flow and patient colocalization.
Patient Flow

Patient flow has received tremendous attention in healthcare practice. From an organizational perspective, patient flow is the movement of patients from one location to another in a health care facility. For example, for a chief medical officer, a patient’s movement between departments without facing bottlenecks such as bed unavailability is a measure of hospital efficiency. From a clinical perspective, patient flow is a representation of progression of a patient’s health status [205]. For example, for a care provider, the length of stay of a patient in a particular department before being discharged is sometimes considered a measure of the quality of care delivered. Inefficient patient flow contributes to the loss of patient volume and revenue, compromised patient care quality, ineffective resource management, patient, physician, and staff satisfaction [206], [175], ED overcrowding [207], [208], delayed patient disposition [209], missed or delayed treatments, and potential for medication errors during patient transitions [210]. Therefore, ensuring effective patient flow improves patient access to care, reduces the waiting times, thereby achieving better patient outcomes. Consequently, patient flow is an important aspect of hospital work that is crucial for the delivery of effective delivery of care. A number of hospital organizations are currently working on establishing new mechanisms to improve patient flow activities such as streamlining admissions and discharge processes, aligning physicians’ and hospital interests monitoring patient flow statistics and performance. Some mechanisms include enhancing the role of physicians in patient flow initiatives, optimizing existing technologies to increase staff accountability, aligning staff levels with peak activity, determining turnaround times for beds, proving access to systems with bed information, and facilitating timely rounding and ordering processes.

However, there are three important factors that affect hospital patient flow: admissions, discharges and transfers. Among these three factors, patient transfer is the most import factor
affecting patient flow because it involves so many departments within the hospital such as inpatient access, sending and receiving departments, transportation and housekeeping departments; any delays in those departments could affect the patient transfer process. The seamless execution of patient transfer activities has multiple implications on the management of patient flow in the hospital. Hence, bottlenecks encountered during the patient transfer process are a significant challenge for achieving smooth patient flow and also ensuring the quality of patient care provided [35].

Most of the bottlenecks in patient flow were caused by negative cross-level interactions during patient transfers. For instance, the intra-departmental ED activities and inter-departmental coordination activities between the ED and the inpatient departments of the hospital had a great impact on patient flow, especially since the ED serves as the front door to the hospital. At Hershey Medical Center, 45% of hospital admissions come through the ED (based on statistics provided by ED nurse manager).

Consequently, negative cross-level interactions that occurred when intra-ED activities affect inter-departmental coordination activities between the ED and receiving departments had a detrimental effect on patient flow. Factors such as patient length of stay in the ED, long waits for completing lab tests and return of diagnostic results and other ED internal dysfunctions affected patient transfer activities between the ED and the receiving departments waiting for new patients from the ED.

Also, negative cross-level interactions that occurred when inter-departmental coordination activities between ED and receiving departments affect inter-departmental ED activities led to significant patient flow bottlenecks. Factors such as consulting service patient evaluation in ED, inpatient department occupancy [207], [208], ED boarders [177], and other resource shortages affected patient flow outcomes. For instance, the lack of promptness of physicians belonging to consulting services in seeing and evaluating new ED patients slows their
disposition process. An ED physician remarked that: “Residents (consults) come at their convenience during normal hours. Physicians come here (to ED) only if they don’t want the patient to be admitted”. As a result, ED patients admitted to the hospital stay in the ED for extended periods of time. This introduced several consequences for the ED staff; for example, the nurses had to provide continuous care to acute patients who needed inpatient care; prevented ED physicians from providing care to patients in the waiting room who had to remain because of the shortage of ED beds.

Another ED attending physician stated that because he had to wait for consulting service physicians to present to the ED after their rounds to evaluate potential admitted patients (who were using their ED beds), he was “sitting here (in ED) not seeing patients, impeding his ability to care for patients”. An ED attending physician emphasized that the admission and transfer delays to inpatient departments caused by consulting physicians made the hospital, “the most obstructive [hospital] in the delivery of care”.

Some of the effects of these negative cross-level interactions on patient flow activities included delays in admitting ED patients awaiting beds in inpatient departments, lack of awareness of resource availability in departments, and assignment of patients to beds in inappropriate services. Consequently, the bottlenecks in patient flow resulted in potential delays and cancellations of hospital transfers, redundancies in activities, ED and PACU (post anesthesia care unit) overcrowding and over-boarding, cancellation of surgeries of both scheduled and unscheduled patients, extended patient length of stay in inappropriate departments, increased costs and decreased revenue for the organization and most importantly, provider and patient dissatisfaction with the hospital management.
Patient Co-localization

Patient co-localization refers to assigning a patient to a bed within a department that can provide the appropriate service required for that patient. For instance, a patient who has severe neurological problems should be transferred to a bed in neuroscience department where the patient can receive appropriate attention from neurological experts for his/her problem [23].

Although co-localization of patients is important to achieve both patient safety and quality of care delivered, negative cross-level interactions hampered the hospital’s efforts of patient co-localization. The main effect of negative cross-level interactions during patient transfers on patient co-localization included inappropriate bed assignments where patients were transferred to beds in off-service departments (e.g., a surgical patient is assigned to a non-surgical bed). The primary consequences of patient non-co-localization include the potential threat to patient safety and increased risks of medical errors, duplication of similar services in different departments and inefficient staff utilization. This is caused either by the sub-optimal care provided by an inappropriate service, or by the lack of training of nurses required to provide care for patients that do not belong to the particular service they are located in, and insurance denials for patients staying in inappropriate services.

Achieving both these organizational goals simultaneously is a complex task. Although these goals are inter-related, one goal may only be achieved at the expense of the other. For instance, patient flow is sometimes achieved at the expense of patient colocalization and vice versa. For example, to maintain patient flow, hospital staff transferred a patient from the PACU to the first available bed in the MICU (medical intensive care unit) though the patient’s diagnosis meets the criteria for a NSICU (neuroscience intensive care unit) bed. In the face of these incompatible goals, the hospital staff employed workarounds to maintain the patient transfer activities. Hospital staff employed certain mechanisms and workaround strategies – “meta-
coordination activities” to ensure these goals by mitigating the effects of the negative cross-level interactions.

Chapter Summary

This chapter provides insights on the organizational issues that contribute to negative cross-level interactions and also the effects of the negative cross-level interactions on two primary goals of the organization. The meta-coordination activities that are employed by hospital staff to mitigate the effects of the negative cross-level interactions are discussed in detail in the next chapter.
Chapter 8

Discussion: Meta-Coordination Activities in Patient Transfer Work

In the previous chapter, I highlighted the effects of negative cross-level interactions that occur at the intersection of intra- and inter-departmental coordination of patient transfer activities. Yet, despite these challenges, patient transfers continuously take place in the hospital. How does this happen? In this chapter, I discuss how staff members deal with the negative cross-level interactions in order to achieve a smooth workflow across the hospital. In particular, I discuss: (a) the specific meta-coordination activities employed in the hospital to mitigate the negative cross-level interactions during patient transfers, and (b) the relationship between meta-coordination activities and the theoretical construct of articulation work.

Meta-Coordination Activities

Large scale organizations are characterized by distributed and collaborative work activities resulting in the need for coordination among different groups and departments within the organization. However, coordination practices in these environments are complex not only because of the number of individuals involved but also by the sheer number of tasks that have to be collaboratively completed by individuals belonging to different departments.

Organizational issues such as competing goals, competing resources and competing teams can lead to negative cross-level interactions. However despite these negative cross-level interactions, the hospital staff still managed the inter-departmental workflow and the hospital functioned fairly smoothly. This raises the question of how do hospital staff prevent the negative cross-level interactions from disrupting their work. Hospital staff deal with the negative cross-level interactions and its consequences by performing a set of activities, supra-type activities [28]
– “meta-coordination activities”. These activities aim at mitigating the conflicts and breakdowns of an already existing coordination activity that span multiple departments (e.g., patient transfer activities); thus, meta-coordination activities occur when “fixing” problems in inter-departmental work activities.

**Types of Meta-Coordination Activities**

The hospital staff used three main meta-coordination activities to fix coordination breakdowns during patient transfers between departments. They are collaborative balancing of goals, collaborative patient-resource prioritization and presence of integrator roles (Figure 8-1).

**Collaborative Balancing of Goals**

The collaborative balancing of local and global goals is a type of meta-coordination activity used to mitigate the negative cross-level interactions caused by departments with competing goals. Goals are higher-level departmental benchmarks set by the organization that has to be achieved during a particular process. For example, in the patient transfer process, the goal for sending department nurse is to give patient report to the receiving department nurse within 15 minutes once the bed is assigned.
Figure 8-1: Negative Cross-level Interactions and Meta-Coordination Activities

The collaborative balancing of goals allows individuals representing different departments to jointly assess and evaluate their goals in order to identify the conflicting goals and minimize their effect on each other’s local activities and on global hospital workflow. For instance, by collaboratively balancing the patient transfer goals of the NSD (that aims at providing intensive patient care services) and IPA (that aims at achieving optimal resource allocation while ensuring that the hospital is not running at a fiscal loss [211]), the staff can ensure their goals do not compete against each other.

The hospital holds individual service bed meetings to manage and evaluate the local departmental goals for that particular service against the global goals of the hospital. For example, there is a bed meeting specific for the neurosciences service conducted once a day. During this meeting, CNs from the different neurosciences departments including neurosciences intensive care unit, intermediate care unit and regular floor unit meet with the IPA senior staff to
discuss their departmental goals for the day and their status on bed utilization and availability.

Based on the information on the status of the entire service (e.g. neurosciences) garnered from the CNs, the staff can jointly balance their goals against the global goals such as patient flow and colocalization.

**Collaborative Resource Prioritization**

Prioritization [212] is a type of decision making process by which priorities are determined. Different prioritization techniques including simplex method, nominal group planning, criteria weighting have been documented in prior research. While the simplex method is based on the development of an efficient questionnaire that allows for weighting of problems, the nominal group planning is based on discussion that fosters creative thinking and open dialogues among participants. Alternatively, criteria weighting is a mathematical prioritization method that uses numerical criteria to prioritize the various options. Fisher and Ury [213] have advocated negotiation techniques based on their method of principled negotiation including establishing super-ordinate goals, separating the people from the problem, focusing on interests, inventing options, and by using objective criteria.

Similar to nominal group planning method, the collaborative resource prioritization allows individuals to jointly rank the available hospital resources in the order of increasing importance. It is hence a type of meta-coordination activity used to mitigate the negative cross-level interactions caused by competing resources.

This is closely linked to collaborative balancing of goals. However, while goals focus on larger organizational issues, resource prioritization focuses on specific resources needed to achieve the goals. In the patient transfer process, the collaborative resource prioritization provides a common forum for different departments to discuss their patient care needs and resource
priorities, which then helps healthcare professionals jointly decide the priority (i.e. order) of patients that need to get resources.

The hospital holds capacity meetings to manage and evaluate the hospital resources (current resource availability, projected use of resources, projected hospital census) for patients. During this meeting, CNs from the ED, PACU (Post-Anesthesia Care Unit), surgery and medicine departments discuss their departmental status with the IPA staff and house managers. These meetings are used as a venue to jointly map out and resolve issues related to personnel (e.g. nurse staffing ratios) and non-personnel resources (e.g. bed management) in the various clinical departments.

**Mediating Role of Integrators**

People with integrator roles [64] are often entrusted with the responsibility of managing organizational coordination. Integrators take the role of supporting meta-coordination activities for mitigating the negative cross-level interactions caused by competing teams and their interactions. For example, integrators can mitigate the inter-departmental coordination challenges related to their training differences, status differences and power structures between the clinical and non-clinical departmental staff. Thus, they help bridge the perceived perceptual and cultural gaps between competing teams that is caused by the differences in work orientations between the clinical (that are patient-oriented) and non-clinical departments (task-oriented). In addition to this, they can also bridge the perceived gap between humans and their use of information systems [214]. The role of an integrator is crucial in patient transfers because they help improve patient flow by facilitating both intra- and inter-departmental coordination activities. Thus, integrators serve as arbitrators in the patient transfer process.
The hospital has four individuals who take the role of integrators in the patient transfer process: a capacity officer, a house manager (house supervisor), an admit nurse and a triage officer. While the capacity officer, house manager and admit nurse serve as integrators at the organizational level, the triage officer acts as an integrator at the departmental level. The integrators at the departmental as well as organizational levels collaborate. The former feeds the latter with departmental-level information for them to act upon for managing organizational activities such as patient flow. The capacity officer is a physician with administrative responsibilities. The house manager, on the other hand is a nurse with hospital-wide duties such as responding to patient and family concerns, planning overtime nurse-staffing ratios, convincing nurses to accept patients, and resolving conflicts between IPA staff and nurses regarding bed placement. The admit nurse in the IPA department is responsible for screening patients by examining patient orders and clinical information available in the EMR to ensure its appropriateness. Finally, while the capacity officer screens inappropriate patients in the entire hospital, the role of the triage officer is specific to screening and triaging patients belonging to a particular service/department. Thus, the capacity officer, triage officer and admit nurse serve as mediators among physicians, while the house manager serves as a mediator among nurses.

To summarize, the meta-coordination activities provide insights into the way people re-coordinate or “fix” their joint activities to ensure the successful completion of work by mitigating the challenges that occur when intra- and inter- departmental coordination activities affect each other (Table 8-1).
Table 8-1: Mapping Meta-Coordination Activities to its Effects

<table>
<thead>
<tr>
<th>Contributors to negative cross-level interactions</th>
<th>Meta-Coordination Activity</th>
<th>Effect of Meta-Coordination Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Competing Goals</td>
<td>Collaborative Balancing of Goals</td>
<td>Aligning goals at local and global levels</td>
</tr>
<tr>
<td>Competing Resources</td>
<td>Collaborative Prioritization of Resources</td>
<td>Optimization of resources at local and global levels</td>
</tr>
<tr>
<td>Competing Teams</td>
<td>Mediating Role of Integrators</td>
<td>Improve collaboration between teams at local and global levels</td>
</tr>
</tbody>
</table>

**Meta-Coordination Activities and Articulation Work**

Articulation work [22], [28] focuses on maintaining the continuity of distributed activities and thus is an integral part of organizational work. The concept was first formulated by Strauss [28] to describe how actors cooperate and get their work done. He defines it as the “specifics of putting together tasks, task sequences, task clusters – even aligning larger units such as lines of work and subprojects in the service of the work flow” [22]. Therefore, articulation work is viewed as “a kind of supra-type of work in any division of labor, done by various actors” [22].

Researchers have highlighted the importance of understanding articulation work in order to capture the real work experiences. They argue that without acknowledging and capturing articulation work, we can only obtain an ideal representation of work [137], [110]. Over time, there have been different interpretations of articulation work. While Strauss’ definition for articulation work remains an overarching concept, different researchers have refined the concept of articulation work to explore different aspects of work. For example, Sawyer et al. [111] define articulation work as the “work that enables other work”. Other researchers view articulation as “work of pulling together everything that is needed to carry out production tasks: planning, organizing, monitoring, evaluating, adjusting, coordinating and integrating activities” [112], as
“work that is often invisible or unnoticed work in everyday activities” that aim at interrelating parts [113], and as “the orderly accomplishment of cooperative work” [114]. Despite these multiple conceptualizations of articulation work, the common thread central to managing the continuity of work is that it involves “additional work” that is either performed at an individual or collective level.

Articulation work has been used to analyze formal work practices in different settings such as software development [116], agency content management [120], interactive customer services [121], criminal justice [111], information infrastructure building [113] and healthcare [122]; however, there are certain limitations to what it describes about maintaining overall organizational coordination process. First, the current concepts of articulation work fail to recognize the coordination challenges that occur across departmental boundaries, especially the challenges that occur when local and global levels intersect with each other. Second, there is very limited understanding on how articulation work helps manage the consequences of coordination work across different units of the organization.

Consequently, by identifying and closely examining meta-coordination activities, I first extend the concept of articulation work by describing meta-coordination activities as a particular type of articulation work. Second, I improve our understanding of articulation work by highlighting the nature and process of articulation work performed across multiple levels to maintain the overall organizational workflow.

A Type of Articulation Work

Meta-coordination activities are a type of articulation work focused on mitigating the effects of negative cross-level interactions in organizations. For example, collaborative prioritization of resources is the additional work performed by hospital staff to manage resources
in an optimal manner. This not only helps ensure that patients get the appropriate resources needed but also helps maintain the continuity of patient care activities during patient transfers.

Based on the four-cell matrix that maps the basic types of articulation work [121] (Figure 8-2 below), meta-coordination activities is a type of “non-routine” articulation work [28]. These activities are always performed in response to negative cross-level interactions and therefore cannot be predicted nor controlled. While “routine” articulation work depicted in cells 1 and 2 is referred to as upper level articulation work, the “non-routine” articulation work depicted in cells 3 and 4 as lower level articulation work [118].

![Figure 8-2: Meta-Coordination Activities: A Non-Routine Type of Articulation Work](image)

**Characteristics**

This subsection highlights the central characteristics common to meta-coordination activities and other types of articulation work [1], [118] and the central characteristics unique to meta-coordination activities. I illustrate these characteristics using examples of the three meta-
coordination activities identified in patient transfer work. Below I examine how meta-coordination activities share the same characteristics with other types of articulation work.

First, all identified types of articulation work are invisible within rational models of work; similarly, meta-coordination activity is an informal work mechanism that is not formalized in the current organizational process. For instance, the collaborative balancing of goals, collaborative prioritization of resources and integrator roles are informal strategies to overcome the breakdowns in coordination at the intersection of intra- and inter-departmental coordination activities.

Second, all types of articulation work involve the coordination of tasks, goals, beliefs and standards; likewise, meta-coordination activities are involved with the management of activity interdependencies between departments that help ensure effective coordination. The patient transfer process comprises of a number of interdependencies that need to be managed including information, task, artifact and role. For example, task interdependency occurs when the initiation of an activity in one department depends on the completion of a particular task or set of tasks by another department. The physical transfer of patient from ED to NSICU requires the NSICU nurse to complete a set of tasks (or actions) such as taking patient report and setting up the room for receiving the patient.

Third, all types of articulation work aim at a high level end goal; similarly, meta-coordination activities are always performed to achieve a high-level goal. For example, although goals at the local intra-departmental levels are different, during the collaborative balancing of goals, the staff strive to meet the hospital goals of patient safety and quality of care.

Having described the common characteristics between meta-coordination activities and other types of articulation work, I also identified that there are some characteristics that make meta-coordination activities unique from other types of routine and non-routine articulation work.
First, meta-coordination activities only occur when activities at the local (intra-) and global (inter-) levels intersect. Meta-coordination activities are a response to the coordination breakdowns that are caused by unexpected contingencies at the intersection of intra- and inter-departmental coordination activities. For instance, it can arise to address the competition between intra- and inter-levels of coordination such as in the presence of competing goals, resources, and teams. Consequently, meta-coordination activities are a type of lower-level articulation work performed to “get things back on track” [30]. Alternatively, although articulation work is an overarching concept that describes the extra work done to maintain the continuity of ongoing work, the identified types of articulation work (such as lower-level articulation work) does not explicitly address the contingencies that occur when local and global levels intersect with each other.

Second, meta-coordination activities are dependent on identifying, assessing and ensuring that the needs and constraints of the different departments are taken into consideration during the joint decision-making process unlike other types of articulation work that do not explicitly focus on collaboration as a feature of articulation work. Furthermore, although articulation work in cooperative work involves the meshing of tasks and efforts, it does not ensure that the needs and constraints of all the involved participants should be taken into consideration. Consequently, the different types of articulation work can either be performed at the intra- or inter-departmental levels or both, while meta-coordination activities are performed at the inter-departmental level.

Third, meta-coordination activities occur for re-coordinating work activities that span multiple departments. In other words, they occur for coordinating an inter-departmental activity by instantaneously fixing the coordination breakdowns that occur at the intersection of intra- and inter-departmental coordination activities while other types of articulation work generally are focused on alleviating breakdowns of group activities.
Fourth, time-dependency is an important feature of meta-coordination activities. Time was found to be an important factor in meta-coordination activities since these activities are always performed in response to a time-critical activity. For example, in the context of patient transfers, meta-coordination activities are focused on eliminating the delays in transferring a critical patient from the emergency department to intensive care unit that can have severe consequences on the health of the patient. Although researchers have discussed how time impacts the articulation work done, there is no clear understanding on whether time is a critical factor to initiate the other types of non-routine articulation work.

Next, meta-coordination activities are highly dynamic; the manner in which they are performed depend on the inter-departmental problem and the context characteristics. For example, the manner in which hospital resources are collaboratively prioritized will vary and consequently have different outcomes depending on the criticality of ED patients waiting for inpatient beds and the capacity of the hospital.

Finally, meta-coordination activities are resource-centric in nature. The findings on negative interactions suggest that the coordination challenges and its effects on inter-departmental workflows can be mitigated when the extra work performed is focused on managing resources (including personnel and non-personnel resources) in an optimal and effective manner at both local and global levels. For example, in the case of patient transfers, meta-coordination activities ensure that rapid bed assignment decisions can be made without compromising any individual department’s goals or resources. This is because unlike other types of articulation work, meta-coordination activities are focused on addressing the source of the breakdown in order to prevent future coordination breakdowns from happening.

Through the identification and characterizations of meta-coordination activities, the understanding of the concept of articulation work can further be enhanced. In the next section, I
discuss how meta-coordination activities can provide more detailed understanding of articulation work performed in complex organizations.

**Organizational Articulation Work in Complex Settings**

Studies have explored the important role of articulation work in managing contingencies during patient care work in complex settings such as hospitals. Achieving smooth coordination and effective communication across the hospital organization can be highly complex [124], [125], [126]. A combination of factors such as the dynamic characteristics of the hospital environment, involvement of multiple healthcare professionals, varying information needs of the different departments, unpredictability of patients’ conditions, uncertainty in clinical decision making, different clinician work patterns, incomplete information and the shortage of resources can lead to breakdowns in coordination activities which consequently increase the need for articulation work [215], [216]. A number of researchers have studied the effect of articulation work on departmental coordination in hospitals [125], [126], [105], [34]. For example, Bossen et al. [33] examined the use of shared interactive displays at a surgical ward. They mainly focused on identifying the effects of shared interactive displays on three main aspects of collaborative work including coordination, articulation and context-awareness. Several features of the display (AwareMedia) to support surgical collaboration such as on-line, updated surgery schedules, video-feeds, RFID (radio frequency identification) tags, chat and mobile phone capabilities helped improve coordination and context-awareness among the surgical team members and also reduced the amount of articulation work that is caused by the need to align different work trajectories in distributed collaboration.

However, despite its prominent role in healthcare work, articulation work remains largely invisible in organizational process flowcharts. As a result, the articulation work to maintain
overall workflow is not fully understood by the various organizational actors. Besides, there are very limited studies that examine how articulation work is used to work-around the unexpected contingencies that arise from lack of coordination across the organization. For example, Faergemann et al. [34] have pointed to the dual nature of articulation work in hospitals. Although they argue that articulation work is done both at a local level (i.e., within local work arrangements) and at a global level (i.e., between the different local work arrangements), it is unclear how articulation work performed at local and global levels interrelate with each other to achieve and maintain a common inter-departmental activity. Consequently, the duality of articulation work fails to address the conflicts that occur at the intersection of local and global levels. Performing local and global articulation work does not guarantee that conflicts between the local and global levels of cooperative work are completely resolved.

Alternatively, the concept of meta-coordination activities sheds light on the articulation work at the intersection of local and global levels that helps mitigate the challenges that arise when activities at the local (intra-) and global (inter-) levels affect each other. Furthermore, meta-coordination activities point to the importance of constant evaluation of articulation work at the local and global levels to ensure that they do not affect each other.

Although the findings from this study illustrate the articulation work performed by staff in a hospital, the insights drawn from examining meta-coordination activities in this setting can help in extending our understanding of articulation work mechanisms that can be used in other complex organizations such as manufacturing firms, aviation and military settings.

Meta-coordination activities highlight three important aspects of articulation work that help us better understand how organizational workflow in complex settings is maintained. They are:

1. The importance of adding a component to articulation work.
2. The process of articulation work performed to manage the coordination of distributed activities across multiple levels of the organization including highlighting the importance of the dynamics of inter-departmental work such as the relationship between information, technologies and teams.

3. The importance of investigating organizational articulation work from a collaborative perspective.

Adding a Component to Articulation Work

The main components of articulation work are arrangements, working things-out and stances [120], [217]. Arrangements represent the operational specifics agreed upon by the different team members for executing a cooperative activity (for example, who does what? when? and how?). This could include intra-departmental local or inter-departmental global protocols and guidelines to be followed by organizational staff. For instance, the IPA departmental staff follow certain patient transfer protocols such as confirmation of a bed assignment 15 minutes after the bed number has been paged to the receiving department.

Working Things Out refers to the upper level articulation work through which the arrangements are maintained. They include negotiation, education, and even at times, coercion of team members. To manage these arrangements, staff have to perform upper-level articulation work. At times when these arrangements are not followed, hospital staff perform certain high level articulation work to work-around them. For instance, when the receiving department charge nurse is not satisfied with the patient assignment after it has been confirmed, the IPA department staff contacts the sending department charge nurse to notify the change.

Stance represents the respective positions taken and strategies adopted by the different team members during the “working things out” process. For example, the clinical and non-
clinical departmental staff could have totally different perspectives on the type of articulation work (e.g. selecting a bed assignment option) that needs to be done to bring things back on track.

These components of articulation work provide only a high-level description of the extra work done; the challenges to integrating and managing these various components in a smooth manner are not explicitly addressed. However, this research study points to importance of uncovering and identifying these challenges that can occur between the components. For instance, coordination conflicts can occur when the protocols do not align with each other, thereby leading to conflicts in maintaining the local and global arrangements. Another instance of conflict is when the arrangements defined at the global inter-departmental level and stances taken at the local intra-departmental level do not match. Therefore, an additional component that would be useful to analyze organizational articulation work is a set of re-coordinating activities that helps to mitigate and fix the conflicts between arrangements and stances which occur during the articulation work.

**Articulation Work across Multiple Levels**

Investigating articulation work across different levels of coordination activities provides an understanding on how the different units of an organization manage the coordination of distributed work effectively that in turn contributes to organizational effectiveness. In addition, the understanding of the process of articulation work can help the organizational staff better achieve effective departmental and organizational outcomes.

However, articulation work has mostly been used to study collaborative work at the group level. As a result, articulation work does not explain the entire articulation process that occurs across multiple levels of the organization. Strauss refers to articulation process as the “overall organizational process that brings together as many as possible of the interlocking and
sequential elements of the total work, at every level of organization” ([28], pg.175). But, there is very limited work that examines the articulation process by which organizations maintain their overall coordination. For example, Strauss [28] describes a theoretical model of the articulation process of project work. He highlights that the model involves work processes, types of work, interactional processes, and specifics of articulation process. He argues that these elements are present at every organizational level, and the presence of unanticipated contingencies can affect the articulation process. Although the articulation process accounts for articulation work done across an entire organization, the theoretical framework does not pay much attention to the challenges between the various levels (e.g. departments) of the organization.

Meta-coordination activities shed light on articulation work that is performed to mitigate the coordination challenges across departmental boundaries. In addition, meta-coordination activities highlight that it is extremely difficult to keep the work processes, types of work and interactional processes at and between the different levels of the organization continuously aligned with each other at all times. Alternatively, meta-coordination activities suggest that organizational articulation work should aim at maintaining a balance between activities across the different levels of the organization.

Next, researchers have highlighted that the dynamics of work need to be addressed in order to effectively analyze the existing work arrangements [218]. But, articulation work does not account for the relationships between humans, work structures and artifacts [218]. Using meta-coordination activities, a deeper understanding of the type of articulation work done to maintain an inter-departmental workflow can be gained. In particular, it helps to understand the following:

- The importance of integrating organizational, technical and clinical issues to maintain smooth hospital workflows.
- The articulation work done to mitigate the challenges caused by the interactions between multiple local workflows comprising of different activities,
technologies, and teams. For example, to ensure timely patient transfers, the mediating role of integrators help teams from the various departments to perform patient transfer activities by effectively using healthcare technologies such as the bed board and EMR.

- The articulation work done to overcome the coordination breakdowns in inter-departmental activities caused by different organizational issues such as competing goals, competing resources and competing teams. For example, the meta-coordination activity of collaborative balancing of goals involves the alignment of local intra-departmental and global inter-departmental goals.

- The articulation work across departmental boundaries. Meta-coordination activities highlight that articulation work across boundaries cannot be fully supported by healthcare technologies because they tend to disrupt the ongoing articulation work done [140]. Instead, meta-coordination activities highlight the importance of face to face discussions (being in same room fosters listening to different people, identifying names, associating names with faces, viewing other’s actions and immediately responding to reactions) to support joint articulation work. Furthermore, this awareness re-establishes the significance of common ground and mutual understanding in performing meta-coordination activities.

- The effect of articulation work between the participating departmental teams on the existing power structure between them. Although hospitals strictly followed a traditional hierarchy between the various professions [211], the need to jointly perform meta-coordination activities create a redistribution of control. As a result, meta-coordination activities require one or more of the participating departments to forego their local autonomy and control in order to ensure smooth
patient flow in the hospital. For instance, the joint activity of collaborative prioritization of resources is a tradeoff between local control of departmental resources and global access to information about resources from other departments. However, assessing the availability of short-term resources can help predict long-term needs which can subsequently support the IPA’s planning activities of placing incoming patients.

**Process of Articulation Work**

Investigating the process of articulation work allows us to identify the features of articulation work including the points of failures that can then be used to overcome future coordination breakdowns. This understanding can help improve the coordination process efficiency by optimizing the extra work done to manage the consequences of distributed work and also maintain the continuity of ongoing work. Despite its importance, there is limited understanding on the process involved in performing articulation work to manage the consequences of an inter-departmental activity. For example, Mi et al., [116] developed a conceptual model that examines the process of articulation work in software engineering process. The steps in the articulation process consists of diagnosis of breakdowns, selection of problem-solving heuristics by selection heuristics, formulation of solutions, selection of solutions, realization and result assessment. However, since this process strictly follows a knowledge-based model which is implemented through inference rules, it cannot be easily applied to other complex settings (characterized by less structured processes) such as hospitals. In another study, Eschenfelder [118] highlights the process of articulation work in agency content management work. Content management work involves review and approval of web content to ensure content availability and quality. She examined articulation strategies that were used to support content
management work including the use of paper, physical contact, not allowing new content to be added on existing websites, ignoring certain reviews, truth based exemptions, system surveillance, and addition of new approval mechanisms. However, these studies do not address the process features of articulation work that is done to manage coordination across departmental boundaries in an organization.

Meta-coordination activities provide deeper insights on the process of articulation work that is performed to mitigate the challenges at the intersection of intra- (local) and inter- (global) levels. A process refers to a set of activities required to accomplish a goal. The process of meta-coordination activities include collaborative balancing of goals, collaborative prioritization of resources and mediating role of integrators in managing organizational coordination. In addition, the various coordination mechanisms that help support meta-coordination activities in the context of patient transfer work including information triage, collective negotiation, collaborative forecasting, and resource commitment were examined. Furthermore, it was confirmed that fundamental articulation work mechanisms such as thought, adjusting, negotiation and adaptation were still used during meta-coordination activities in addition to these new coordination mechanisms.

As noted by Gerson et al., [110], articulation work resolves glitches locally and temporarily so that work can go on. They emphasized that “every real world system thus requires articulation work to deal with the unanticipated contingencies that arise. Articulation resolves these inconsistencies by packaging a compromise that ‘gets the job, that is closes the system locally and temporarily so that the work can go on’ done’ ([110], pg 266). Instead, meta-coordination activities highlight that glitches and inconsistencies especially that arise at the intersection of local and global activities require a global rather than a local solution. Meta-coordination activities require simultaneous collaboration between multiple departments to ensure that intra-departmental and inter-departmental activities do not affect each other. The three meta-
coordination activities identified in the patient transfer process are collaborative in nature. For example, the collaborative balancing of goals, for instance is a joint activity that allows the various departmental staff to voice their departmental perspectives, and also simultaneously become aware of varying perspectives and concerns of other departments regarding specific patient transfers. The benefits derived from such pooling and aggregation of information will motivate the departments that were initially hesitant to share information in order to achieve their departmental goals to follow suit, especially when they see the evidence of other departments’ goals being achieved. It also helps in developing a common understanding of how the IPA department makes their bed assignment decisions, which would enable the clinical departments to understand the non-clinical perspectives in patient transfer activities and also change their negative perceptions of the IPA department. This not only ensures that all the different perspectives (on local and global goals and needs of staff from these multiple departments are taken into consideration during the decision making process but also helps them reach at a globally accepted solution.

Some key features that are fundamental to effective collaboration during meta-coordination activities are discussed in the following paragraphs. The understanding on the collaborative process features can in turn provide insights on the specific details of the articulation process (that help mitigate the coordination challenges affecting inter-departmental workflows) in complex large-scale organizations such as hospitals.

First, meta-coordination activities depend on synchronous communication between departmental staff. This communication helps in resolving the ongoing negative cross-level interactions and its consequences in a timely manner. Furthermore, it facilitates an instantaneous exchange of information thereby supporting mutual deliberations. For example, the collaborative prioritization of resources allows them to not only share timely information on the availability of both personnel and non-personnel resources within their respective departments but also
information on the most critical patients who have requested for immediate beds. This helps the staff to collaboratively evaluate the ongoing resource needs and department/patient constraints before making any hasty decisions about assigning them to inappropriate locations. The simultaneous exchange of information also eliminates the possibility of hiding information on resources, thus preventing patient non-colocalization.

Additionally, the feedback mechanisms supported by the collaboration enhances the effectiveness of meta-coordination activities. The feedback mechanism fosters information sharing during meta-coordination activities. For example, the collaborative balancing of goals can mitigate the inter-departmental coordination conflicts that cause the lack of information sharing. Once team members perceive the inclusiveness of their feedback and contributions in the collaborative activity, it motivates them to unreservedly share information at their disposal with other departments. This in turn facilitates their interactions by promoting mutual trust between the team members and increasing their willingness to take a cooperative effort [219]. For example, although at first, the CN might not share information fully on the bed availability in the department during this activity, once she realizes that her local departmental goals are being recognized and her perspective are taken seriously, she begins to share the required information with others. This helps the departments jointly coordinate their goals to contribute to effective hospital performance and productivity. Furthermore, when the CN discusses her local goals related to nurse assignment, the feedback provided by other staff allows the IPA staff to help the CN deal with their local goals such as calling central staffing office to arrange additional personnel and also holding off admissions to the department to give the departmental staff additional time to organize their tasks before the arrival of new patients. In this example, they jointly try to balance the availability of beds against the efficient utilization of an expensive hospital resource. Thus the feedback feature contributes to enhance the collaborative knowledge which can assist in making quick and effective decisions regarding specific patient transfers.
Next, since meta-coordination activities are dependent on identifying, and assessing the requirements of the different departments, the collaboration provides a level of transparency of coordinating actions across departmental boundaries. This understanding allows the participating departments to ensure that their needs and constraints of are taken into consideration during the joint decision-making process and thus provides appropriate coordination support that help mitigate the conflicts at the intersection of intra- and inter-departmental coordination activities. For example, the collaborative resource prioritization allows CNs to not only voice their opinions on the inappropriateness of bed assignments made by the IPA, but also acquire an understanding on the rationale behind the IPA’s decisions. This understanding will help change some of the negative attitudes towards the IPA staff. The transparency feature provides the clinical staff an awareness of the status of their patient transfers and also the IPA decisions within the context of ongoing hospital work. In addition, the awareness also helps eliminate the ineffective use (i.e., misuse) of the bed board system information by CNs, who covertly transfer their patients without the involvement of IPA and the receiving departments. Finally, the transparency of information during the joint prioritization allows the staff to identify the bottlenecks and backlogs and also investigate different strategies that can be applied to resolve them. Thus, the staff can optimize patients’ length of stay by assigning them to appropriate departments which eliminates the duplication or delay in provision of services to genuinely critical patients.

The collaboration during meta-coordination activities helps in maintaining a common ground among staff in the different departments [90]. Common ground refers to the understanding (knowledge, beliefs, suppositions) accumulated during the course of joint actions, which the participants involved believe that they share. Thus, to ensure common ground, the various departmental staff share information of their local activities to build a mutual knowledgebase which consequently helps in minimizing the conflicts between departments. For example, the common ground achieved during collaborative prioritization of resources helps in
minimizing representation gaps that lead to conflicts especially between clinical and non-clinical departments. A representational gap as described by Cronin et al. [220] is an incompatibility between team members joint representation. As a result, the teams interpret information differently, which consequently affects the way they weigh their needs and prioritize resource values. However, the common ground between the clinical (e.g. physicians) and non-clinical (e.g. IPA) staff in various departments involved in patient transfers allows them to better understand patient care workflows in addition to being aware of the clinical and non-clinical (i.e., organizational) aspects of the patient transfer process. Besides common ground, the collaboration (i.e., required to perform meta-coordination activities) requires the participating departments to develop a collective thought to assess and evaluate the options to select the best option. This option will not only mitigate the coordination breakdown but also ensure that the ongoing activities (or articulation needs) do not get affected [110].

Further, the effectiveness of collaboration during meta-coordination activities depends on the skills of the participants from the functionally diverse departments [110]. For instance, the identification of coordination breakdowns in the patient transfer process depends on the skills and knowledge of integrators who take the primary responsibility for fixing the breakdown and re-coordinating the organizational work. During instances where the physicians’ transfer orders does not match with the actual diagnosis of the patient, the IPA admit nurse (in the integrator role) uses her tactical and conciliatory skills to negotiate with physicians about changing their inconsistent orders. In addition, the integrators possess managerial skills and persuasive tactics needed to discuss important issues (such as effects of local-departmental clinical work on other departments especially the IPA) and strategies with their colleagues. Although coordination activities require the staff to have a collective mind to achieve shared goals, the diverse skills of the different departmental staff allow them to become creative in performing articulation work to achieve their desired goals. For example, staff find different ways to switch patients between departments to
accommodate more patients to the hospital. This helps achieve the global goal of patient flow as well as ensure the local departmental goals are not being sacrificed.

In addition to skill and knowledge required to perform any kind of articulation work, experience of departmental staff has a significant effect on how the meta-coordination activities were performed. For example, the operational and organizational experience of integrators makes them proficient and well-versed in all aspects of hospital work including patient care and patient transfer activities. This helps eliminate the unnecessary work done by both the clinical teams in sending and receiving departments and the non-clinical team in the IPA in transferring off-service patients to inappropriate locations. The experience of integrators also helps in resolving conflicts and other discrepancies in transfer decisions between admitting physicians and IPA staff. Furthermore, the effectiveness of the collaboration activity depends on the diverse expertise and hands-on experience in various aspects of work processes at all levels of organization. For example, the capacity officer can make physicians aware of the benefits of effective patient flow (such as increase in number of patients that gain access to the hospital) to physicians’ work as well as the hospital.

**Generalizability: Meta-Coordination Activities in Large-Scale Organizations**

In this subsection, I highlight how meta-coordination activities that were identified in a hospital setting can help provide insights on the concept of articulation work in other large-scale organizational settings. First, this particular type of lower-level articulation work that is performed to mitigate the coordination challenges that occur at the intersection of intra- and inter-departmental coordination activities – “meta-coordination activities” manifest in any type of large-scale organization with multiple departments. An understanding of the unique characteristics central to meta-coordination activities can help in addressing the inter-
departmental challenges in all organizations. For example, meta-coordination activities arise when there is a conflict between local and global levels of work. The organizational issues such as competing goals, resources and teams that have an effect on how the interdependencies between the departments are managed are prominent in all large-scale organizations. This can have a detrimental effect on both intra and inter-departmental coordination activities of an organization.

Second, I have identified four main aspects of meta-coordination activities that can help us better understand organizational articulation work in other complex settings. Grinter [31] highlighted three general aspects of articulation work which include (a) the challenges of representing work, (b) the need to support individuals and groups working together and (c) the assumptions about the work built into tools. By closely examining meta-coordination activities performed at the intersection of intra- and inter-departmental coordination activities, this research study provides deeper insights into the aspects of articulation work that helps maintain organizational coordination. They include (a) the significance of maintaining inter-departmental workflows (across multiple levels) that supports a system-based approach to work, (b) the need to support seamless collaboration between functionally diverse teams working together, (c) the assumptions about inter-departmental work built into tools, and (d) the importance of viewing articulation work from a socio-cognitive perspective of coordination behavior.

First, meta-coordination activities describe how articulation work across multiple levels in hospital organizations can be achieved. In particular, it confirms that the articulation work done in response to coordination breakdowns and other non-routine events (i.e. lower level articulation work) is more effective in a hospital setting when compared to the articulation work done during normal activities (i.e. upper-level articulation work). Meta-coordination activities help us think about the importance of a structured process to the extra work performed to effectively respond to coordination breakdowns. For instance, the collaborative balancing of goals pays attention to the
process of evaluation of goals using coordination mechanisms such as informal relationships, explanations and collective negotiation. It also highlights the important role of context and time in the effectiveness of articulation work in hospitals. For instance, meta-coordination activities become extremely useful in patient transfer situations where decisions need to be made under scenarios of incomplete information, uncertain diagnosis, changes in patient condition and other medical alerts which can have a detrimental effect on organizational and departmental workflows. Finally, meta-coordination activities emphasize the importance of adopting a system-based approach when performing articulation work in hospitals rather than a patch and move based approach such as work-around. The system-based approach relies on understanding the organizational setting and the relationships between humans, technologies and organizational structures such as policies.

Second, meta-coordination activities help us in understanding that articulation work done collaboratively is not a temporary work-around just to maintain the continuity of ongoing work but instead it aims at resolving the coordination issues and track the factors that contributed to the coordination issues. The collaboration between the participating departments also reduces the amount of articulation work that needs to be figured out independently at the local level. For example, a study examined the amount of local articulation work done by mothers in the care process of their asthma children. Timmermans [130] examined the price paid by women who take on an extensive caretaking role at the expense of their reduced involvement in the paid labor force, due to the indeterminate nature of articulation work. Meta-coordination activities highlight the concerted effort in articulation work where the cooperation and collaboration between the participants can help mitigate the challenges caused by competing activities (with competing goals, competing resource needs and competing teams). Therefore, it pays importance to providing incentives for individuals and teams in their effort to perform articulation work
especially in hospitals in view to achieve both clinical (e.g. patient care and safety) and organizational goals (e.g. high performance and throughput).

Meta-coordination activities describe the importance of global collaboration between the participating individuals (and its respective features such as feedback mechanisms, common ground, role of expertise and experience of staff) that will minimize the amount of articulation work done independently at the local levels. Furthermore, the findings on meta-coordination activities shed light on how articulation work can be performed collectively to balance both local and global issues. It also describes the articulation work performed to alleviate the coordination disruptions created by functionally diverse teams and their hierarchical structures. For example, the differences in work orientations of the diverse teams can be mitigated by incorporating key integrators in the articulation process who overlook professional hierarchies and resulting power differences. Thus the understanding of meta-coordination activities extends the concept of articulation work (performed to manage an inter-departmental activity) by shifting our attention from considering a local perspective of a single department to adopting a comprehensive global perspective involving multiple departments.

Third, meta-coordination activities highlight that the effectiveness of articulation work across levels especially in hospital settings depend on incorporating functionalities that can support similar features afforded by face to face collaboration. Therefore, this understanding can help in developing and designing technological features that can support coordination that can maintain effective and seamless organizational workflows (more details on design features provided in the next chapter).

Finally, meta-coordination activities highlight the importance of analyzing articulation work in complex settings from a socio-cognitive perspective. The coordination challenges reported in chapter 6 can be attributed to the social and cognitive aspects of team coordination practices. Social aspects of coordination behavior include coordination structures, policies, and
protocols while cognitive aspects of coordination behavior focus on individual and team cognitive processes (such as collective expertise, team awareness, shared mental models, common ground and team cognition). Therefore, the social and cognitive aspects of the various departmental teams and its effect on inter-departmental coordination practices need to be evaluated when performing the articulation work to mitigate coordination breakdowns.

Chapter Summary

Meta-coordination activities are prominent in large-scale organizations with functionally diverse departments. However, organizations are often unaware of the important nature of these activities in achieving efficient work processes. Using data gathered from a large hospital, I have demonstrated the importance of these meta-coordination activities in maintaining continuity of organizational work.

In this chapter, I described three meta-coordination activities that are used in the patient transfer process. Furthermore, I discussed how meta-coordination activities were manifested in hospital work. This helped in extending our understanding on articulation work to maintain organizational coordination. In the next chapter, I present a conceptual framework and also highlight some key socio-technical design issues that need to be considered when designing inter-departmental coordination tools.
Chapter 9

Discussion: Informing Design

Meta-coordination activities provide insight on how staff members in different departments manage inter-departmental coordination activities. In the previous chapter, the role of meta-coordination activities in ensuring inter-departmental coordination and workflows were described. In particular, I illustrated how hospital staff collaboratively balanced their local and global goals, prioritized local and global resources and how key integrators at the local and global levels performed their mediating roles.

This chapter provides a deeper understanding towards the design of inter-departmental coordination technologies. In the first section, I present a framework that ties the concepts of negative cross-level interactions and meta-coordination activities. In the second section, I discuss the socio-technical design issues important for supporting meta-coordination activities that can help ensure effective inter-departmental coordination. While the framework helps in understanding the underlying inter-departmental coordination behavior in a more general context of organizational work in hospitals, the socio-technical issues help in developing tools that can fit well with existing organizational practices. Thus, the framework and the socio-technical design issues can serve as a guide when developing healthcare technologies.

Framework of Inter-Departmental Coordination

Hospital workflows are characterized by collaboration and coordination of distributed activities between functionally similar and dissimilar departments. To ensure smooth inter-departmental workflows, we need to understand and evaluate the effects of intra-departmental activities on inter-departmental coordination activities and vice versa (Figure 9-1). Effective
hospital coordination can result in streamlined work processes, increased performance and
effectiveness, higher productivity, and effective resource management.

I developed a descriptive framework (Figure 9-2) of inter-departmental coordination
emphasizing aspects of negative cross-level interactions and meta-coordination activities and the
relationship between them. In addition to being descriptive, it provides a set of meta-coordination
strategies and mechanisms to foster seamless inter-departmental workflow. A bottom-up
approach (using grounded interpretation of fieldwork data) was used to build this framework.

Figure 9-1 below shows the details of inter-departmental coordination work. When we
investigate the process of inter-departmental coordination in an organization, we need to consider
two main aspects (or components) that contribute to this process: the local intra-departmental
level and the global inter-departmental level. The local intra-departmental level is defined by a
number of departments that comprise of activities, resources, goals and workers. At this local
level, the departments are independent of each other. In other words, the various activities,
resources, goals and workers have their unique departmental workflows and follow respective
local protocols defined by the department because they do not share anything in common. In
Figure 9-1, the departments are represented by the square boxes (with dashed lines). The global
inter-departmental level encompasses multiple departments and their interactions. These
departments perform collaborative activities. As a result, interdependencies between the various
departmental workers, goals and resources arise. In addition to these interdependencies, the local
departmental workflows and respective protocols are governed by global rules and protocols. To
successfully achieve inter-departmental coordination, the interdependencies between the
departments need to be effectively managed.
Figure 9-1: Microstructure of Inter-Departmental Coordination Work

However, when the departments try to coordinate their shared activities, the organizational issues such as competing goals, resources and teams of the different departments at these two levels of work affect the way the interdependencies get managed. Consequently this lead to coordination challenges across the levels that in turn result in negative cross-level interactions where intra- and inter-departmental coordination activities negatively impact each other (represented by stars). An instance of a negative cross-level interaction is when the intra-departmental activities of department 1 affect the inter-departmental coordination activities between departments 2 and 3 (represented by red star). Another instance of a negative cross-level interaction is when the inter-departmental coordination activities between 1 and 2 affect the intra-departmental activities of department 3 (represented by orange star).

To mitigate the effects of negative cross-level interactions, the departments used meta-coordination activities that aim at re-coordinating the inter-departmental coordination process (represented by circular arrows). The three main meta-coordination activities identified in the
patient transfer process are the collaborative balancing of goals, collaborative prioritization of resources and integration by mediators. These activities highlight the importance of balancing the workflows at the two levels in order to ensure the continuity of an inter-departmental activity.

Based on the representation of microstructure of inter-departmental coordination work in Figure 9-1, I developed a framework for describing how negative cross-level interactions and meta-coordination activities manifest in organizational work. Figure 9-2 represents a condensed framework of inter-departmental coordination. The framework depicts the multiple levels that need to be considered in the process of inter-departmental coordination and illustrates the importance of balancing activities between local and global levels during inter-departmental coordination.

Figure 9-2: Framework of Inter-Departmental Coordination

This framework comprises of two core aspects – negative cross-level interactions and meta-coordination activities (represented by blue squared boxes). Both these aspects of inter-departmental coordination process occur at the intersection of local and global levels of work.
Negative cross-level interactions occur when the interactions between local and global levels are not managed properly. For instance, departmental staff constantly transition between these levels to maintain effective intra- and inter-departmental workflows. The box representing the negative cross-level interactions highlights three main features of negative cross-level interactions that occur when intra- and inter-departmental coordination activities negatively affect each other.

First, the framework shows that negative cross-level interactions shift the focus of coordination problems from an activity problem at the intra-departmental local level to a collaborative process problem at the inter-departmental global level. Furthermore, negative cross-level interactions can be cumulative if they are not attended to in a timely manner. For instance, an intra-departmental activity of department 1 affects the inter-departmental coordination activity between departments 2 and 3. The intra-departmental activities of department 2 can affect the inter-departmental coordination activities between departments 4 and 5 which in turn can affect intra-departmental activities of 5 which in turn can affect the inter-departmental coordination activities between departments 5 and 6 and so forth.

Second, as we move from local to global levels of work, the degree of problem certainty increases while the functional similarity (in goals, resource needs and priorities, and teams) varies from high to low. Furthermore, these negative cross-level interactions occur when the degree of staff involvement with patient vary from high to low. At the local level, the degree of staff involvement in patient’s treatment process is high when compared to the decreased involvement in patient’s treatment process at the global level. For example, the ED staff pays more attention to the ED patient at the local departmental level. But, once she becomes an admitted inpatient (at the global level), the ED staff do not actively involve themselves in the patient’s care process although the patient is still bring boarded in the ED. This hampers the inter-departmental transfer
and care activities such as quality of verbal patient report, the completeness of diagnostic procedures, monitoring of patients.

Finally, the negative cross-level interactions are caused by coordination challenges that are primarily activity-driven in nature. During patient transfer process, the inefficiencies in ADT process, the lack of information sharing, the ineffective interactions, and ineffectiveness of artifacts are all examples of patient transfer activity-driven problems.

The effects of negative cross-level interactions are mitigated (highlighted by the yellow arrow) by meta-coordination activities (represented by the circular arrow).

*Meta-coordination activities* take a comprehensive approach (by evaluating all departmental activities) before resolving the conflict. The box representing the meta-coordination activities highlights two main features of meta-coordination activities.

First, meta-coordination activities occur at different levels of analysis ranging from general level (i.e. organizational) to specific (i.e. individual) level. For example, the collaborative balancing of goals takes place at a general level where the competing goals are being evaluated and balanced to ensure high-level organizational goals. The collaborative prioritization of resources takes place at a departmental level where the competing resources are being assessed and prioritized to ensure the departmental resources are optimally used. Finally, the integrators play an active role at a more specific level to ensure that individual patients’ and staff concerns are being addressed in a timely manner. Since these activities are coupled with each other and therefore not mutually exclusive, there exists an overlap between them.

Second, despite these different levels of analysis, meta-coordination activities are always resource-driven. For example, the collaborative balancing of goals is driven by “how to get appropriate care for patients without overwhelming the staff?” The collaboratively prioritization of resources is driven by “how to get patients the right resources and move them to the right place at the right time?” The integrators resolve staff concerns such as identifying patient flow
bottlenecks to minimize the number of ED and PACU boarders, and ascertaining the appropriateness of physician orders to ensure patient receives the appropriate care required.

As highlighted in the description above, this framework takes a process-oriented approach; the determinants of the coordination process include the context characteristics, the coordination steps, the interdependencies, the challenges to coordination, negative cross-level interactions and the meta-coordination activities.

The framework can be used in different ways:

- As a common framework for understanding inter-departmental coordination practices and how it affects the overall functioning of the hospital
- As an abstract representation that enables researchers to describe coordination practices in large-scale dynamic organizations
- To identify strengths and weaknesses of inter-departmental coordination activities
- To identify the effects of intra-departmental activities on inter-departmental coordination practices and vice versa
- To guide the development and design of inter-departmental coordination tools

**Socio-Technical Design Issues**

The effective management of patient transfer activities that occur at the intersection of intra- and inter-departmental coordination can be achieved by mitigating negative cross-level interactions and its effects on coordination goals of the hospital. Consequently, the smooth functioning of the organization depends on the effective design of coordination technologies that can incorporate features to both reduce the negative cross-level interactions and also support meta-coordination activities.
Medical informatics researchers have highlighted the importance of socio-technical requirements for healthcare technologies [222], [184], [223]. The central tenet of this approach is that information technology is intertwined within the organizational context of work and therefore cannot be studied or understood independently [224-226]. Therefore, in order to design information systems to help alleviate inter-departmental coordination challenges affecting patient transfer workflow, designers need to pay attention to the socio-technical requirements for those systems. Consequently, I have identified key socio-technical design requirements (and the coordination mechanisms) that can facilitate inter-departmental coordination. These requirements are interdependent and therefore, should be considered collectively in order to ensure effective and seamless inter-departmental workflow.

The various coordination mechanisms that can support meta-coordination activities are described. For each meta-coordination activity, one associated socio-technical issue supporting the coordination mechanism is described.

**Collaborative Balancing of Goals**

To support the collaborative balancing of goals, hospital staff members can use coordination mechanisms such as informal relationships, explanations and collective negotiation which help them jointly balance the competing goals. For example, informal relationships [63] between CNs and IPA staff help them understand each other’s goals and respective needs especially during non-routine events. While these relationships exist in almost every organizational structure, their importance in managing and mitigating the effects of negative cross-level interactions is often hidden. Another coordination mechanism that is useful in collaborative balancing of goals are explanations [227]. Explanations can help staff not only clarify but also justify the rationale behind impromptu patient transfer decisions made such as
swapping of patients between rooms in a single department. Finally, collective negotiation [228], [117], [229] is another coordination mechanism that can be used to collaboratively balance competing goals. Researchers have highlighted the important role negotiation plays in coordination [230], [117], [231]. They have examined how negotiation is used to reach a consensus when a problem occurs [232], [106], [97]. For example, Xiao et al., [233] conducted a study to investigate the coordination activities that are needed for the management of surgical operating rooms. The authors mainly examined the role of negotiation in managing conflicts that result from resource limitations, goal incompatibilities and uncertainties in work. Some of the conflicts highlighted include misunderstanding, miscommunication, limited resources, prestige, control issues, and incompatible personalities.

Currently, the negotiation of bed assignment decisions is mediated by the IPA department. Once a bed is assigned, the CN's from either the sending or the receiving departments contact the IPA staff voicing their concerns regarding their dissatisfaction with the assignment. The IPA staff then tries to negotiate separately with the two departments to reach a consensus on the bed assignment decision. The negotiation process is managed independently by the IPA staff which consequently affects their bed assignment decisions. First, the IPA plays the dual role of acting as the advocate for both the sending and the receiving department (while negotiating with the other department). The dual role results in less than optimal outcomes from a patient transfer perspective. Second, due to the time critical nature of patient transfers, the IPA staff have to often work with limited information on the bed board to assign patients as opposed to gathering complete information regarding bed status and patient case. Third, the IPA has to rely on verbal communication with charge nurses to help them make explicit connections between distinct pieces of information on the bed board and EMR systems. Furthermore, due to the physical distance between the IPA and clinical departments, the IPA staff sometime make bed assignment decisions without being aware of certain contextual factors such as staffing, mishap in patient
rooms, critical nature of patients, and schedule of charge nurses that may have an effect on clinical departmental goals. And finally, the IPA staff do not always have the clinical knowledge to make judgments on certain bed assignments. With the bed board being a tracking system, it does not have features that will support their negotiation with charge nurses such as interpretation of diagnosis information or help them ascertain the match between patient diagnosis and level of care/bed requirements based on patient criticality levels or specific medical reasons behind a patient transfer.

These issues can be alleviated by employing collective negotiation techniques that allow a direct interaction between the CN's of the sending and receiving department which is mediated by the IPA would help in contextualizing the challenges for both these departments and creating a common platform for negotiation based on a better understanding of the goals and the respective challenges. For example, if a patient needs to be transferred from ED to a floor unit, the ED CN can negotiate till she reaches at an agreement with the IPA staff by voicing her opinion on why the patient needs to be moved to the floor rather than having to wait for an appropriate bed to ensure a global goal such as patient colocalization.

Therefore, when designing inter-departmental workflow technologies, we need to pay attention to specific features that can support collective negotiation. Mechanisms to support collective negotiation tasks among the various CNs and IPA staff include the use of shared workspaces [78, 234] and teamrooms [235]. Foster et al. [234] described the Cognoter tool for online collaboration. It provides a multi-user interface for a structured meeting. The Cognoter develops a summary of meeting themes in three stages of brainstorming, ordering and evaluation. In another study, Dourish and Bellotti [78] found that awareness information in a shared workspace allowed users to dynamically assign and coordinate their work effectively. They also found that the passive awareness afforded by the shared workspaces helped users identify the pertinent information during a shared task and increased the effectiveness of collaboration.
Roseman et al., [235] described how teamrooms can help teams to not only meet online but also organize their work. They highlight the importance of team rooms as repositories of documents. Teamrooms serve as permanent shared space that allows team members to collaborate both synchronously and asynchronously. The two tools provided in teamrooms include chat tool, and a shared whiteboard. The awareness features incorporated in teamrooms allowed the team members to not only see each other but also see each other’s actions in the workspace both through immediate changes in the room’s artifacts and through mechanisms such as multiple telepointers to communicate gestures.

Similarly, such workspaces and team rooms can help the IPA staff to act as mediators in the negotiation activity, while supporting direct online interaction between the charge nurses. For example, if a patient needs to be transferred from ED to a floor unit, the ED CN can negotiate with the IPA staff and the floor CN by voicing her opinion on why the particular patient takes priority over others. At the same time, the floor CN can also negotiate with the ED CN about transferring the patient to a semi-private bed on the floor. These direct interactions help in developing a shared understanding of the needs and challenges of the IPA and ED while facilitating a joint balancing of their patient transfer goals.

Additionally, a shared workspace provides a medium for persistent storage of interaction history and negotiation pattern. For example, methods of negotiation used, departments that participated in the negotiation, negotiation-compliant vs. negotiation-non-compliant departments, negotiation frequency, frequently encountered negotiation problems, patient transfer scenarios. Such information will help to prompt the participants to accommodate other departments’ requirements and needs. Additionally, the shared workspace will allow the IPA to track the online collaboration to ensure that departmental goals are being met during the negotiation activity.
Collaborative Resource Prioritization

Although there are a number of existing prioritization tools including binary search tree [236], numerical assignment technique [237], Wiegers’ method [238], AHP [239] that can detect conflicts in resource needs and address incompatibility between them, the three main coordination mechanisms that can help hospital staff in the collaborative prioritization of patients to resources include resource commitment, collaborative forecasting and information triage. Using these mechanisms, the staff can no longer make decisions in their own interests. Resource commitment [240] helps staff from various departments to commit to resources within their respective departments based on their understanding of the inter-departmental coordination needs. For example, the IPA staff did not assign an ED patient (with a NSICU transfer order) to other intensive care units because of a lack of availability of beds in the NSICU. However, the IPA staff got the NSD CN to commit to a bed in the department that would potentially be available in a later shift. Although the commitment provided by the CN can be realized only in the future it helped in the bed management planning activities for the IPA staff. Related to the concept of commitments, are conventions. Conventions provide a mechanism to monitor and evaluate the changes to the original commitments and ensure whether the commitments are still valid in the current changed environment. The patient transfer conventions can provide guidelines that need to be followed by staff when a commitment needs to be abandoned or reassessed in the light of current work.

Collaborative forecasting is another coordination mechanism that can support collaborative prioritization of resources. Forecasting is an activity where future trends are predicted based on prior history and is useful for preparing for immediate future needs. While forecasting cannot take into account the effect of highly unexpected events, it provides a benchmark for personnel for future preparedness. Hospital staff can jointly forecast the
availability of resources (e.g., beds) based on current information (e.g., pending discharges, time of physician rounds). This helps in creating a priority list of patients that need to be assigned beds in the near future. The joint preparation of priority list by CNs helps to eradicate any false perceptions or partiality on the part of IPA in the assignment of beds. Finally, information triage [241] is a coordination mechanism that can help categorize and rank the available patient transfer information based on certain patient criteria such as acuity of patient and special bed requirements during collaborative prioritization of resources. The CNs and the IPA staff can triage the different kinds of available information before they jointly prioritize the most critical patients to the available non-personnel resources such as beds while at the same time ensuring that the personnel resources are not overwhelmed. For instance, patient transfer information can be categorized and rapidly filtered based on certain patient care criteria such as acuity levels, monitor requirements, intravenous drip (IV) constraints and administrative criteria such as treatment protocols and insurance coverage.

Therefore, to better support the collaborative prioritization of patient resources during bed meetings, features to support information triage have to be incorporated to facilitate and ensure the continuous management of patient and bed assignment information. Features to support information triage such as filtering and foraging can allow the CNs and the IPA staff rapidly triage the different kinds of departmental information (important vs. unimportant patient cases) available to them before they jointly prioritize and assign the most critical patients to the available non-personnel resources such as beds while ensuring that the personnel resources are not overwhelmed. Once the triage is completed, the CNs can document their individual departmental priorities on an online semi-structured form. The online form allows all the CNs and IPA staff to view the information before they can jointly create rank and assign patients.

Similar to the shared collaborative technologies described earlier to support the joint balancing of goals, information systems with features that support information triage will allow
the CNs and the IPA staff triage the different kinds of departmental information (high priority vs. low priority patient cases, long-term vs. short-term needs) available to them. The triaged information can then be jointly prioritized and appropriate bed assignments can be made. The IPA staff can then record the bed assignment information on the bed board based on the joint priority list. Thus, the role of the IPA becomes clearly defined as a facilitator for bed assignments as opposed to a decision maker (for bed assignments). A collaborative shared space with video-communication facilities can be used to develop a relative priority list of the patients by comparing the similarities and differences across multiple departments in terms of patient needs and available resources. The details of the triage process can be documented (such as departmental priorities, available resources) for future use. This subsequently will help the IPA staff identify the important patient transfers vs. urgent transfers. However, due to any unforeseen events, if the CNs want to modify the order of the items on the list, they would need to notify the IPA and other concerned departments that might be potentially affected by the change. To reflect the changes to the priorities, the IPA staff can flag the modified information on the system.

With the advances in video-conferencing technology, it is possible that these online conferences would be more time-efficient and would result in better interaction between the departments and more efficient patient-transfer outcomes. The primary difference in the use of this technology is the support for immediate resolution of high priority tasks while taking into account the needs of all concerned parties. The video conferencing session can be scheduled every couple of hours and would be mandatory for all CNs.

**Mediating Role of Integrators**

A proactive nature and a persuasive approach are the two main coordination mechanisms that integrators require to successfully complete their tasks. The proactive nature of the
integrators will allow them to take immediate steps to resolve patient transfer issues. For example, the triage officer can ensure that his departmental staff such as physicians and nurses are making progress in their patient transfer activities by contacting them on a timely basis to find information on status of patients and beds in the department. To respond to non-routine events, the triage officer can inform the other care providers of the hospital’s status quo and requests them to take necessary steps to expedite potential patient discharges and transfers. The act of persuasion [242] by clinical staff is useful and powerful during patient transfer activities. For example, the capacity officer often times persuaded the physicians to change their inconsistent transfer orders. As a result, this can eliminate a number of non-colocalized patient transfers.

Although, the integrators are contacted by the IPA staff who provide information on overall hospital bed status and individual departmental statistics, currently the integrators have to spend a considerable amount of time and effort on secondary activities such as seeking information on hospital status and marshalling evidence to make key transfer decisions that could have been avoided if the information on systems such as the EMR and bed board were updated in a timely manner.

Integrators should have instantaneous access to hospital information that can help them identify glitches and logjams in the hospital system that affects patient transfer workflow. Therefore, we need to develop system features that can help integrators take a more proactive role in the patient transfer process. This would allow the integrators to take initiatives (such as departmental rounds) to not only “push” inappropriate patients from their department but also “pull” appropriate admitted patients from departments such as the ED and PACU on a day-to-day basis [243]. For example, the capacity officer can inform the attending physician to enter transfer or discharge orders if he feels that a patient in the NSICU does not meet NSD care requirements. The continuous push and pull model can reduce the number of backlogs within and between clinical departments by preparing the hospital to meet the anticipated patient demand for
particular services. In addition, capacity officers can hold weekly meetings with attending physicians of different services to evaluate past, current and future events that may have an effect on the timeliness of patient transfers. This will compel the attending physicians to become accountable for their departmental activities.

To support a more active role, integrators would require a better EMR system that is well-integrated, comprising of both clinical and non-clinical information needed to rapidly assess both individual departmental status and examine its effects on the overall hospital status and on patient care outcomes. Employing information visualization techniques can not only provide integrators with the capability to visualize the different paths a patient can travel but also can help them in contextualizing and organizing the entire hospital data to see patterns and relationships between patient transfers and bed turnovers. The availability of information in an integrated manner with one click access would help them monitor the patient transfer trajectory [28]. Strauss defines trajectory as “the course of any experienced phenomenon as it evolves over time and the actions and interactions contributing to this evolution”. Thus, patient transfer trajectories can help the integrators map out the entire patient pathway traveled from sending department to the receiving department. They can also monitor both patient care trajectory and patient transfer activities. This will allow the integrators to ensure that the patient transfer goals (efficient, effective, timely and safe) are being met by the various departments throughout the patients’ care pathway in the hospital. For example, the capacity officer can identify where the patient is in the process, status of patient report, transport and housekeeping department status. Using this information, they can rapidly identify and contact the particular department that is causing the backlog and help them expedite the transfer process instead of having to call various staff to track patient delays. For instance, they can directly contact the attending of services and expedite the transfers once they know ahead of time the services that are slow in pulling their patients from these critical areas with interchangeable resources. The system information will also allow the
integrators to be aware of ongoing hospital events rather than having the IPA contact them when
the need arises. For example, factors such as number of boarders in ED and PACU, hours of
patient boarding in PACU and ED average time for patient transfer from these departments,
average and peak daily admissions should be presented to the integrators in a visual chart that can
help forecast and predict the status of the departments and their demand for resources for the next
couple of hours. Thus, the transparency of information on resources will provide them with
detailed knowledge of admission, discharge and transfer patterns over time and also bed
utilization and availability to allow strategic assessments of resource needs.

Chapter Summary

In this chapter, I highlighted two ways that can inform the design of coordination
technologies. First, I described a framework of inter-departmental coordination that highlights the
relationship between negative cross-level interactions and meta-coordination activities. Second,
the key socio-technical issues that has to be considered when designing healthcare technologies to
support inter-departmental coordination are investigated. In particular, I discussed several
coordination mechanisms used to support the three main meta-coordination activities and also
identify some design ideas that can help support these coordination mechanisms. In the next
chapter, I address the research questions that were raised in chapter 1 and also describe my major
research contributions to CSCW and MI, and finally close with some concluding remarks on my
dissertation and future work.
Chapter 10

Conclusion

In this chapter, I revisit and answer my research questions. I then present my research contributions, and close with some concluding remarks on my dissertation and future work.

Answering the Research Questions

RQ 1: How do negative cross-level interactions affect organizational workflow?

- What are negative cross-level interactions?
- What are the challenges that lead to negative cross-level interactions?

Prior research has focused on investigating coordination issues at the intra- and inter-departmental levels [139], [182]. In this thesis, I shift our attention to focus on a unique set of challenges that occur at the intersection of intra- and inter-departmental coordination activities. I refer to these challenges as “negative cross-level interactions”. To examine negative cross-level interactions, I investigated the coordination of patient transfer activities at a hospital. Through this study, I identified four prominent coordination challenges that lead to negative cross-level interactions in patient transfers. The challenges to the coordination of inter-departmental activity: ADT process inefficiencies, ineffective information handoffs, ineffective interactions and ineffectiveness of artifacts. As a result of the negative cross-level interactions, the overall organizational workflow was affected. In particular, the negative cross-level interactions had a detrimental effect on the two primary goals of the hospital organization: patient flow and patient colocalization; they created bottlenecks to patient flow and distorted patient colocalization efforts. Consequently, this lead to a number of issues such as ED (emergency department) and PACU (post-anesthesia care unit) overcrowding, potential delays and cancellations of hospital transfers,
ambulance diversions, provider and patient dissatisfaction with hospital management, and most importantly, the potential threat to patient safety by increasing the risks of medical errors and adverse events.

RQ 2: What are the meta-coordination activities employed by organizational staff to alleviate the effects of negative cross-level interactions?

- What are the unique features of meta-coordination activities?
- How does meta-coordination manifest itself in hospital work?

In this study, I identify a set of activities used to mitigate the effects of negative cross-level interactions. These activities are referred to as meta-coordination activities; they aim at re-coordinating activities by fixing the coordination breakdowns in work. Thus, meta-coordination activities play an important role in maintaining the continuity of organizational work. I have identified three types of meta-coordination activities. They were collaborative balancing of goals, collaborative prioritization of resources and mediating role of integrators. These activities share a set of common characteristics. They are: (a) meta-coordination activities only occur when activities at the local (intra-) and global (inter-) levels intersect, (b) meta-coordination activities are dependent on identifying, assessing and ensuring that the needs and constraints of the different departments are taken into consideration during the joint decision-making process, (c) meta-coordination activities occur for re-coordinating work activities that span multiple departments, (d) meta-coordination activities are performed in response to a time-critical activity. These characteristics of meta-coordination activities help us better understand how hospital organizations function in a smooth manner despite all the coordination breakdowns.

To provide insights on how meta-coordination activities manifest in hospital work, I highlighted some central features of work that helped maintain the continuity of patient transfer work: (a) meta-coordination activities depend on simultaneous collaboration and synchronous communication between departmental staff, (b) since meta-coordination activities are dependent
on identifying, and assessing the requirements of the different departments, the collaboration provides a level of transparency of coordinating actions across departmental boundaries and (c) the effectiveness of collaboration during meta-coordination activities depends on the skills and experience of the participants from the functionally diverse departments.

RQ 3: How is meta-coordination activity an aspect of articulation work?

Through this study, I identified meta-coordination activities as a type of non-routine (i.e. lower-level) articulation work. Meta-coordination activities share the same characteristics with other types of articulation work [1], [12]. The common characteristics are: (a) they are invisible within rational models of work; (b) they involve the coordination of tasks, goals, beliefs and standards; and finally, (c) they are performed to achieve a high-level end goal.

Consequently, through this study, I highlight how the conceptual understanding of meta-coordination activities allow us to (a) extend the concept of articulation work by identifying and uncovering an unique type of articulation work and (b) improve the understanding on articulation work performed across multiple levels of an organization.

**Intellectual Contributions**

The findings from this thesis make contributions to two research fields: Computer Supported Cooperative Work (CSCW) and Medical Informatics (MI).

**Computer Supported Cooperative Work Field**

CSCW researchers have long been interested in understanding and supporting coordination at the individual, team, and organizational levels [244]. Furthermore, researchers have examined a wide variety of issues that are important to achieve smooth coordination of
distributed activities such as various coordination processes [245], coordination and awareness mechanisms [117], [78], construction of interdependencies [246], coordination requirements [17], the effect of conflicting motivations [97] and the role of information systems in coordination [6]. However, there is little research on effects of intra-departmental activities on inter-departmental activities and vice versa. As a result, there is only a limited understanding of the challenges that occur at the intersection of intra- and inter-departmental coordination activities which could potentially result in fragmentation of work in organizations. To maintain the continuity of ongoing work CSCW researchers have examined the role of articulation work [145], [133]. Although, there has been research on the role of articulation work in managing the consequences of coordinated work [31], [32], [33], [34], there is very little empirical understanding of what type of articulation work is used by organizational staff to mitigate the issues related to the coordination challenges caused by the interplay of intra- and inter-departmental coordination activities to ensure seamless organizational coordination.

Although coordination and articulation work have been examined in a variety of domains [6], [7], [116], [118], the CSCW community’s interest in studies investigating these issues in the healthcare domain has been consistently increasing over the past couple of years [33], [34]. Coordination is a critical aspect of hospital work [105] especially within and between departments. However, the research has been focused primarily on investigating intra- and inter-departmental coordination of clinical activities (activities directly related to patient care). Furthermore, besides the limited research on articulation work in healthcare domain [33], [34], most of these studies in the healthcare domain are primarily focused on articulation work done to maintain the continuity of clinical work; it fails to identify the work of non-clinical departments which play a vital role in maintaining hospital coordination. Consequently the overall body of knowledge in this research space is considerably limited. In this thesis, I shift the focus of the CSCW community to the significant role played by non-clinical departments in healthcare work
by highlighting a hospital wide activity that depends on the coordination of activities between clinical and non-clinical departments.

I make four main contributions to the field of CSCW. First, I identify a set of coordination challenges (i.e. negative cross-level interactions) that occur at the intersection of intra- and inter-departmental coordination activities. This thesis not only highlights the importance of coordination of activities both within and between departments but also provides a detailed understanding of the problems at the intersection of inter-departmental and intra-departmental activities. I develop an understanding about the inter-relationships between the factors that contribute to the negative cross-level interactions. I highlight how the three main organizational issues created challenges to the effective management of interdependencies, which then results in coordination challenges that consequently lead to negative cross-level interactions. To mitigate the effects of the negative cross-level interactions, staff perform an additional set of activities that are not part of the formal model of work practice.

This leads into my second contribution which is based on uncovering a particular set of activities - meta-coordination activities - that are performed to mitigate the effects of negative cross-level interactions. In addition, I identified meta-coordination activities to be a particular type of articulation work focused on fixing breakdowns that occur when intra- and inter-departmental coordination activities affect each other. Furthermore, by exploring meta-coordination activities, I provide deeper insights on articulation work performed to maintain coordination across the entire organization. Since, one of the primary goals of CSCW is towards the design and development of information systems to support cooperative work, this understanding on the nuances of the meta-coordination activities and the nature of organizational articulation work can then help in designing better inter-departmental coordination technologies.
Third, I develop a framework of inter-departmental coordination work that highlights the relationship between the concepts of negative cross-level interactions and meta-coordination activities.

The final research contribution is based on highlighting the coordination of organizational-wide activities (e.g. patient transfer) that has both clinical (e.g. patient report) and organizational/ non-clinical (e.g. bed management) components integrated into it.

**Medical Informatics Field**

Medical informatics researchers have primarily focused on clinical teams and departments performing patient care activities. The most studied team in hospital work is the patient care team comprising of clinical staff such as physicians, nurses, and pharmacists. These studies have investigated different information behaviors of patient care teams such as information seeking (e.g., [247], [248]), decision support (e.g., [249]), and coordination practices (e.g., [250]). Patient care activities are considered as being central and fundamental to hospital work. Furthermore, most hospital systems are primarily designed to support clinical activities of health care providers (e.g., whiteboard [106], CPOE [251]).

However, there are a number of significant gaps in the medical informatics research specific to the type of activities and workflows. The management of care delivery in hospitals requires seamless coordination between clinical staff and non-clinical staff. Yet, most research in medical informatics has not sufficiently focused on the significant role played by non-clinical staff in hospital work. As a result, limited attention has been paid to activities that involve non-clinical staff such as patient transfers. These peripheral yet crucial activities can impact a hospital’s performance and the quality of care delivered. When medical informatics researchers have examined patient transfers, they have focused primarily on the clinical aspects of the patient
transfer process. For example, researchers have examined coordination of “care” activities between healthcare professionals [155], [156] with an emphasis on transitions of care during patient handoffs [26] and its respective challenges such as adverse drug events and medical errors [158]. However, most of these studies have not examined the organizational impacts of patient transfer activities. Since the clinical aspects cannot be separated from the organizational aspects, I investigate the effects of patient transfer workflow on organizational and clinical outcomes.

Patient transfer involves the movement of patients and their respective information between various departments. Therefore, the success of a patient transfer between clinical departments depends not only on the internal workflows of those departments but also the inter-departmental workflows of all the involved departments. However, most workflow studies have examined workflows within a single department [252], [163], [151], [152]. There are few medical informatics studies that investigate workflow activities that span multiple departments. Besides focusing on single departments, most studies focused on investigating only clinical departmental workflows [160], [161]. While some researchers have examined the various activities that affect departmental workflow such as information sharing and communication [162], others have focused on the effects of technology use such as EMR, CPOE and whiteboards on the departmental workflow [163], [164], [253], [254]. Finally, the medical informatics community has long been interested in the design of systems to support departmental workflows [163], [255]. But, the systems that support departmental workflows often fail to adequately support workflows that span across multiple departments. Although one critical factor that is crucial to patient transfers is the design of technologies that can support inter-departmental coordination, there has been less attention paid to technologies necessary to support larger inter-departmental workflows.

This research study has three significant contributions to the medical informatics (MI) field. First, the thesis sheds light on the non-clinical staff activities during patient transfers such
as resource allocation and planning, management of transport services that help manage patient flow activities in the hospital. The second contribution is based on providing deeper insights on a workflow (e.g. patient transfer) that not only involves more than one department but also depends on the coordination between clinical and non-clinical departments. Furthermore, I investigate the challenges to both the clinical and organizational aspects of the patient transfer workflow. Finally, this thesis provides deeper insight into the design of systems that can support inter-departmental workflows. High quality of care can be achieved by developing such hospital-wide coordination systems that can support the work of clinical and non-clinical departments. The different socio-technical design issues to achieve effective inter-departmental coordination are described. By improving the design, these systems help reduce the fragmentation of the care process by mitigating the negative cross-level interactions between coordination activities.

Future Work

I will continue the stream of research that I have been currently exploring with respect to coordination in hospitals. I have analyzed my future work into five main categories:

Exploring Cognitive Aspects of Coordination Behavior

In this dissertation, I mainly focused on the social aspects of coordination behavior between departments. However, my findings point to the importance of mentalities (frames of mind) of competing teams in managing effective inter-departmental coordination. An ED nurse manager commented on the effect of competing mindsets of different departments on coordination of a shared patient transfer activity: “Culturally, the mindset of inpatient departments is that we are creating work for them. And they want to manage their day without
the surprise of a new patient from the ED. I think they need to change their culture – it’s not a surprise that a new patient is coming in. The inpatient departments know that we are going to fill up half this house, so they should plan. It shouldn’t be ‘Oh there is a patient in the ER waiting to come here’, instead it should be ‘Oh, they are a little late’. So I think culturally that’s why it is difficult for the inpatient departments to want to take report from us. Cultural changes are going to be hard and painful”.

Therefore, as part of future work, I would like to investigate the cognitive aspects of inter-departmental coordination work. In particular, I will closely examine the role of factors that affect inter-departmental workflow such as department efficacies, knowledge, skill, training and experience in cognitive coordination. Additionally, I want to explore the role of related factors such as collaborative sense-making and common ground in activities that require inter-departmental decision making. Help to understand how people represent information and how it affects the coordination decisions. For instance, how the representation of information by a department affects its comprehension by another department.

Furthermore, although in my thesis research, I explored the role of healthcare information technologies in coordination of patient transfers, there was very limited exploration of cognitive elements of technology use and staff-technology interactions. Therefore, in the future, I will investigate the effect of structural aspects of EMR and bed board systems (e.g., organization of UI elements) and how they affect healthcare practitioners’ effectiveness. Another research stream that I would explore on healthcare practitioners’ use of EMR is the effect of interruptions (especially in critical care settings) and how it increases the possibility of errors. Through this endeavor, I want to examine the effect of interruptions on physician performance and productivity (with current research showing that sometimes interruptions are good, e.g., such as providing critical information).
By examining the cognitive aspects in addition to the social aspects of coordination behavior, we can match the design requirements with the healthcare practitioner’s mental models which can consequently result in effective coordination systems. To pursue this, I will be supplementing my current research methods by additional methods such as cognitive task analysis, critical incident methods, process-tracing and verbal protocol analysis [256, 257].

Evaluating the Effects of Negative Cross-Level Interactions

Having stressed the importance of mitigating the effects of negative cross-level interactions, we also need to evaluate its effect on not only organizational but also clinical outcomes. For instance, I want to assess the effects of negative cross-level interactions on medical errors and other adverse events occurring in hospital environments. This is important because currently, medical errors cause approximately 98,000 deaths every year in the United States [258].

Evaluating the Impact of External Factors on Hospital Coordination

I would extend my research to investigate factors external to the hospital such as hospital transfers, patient re-admissions, ambulance diversions and their effects on hospital coordination goals including patient flow, patient colocalization, patient safety and quality of care. I also want to examine the following questions such as: (a) Do these external factors lead to negative cross-level interactions?, (b) What and how meta-coordination activities can help mitigate the effects of these external factors, (c) Are the three meta-coordination activities effective in accommodating the effects of the coordination challenges created by the external factors?
Exploring Coordination Activities in Non-Academic Hospitals

Currently, I have examined the coordination practices at an academic hospital. Consequently, my thesis research findings may be influenced by certain characteristics that are unique to academic hospitals such as time spent on teaching residents. Therefore, to generalize my findings, I want to collect data at a non-academic hospital. This will provide insights on whether there are any differences in the coordination challenges that occur at the intersection of intra- and inter-departmental coordination activities between academic and non-academic hospitals. And also, help me explore whether other types of meta-coordination activities are used to mitigate these challenges. This can eventually help me in replicating my research findings to provide robust design guidelines for healthcare processes and systems.

Exploring a Clinical Inter-Departmental Activity

Finally, I want to investigate the inter-departmental coordination of a distributed clinical activity to ascertain whether similar negative cross-level interactions occur and explore types of coordination mechanisms used to mitigate their effects. For instance, it would be interesting to examine the coordination of scheduling tests and return of results between the laboratory and the ED. These findings can have significant impact on improving clinical inter-departmental workflow processes.

Concluding Remarks

In this thesis, I studied the challenges to maintaining an organizational workflow, with a particular focus on investigating the effects of coordination practices on managing an inter-departmental activity. In doing so, I identified a unique type of coordination challenge (i.e.
negative cross-level interaction) that occurs when intra-departmental and inter-departmental activities affect each other. Furthermore, I have uncovered a particular type of articulation work (i.e. meta-coordination activities) that helps mitigate these negative cross-level interactions. By closely examining and demonstrating the nature and characteristics of meta-coordination activities I have expanded the concept of articulation work; the articulation work that is performed to maintain the continuity of organizational work.

Building on the understanding of the nature and characteristics of meta-coordination activities, I provide insights on the socio-technical design issues that need to be considered when developing new or improving upon existing healthcare informatics tools and technologies. The findings on the relationships between interdependencies, coordination challenges, negative cross-level interactions and meta-coordination activities and its characterizations reported in this study are grounded in empirical data. However, as the future work section points out, there is still much that can be learnt and done.
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Appendix A: Data Collection

Non-Electronic Artifacts

Patient Handoff Form

<table>
<thead>
<tr>
<th><strong>Patient Handoff Form</strong></th>
<th><strong>Addressograph</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Required for any temporary relocation of a patient if not accompanied by primary care provider.</td>
<td>Nurse Contact: ___________________</td>
</tr>
<tr>
<td>Place inside pink chart in front pocket</td>
<td>Phone #: ___________________</td>
</tr>
<tr>
<td>&quot;MUST COMPLETE ALL AREAS&quot;</td>
<td></td>
</tr>
</tbody>
</table>

| Date: ___________________ | Nurse Contact: ___________________ |
| Procedure: ___________________ | Phone #: ___________________ |
| Primary Diagnosis: ___________________ | |

<table>
<thead>
<tr>
<th><strong>Safety Concerns</strong></th>
</tr>
</thead>
</table>
| Code:  
- Full  
- DNR  
- DNI  
- Limited Support: ___________________ |
| Allergies: ________________ |
| Isolation Type:  
- Contact  
- Droplet  
- Airborne  
- N/A  
| Restraint Device: ________________  
- N/A  
| Fall Risk:  
- Yes  
- No  
| Communication Barrier:  
- No Barriers  
- HOH  
- Deaf  
- Vision  
| Language: ________________  
- N/A  
| Transfer:  
- Independent  
- 1 assist  
- 2 assist  
| Other Pertinent Information: ________________  
- N/A  

**Return Communication - Treating Location**

- No change in patient condition

- Change in patient condition
  - Call Unit, Verbal Report given to: ___________________
  - Write note in progress note

Contact Name for questions: ___________________

Phone #: ___________________
### Patient Transfer Report

**Receiving area gets call from Patient Placement giving room assignment, etc.**  
Receiving nurse calls sending nurse for report

- Receiving unit room number  
- Current unit room number

- Patient Name  
- Medical Record Number

- Age  
- Weight  
- Attending (Primary Service)

**Chief Complaint**

**NOTES:**

**Sending Nurse:**

<table>
<thead>
<tr>
<th>Diagnosis/es</th>
<th>Surgical procedure/s</th>
<th>Other medical problems</th>
</tr>
</thead>
</table>

**Review of systems**

<table>
<thead>
<tr>
<th>Neuro (orientation)</th>
<th>CV (heart rate/rythm, monitor, base, etc)</th>
<th>Respir (breath sounds/rhythm, f/c)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GI (Loose stools, abdomen)</td>
<td>BP: P: R:</td>
<td>GU (catheter, urine, dysuria)</td>
</tr>
<tr>
<td>Pain (scale/score, extremity)</td>
<td>L&amp;D, IV fluids, Drip, EBL</td>
<td></td>
</tr>
</tbody>
</table>

**Labs**

<table>
<thead>
<tr>
<th>Allergies</th>
<th>Isolation</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRSA y n</td>
<td>VRE y n</td>
</tr>
<tr>
<td>Resp y n</td>
<td>Other</td>
</tr>
</tbody>
</table>

**Palliation**

<table>
<thead>
<tr>
<th>Pump Programming</th>
<th>Tubes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Profile</td>
<td></td>
</tr>
</tbody>
</table>

**Special Equip/needs** (bed, neebrine, 1, 2, etc)

**Meds**

---

*Not for inclusion in medical record*
I illustrate how I used this template to guide my data collection during my shadowing of patient transfer activities. The example highlights a patient transfer that occurred from the ED (i.e. sending department) to NSD (i.e. receiving department).

<table>
<thead>
<tr>
<th>Patient location</th>
<th>Person responsible for patient</th>
<th>Current tasks performed</th>
<th>Artifacts used</th>
<th>Collaborators</th>
<th>Challenges affecting patient transfer task</th>
<th>Additional Work</th>
</tr>
</thead>
<tbody>
<tr>
<td>ED room no. 23</td>
<td>ED Nurse</td>
<td>Call patient report, taking vitals, preparing patient to leave, packing belongings, updating records, call transport</td>
<td>Phone, EMR, paper record of patient and pager</td>
<td>NSD nurse, Transport staff, ED attending responsible for patient, ED CN (charge nurse), IPA staff (in cases where clarifications and issues regarding the bed assignment occurs)</td>
<td>When report was called by ED nurse, the NSD nurse says that another patient is already there in the room and is not being discharged soon.</td>
<td>ED nurse informs the ED CN about this issue. Then the ED CN contacts the IPA staff to find out about the status of the room. The IPA staff contacts the NSD CN to inform her about this issue and find out why the room was put in as “dirty” when the patient was still physically present in the room. Then the IPA finds another available bed for the ED patient and makes the changes to system information. The IPA pages the receiving department about the ED patient. Once she gets the confirmation from the receiving department CN, the IPA pages the ED CN with the new bed assignment.</td>
</tr>
</tbody>
</table>
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Publications


