Challenges to inter-departmental coordination of patient transfers: A workflow perspective

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Objective: The purpose of this study is to identify challenges to inter-departmental coordination activities that affect patient transfer workflow and to provide socio-technical requirements for the design of technologies to better support patient transfer workflow.

Design: We conducted our study in two clinical and one non-clinical department at a major academic hospital. We utilized qualitative data collection techniques including observations of patient transfer practices of the different departments and interviews with departmental staff to collect data on the inter-departmental coordination activities and its effect on patient transfer workflow.

Results: We identified three inter-departmental challenges that affected the patient transfer workflow: ineffective inter-departmental interactions, ineffective information handoffs, and ineffectiveness of current information technologies.

Discussion: To address these challenges, we discuss three socio-technical design requirements that designers need to pay attention to while developing inter-departmental healthcare information systems. To ensure effective inter-departmental coordination, the systems should incorporate features that can support the mediating role of integrators, the collaborative balancing of goals, and the collaborative prioritization of resources.

1. Introduction

Patient transfers are an important aspect of hospital workflow; on average 40–70% of patients in inpatient departments of U.S. hospitals are transferred each day [1]. Consequently the patient transfer process impacts both organizational and clinical goals of the hospital. Currently, many hospitals function at 100% patient capacity. Therefore, on one hand, ensuring that patients are transferred efficiently and quickly is crucial to achieve effective patient flow within the hospital [2]. On the other hand, 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 can provide the services and care appropriate for those patients.

Furthermore, since patient transfers involve multiple departments the patient transfer workflow impacts not only activities within a single department but also activities that take place between multiple departments. Hence, one of the key features for maintaining effective patient transfer workflow is developing seamless inter-departmental coordination technologies. However, current healthcare technologies employed in most hospitals (e.g. electronic medical record and computerized patient order entry systems) are designed to be used primarily by clinical departmental staff and therefore, mainly are focused on patient care activities such as physician order entry, medication administration,
scheduling, and documentation of patient care summary and progress notes [3]. 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. Therefore, we need to design systems that can better support these types of coordination activities between clinical and non-clinical departments. However, before we can design these technologies, we need to first identify the challenges that affect inter-departmental coordination during patient transfers.

To examine the challenges to inter-departmental patient transfers, we conducted a qualitative research study at a large academic hospital in the Northeastern United States. We focused on the patient transfer workflow between two clinical departments and the role of a non-clinical department in managing this inter-departmental workflow. We utilized standard qualitative methods including observations and interviews. These methods have been widely used in medical informatics to help identify and provide a detailed understanding of complex interactions of technical and organizational issues [4].

The paper is organized as follows. In the next section, we present the relevant background research related to workflow and patient transfers. In Section 3, we describe our methodology where we highlight the study setting and data collection and data analysis methods. Next, we identify and describe three prominent challenges to inter-departmental coordination that can affect the patient transfer workflow. We then discuss some key socio-technical design requirements for developing information technologies to support inter-departmental coordination during patient transfers.

2. Background

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, few medical informatics studies have investigated workflow activities that span multiple departments; most have examined workflows within a single department [5,6].

Besides focusing on single departments, most studies investigate only clinical departmental workflows [7,8].

While some researchers have examined the effects of clinical activities that affect departmental workflow such as patient care team information sharing and communication [9], others have focused on the effects of clinical technologies such as EMR, CPOE and whiteboards on the departmental workflow [10,11].

Very few studies have examined the effects of organizational activities such as patient transfers on inter-departmental workflows. 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 [12,13] with an emphasis on transitions of care during patient handoffs [14] and its respective challenges such as adverse drug events and medical errors [15]. 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, we need to investigate patient transfer workflow from both an organizational and clinical perspective.

Besides these workflow studies 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 [16,17], ED boarding issues [18], and hospital bed management [1,19]. Much of this research focuses on mechanisms and technologies [1,20] that will help reduce the bottlenecks affecting patient flow. For example in a book edited by Hall [21], 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 modeling techniques, queuing theory, and patient flow project management tools. However, although patient transfer is 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 our analysis of existing research on patient transfer workflows, we identified three significant gaps in the medical informatics research. 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 effect on managing inter-departmental workflows. Finally, there is limited research that investigates the organizational aspects of the patient transfer process.

To address these gaps, we conducted a qualitative research study at a hospital. The study: (a) examines a workflow that involves more than one department, (b) describes the importance of non-clinical staff activities during patient transfers such as resource allocation and planning, (c) focuses on both the clinical and organizational aspects of patient transfer process, and finally, (d) identifies the challenges encountered in maintaining inter-departmental coordination and its effect on patient transfer workflow.

3. Methods

Qualitative methods are widely being used in the medical informatics domain [4,22–24]. These methods allow for a situated in-depth evaluation of the healthcare practices by focusing our attention on the interaction of people, information technologies, and organizational structures.

Qualitative methods allowed us to gain a deeper understanding of the specific details of the ongoing patient transfer process. These methods played an important role in this study—it helped us examine how patient transfers actually occur in hospitals and focused our attention on the inter-dependencies between multiple departments. Since these
interdependencies need to be understood in the context of patient transfer work, qualitative methods helped us develop a rich description of the environment, its users, and their interactions. It also helped us identify conflicts that could potentially impact patient transfer workflow. For instance, issues such as 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.

### 3.1. Data collection

We collected data in three departments: Inpatient Access Department (IPA), Emergency Department (ED) and Neurosciences Department (NSD) (Table 1). We utilized qualitative data collection techniques including observations and interviews to develop an understanding of work activities performed by the various departments involved in patient transfers in the hospital. In the medical informatics domain, these methods are used to investigate a variety of issues related to workflow, technology adoption and evaluation issues, and organizations [11,25].

**Observations:** Observations were used to capture both routine and non-routine events that arise during patient transfer activities, and to examine peripheral activities surrounding patient transfers. The observations were conducted during different times of the day to ensure that representative data was captured. The first author conducted approximately 440 h of observations of work activities in the three departments over a year (between February 2007 and October 2007, June 2008 and July 2008, December 2008 and January 2009).

**Interviews:** Interviews were used to obtain the perspectives of the different participants in the study on patient transfer issues. The first author conducted 72 formal semi-structured interviews and a number of informal interviews during her observational sessions. She conducted interviews with the various departmental staff and their respective managers, charge nurses of clinical departments, staff nurses, transport manager, house managers and other clinical heads. The questions focused on 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 formal interviews were audio recorded and lasted between 30 and 45 min. Informal interviews were conducted during the observations with IPA staff, admit nurses, physicians, physician consultants, residents, charge nurses, nurse managers, housekeepers, and department secretaries to clarify comments made during patient transfer activities.

### 3.2. Data analysis

The analysis was performed by closely reviewing the transcripts of the individual interviews and observation notes. We used the grounded theory approach [26] to analyze the data because of the exploratory nature of our study. We 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, dependencies, sequence of steps during patient transfer, various patient and information flows, examples of routine exceptions, and information breakdowns. We then reanalyzed the data to examine the relationships between the open codes and developed categories. Finally, we integrated the core categories to describe the patient transfer process and also the coordination challenges between departments that had an effect on the patient transfer workflow. We followed a “constant comparison” method where the constructs were compared and grouped together based on their similarities. The coding was first performed manually and then using Atlas.ti™ software. Due to the voluminous nature of data that required analysis, we performed both manual coding that helped us first develop an overview of the data and Atlas.ti™ coding that helped analyze themes and patterns of

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**Table 1 – Data collection methods.**

<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>Inpatient Access</td>
<td>Observation</td>
<td>Varied among sessions</td>
<td>Bed placement staff and IPA manager</td>
<td>175</td>
</tr>
<tr>
<td>Department</td>
<td>Interviews</td>
<td>18</td>
<td>IPA staff, IPA manager and house managers</td>
<td>10</td>
</tr>
<tr>
<td>Emergency Department</td>
<td>Observation</td>
<td>Varied among sessions</td>
<td>Charge nurses, staff nurses, physicians, residents, consults, transport staff, emergency technicians, registration associates and patient advocates</td>
<td>155</td>
</tr>
<tr>
<td></td>
<td>Interviews</td>
<td>29</td>
<td>Charge nurses, staff nurses, physicians, residents, consults and interim nurse manager</td>
<td>14.5</td>
</tr>
<tr>
<td>Neurosciences</td>
<td>Observation</td>
<td>Varied among sessions</td>
<td>Charge nurses, staff nurses, physicians, transport staff, and unit secretaries</td>
<td>110</td>
</tr>
<tr>
<td>Department</td>
<td>Interviews</td>
<td>25</td>
<td>Charge nurses, staff nurses and unit secretaries</td>
<td>12.5</td>
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<tr>
<td>Total data collection time</td>
<td></td>
<td></td>
<td></td>
<td>477</td>
</tr>
<tr>
<td>Total number of patient transfers observed</td>
<td></td>
<td></td>
<td></td>
<td>64</td>
</tr>
</tbody>
</table>
3.3. Research site

The study was conducted in three departments—Emergency Department (ED), Neurosciences Department (NSD), and Inpatient Access Department (IPA) at a large academic hospital with an advanced technological infrastructure. Consequently, the findings are generalizable to hospitals with similar characteristics. This hospital comprises of 501 hospital beds, and 50,000 Emergency Department visits per year. 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.

Inpatient Access Department (IPA): The IPA is responsible for the admissions, discharges and transfers both within and between hospitals. The bed placement team in the IPA plays a prominent role in facilitating patient transfers by ensuring a bed is available for patient who is being transferred. The bed placement team has 2–3 non-clinical staff members who assign patients to beds in the hospital and 1–2 clinical staff (i.e. nurses) who primarily support the non-clinical staff in their bed management decisions. For example, when a non-clinical staff member receives a bed request for a transfer patient with a diagnosis that does not sound familiar, the nurse would explain the bed requirements for the patient based on her diagnosis and condition to the non-clinical staff member. (The bed placement staff will be referred to as IPA in the rest of the paper.)

Emergency Department (ED): The team involved in the patient transfer process in the ED includes the charge nurse (CN), staff nurses, attending physicians, residents, and consulting physicians. 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. A staff nurse, in addition to the care delivery responsibilities, prepares the patient for transfer. For example, when a patient is assigned a bed in an inpatient department, the staff nurse physically transfers the patient. The attending physician contacts the consulting physician when she wants a patient to be admitted or evaluated by specialized physicians belonging to specific services. 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. The consulting physician makes the decision on whether to accept the patient to her service.

Neurosciences Department (NSD): 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 NSIMCU provides care for patients that do not require intensive care for diagnoses such as ENTs, brain seizures, heart alerts, traumas, and spinal injuries. Each unit has a charge nurse, staff nurses, and physicians. The team involved in patient transfer process includes the charge nurse, staff nurses, the attending physician, residents, and a triage officer. All team members share similar responsibilities as that of the ED staff except for the triage officer. The triage officer is a physician belonging to NSD. He screens and monitors the types of patients that get admitted to the department when there is a shortage in resources. For example, 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.

3.4. Systems used in patient transfers

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: The EMR is primarily used to support coordination of care activities within clinical departments. However, during the patient transfer process, the
sending and receiving department nurses use it to share clinical information with each other regarding the transfer patient. For example, when a patient is transferred from the ED to the ICU, the ED nurse uses the EMR to provide a 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. The EMR is also employed by the IPA. The IPA staff obtains patient admission, discharge and transfer (ADT) orders entered by physicians on the ADT tab of the EMR system. However, they do not have access to the clinical information contained in the EMR due to patient privacy issues (Fig. 1).

Bed board tracking system: The bed board tracking system is primarily used by the IPA staff to assign and manage beds within the hospital. 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. The bed board tracking system contains multiple columns, each column representing each department in the hospital. CNs use it to locate clean and available beds in the hospital (Fig. 2).

3.5. Ethical considerations

Before beginning the study, we received approval from the hospital’s Institutional Review Board. To protect the privacy of the patients, we did not record any information that could identify individual patients. Although observing the patient transfer process required us to physically be present during the process, we took careful precautions to ensure that we did not interfere with the transfer process.

4. Results

We briefly highlight the various inter-departmental activities involved in an ideal patient transfer workflow. We then identify three challenges that affect the inter-departmental coordination of the patient transfer activities.

4.1. Patient transfer process

Fig. 3 highlights the sequence of steps in an ideal patient transfer process between two clinical departments. As it highlights, there are a number of interdependencies between these departments that need to be managed to achieve timely transfers. For example, the physical transfer of patient from ED to NSICU requires the ED nurse to complete a set of activities such as calling for report and arranging transport for patient. Furthermore, the ED requires the IPA staff to complete a set of activities such as confirming the assignment, paging the CN of the NSICU before the transfer process can be initiated.

Although Fig. 3 depicts the ideal patient transfer workflow, many patient transfers had challenges that caused them to deviate from the ideal model. In the following section, we identify the challenges that affected these patient transfers.

4.2. Challenges to inter-departmental coordination of patient transfers

We highlight three prominent challenges to effective inter-departmental coordination activities and its effect on patient transfer workflow. These inter-departmental challenges are (1) ineffective inter-department interactions, (2) ineffective information handoffs and (3) ineffectiveness of information technologies.

4.2.1. Ineffective inter-departmental interactions

The interactions between the various departments play an important role in ensuring that patients are transferred to the right department. The two prominent interactions during patient transfers are between clinical and non-clinical departments, and between the sending and receiving clinical departments. We identified a number of factors that affected these interactions, which in turn hampered the patient transfer workflow.

Clinical/non-clinical departmental interactions: 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, decides who gets transferred to the first available bed. 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 interacted with the IPA. In a hospital, the clinical staff has significant control in most patient care activities. However, in the case of patient transfers, the IPA's non-clinical staff has complete authority over bed assignment decisions. Yet, the clinical staff, because of their “direct” involvement in patient care, believed that they should have the ultimate authority in any issue dealing with patient care including patient transfer. This affected their interaction with the non-clinical staff. 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". As a result, the clinical staff felt a loss of control regarding bed assignment decisions which often resulted in conflicts between the clinical and IPA staff. 

As a result, the ineffective interactions between clinical and non-clinical departments increase the possibility of inappropriate patient transfers and consequently hampered the smooth patient transfer workflow between departments. One of the house managers described how the 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”. 

Clinical clinical departmental interactions: The effectiveness of both patient care and patient transfer activities depend heavily on smooth collaboration between the sending and receiving clinical departments. However, the different workflows in their local departments affected their interactions with each other. 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. Consequently, the approach towards patient care is starkly different in the ED and NSD. As a result, the patients' increased length of stay in inpatient departments such as the NSD constrains the limited available resources creating a bottleneck in the patient transfer process. 

The varying levels of interest in ensuring patient flow also influenced the interactions between the clinical departments. While the ED was focused on achieving the optimum patient flow to accommodate the constant influx of new patients, the inpatient departments were not as committed to rapid patient flow because they did not have to deal with the same influx of new patients. As a result, often, only a preliminary evaluation was 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. When asked about this, an ED CN stated that “But that’s not our job”. However, this affected their collaboration during patient transfer activities. 

4.2.2. Ineffective information handoffs 

The IPA’s ability to arrange a patient transfer from ED to NSICU depends on receiving accurate and timely patient and nurse staffing information from both the ED and NSICU. However, the departments’ ability to meet their information needs was affected by two important factors: timeliness of information handoffs and withholding of information. 

The timeliness of information handoffs between clinical departments during patient transfers was critical in patient transfers in order to maintain the continuity of patient care activities. An important information handoff activity during patient transfer is the “calling of patient report”. During patient report, the sending department nurse provides the patient’s clinical information to the receiving department nurse. To initiate the actual patient transfer process, patient report should be provided once a bed is ready in the receiving department. However, delays often occurred when the receiving department nurses were not ready to receive patient report. For instance, as highlighted in the vignette below, the inpatient (e.g. receiving) department’s nurse was not ready to take report when ED nurses called. 

Once a NSICU bed becomes available, the ED nurse (EN) immediately contacts the NSICU nurse (NN) receiving the patient to give “report”. 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. As a result, the patient stays in the ED for couple of hours after the bed has been assigned. 

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. The delay in handing off information had a detrimental effect on the quality and detail of the information. 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 with other activities while waiting to give the report. Thus, the timeliness of information handoffs can have an effect on the completeness and accuracy of information shared between the departments, which consequently increases the potential risks of medical errors thereby affecting patient quality of care and safety. 

Another factor that affects information handoffs was the deliberate withholding of information. During the patient transfer process, clinical and non-clinical departments exchange information. To help the IPA with its bed assignment decisions, all the clinical departments had to provide bed availability information to the IPA. However, they did not always provide this information to the IPA for a variety of reasons. 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) when close to shift change. Furthermore, with a constant influx of patients, the nurses wanted to postpone the addition of another critical patient to their already extensive workload. As a result, the lack of information sharing by the clinical departmental staff affected the bed assignment decisions of the IPA. For example, there were several instances where information on patient movements was not shared with the IPA. An IPA staff member described the process of hidden transfers where patients got moved between units without their knowledge: “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”.

Nurses were able to “hide beds” in their departments for a short span of time, especially at the end of shift, by not providing information to the IPA staff. Although the withholding of bed availability information by the two clinical units helped the local clinical departmental workflows, it negatively impacts the coordination between the IPA and those departments. Without appropriate information, the IPA may not only make inappropriate assignments but also have to deal with temporary bottlenecks in the patient flow by holding up resources (beds). As a consequence of withholding of information highlighted in the example above, the IPA staff did not assign a patient to the available bed in Unit A based on the assumption that the bed was currently being occupied. Instead, the patient was assigned to another less-suited department. Thus, withholding bed information affected the normal patient transfer workflow of that department receiving the patient and also the IPA department by forcing them to deal with a patient that should have already been provided an appropriate bed.

4.2.3. Ineffectiveness of information technologies
One of the key requirements of information technology (IT) in the patient transfer process is the ability to support both intra-departmental and inter-departmental coordination activities at the same time. However, the bed board management system and the electronic medical record system were not as useful as they could have been in the patient transfer process.

Although the bed board is primarily designed to help the IPA staff in their bed management activities, the clinical departments could also access the system. This allowed the clinical departmental staff to maintain an awareness of other clinical departments’ bed availability. Charge nurses used the bed board to track the status of ongoing 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 problem for the IPA staff when they made unfavourable bed assignment decisions for a particular clinical department. 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)”.

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 was 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.

The detrimental effects of the passive awareness offered by the bed management system created conflicts between CNs and the IPA staff. These conflicts led to actions by the CNs such as withholding information regarding beds, refusing to accept transfers, and delaying discharges in order to avoid new admissions which subsequently affected the patient transfer workflow.

A related challenge cause 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 (Post Anaesthesia Care Unit) CN, based on bed availability information on bed board system, transferred a paediatric patient to the NSIMCU without giving prior notification of the transfer to NSIMCU and IPA. This particular incident disrupted the NSIMCU departmental workflow. The NSIMCU nurse had to search for additional monitors and a bigger sized bed to meet the special medical requirements of a paediatric patient. 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.

As a result of this unofficial transfer by the PACU, the inter-departmental coordination of transfer activities between IPA and NSIMCU were affected. 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 identify beds in other departments that would be appropriate for this patient.

In the patient transfer process, the EMR is used by physicians to record transfer/admit orders when they decide to transfer a patient to their respective department. The information on the EMR is organized into tabs. Although this particular tabbed browsing feature helped the admitting physicians, it failed to adequately support the transfer activities of other care providers such as the ED nurse and charge nurse. 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.

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 neurology 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.

Because of the fragmented and compartmentalized nature of information in the EMR, there were several instances where nurses continued their normal care activities without realizing that transfer orders had been entered into the system. Unless they checked the status on orders of their patients, the nurses knew about the transfer only when they were notified.
that beds were available to move their admitted patients. This lack of awareness significantly disrupted the nursing activities and their plan for their care activities, which consequently affected the patient transfer workflow. Since, the staff nurses in the ED are simultaneously responsible for the care of 4 or more patients, they often do not have sufficient time to check for order changes on the EMR. This created a significant lag between when the physician enters the orders and when the nurse checks for order updates. As a result, delays in the subsequent patient transfer activities are introduced and beds remained unoccupied for couple of hours, which introduced bottlenecks in patient flow.

5. Discussion

In this section, we discuss three socio-technical issues that should be considered when designing health information technologies to support patient transfer activities in particular and inter-departmental workflow in general.

5.1. Socio-technical design issues

Medical informatics researchers have highlighted the importance of socio-technical requirements for the design of healthcare technologies [22,27,28]. The central tenet of this approach is that information technology is intertwined with the organizational context of work [29–31]. Therefore, in order to design information systems that can help alleviate some of the inter-departmental coordination challenges that affect patient transfer workflow, designers need to pay attention to the socio-technical requirements for those systems. We identified three socio-technical design requirements to facilitate the inter-departmental coordination: (1) supporting the mediating role of integrators, (2) supporting the collaborative balancing of goals, and (3) supporting collaborative resource prioritization.

5.1.1. Mediating role of integrators

Integrators [32] are often entrusted with the responsibility of managing organizational coordination and helping bridge the perceived gap between humans and their use of information systems [33]. Integrators play an important role in the patient transfer process by facilitating inter-departmental coordination activities. They can identify problems that affect patient transfer workflow and serve as arbitrators during the patient transfer process. One example of an integrator in our research setting is the capacity officer. The capacity officer is a physician with administrative responsibilities. He resolves conflicts and other discrepancies in transfer decisions between admitting physicians and IPA staff. For example, he screens the inappropriate patients, helps identify patients that can be downgraded, and also convince physicians to accept urgent patient cases.

Because of their background, the integrators can help mitigate the inter-departmental coordination challenges related to ineffective interactions by bridging the gap between the departments. However, their current role in the research site is mostly reactionary in nature. For instance, the capacity officer only intervenes when the normal procedures for patient transfer is not working. Consequently, rather than monitoring and proactively dealing with potential problems, the integrator is primarily resolving already existing problems. Instead, the integrators should play a more proactive role in the patient transfer process. For instance, they can not only “push” inappropriate patients from their department but can also “pull” appropriate admitted patients. The continuous push and pull model can reduce the number of backlogs in clinical departments by preparing the hospital to meet the anticipated patient demand for particular services.

To support integrators, we need to develop system features that can help them take a more proactive role in the patient transfer process. To support their active role, integrators need features that connect both clinical and non-clinical information to rapidly assess the individual departmental status and overall hospital needs. The availability of information in this manner would help them monitor the patient transfer trajectory [34]. Using this information, they can rapidly identify and then contact the particular department that is causing the backlog and help them expedite the transfer process. 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, average time for patient transfer from these departments, average and peak daily admissions can 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.

5.1.2. Collaborative balancing of goals

The collaborative balancing of goals allows individuals representing different departments to jointly evaluate their goals in order to identify the conflicting goals and minimize the effect of these goals on each other’s activities and workflow. During this process, the various staff can share their departmental perspectives, and also simultaneously become aware of varying perspectives and concerns of other departments regarding specific patient transfers. This can help mitigate the inter-departmental coordination conflicts caused by the lack of information sharing. Furthermore, the collaborative balancing of transfer goals can support rapid bed assignment decisions while at the same time ensuring that minimal individual departmental goals are compromised. This becomes extremely useful in patient transfer situations where decisions have to often be made with incomplete information, uncertain diagnosis, and changes in patient condition.

Therefore, coordination mechanisms such as collective negotiation [35,36] is needed to support staff in collaboratively balancing of goals. 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 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. Consequently, when designing inter-departmental workflow technologies, we need to pay attention to specific features that can support collective negotiation. One mechanism to support the negotiation tasks among the various CNs and IPA staff is the use of shared workspaces [37,38]. Foster et al. [37] 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 [38] 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.

In patient transfer coordination, a shared workspace can provide a medium for persistent storage of interaction history and negotiation pattern. For example, information such as results of negotiations, departments that participated in the negotiation, negotiation-compliant vs. negotiation-non-compliant departments, negotiation frequency, frequently encountered negotiation problems, patient transfer scenarios. Such information can help participants to better accommodate other departments’ requirements and needs.

5.1.3. Collaborative resource prioritization

Collaborative resource prioritization allows individuals to jointly rank the available resources in the order of importance. This is closely linked to collaborative balancing of goals. However, while goals focus on larger organizational issues, resource prioritization focuses on specific resources need to achieve the goals. In patient transfer process, the collaborative resource prioritization process can provide a common forum for different departments to discuss their patient care needs and resource priorities.

In order to allocate the available resources appropriately, the relevant resources priorities of all the departments that are affected by the patient transfer decision have to be considered. Furthermore, the CNs can not only voice their opinions on inappropriate resource assignments made by the IPA, but also notify them of urgent resource needs for patient transfers in their departments. This can help mitigate the inter-departmental coordination challenges related to ineffectiveness of technologies that affect the patient transfer workflow. Since the CNs are part of this process, they are aware of the status of their patient transfers. Therefore, this awareness will help 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.

Since this activity involves the joint prioritization of immediate departmental requirements and resource needs, departments have to forego some of their local autonomy in order to support inter-departmental coordination activities. This joint activity is a tradeoff between local control of departmental resources and global access to information about resources from other departments.

Therefore, to better support the collaborative prioritization of patient resources, features such as information triage have to be incorporated to facilitate and ensure the continuous management of bed assignment information. Especially in a dynamic organization such as a hospital, there is constant influx of new clinical and organizational information that requires continuous monitoring to appropriately assign patients to beds. Information triage [39] can be used to categorize and prioritize of information based on the relevant criteria. 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.

Similar to the features described earlier to support the collaborative balancing of goals, information systems that support information triage will allow the CNs and the IPA staff triage access to different kinds of departmental information (high priority vs. low priority patient cases). The triaged information can then be used to make appropriate bed assignments. The details of the triage process can be documented (such as departmental priorities, available resources) for future use. A collaborative shared space with video-communication facilities can be used to develop a priority list of the patients by comparing the similarities and differences across multiple departments in terms of patient needs and available resources. With this type of communication, there may be less likelihood that, for instance, beds may be hidden because there will be a greater opportunity for everyone involved in the inter-departmental process to understand the intra-departmental resource needs of the participating departments. 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.

6. Conclusion

The findings from this study highlight the complex and multi-departmental nature of patient transfer workflow. This study also starts to lay the foundations for future research examining other issues related to patient transfer workflow such as the role of hierarchical power structures in hospitals, workers’ self-interest, and unintended consequences of information technologies. For instance, the first challenge related to the ineffective inter-departmental interactions is impacted by the perceived status differences between the staff members of the various clinical and non-clinical departments. Researchers have discussed the role of professional hierarchies between physicians and nurses [40]. Our study highlights the importance of understanding the role of hierarchy between clinical and non-clinical staff in hospital activities such as patient transfers. The second challenge of ineffective information handoffs may be driven in part by workers’ self-interest. Researchers have been investigating the reasons for ineffective handoffs between care providers [41]. Our study highlights the possibilities that workers’ own particular needs may affect the how and when they share information during patient transfer workflow. Consequently, we need to examine how information technology can play role in ensuring ethical behavior in activities such as patient transfers. Finally, the
Summary points

What was already known:

- Patient transfer process has been analyzed primarily using quantitative mechanisms such as simulation modeling techniques and queuing theory as a way of modeling patient flow in the hospital.
- The effects of the coordination of patient “care” activities on intra-departmental workflows.
- The importance of designing technologies to support clinical workflows in single departments.

What the study has added to our knowledge:

- We utilized qualitative methods to highlight the details of challenges that affect the patient care transfer process. We identify challenges that developers of health information technologies should be aware of when designing to support this process.
- We have identified three major challenges to the coordination of patient transfer activities on inter-departmental workflows: (1) ineffective inter-departmental interactions, (2) ineffective information handoffs and (3) ineffectiveness of information technologies. We provide details of how these challenges occur and how they affect the patient transfer process.
- These inter-departmental coordination challenges highlight the importance of designing technologies to also support multi-departmental workflows.

last challenge related to ineffectiveness of information technologies could have been affected by the issue of unintended consequences of IT. The use of existing clinical technologies such as electronic medical records and computerized patient order entry systems [42–44] in processes that they were not designed for (i.e. patient transfer) may have unintended consequences that need to be studied. We need to understand the potential organizational and other uses of clinical systems in order to minimize their unintended consequences on hospital workflow.

Patient transfer is an important process that affects not only clinical but also organizational aspects of the hospital workflow. The effectiveness of patient transfers depends on the seamless coordination between multiple departments. Yet, there are a number of challenges that can disrupt inter-departmental coordination activities. Consequently, through this study, we contribute to the medical informatics research by providing a detailed understanding of patient transfer workflow, with a particular emphasis on (a) the challenges to inter-departmental coordination and its effect on patient transfer workflow and (b) the socio-technical issues that need to be considered when designing inter-departmental workflow management tools. To address the challenges raised in this paper and better support patient transfer activities, we need to examine the clinical, organizational, and technical issues in an integrated manner.

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