A Qualitative Study of Risks Related to Interhospital Transfer of Patients with Nontraumatic Intracranial Hemorrhage

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Goal: Interhospital transfer (IHT) facilitates access to specialized neurocritical care but may also introduce unique risk. Our goal was to describe providers' perceptions of safety threats during IHT for patients with nontraumatic intracranial hemorrhage. *Materials and Methods*: We employed qualitative, semi-structured interviews at an academic medical center receiving critically-ill neurologic transfers, and 5 referring hospitals. Interviewees included physicians, nurses, and allied health professionals with experience caring for patients transferred between hospitals for nontraumatic intracranial hemorrhage. Interviews continued until data saturation was reached. Coding occurred concurrently with interviews. Analysis was inductive, using the constant comparative method. *Findings*: The predominant impediments to safe, high-quality neurocritical care transitions between hospitals are insufficient communication, gaps in clinical practice, and lack of IHT structure. *Insufficient communication* highlights the unique communication challenges specific to IHT, which overlay and compound known intrahospital communication barriers. *Gaps in clinical practice* revolve primarily around the provision of neurocritical care for this patient population, often subject to resource availability, by receiving hospital emergency medicine providers. *Lack of structure* outlines providers' questions that emerge when institutions fail to identify process channels, expectations, and accountability during complex neurocritical care transitions. *Conclusions*: The predominant impediments to safe, high-quality neurocritical care transitions between hospitals are insufficient communication, gaps in clinical practice, and lack of IHT structure. These themes serve as fundamental targets for quality improvement initiatives. To our knowledge, this is the first description of challenges to quality and safety in high-risk neurocritical care transitions through clinicians' voices.

Key Words: Patient transfer—intracranial hemorrhages—qualitative research—quality improvement—communication—interview

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Introduction

As critical care grows more regionalized, the need for interhospital transfer (IHT) is increasing, especially for acute neurologic emergencies requiring neurological specialists or resource-intensive care.[1-3] However, common gaps in IHT processes present threats to patient safety, including incomplete documentation and mismatched priorities between referring and receiving hospitals.[4-6]

IHT exposure for patients with nontraumatic intracranial hemorrhage has been shown to be associated with longer ICU and hospital lengths of stay, lower likelihood of being discharged home, lower Glasgow Outcome Scale scores, and worse 3-month cognitive outcomes.[7-10] Exposure to IHT may even be associated with higher mortality.[10] However, the etiology of the relationship between IHT and patient outcomes cannot be further elucidated by prior work conducted using administrative claims data, retrospective chart review methods, and observational designs that lack clinical detail and clinicians' perspectives.

In 2015, our institution conducted a root cause analysis following 2 cases of transferred patients with nontraumatic intracranial hemorrhage with poor outcomes that triggered creation of a multidisciplinary quality improvement (QI) project team. This team developed a multimodal problem analysis plan as a critical first step to systems-based QI.[11] Specifically, this team sought a rigorous qualitative evaluation of providers' perspectives on the safety threats inherent in IHT. Qualitative methods are increasingly used in healthcare implementation science to reveal underlying drivers of observed differences in outcomes, explore the etiologies of rare safety events, and offer in-depth insight into complex healthcare-related questions.[12-14] While previous qualitative studies have uncovered quality and safety threats inherent to care transitions within hospitals[15,16] and have explored referring physicians' decision-making regarding IHT destinations,[6] the safety threats unique to acute neurological emergencies and exposure to IHT have not been examined.

The purpose of this paper is to understand safety threats related to IHT in a manner that can be used by neurocritical care clinical teams, researchers, and QI professionals when designing interventions that address these underlying safety risks.

Materials and Methods

Study Design

We selected a semistructured interview method to elicit underlying perceptions and explore individual providers' experiences with IHT.[17] This project was deemed QI work and exempted by the IRB as human subjects research. We report study design and findings following the Consolidated Criteria for Reporting Qualitative Studies[18] (see Supplement).

Study Setting and Context

Semistructured interviews were conducted between June and September 2016, as part of a larger QI initiative aimed at improving transfers of care into our urban 1541-bed academic medical center (AMC) receiving patients via IHT, and 5 referring hospitals within the state. Our hospital receives approximately 600 IHT per month, of which approximately 20 are nontraumatic intracranial hemorrhage patients. Our institution faces limited neurointensive care unit (NICU) bed capacity in conjunction with preferential emergency department (ED) accessibility to some diagnostic modalities, including advanced imaging. As such, most IHT for patients with nontraumatic intracranial hemorrhage involve admission through the ED rather than direct transfer to the NICU. IHT into our institution is coordinated by paramedics located at a call center at our main hospital campus.

Definitions

To ensure consistency across interviews, the study team developed consensus definitions for our clinical focus. While nontraumatic intracerebral hemorrhage and subarachnoid hemorrhage vary clinically, this project does not differentiate between them, as many referring hospitals' diagnostic tools and providers are unable to definitively identify the type of hemorrhage upon initial noncontrast imaging available at the time of transfer. Thus, we define these 2 separate diagnoses under one diagnostic umbrella, nontraumatic intracranial hemorrhage. In addition, we defined IHT as any transfer originating at an outside hospital, including those within the same health system as our institution, but not from extended care facilities, doctor's offices, or other nonhospital facilities.

Data Collection and Sampling

Most prospective interviewees were identified using purposive sampling. Project investigators (J.E.S., K.N.S., C.C.M., L.T.L.P., and A.K.V.), physicians involved with IHT of relevant patients, identified key stakeholders to interview with a goal of ensuring inclusion of both frontline and leadership staff with in-depth knowledge of relevant transfers. In addition, snowball sampling was used, with some interviewees referring other potential interviewee types to ensure inclusion of all key informants. For example, snowball sampling identified blood bank and pharmacy as important service lines to include in this project. Prospective interviewees were invited to participate by email. The emailed invitation explained the goals of the interview project and noted that participation was voluntary; 4 invitees did not respond to our request. Interviews were scheduled at a time and location convenient to interviewees; most were conducted in-person (n = 21),

either in the interviewees' clinical area or office, with the remaining conducted by phone.

Interviewers followed a semistructured interview guide, developed with input from project investigators. Separate guides were developed for referring and receiving hospital participants. The guides followed largely the same format, beginning by assuring interviewees of confidentiality, then asking about general perceptions of IHT for patients with nontraumatic intracranial hemorrhage, threats related to these transfers, and ideas or models for improvement (see Supplement). The average interview lasted 26 minutes. Interviews were conducted until data saturation was reached, with the final few consecutive interviews resulting in no new codes or new insight being shared.[19] With participant permission, all interviews were audio-recorded, professionally transcribed, and then imported into Atlas.ti (Scientific Software, Berlin, Germany, Version 7) for coding and analysis.

Data Coding

Coding occurred concurrently with interviews. Analysis and code key development were inductive, using the constant comparative method, where code key components are compared and revised as needed across interviews.[20,21]

The coding team was comprised of 3 authors (E.B.F., M. J.C.B., and A.P.R.), representing public health and social work, and was complemented by 2 emergency medicine and critical care clinicians (J.E.S. and E.G.M.), who verified the coding of clinical details. Each transcript was reviewed line-by-line by each coder individually, and then by the coding team together. Through iterative review, the coders developed a code key representing similar themes across transcripts. Disagreements in codes were discussed and resolved by group consensus. Interviews and coding continued until data saturation was reached, at which point the code key was finalized and applied to all transcripts.

Data Analysis

Findings from the coding team's analysis were presented to interviewees and stakeholders in a group setting. This allowed the team to ensure shared sensemaking, that is, that the analysis accurately represented how all involved stakeholders conceptualized these issues. The project lead (A.K.V.) presented the findings from this study, and facilitated a moderated discussion with attendees to validate the main themes and generate ideas for addressing the identified threats.

Results

We conducted 32 interviews (see Table 1 in supplement for demographics), including 25 from the receiving hospital, 5 from referring hospitals, and 2 from transport teams. Interviewees included clinicians and staff from diagnostic radiology (DR), emergency medicine (EM), neurology/neuro-intensive care, neurosurgery, the IHT coordination center, bed management, blood bank, and pharmacy.

We identified 3 broad threats to high-quality, safe care transitions for patients with nontraumatic intracranial hemorrhage; while some do not originate in the IHT process itself, they are amplified through the IHT process (Table 2). The first threat, *insufficient communication*, highlights the unique communication challenges specific to IHT, which overlay and compound known intrahospital communication barriers. The second, *gaps in clinical practice*, revolves primarily around the provision of clinical care for this patient population, often subject to resource availability, in the receiving hospital ED. The third, *lack of structure*, outlines providers' questions that emerge when institutions fail to identify process channels, expectations, and accountability during complex care transitions.

Insufficient Communication

Multiple interviewees compared communication about this patient population to the children's game of telephone, with frequent chances for critical details to be missed or mistaken.

Communication Between Hospitals

When discussing communication between referring and receiving hospitals, interviewees identified challenges with 2 primary communication modes: verbal (by phone) and paper-based documentation. The overarching challenge was inadequate information from the referring hospital, with interviewees noting frequent gaps in referring hospital documentation:

> *"You never know what they've done [at the referring hospital], why things were done." (NICU fellow)*

Relatedly, several interviewees felt that access to referring hospital imaging was lacking. While most referring hospitals can utilize electronic image exchange software, prior imperfections in the data system created variability in care processes. One participant discussed the issue of poor interoperability between image exchange software and the receiving hospital's picture archiving and communication system:

> *"There's a real challenge there. I mean, ideally, given the fact that the patient is coming from a distance, all the imaging should be delivered into our PACS system before the patient arrives. I can't even come up with a good excuse anymore" (DR attending)*

A neurosurgery resident explained why it would be beneficial to have more referring hospital imaging sent electronically before requesting a transfer:

Table 1. *Interviewee demographics*

Position	Referring hospitals	Transport teams	Receiving hospital								
			Interhospital transfer coordination ctr	Emergency medicine	Neuro-intensive care	Neurosurgery	Diagnostic radiology	Blood bank	Bed management	Pharmacy	Total
Leadership role		1	1					1			3
Attending (physician)	4			2	1	1	1				9
Fellow (physician)					1						1
Resident (physician)				3	1	2	2				8
Advanced practice provider					2						2
Nurse				2	1						3
Paramedic		1	2						1		3
Other	1									1	3
Total	5	2	3	7	6	3	3	1	1	1	32

"I know a lotta the hospitals in the state now have access to our system and [could] upload images themselves, which would be nice 'cuz before the patient arrives we already know what it looks like and we could already — 'This patient will likely need the OR, or they would likely need a ventriculostomy.' We're all ready to go."

Another challenge was accurately understanding a patient's clinical status based on details shared by the referring doctor requesting IHT. A neurosurgery attending shared:

"Certainly there are many instances where the information that you get makes the patient sound like it's a lower acuity level. Then they get here, and you realize that, actually, the information is incorrect. This should be treated with a higher acuity level, and then you have to switch gears."

One referring hospital EM attending shared his thoughts on how to improve the transfer process. He felt that if he had the opportunity to work closer with the receiving hospital, he could provide better care for this patient population:

"I don't know…what services are offered at [the receiving hospital]…If the accepting provider has expectations, it would make it easier."

Communication Between Receiving Hospital Services

When discussing communication between receiving hospital services involved with nontraumatic intracranial hemorrhage patients undergoing IHT, interviewees identified 3 main gaps.

First, several interviewees felt that notification and handoff between services were insufficient. EM providers are often not notified when an IHT patient has been accepted for transfer via the ED. In addition, the NICU team does not always receive sufficient detail about a patient being admitted to them:

"If it is a neurosurgical patient we don't know anything because the neurosurgical resident who is admitting the patient will just send you like a one liner like, 'Hemorrhage coming up, large hemorrhage coming up needs EVD [extraventricular drain].'" (NICU fellow)

Second, some EM respondents expressed a need for clearer guidance on the clinical care of these patients from the specialty services. Several EM interviewees mentioned receiving conflicting guidance, typically blood pressure management goals, a scenario with which a NICU attending could empathize:

"…there are probably situations where the neurosurgery attending says, 'I think the blood pressure should be below 140 systolic,' and then I say, 'Well, I think the blood

Table 2. *Quality and safety threats associated with interhospital transfer*

Insufficient communication	Gaps in clinical practice	Lack of structure
Communication between hospitals	Nurse-to-patient ratio	Uncertainty as to which specialty service(s) to consult
Communication between receiving hospital services	Emergency Medicine provider relative inexperience with neurocritical care	Confusion identifying admitting service
Communication within the same service	Inadequate blood pressure management	Ambiguity of responsibility for patient care
	Delayed anti-coagulant reversal	Lack of awareness of existing protocol
	Difference in definition of urgency	

pressure should be below 180 systolic,' then the ED is probably sitting there, scratching their heads, going, 'What are we supposed to do?'".

This challenge was felt to be exacerbated by delays resulting from the teaching hospital model, in which specialty services evaluate patients with a series of increasingly experienced providers. While the specialty service residents' time to initial consult was deemed timely, an EM resident noted:

"...very noticeable delay between them seeing the patient and us getting our recommendation."

Last, documentation was often noted to be inadequate, which, given increasing reliance on electronic health record documentation for care communication, resulted in questions about the care provided in the ED. A NICU Physician Assistant shared:

"...did they get the anticoagulant reversal agents in the ED? Do they still need them? . . . It's not documented."

Communication Within the Same Service

The primary challenge identified regarding within-team communication revolved around notification of all relevant team members. Interviewees across service lines spoke to the potential for improving care by sharing pertinent details with the entire team, especially among the neurosurgical service. An EM resident noted:

"The (neurosurgery) residents don't usually know about the patients who're incoming when I call and speak to them."

Gaps in Clinical Practice

While several interviewees mentioned cases where care at the referring hospital ED could have been better, more time was spent discussing concerns about the quality of care provided in the receiving hospital ED.

Nurse-to-Patient Ratio

Across services, interviewees noted that nontraumatic intracranial hemorrhage patients require ICU-level resources, which they felt could not be delivered in the ED. A NICU fellow shared,

"...they may not have the nursing availability to keep a close eye on blood pressure control in the emergency department."

This sentiment was shared by an ED nurse:

"When the patient comes in, most likely they're coming to the Emergency Department because the NICU's full. That's the part where it actually gets tricky...where you then hang onto patients for six-plus hours. Upstairs, it'd be one-on-one care, and down in our department, it can be one-to-four. That's the part that gets stressful."

EM Provider Relative Inexperience with Neurocritical Care

In addition to the case load, several EM respondents felt uncomfortable with select aspects of clinical management typically provided in the NICU, including administering hypertonic saline and managing extra-ventricular drains (EVDs):

"If they're having to stay a couple hours in the ED...then you're giving medications you're not as familiar with. Mannitol and stuff, that's basic stuff we do, but then when you talk about hypertonic saline and management of that...it's like, all right, those are things that you're not as comfortable with." (ED nurse)

To alleviate anxiety around EVDs specifically, NICU providers created an EVD Alert to support non-NICU providers managing EVDs:

"...we've developed an EVD alert for any patient outside of the Neuro ICU. We will have routinely gone to the medical ICU or to the ED, Peds, whatever, to assist with the placement and teaching the maintenance of EVD." (NICU nurse)

Inadequate Blood Pressure Management

Specialty service interviewees had different perceptions of ED-based blood pressure management, ranging from dissatisfaction:

"Any time a patient sits in the ER, unless you stay at bedside, their blood pressure's not gonna be managed appropriately" (neurosurgery resident)

to equivocation:

"I think that the ED being in tune with blood pressure control would be a good thing, not that they are not but maybe we are hyper vigilant about it" (NICU fellow)

to satisfaction:

"A lot of the ED nurses, they know already if blood pressure is in the 200s and they're not on a Nicardipine drip, they'll just start that." (neurology resident)

Overall, interviewees' perceptions seemed to indicate that ED-based blood pressure management could be improved.

Delayed Anticoagulant Reversal

Interviewees described several barriers to timely reversal of anticoagulants, including difficulty staying up-to-date on new blood thinners and their reversal agents, and challenges in ordering, obtaining, and administering reversal agents. Also, interviewees reported that EM providers often ordered incomplete coagulation studies. These challenges contributed to at times significant delays in anticoagulant reversal. An EM attending stated:

"We've seen some cases with four-hour delays, more than ten-hour delays. I'd probably say across the board, we very rarely get these agents to patients within 60 minutes."

Difference in Definition of Urgency

Perhaps compounding the above challenges, an interesting dichotomy in sense of urgency became apparent when comparing EM to specialty service interviewees. Specialty service providers were frustrated by the loss of each individual minute:

"…for every minute that we don't do this, this patient may not be able to walk in the future, this patient may not be able to think in the future." (NICU attending)

However, EM interviewees expressed satisfaction of gaps of 10 minutes or longer.

Interviewer: "How long does it take for neurosurgery to come down?"

Interviewee: "Actually, coming down they're pretty good. I mean granted, crazy things happen, but in general they are down assessing the patient in 30 minutes of being called." (EM resident)

Lack of Structure

Interviewees reported several safety threats resulting from the lack of a protocol to guide care transitions for this patient population. This lack of structure took several forms.

Uncertainty as to Which Specialty Service(s) to Consult

Interviewees across services discussed EM providers' uncertainty over which specialty service should be consulted upon patient arrival. As shared by a neurosurgery resident,

"…there are lots of hemorrhages where the emergency room only calls the neurology team and then some hemorrhages where they only call the neurosurgery team…it depends on who composes the team downstairs."

Confusion Identifying Admitting Service

EM interviewees felt that challenges identifying the admitting service delayed ICU-level care and potentially risked patient safety, with several expressing frustration with the neuro-intensivist and neurosurgery teams debating which service would admit a patient. An EM resident shared,

"Nothing is more frustrating or time consuming and just kind of bad for the patient care overall for the services to be fighting over who won't take the patient. It's a big old headache."

In addition, several interviewees discussed some EM providers' perception that if neurosurgery accepted a patient for IHT, they were responsible for admitting that patient. While inconsistent with institutional guidelines, interviews indicate that this perception exacerbates confusion and frustration for all involved.

Ambiguity of Responsibility for Patient Care

Insufficient structure was also evident in a sense of uncertainty as to who is responsible for the patient while in the ED. A neurosurgery attending reports that:

"…as far as the ER team's concerned, neurosurgery or neurology's already been called. That's their patient. As far as neurology or neurosurgery's concerned, the patient's still in the ER. There can be some questions about who's actually running the show."

A NICU attending explains how this can affect care:

"Getting [the anti-coagulant reversal agent] into the patient quickly is a little bit of a challenge. It's time-dependent… The ED team's definitely responsible for writing the order, but who's actually responsible for getting [it]…It's always a bit of an open question. … it's not one of those things where…the neurology consultant's job ends once you tell the ED resident to put the order in. The idea is that your job's not over until the FFP is actually in the patient."

Lack of Awareness of Existing Protocol

Many interviewees expressed a desire for an intracranial hemorrhage protocol, like the well-known stroke or trauma protocols, to guide clinical care for these patients:

"There needs to be a quote-unquote code for these patients so everyone should be alerted and should have their attention on these patients" (neurosurgery resident)

However, such a protocol has existed for several years:

"…it was probably five years ago that we came up with the first ICH and SAH protocols" (EM attending)

Discussion

Critically-ill patients with nontraumatic intracranial hemorrhage often undergo 3 distinct transitions in care during IHT: into the referring hospital; from referring hospital to receiving hospital ED; and from receiving hospital ED to inpatient unit—each of which is prone to unique latent safety threats related to the complex IHT process. Our work identified 3 distinct areas for improvement: (1) inadequate communication, (2) gaps in clinical practice, and (3) lack of structure guiding the IHT process. While suboptimal communication and concerns regarding care quality and safety were recurrently identified as threats, lack of structure appears to be an underlying driver across all themes.

Our work expands upon prior work demonstrating quantitative differences in outcomes based on patient exposure to IHT by utilizing qualitative data to develop a more comprehensive understanding of the IHT structure and associated processes that may contribute to differences in outcomes. Notably we found that rather than a lack of clinical knowledge that could be amenable to educational interventions, most clinicians identified a lack of clinical processes and communication as specific gaps that may hinder safe care transitions and be valuable targets for improvement.

Prior work studying the safety of IHT processes identified incomplete information transmission from the referring hospital, and longer transfer times and distances as safety threats originating in the IHT process itself.[4,5,7,22] Our work confirms the perceived risks associated with inadequate information transmission processes and notes that they are not remedied solely by the adoption of electronic health records and may even be exacerbated by some electronic data systems. Improving clinical practice is dependent, at least in part, on timely and complete data transmission; as such, the standardization of communication and development of new health IT tools is likely necessary to successfully improve care transitions in this regard.

Interestingly, some of the risks identified do not originate in the IHT process itself, and thus reach patients with nontraumatic intracranial hemorrhage even when initially presenting to an AMC for evaluation. As such, lessons from this study designed to address IHT can be applied to the more general care processes for critically-ill patients subject to care transitions within the same institution. Previous evidence has demonstrated that processes of care for various nonneurological conditions can be standardized and improved by implementing local care pathways and guidelines to reduce ambiguity and variability in practice[23-25]; we embarked on such an initiative locally based on the focused gaps in clinical practice such as blood pressure management and anticoagulant reversal.

Our study not only confirms prior research documenting the complexity of communication in AMCs amidst the inherent hierarchy and diffusion of responsibility, but also amplifies the importance of creating common agreements regarding accountability during complex care transitions involving multiple specialty services.[26-28] The serial evaluation of critically-ill patients by trainees of different levels prior to the directly responsible attending physician is noted as a potential delay to care and decisions; the involvement of multiple specialty services compounds this delay. By building cross-service line accountability and fostering direct, attending-to-attending communication, ideally before the IHT patient arrives at the receiving hospital, all relevant care providers have a clearer sense of not only the overall care plan but also their individual roles and responsibilities within it.

The findings of this work must be interpreted within the limitations of its design. As a single-system study utilizing in-depth qualitative methods, it is possible that specific barriers to safe care transitions that are unique to our local context may be overemphasized while failing to capture other obstacles present in different hospitals or health systems. However, given the consistency of our findings with both prior work and concurrent local work utilizing other quantitative and qualitative methods, we believe the broad principles and themes identified in this work may be both generalizable and actionable for QI purposes. Also, our study was conducted with the framing of each interview to a specific clinical syndrome, nontraumatic intracranial hemorrhage. While we identified many threats to care transitions that are likely universal and agnostic of condition, additional or distinct threats to care transitions may have been identified by a study grounded in a different clinical condition or less dependent on multiple specialty services.

Each of the challenges identified in this work has subsequently informed the development of a comprehensive multimodal QI initiative within our institution to structure to the process of IHT for patients with nontraumatic intracranial hemorrhage. Specifically, we improved communication by designing a process that promotes prearrival attending-level discussion between specialty services and emergency medicine. We also developed a notification system, to alert all relevant providers, including nursing leadership, upon patient arrival at the ED. To address gaps in clinical practice, we developed standard clinical guidance specifying blood pressure goals and anticoagulant reversal protocols for statewide dissemination and integration into EMR for ED providers. To ensure process standardization we developed an explicit communications sequence and patient accountability agreement through the IHT coordination center.

Interviews with providers involved in the transfer of nontraumatic intracranial hemorrhage patients between hospitals suggest that IHT is a complex process primarily challenged by insufficient communication, gaps in clinical practice, and a lack of IHT structure. As the care of critically-ill neurologic patients is increasingly regionalized to improve access to specialized services and interventions, QI initiatives should utilize this framework for designing care transitions that minimize safety threats inherent in IHT.

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Supplementary Material

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