Barriers to Interorganizational Knowledge Transfer in Post-Hospital Care Transitions: Review and Directions for Information Systems Research

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Abstract: Post-hospital care transitions involve coordination and continuity of care from hospital providers to patients and community providers. These care transitions represent a domain of high-risk interorganizational collaborations. However, a conversation about how health information technology (HIT) can enhance interorganizational

Journal of Management Information Systems / 2015, Vol. 32, No. 3, pp. 48–74.

ISSN 0742–1222 (print) / ISSN 1557–928X (online)
DOI: 10.1080/07421222.2015.1095013

knowledge transfer during care transitions is largely absent in the information systems literature. We conducted a review of qualitative studies of post-hospital care transitions to better understand barriers to knowledge transfer in high-risk interorganizational collaborations. Our analysis highlights how time pressures inhibit multilateral knowledge transfers, accommodation of fluctuating absorptive capacity, and reconciliation of knowledge and goal conflicts. We advance research questions that focus on HIT capabilities to ease these barriers.

KEY WORDS AND PHRASES: absorptive capacity, health information technology, healthcare transitions, interorganizational knowledge transfer, IS design, knowledge management.

Imagine a diabetic patient who undergoes an amputation in the hospital. The surgeon and nurses who discharge him teach him how to take care of his wound during recovery. They also instruct him to follow up with his primary care physician (PCP) and physical therapist (PT) in two weeks. Then the surgeon sends the PCP and PT a document that summarizes the care provided during the patient's hospitalization, medications prescribed, and additional information about his diabetes. Groggy from his pain medication, the patient has forgotten how he was taught to manage his wound; he was discharged so quickly. The wound has gotten infected. The patient makes an appointment to follow up with his PCP, but when he shows up, the PCP's staff members cannot locate the summary document. The PCP now has to question the patient for details about his surgery to provide effective follow-up care.

The scenario is a common example of care transitions that occur when patients have been hospitalized and get discharged. Care transitions include "the set of actions designed to ensure the coordination and continuity of healthcare as patients transfer between different locations or [between] different levels of care within the same location," such as within and between hospitals, nursing facilities, and primary or specialty care offices [17, p. 549]. When patients transition from a hospital setting, they often have to manage their own care or seek follow-up care with community provider(s). In this paper, we focus specifically on care transitions that originate from hospitals because of the high risk and vulnerability present for patients post hospitalization [47]. Knowledge transfers between these organizations and with patients are essential during care transitions to ensure continuity of care [47, 59].

Knowledge transfers occur at multiple boundaries during care transitions: (1) between hospital providers and patients, (2) between hospitals and community providers, and (3) between patients and community providers. By providers, we refer to organizations providing clinical care. These organizations comprise clinical staff, such as physicians, nurses, therapists, and pharmacists, from multiple medical professions. By community providers, we refer to nonhospital providers, which include primary care physicians (PCPs), nursing homes, and rehabilitation centers.

Care transitions present a phenomenon of interorganizational knowledge transfer in a complex environment. Knowledge transfers between knowledge senders and

recipients in care transitions and hospitalizations often involve nonrepeated interactions under time pressure: patients might be referred from or referred to providers with whom they have had no prior interaction [54, 83]. Providers also coordinate with other providers with whom they may not have existing relationships [73]. Most knowledge transfer pairings are thus individually determined. For instance, a patient interacts with a surgeon about an amputation procedure, hoping it will be the last amputation the patient may undergo. Likewise, the patient's PCP and surgeon may not have previously worked together. This sort of sender–recipient relationship might neither result from nor produce any ongoing relationship between the knowledge senders (hospital providers) and knowledge recipients (patients and community providers). Knowledge transfer processes and sender–recipient relationships in care transitions are often exacerbated by large multidisciplinary teams [38, 54, 88], short lengths of stay [2, 11, 70, 77], and time pressures (e.g., [58, 61, 86]), all of which limit the time available for knowledge transfers. However, task interdependence requires the need for effective knowledge transfers across organizational boundaries [13, 26, 73].

Prior information systems (IS) research recognizes the importance of knowledge transfers in health-care settings (e.g., [53]). However, the focus has been on intraorganizational health information technology (HIT) (e.g., electronic medical records). Research on interorganizational knowledge transfers during care transitions is limited. Some IS scholars have begun to examine how HIT can support providers [1] and patients (e.g., [3, 52]) during care transitions, but HIT solutions that focus on organizations separately in care transitions may be inadequate.

This paper identifies barriers to knowledge transfer during care transitions and advances research questions for developing HIT capabilities to ease these barriers. To identify barriers, we reviewed qualitative studies in the health-care literature. We focused on qualitative studies because they provided the richest data, with details on knowledge senders, knowledge receivers, and knowledge transfer processes. Based on the results, we developed research questions for HIT capabilities.

We grounded our conceptual analysis of knowledge transfer challenges in care transitions using the interorganizational knowledge transfer model of Easterby-Smith et al. [25]. We defined interorganizational knowledge transfers during care transitions as exchanges of knowledge between sender and recipient organizations. Like providers, patients are independent legal entities and are thus considered here as separate "organizations." We refer to knowledge senders as organizations that are knowledge sources and knowledge recipients as organizations that acquire knowledge. Factors identified by Easterby-Smith et al. that influence interorganizational knowledge transfers include characteristics of knowledge senders and recipients (e.g., absorptive capacity), nature of knowledge (e.g., complexity, ambiguity), and interorganizational dynamics (power, social ties) [25]. Absorptive capacity refers to the ability to recognize the value of, assimilate, and use knowledge [16].

A key finding of our review is that knowledge transfers in care transitions are multilateral; that is, knowledge transfers from knowledge senders involve two or more groups of knowledge recipients. Time pressures inhibit multilateral knowledge

transfers between knowledge senders and recipients by affecting many of the barriers in the Easterly-Smith et al. model [25]. Because of time pressures, certain knowledge transfers were avoided and replaced solely or partly by the use of a knowledge artifact (e.g., the discharge summary); this knowledge artifact was not adapted to the needs of different recipients. Our review also found that patients' absorptive capacity seemed to fluctuate over time throughout care transitions and across patients. Patients' deteriorating emotional and physiological conditions during and immediately following hospitalizations appeared to decrease absorptive capacity and impede knowledge transfer. Our review also alluded to the fact that knowledge senders could positively influence knowledge recipients' absorptive capacity but often did not manage to because of time pressures. Finally, goal conflicts between providers across organizations and professions presented patients with conflicting knowledge. However, given time pressures, providers were often unable to reconcile their goal differences. Conflicting knowledge inhibited application of knowledge by both providers and patients.

Based on these findings, we advance a number of research questions for future IS research on HIT capabilities. First, we develop research questions to guide the development of HIT capabilities for facilitating multilateral knowledge transfers under time pressure. The questions center on improving the identification of dynamic knowledge needs and the efficiency of knowledge dissemination, as well as on streamlining nonrepeated knowledge transfers to multiple recipients. Second, we explicate research questions for analyzing HIT capabilities that can accommodate fluctuations in recipients' absorptive capacity. These questions include roles of HIT in enabling continuous assessment of recipients' absorptive capacity and streamlining of recipient-appropriate knowledge transfer, amid time pressures. Finally, we propose research questions to improve our understanding how HIT can enable knowledge senders and recipients to address goal and knowledge conflicts.

Conceptual Background

Interorganizational knowledge transfer and care transitions

Interorganizational knowledge transfers have been studied by many IS researchers, but not in the health-care context (e.g., [34, 67, 68, 78]). Patnayakuni et al. [63] included a review of this stream of literature. IS scholars have examined (1) capabilities of interorganizational IS [34, 67, 68, 78] and (2) the importance of relationships between organizations [36, 64] for interorganizational knowledge transfer.

To understand care transitions, we leverage Easterby-Smith et al.'s [25] model on interorganizational knowledge transfers. The model builds toward an efficient knowledge-transfer capability. We chose this model as a backdrop for our review because it is based on a comprehensive review of the interorganizational knowledge transfer literature in organization sciences. The authors see knowledge transfers as

dyadic interactions between donors and receivers and recognize that roles and relationships change over time [25]. They also note that power relations can change over time, as learning by recipients affects their dependence on the knowledge sender. The model specifies resources and capabilities of donor and recipient firms, the nature of knowledge, and interorganizational dynamics [25]. Among many factors in the model, the authors incorporate absorptive capacity [16], power relations, trust, risk, structures and mechanisms, and social ties. They also consider the tacitness, ambiguity, and complexity of knowledge in knowledge transfers because all of these characteristics affect the rate of assimilation and retention during knowledge transfers [5].

In our care transitions context, we call donors knowledge senders. The recipient firms, or organizations, are labeled recipients (e.g., patients or community providers). In care transitions, recipients' absorptive capacity is important because knowledge receivers need to be able to receive and apply the knowledge during their care transitions to advance their recovery. Many factors in the Easterby-Smith et al. [25] model are thus relevant in care transitions. What is particularly salient in care transitions is the highly specialized nature of the knowledge from diverse professional fields. The specialized knowledge contributes to complex power relations that can complicate knowledge transfers.

Existing literature in IS in other contexts provides guidance on ways in which we can begin to think about easing these barriers [14, 41, 56, 60, 85]. For instance, Markus [56] put forth a theory of knowledge reusability in situations in which knowledge needs to be accessible to multiple types of users at different times. Knowledge repositories alone were insufficient; human intermediaries or facilitators were needed to facilitate knowledge reuse. Other information technology (IT) capabilities discussed include analysis and visualization capabilities to reduce information overload during knowledge discovery on the web [14], operations support systems and interpretation support systems [41], and the use of boundary objects and networks [35, 41]. These capabilities provide suggestions on designing HIT that have not been explored in existing HIT research.

Health information technology in information systems research

In this section, we review selectively HIT literature by IS scholars. We adopt a broad definition of HIT that includes IT used in provider organizations, as well as patient-driven IT, such as personal health records, health applications, and online communities and websites. Although the HIT literature spans many disciplines, we primarily review literature in IS journals.

Several IS researchers have begun to examine the ability of HIT to improve the knowledge bases, and consequently absorptive capacity, of knowledge recipients, especially of patients, during patient recovery. Patients' knowledge bases can be improved by participation in online health-care communities [51], use of web-based health infomediaries for patients' medical decision making [82], and online health

websites [55]. Although social media and other HITs have improved the diversity of knowledge sources for patients, these channels are directed toward improving patients' knowledge for self-care and less toward improving knowledge transfer across organizations and professions.

IS scholars have also focused on HIT and knowledge senders, although to a lesser degree. Research on clinical decision support systems has examined how providers can determine the probabilities of patient hospital readmissions [1] to aid decision making about discharges and care plans. Some studies focus on knowledge transfers between providers within hospital settings, for instance, between hospital and subspecialist physicians in care transitions [53]. Although the research contributes to our understanding of the dynamics of knowledge transfers between various providers across organizations, it has not explicitly accounted for the interorganizational context. Power issues and conflicting knowledge can compound the challenges of transfer across organizational boundaries.

Moreover, IS research has examined knowledge senders and receivers independently of each other and without considering hospital and community providers and patients as part of the knowledge transfer process. Hence, HIT developments are not examined in terms of how they facilitate knowledge transfer during complex and multilateral care transitions. For instance, Li et al. [52] sought to understand how to get patients involved in personal health record (PHR) systems, but they did not explicate the capabilities required of these PHR systems for patients or for other roles that might be present in care transitions. Angst and Agarwal [3] focused on making knowledge in electronic medical records available in an identified way to those who have permission to access it, and to others without such permission, in a de-identified, aggregated format. They investigated ways to influence patients' attitudes toward these electronic medical record (EMR) systems. However, community providers were not considered [3].

In addition, HIT studies also illustrated the need for HIT design to consider the context of knowledge transfer, that is, care transitions that differ from other contexts [51, 64]. Leimeister et al. [51] discovered that a virtual community supporting breast cancer patients was unlike other virtual communities due to the characteristics of the participants and nature of the knowledge shared. The breast cancer virtual community had to account for disease incidence that brought with it extreme physical and physiological stress and the sensitive and sometimes stigmatized nature of the knowledge discussed (i.e., breast cancer). This resulted in the need for a comprehensive informational resource that had high trustworthiness, not only in terms of the content, but also of its members.

Overall, the IS literature has improved our understanding of HIT by knowledge senders and receivers, but it provides only glimpses of the complex, interorganizational knowledge transfer processes of care transition. IS scholars also have not theorized about these capabilities in light of the severe time pressure faced by knowledge senders and recipients during care transitions. We need a more coherent understanding of barriers to knowledge transfer during care transition processes and of how HIT can facilitate such processes.

Methods

This review complements the systematic reviews on care transitions in the health-care literature that focus on health-care outcomes, such as rates of readmissions (e.g., [49]). These reviews draw on quantitative studies and focus less on processes that occur during care transitions. Conclusions from some reviews have been mixed, and no consensus has been reached on how to improve care transitions [69, 92]. To complement these outcomes-focused reviews, we focus on knowledge transfer processes. Our process perspective may provide suggestions for resolving the mixed conclusions of the outcome-focused reviews; however, our primary focus in this paper is on deriving research questions for HIT research.

To analyze knowledge transfer processes, we limited our review to qualitative articles reporting on empirical findings and observations of barriers and contextual factors in care transitions. Our methods involved searching, content screening, and analyzing a set of articles.

Searching

To search for articles, we used the following key words: *knowledge or information and/or transitional care, discharge planning or care coordination*, and their Boolean combinations; the search ranged from 2010 to 2014 in MEDLINE and Web of Science databases, which index health-care journals. The key words for identifying the context were adapted from existing systematic reviews conducted on the care transition process [47]. We retrieved 3,781 articles. From this set, we added the following three terms: *interview, focus group*, or *qualitative* to exclude studies that used quantitative methods, such as randomized control trials and surveys. Protocol papers dictating plans for study, review papers, policy papers, and papers focusing on predictive factors of discharge or readmissions were also excluded because the papers did not report empirical observations or findings on knowledge transfer processes. These exclusions left us with 662 papers.

Content Screening

Next, we read the abstracts of the 662 studies to screen the studies for their contexts and patient populations. The papers that did not address care transitions after hospital discharge were not reviewed. Any nonqualitative articles not filtered out by the search terms were also excluded. We also excluded nonhospital discharges, such as, within-hospital transfers, day surgeries, and emergency department discharges. Within-hospital transfers involved intraorganizational, not interorganizational, knowledge transfers. Day surgery patients referred to patients who underwent surgery in the hospital or clinics and were discharged on the same day. This group of patients represented lower levels of vulnerability and risk than patients who had to be admitted to hospitals. Emergency Department (ED) discharges were

also excluded, as patients were discharged directly from the ED without a hospital admission. Pediatric patients were excluded because of their limited decision-making authority, which would have introduced questions of agency. Content screening reduced the number of articles to seventy.

We also searched on "hospital" and "discharge" in the key management and IS journals. They included *Management Science, Academy of Management Journal, Academy of Management Review, Administrative Science Quarterly, Organization Science, European Journal of Information Systems, Information Systems Journal, Information Systems Research, Journal of the AIS, Journal of Information Technology, Journal of MIS, Journal of Strategic Information Systems*, and *MIS Quarterly*. Only six papers were retrieved, none of which addressed the post-hospital discharge care transition knowledge transfer process. All six were excluded from this review.

Analysis

The analysis was iterative and involved three rounds. The first round focused on analysis of the factors in the Easterby-Smith et al. [25] model, including knowledge sender and recipient characteristics (e.g., absorptive capacity), interorganizational dynamics (e.g., structures and mechanisms, power relations), and the nature of knowledge. The codes for the first round are listed and marked with an asterisk in column B of Table 1.We also noted mechanisms used during knowledge transfer (i.e., use of HIT and artifacts) and knowledge transfer processes, which are highlighted in column B. All the constructs outlined in the Easterby-Smith et al. [25] model were observed across the studies reviewed. However, "other barriers" also emerged in the first round of analysis that were not represented as factors in this model.

The second round focused on these "other barriers." We classified these barriers as knowledge and goal conflicts, time pressures and temporary lapses in absorptive capacity (see Table 1, column B, without an asterisk).

In the third and final round, we returned to the reviewed articles to understand these other barriers and arrived at the findings reported in the next section. To our knowledge, these barriers (Table 1, column C) have not been well examined in the existing IS literature on HIT. The list of articles reviewed is included in online supplemental Appendix A. Access can be requested from the first author.

Findings

Finding 1. Time pressures prevailed and impeded the ability to engage in methods for effective multilateral knowledge transfers

Time pressure was omnipresent in knowledge transfer during care transitions [30, 58, 61, 86]. Because of this time pressure, knowledge transfer was often avoided [22, 33] or discharge summary documents were used extensively as knowledge

Table 1. Rounds of Analysis Conducted

(A) Quotes[1]	(B) Codes[2]	(C) Emerging findings
"It is not always so obvious to answer their questions. In primary care, we have a lot of different patients; patients with psychiatric problems, patients with heart diseases, etc. We see a lot. It is not easy to know everything." [90]	Absorptive capacity of knowledge sender*	
Although aware of their chronic illnesses, some patients tended not to acknowledge the severity of their illnesses or the implications of their symptoms. [12]	Temporal lapses in absorptive capacity	Patients' Fluctuating absorptive capacity
All participants appreciated the follow-up program because their medication knowledge had increased, participation had made them feel safe, they were reassured about the appropriateness of their medications, and they had become more involved in their own medication. [31]	Absorptive capacity of knowledge recipient*	
The majority of participants accepted medicine changes in the hospital and after discharge because they trusted the doctors. "If they'd have given me a ton of them [medicines], I would still have taken them because they know better than I do." [8]	Trust and risk*	
"I believe the hospital could initiate more meetings . . . it costs the hospital money when the patient is readmitted. . . . Of course I could have initiated meetings myself but it is an effort to organize during a busy day." [84]	Time pressures	

“The meeting is dominated by the physician, in that he or she determines the agenda, speaks the most, initiates lines of discussion, contributes the key statements, and summarizes and concludes the discussion.” [65]	Power relations*		
“Complex medication regimens make it difficult to reconcile medications unless the patient or their caregiver is a good ‘historian.’” [45]	Nature of knowledge*		
“I think it is very important that you work with a more or less fixed team. Now, you say [to the patient], ‘find a healthcare professional, do whatever.’” [90]	Social ties*		Knowledge and goal conflicts prevailed
“When he’s been in the hospital, he’s got heart trouble, then you go again, no he hasn’t got heart trouble. It’s very confusing. . . . See one says he has, one says he hasn’t.” [22]	Knowledge conflict		
“The surgeon thought I just needed radiation after surgery and the oncologist said no, she thought I needed chemo. So after they discussed it, I made the decision myself. . . . The decision was up to me.” [91]	Goal conflict		
“ They have computers over there. So the information should be on each other’s screens I thought (Patient)” [22]	Use of IT		HIT solutions are inadequate

[1]The above quotes were all direct quotes from the articles. However, the anecdotes within quotation marks were specific quotes provided by the patients or providers interviewed in the studies.

[2]Codes are from Easterby-Smith et al. [25].

*The codes for the first round are listed and marked with an asterisk in column B.

artifacts for multilateral transfers. Discharge summaries were often not tailored to the needs of specific knowledge recipients [8, 81]: patients and their community providers received the same copy of the discharge summary. Problems associated with discharge summary documents as knowledge artifacts will be described in further detail in Finding 4. Overall, the avoidance of interorganizational knowledge transfers and uninformative knowledge transfer artifacts (discharge summary documents) led to poor knowledge transfers.

Time pressures were weighty and notable in knowledge transfer processes (e.g., [58, 61, 86]). Hospital providers recognized the need to transfer knowledge to patients and community providers to enable follow-up care [13, 26, 73], but hospital and community providers and patients perceived time pressures as a major barrier to knowledge sharing (e.g., [58, 61, 86]). As such, approaches that might have accommodated the time pressures remained unexplored. Patients and their families were often excluded from discussions due to time pressures, despite their attempts to reach out for and encourage knowledge sharing [50, 61]. The busyness of staff and stress of hospitalizations and care transitions discouraged conversations, explanations, and other meaning-making interactions [8, 46, 80] for knowledge transfer. Patients could sense the time constraints and often felt intimidated about asking questions [44, 88]. They often heard about their care during a hospitalization or during follow-up from second-hand sources, (e.g., other providers instead of the surgeon who performed the procedure) [57], or not at all [22]. As one patient stated, "I needed some serious education about some things. . . . I didn't know if they were not explaining things to me because I was not going to live much longer and it was just not worth it" [30, p.266].

Multiple providers in the studies we reviewed described having little time for coordination of care, which compounded frustration when community providers or patients had difficulty contacting hospital providers by phone for follow-up questions [20, 22, 23]. Given time pressures, some community providers gave up trying to contact hospital providers to obtain knowledge and avoided knowledge transfers from hospital providers. Instead, they relied on patients as the chief source of knowledge about what transpired during the hospital stay [62, 84]. The following quote illustrates this reliance on the patient: "The nursing report is missing . . . but we know the patient well, so it is okay and not necessary" [84, p.7]. This problem appeared to be pervasive [9, 62]; knowledge transfers between hospital and community providers were consistently poor: "For none of the patients included in our study was the patient's health information able to 'follow him/her' throughout the entire pathway of care" [62, p.9]. Providers stated that "[caregivers] can provide hospitals with information about the patient that is not documented in the health record" [84, p.6]. Failure of hospital–community provider knowledge transfers resulted in community providers' reliance on patients and their family members as chief knowledge sources. However, patients often could not provide knowledge effectively, as they encountered difficulty remembering what they were instructed [8, 75].

Finding 2: Knowledge senders' abilities to accommodate patients' fluctuating absorptive capacity were impeded by time pressures

The review highlighted fluctuations in knowledge recipients' absorptive capacity throughout care transitions. Emotional and physiological conditions appeared to decrease absorptive capacity and impede knowledge transfer [8, 61, 76, 80]. Time pressures inhibited knowledge senders' abilities to assess recipients' absorptive capacity [11, 29, 93] and limited opportunities for interactions that could improve recipients' absorptive capacity [8, 46, 80].

Decreases and sometimes temporary lapses in absorptive capacity were reported. Diminished absorptive capacity might result from patients' emotional and physiological conditions or from the physical or emotional stamina needed by providers in a complex health system [10, 12]. For instance, patients' engagement with the knowledge was often low during hospitalization. They frequently reported feeling physically unwell during the hospital stay, mentally compromised, and disoriented by medications [21, 61, 76, 80]. Poor physiological conditions thus led to decreased knowledge-seeking and diminished self-care efficacy during or after discharge [26, 61, 76]. However, providers reported that time pressures inhibited assessments that would have made apparent the patients' trajectory and fluctuations in absorptive capacity [11, 12, 27, 29, 66, 93]. For instance, providers explained that getting to know recipients personally over the course of care enabled them to uncover obstacles related to recipients' lack of knowledge and to essential knowledge that might not have been evident to other providers [12]. However, time pressures inhibited these interactions [38, 54, 88].

Time pressures also exacerbated disorientation resulting from multiple transfers between locations during care transitions between organizations [9, 11]. Rushed discharges and multiple abrupt transitions between organizations exacerbated patients' disorientation, even when they were not cognitively impaired [4, 9]. Patients were given little notice about transitions and insufficient time to prepare for the discharge (mentally and logistically), further reducing patients' absorptive capacity during discharges that limited their abilities to navigate care transitions.

The review also suggested that time pressures prevented knowledge senders from engaging in knowledge transfer practices that could improve recipients' absorptive capacity [8, 9, 46, 80]. When knowledge transfers occurred, timing knowledge transfer accordingly to recipients' absorptive capacity was important for improving patients' absorptive capacity [4, 10, 31, 81]. When knowledge senders engaged patients in knowledge transfer, patients reported feeling confident and able to "put the pieces of a puzzle together" to manage their expectations of their conditions and treatments [61]. Effective knowledge transfer eased their concerns, reduced anxiety, and improved their absorptive capacity [4, 31, 81]. Unfortunately, knowledge transfers that accommodated fluctuations in absorptive capacity did not occur because of the time pressures experienced by knowledge senders [8, 9, 22, 46, 80].

Finding 3: Knowledge and goal conflicts prevailed, and reconciliation was inhibited by time pressure

The review indicated that knowledge conflicts often emerged over time as more providers across professions and organizations with varying therapeutic goals became involved in care for the patient [9, 44, 71]. Faced with conflicting knowledge, some patients sought external knowledge that resulted in further conflicts [48, 79, 80]. However, providers often faced time pressures and did not discuss the conflicting knowledge [9, 22, 23]. Conflicting knowledge inhibited patients' application of knowledge [44, 46, 81].

Conflicting knowledge was a result of varying therapeutic goals for patients of multiple providers across professions and organizations. Goals were prioritized differently by different providers during decision making, as reflected by the following statement: "I assess things from a nursing point of view . . . and then the physio [therapy] might come in and see things differently. . . . We are trying to tell the patient what to do and what not to do. The goals where we are meeting are a bit different" [50, p.10]. Providers' focus on their own specialties contributed to these differences in goals [7, 50, 81].

The findings suggested that time pressures were one of the key factors that inhibited reconciliation of goal and knowledge conflicts [6]. When knowledge donors and senders created a shared understanding between themselves, they could bridge the differences between their goals [39, 42, 73], as illustrated by the following: "Gradually, we accepted that each group had a completely different approach to the problem—that we came from different areas of expertise. The geriatric nurse helped us to speak the same language" [73, p.4]. Interactions thus promoted communication and effective knowledge transfer. However, face-to-face interactions between multiple providers were often not feasible because of time pressures [73]. As such, goal conflicts continued to perpetuate in many knowledge sender–recipient relationships.

In addition, providers often ignored the conflicting knowledge presented by the patients [23], or they deferred to the other provider [22, 23]. For instance, when patients questioned the conflicting advice from different providers, providers were noted to reply: "Well, quite obviously, somebody didn't understand your situation" [23, p.280]. Community providers also deferred to specialist knowledge senders when conflicting knowledge was observed during follow-up care. "One will prescribe one medicine and they'll prescribe another. And all they say is, '[the PCP] will bow to [the surgeon],' and say, 'okay, do whatever they say'" [23, p280]. Instead of addressing the conflict, this community provider simply deferred to the instructions of the specialist.

Other more proactive knowledge recipients sought cues from external sources to validate knowledge senders' credibility in attempts to resolve conflicting knowledge [15, 48, 79, 80]. However, searching for additional knowledge often only introduced additional conflicting knowledge: "This time [the providers] said it was angina. But angina doesn't keep filling your lungs up with fluid. . . . My daughter says she

looked on the Internet and it didn't say anything about fluid building up in your lungs and now it's his liver and all" [80, p.450]. As a patient explained, "I mean the internet's okay, but it only takes it so far. Sometimes you need a person to put it into terms that you understand" [15, p.754]. Knowledge senders were still needed to address these conflicts with patients.

Finding 4: Current physical and HIT-enabled artifacts were inadequate for removing barriers to knowledge transfers

The results reveal that neither manual systems (e.g., paper files) nor HIT used were adequate for resolving the barriers to knowledge transfers highlighted in Findings 1 through 3.

HIT was inadequate in facilitating multilateral knowledge transfers. Artifacts summarizing the hospitalization (discharge summary) were often used to facilitate knowledge transfers across organizations. Two problems emerged: First, dissemination of artifacts appeared difficult. Discharge summary documents were often distributed through HIT, fax, or e-mail or were physically carried by the patient, but the summaries were not necessarily received by the intended organization or were misplaced [22]. Providers also had trouble with interoperability of HITs, which inhibited sharing of knowledge artifacts across organizations [24, 89].

The second difficulty relates to the time and resource constraints. Time pressures prevented hospital providers from creating multiple versions of the artifact for different recipients [33, 62]. Medical jargon used in descriptions of patient conditions in discharge summaries also worried patients unnecessarily [8, 81]. Community providers also had to follow up with hospital providers with questions regarding knowledge documented on discharge summaries [19]. As illustrated, single documents were inadequate for multilateral transfers in which recipients had variable knowledge needs and understanding.

HIT was also rarely used to address fluctuations in absorptive capacity. Patients were sometimes given paper pamphlets and educational materials [15, 81]. Some patients found these materials to be useful because they could refer to them after they left the hospital [81], whereas others felt that the material was static and the knowledge documented not always relevant [15]. Patients welcomed access to an electronic care plan, which identified their medical and nursing needs. They could access the plan post-hospital discharge [90].

Interactions were found to help alleviate goal and knowledge conflicts [62, 84]. Multiple providers requested HIT capabilities that would improve communication between providers in the hospital and community, including having access to the same EMR and/or health-care information system or direct messaging capabilities [20, 32, 37].

We were also perplexed by one study that did not discuss the use of EMRs, although the health system studied was known for its EMR system. Communication problems were reported to be significant at this facility: "It seems rather ridiculous,

but they just don't deal with each other. And they don't even agree with each other" [23, p.280]. In this specific case, the community providers and hospital providers had a unique setup in which they were part of the same organization. They also had a long history with an interfacing HIT that all providers (hospital and community) could access. They had access to patient records and communication tools enabled by HIT, but knowledge conflicts were still observed. Patients were also perplexed by the lack of knowledge transfer among providers, given that their providers were often observed to use the computer and had " information on their computers but [the patient doesn't] know how much. . . . If you go 50 times to the hospital, the doctor still has no idea" [35, p.i70].

Discussion and Research Questions

The review focused on barriers of knowledge transfer in care transitions and on the role of HIT capabilities in overcoming, and not overcoming, these barriers. We leveraged an existing interorganizational knowledge transfer model from organization sciences—the Easterby-Smith et al. [25] model—to identify known barriers in interorganizational knowledge transfers. The model provided an excellent lens for our analysis. The analysis found that all barriers mentioned in the model were present in the reviewed articles. Moreover, we were able to expand the model by identifying several other barriers that were not originally included.

First, the Easterby-Smith et al. [25] model captures dyadic knowledge transfers between knowledge senders and recipients. In our care transition context, we found multilateral transfers that involved a knowledge sender communicating simultaneously or sequentially with two or more knowledge recipients who had different needs and backgrounds. Care transitions were multilateral processes consisting of many points of knowledge transfer across multiple organizations. Failures in multilateral knowledge transfers exposed patients to vulnerability and risk.

Second, while time is acknowledged as a feature in the Easterby-Smith et al. [25] model, it is largely addressed in terms of a reversal of sender and recipient roles or a change in dependencies over time, as knowledge recipients learn from knowledge senders. Time pressures are not explicitly discussed in the model. However, time pressure was a salient barrier mentioned in most of the papers in our review. Providers and patients experienced time pressure in various forms, such as lack of time, or labor constraints. Time pressures in turn exacerbated the many other factors that were identified in the Easterby-Smith et al. [25] model, such as the absorptive capacity of knowledge recipients and the nature of knowledge. Knowledge recipients avoided engaging in knowledge transfers with key actors in the care transition process when faced with time pressures, and knowledge senders relied on knowledge artifacts that the recipients were not able to absorb. As these knowledge recipients became knowledge senders and further conveyed knowledge to others during care transitions amid time pressure, the knowledge deteriorated to the point that it impeded rather than facilitated patient care.

Third, our review found that patients had fluctuating absorptive capacity as a result of their emotional and physiological conditions. However, time pressures prevented knowledge senders from accurately assessing absorptive capacity and from adapting knowledge transfers to accommodate fluctuations. Although absorptive capacity is recognized in the Easterly-Smith et al. [25] model, existing organization sciences [16, 94] and the IS literature [72] generally treat absorptive capacity as being determined solely by prior related knowledge or preexisting cognitive structures. Although some researchers have begun to recognize the dynamic nature of absorptive capacity [87], HIT research has yet to explicitly consider fluctuations in knowledge recipients' absorptive capacity during care transitions.

Fourth, we found that goal and knowledge conflicts occurred when multiple providers were involved and time pressures prevailed. The goal and knowledge conflicts were inevitable in complex medical conditions. Conflicting knowledge leads to confusion among patients, especially in those who might also be experiencing lapses in absorptive capacity. Shared understanding has been described as a way to overcome goal conflicts [18], but it is difficult to achieve because it takes time. In care transitions, goal conflicts have materialized in the form of knowledge conflicts precisely because time pressure inhibited knowledge senders from creating shared understanding. Hence, the lack of shared understanding is another contextual reality, in addition to time pressure, that needs to be accepted in advancing our understanding of HIT capabilities.

Finally, while the studies reviewed begin to allude to the potential of HIT to help ease barriers in knowledge transfer, they also caution against relying too heavily on HIT to resolve these barriers. Care transitions involve high-risk interorganizational knowledge transfer. Improved coordination, application, and integration of knowledge via HIT required social ties to be in place.

Research Directions for HIT

Our paper contributes by advancing a number of research questions for future research in IS on HIT capabilities. We organize the research questions according to our four findings: (1) facilitating the multilateral nature of knowledge transfers; (2) accommodating fluctuations in recipients' absorptive capacity; and (3) enabling knowledge senders and recipients to address conflicts (see Table 2). (4) We do not explicate research questions specifically for HIT from Finding 4. As research begins to shed light on how HIT can help address the barriers in the first three findings, the efficacy of HIT should also improve.

Research Questions for Finding 1: Facilitating multilateral knowledge transfers under time pressure

To enable multilateral knowledge transfer during care transitions, knowledge senders need to be able to transfer knowledge under time pressure for different recipients.

Table 2. Findings and Resulting Research Questions

	Findings	Questions on HIT capabilities
Finding 1	Time pressures prevailed and impeded the ability to engage in methods for effective multilateral knowledge transfers.	Facilitating multilateral knowledge transfers under time pressure – *How can HIT facilitate the capturing of this highly technical and domain-specific knowledge for community provider recipients that require technical knowledge?* – *How can HIT facilitate the translation of technical knowledge into terms that nonexperts can understand?* – *How can HIT facilitate the transfer of recipient-appropriate knowledge across multiple organizations, amid time pressure?* – *How can HIT enable knowledge senders to identify the dynamic knowledge needs and abilities of knowledge recipients?* – *How can HIT enable knowledge recipients to more efficiently absorb and further convey the knowledge to others in the care transition?* – *How can HITs facilitate and streamline coordination and creation of mechanisms for multiple and potentially nonrepeated knowledge transfers between organizations?*
Finding 2	Knowledge senders' abilities to accommodate fluctuating absorptive capacity were impeded by time pressures.	Accommodating fluctuations in absorptive capacity under time pressure – *How can HIT enable knowledge senders to assess patients' absorptive capacity including changes in absorptive capacity?* – *How should knowledge senders and recipients be engaged in the knowledge transfer process?* – *How can HIT present recipient-appropriate levels of knowledge, without omitting complex but critical knowledge?* – *How should these critical pieces of knowledge be presented to ensure ease of understanding?* – *How can HIT streamline knowledge transfer for knowledge providers, without having to customize knowledge transfer for every patient at every level of absorptive capacity?*

(continues)

Table 2. Continued

	Findings	Questions on HIT capabilities
Finding 3	Knowledge and goal conflicts prevailed, and reconciliation was inhibited by time pressures.	Addressing knowledge and goal conflicts under time pressure – *How can HIT facilitate the exposure of conflicts?* – *How can HIT minimize the burden and time required for documentation?* – *What sorts of knowledge do we need to capture to recognize goal and knowledge conflicts amid time pressure?* – *How can HIT support the interdependencies between providers?* – *How can HIT enable knowledge providers and recipients to recognize conflicts and address them?* – *How can HIT enable knowledge senders and recipients to recognize the contributions of each alternative provided and/or find a way to integrate the opposing knowledge?* – *How can HIT facilitate discussions to address conflicts?*

Transfer has been difficult for two reasons. First, knowledge recipients in multilateral transfers have varying knowledge needs and different bases of knowledge. For instance, the studies reviewed show that hospital providers needed to transfer knowledge to both patients and community providers, but these groups had different needs (recovery vs. treatment provision for patients and community providers, respectively) and varying levels of clinical knowledge. Documentation and knowledge transfer takes time, and because of time pressure, knowledge senders either avoided some of these knowledge transfers or relied on single knowledge transfer artifacts that did not adequately meet the needs of the recipients. In addition, some of the knowledge in the summary document confused the recipients and thus became problematic [8, 81]. When too much medical jargon or knowledge about the patient condition was included in the summary document, misunderstandings or confusion occurred and led to unnecessary worrying or negative outcomes. HIT-enabled multilateral transfer thus needs to be able to present knowledge that lay patients can comprehend. IS scholars have begun to explore capabilities for easing similar barriers in other contexts, such as reusable knowledge that can be accessed by multiple types of users at different times [54]. However, as Markus [54] determined, human intermediaries were still needed to facilitate knowledge reuse because recipients may not understand some of the knowledge.

Knowledge transferred from hospital providers to other providers is highly technical and is often domain-specific. Community providers need the knowledge and diverse perspectives from multiple providers that interacted during hospitalization to be

synthesized into a summary to provide follow-up care after care transitions [74]. Swap et al. [85] proposed the use of storytelling for relaying complex and tacit knowledge within and across organizations. However, storytelling can be time consuming and time pressure might make storytelling infeasible in complex care transitions. This leads to questions of: *How can HIT facilitate the capturing of highly technical and domain-specific knowledge for community provider recipients that require such technical knowledge? How can HIT facilitate the translation of technical knowledge into terms that nonexperts can understand? How can HIT facilitate the transfer of recipient-appropriate knowledge across multiple organizations amid time pressure? How can HIT enable knowledge senders to identify the dynamic knowledge needs and abilities of knowledge recipients? How can HIT enable knowledge recipients to more efficiently absorb and further convey the knowledge to others in the care transition?*

Second, HIT literature in IS focuses on intraorganizational transfer but does not recognize the interorganizational, often nonrepeated nature of knowledge transfer in care transitions [73]. As the findings revealed, providers and patients often reported having limited interactions and sometimes no prior relationships [43, 54, 73, 83]. When these interorganizational knowledge transfers during care transitions are nonrepeated exchanges, the mechanisms of knowledge transfer (e.g., policies for communication or contact information) often do not exist. For example, discharge summaries, whether faxed or carried by patients to their community providers, were commonly used as an artifact for knowledge transfer. However, as indicated, use of a single discharge summary was often inadequate. The findings also indicated the need for increased communication and mechanisms between providers for knowledge transfer. Multiple community providers reported difficulty contacting hospital providers when they had questions.

IS scholars have identified ways to leverage information technology to facilitate interorganizational knowledge transfer in other contexts, but these ways need to be examined in multilateral knowledge transfers in care transitions. Scholars have proposed the use of boundary objects and networks with standard interfaces [36, 40, 68] to support knowledge sharing across organizations. Providers in the reviewed studies also suggested the use of shared HIT knowledge bases (e.g., shared access to electronic medical records). However, interoperability continues to be a challenge when organizations had different or no HITs in place. Thus, we propose the following research question for HIT capabilities for facilitating multilateral knowledge transfers: *How can HITs facilitate and streamline coordination and creation of mechanisms for multiple and potentially nonrepeated knowledge transfers between organizations?*

Research Questions for Finding 2: Accommodating fluctuations in absorptive capacity

To accommodate fluctuations in absorptive capacity, knowledge senders need to first be able to continuously assess patients' absorptive capacity and then adapt the

knowledge to recipients' specific levels. However, as the findings indicated, assessments are time-consuming and thus, are performed only occasionally. The question to be addressed is this: *How can HIT enable knowledge senders to assess patients' absorptive capacity including changes in absorptive capacity?*

Our findings indicate that when hospital providers engaged patients in knowledge transfer, their absorptive capacity improved. While patient-driven HIT developments, such as online patient communities, might help improve recipients' knowledge bases, these HITs rely on patients to be proactive knowledge seekers. What happens, then, to patients facing temporary lapses in absorptive capacity with decreased knowledge-seeking behaviors? HIT developments that rely on patients to be proactive knowledge seekers may be inadequate for patients. These variations lead to a question: *How should knowledge senders and recipients be engaged in the knowledge transfer process?*

The fluctuating nature of absorptive capacity also presents another challenge for knowledge transfer and HIT design. HITs need to be sensitive to changes in recipients' absorptive capacity. Adaptation of knowledge content according to absorptive capacity reduces both the cognitive demands on recipients and their confusion and frustration. Although patients sometimes experience low absorptive capacity, there exists critical complex knowledge that must be transferred. Our findings indicate that when patients become confused by knowledge received, such as medication instructions, they choose to ignore the instructions given [46]. Adherence to these medication instructions is, however, critical for recovery or management of a condition. IS scholars have begun exploring technology-enabled capabilities for reducing knowledge overload in other contexts. For instance, Chung et al. [14] described the need for improved analysis and visualization capabilities to reduce knowledge overload during knowledge discovery on the web. Discussion on analysis and visualization capabilities is limited in the HIT literature, beyond clinical decision support systems that help providers (e.g.,[1]). To avoid vulnerabilities that occur as a result of lack of effective knowledge transfer during care transitions, we have the following research questions: *How can HIT present recipients with appropriate levels of knowledge, without omitting complex but critical knowledge? How should these critical pieces of knowledge be presented to ensure ease of understanding? How can HIT streamline knowledge transfer for knowledge providers, without having to customize knowledge transfer for every patient at every level of absorptive capacity?*

Research Questions for Finding 3: Addressing knowledge and goal conflicts

To address goal and knowledge conflicts, we start with the underlying premises that (1) goal conflicts are likely introduced with increased multilateral knowledge transfers, and (2) time pressures impede reconciliation of goal and knowledge conflicts.

Both knowledge senders and recipients need to recognize the inevitability of these conflicts in complex care transitions to resolve these conflicts.

The first step in addressing goal and knowledge conflicts is to expose them. Doing so allows knowledge senders to help recipients manage these conflicts and reduce confusion in managing their care during care transitions. This leads to several questions: *How can HIT facilitate the exposure of conflicts? How can HIT minimize the burden and time required for documentation? What sorts of knowledge do we need to capture to recognize goal and knowledge conflicts amid time pressure? How can HIT support the interdependencies between providers?*

Simply exposing knowledge conflicts is insufficient. As our findings indicated, some providers chose to ignore or dismiss conflicting knowledge when it was presented. The findings suggest that when knowledge conflicts arose, patients and community providers tended either to take a side or to ignore the conflict. Providers would then simply defer to the instructions of other providers, or patients would simply follow instructions blindly or not take their medications. Such choices left patients vulnerable and at risk. Some researchers have proposed the need for a shared understanding of goals and knowledge to reconcile conflicts [e.g. 18]. Although this approach would be ideal, it is time-consuming and thus not always feasible. We propose the following questions: *How can HIT enable knowledge providers and recipients to recognize conflicts and address them? How can HIT enable knowledge senders and recipients to recognize the contributions of each alternative provided and to find a way to integrate the opposing knowledge? How can HIT facilitate discussions to address conflicts?*

Limitations

The questions of our study emerged from the findings but the findings need to be considered in light of the limitations of our review. Our review is limited by the nature of the qualitative studies on care transitions. The qualitative studies helped us to understand the breakdowns in knowledge transfers that were observed in care situations across a wide variety of patients, settings, and global regions (North America, Europe, and Asia). However, we recognize that our nomological networks were subject to interpretation. For instance, determining whether the patients stopped asking questions because they were satisfied or had given up or did not understand was challenging and subject to interpretation, in the absence of contextual knowledge. In addition, findings would have been stronger had the studies been longitudinal. Future research on care transitions and interventions in care transitions should explicitly measure knowledge transfer process indicators and outcomes. Such research needs to account for heterogeneity and complexity associated with care transition processes and populations (organizations involved) in order to derive robust recommendations for the design of HIT capabilities.

Conclusions

Through the review, we uncovered barriers associated with knowledge transfer and advanced research questions for developing HIT capabilities for facilitating interorganizational knowledge transfer during care transitions. HIT capabilities to ease the identified barriers include facilitating multilateral knowledge transfers, accommodating recipients' fluctuating absorptive capacity, and enabling knowledge senders and recipients to address knowledge and goal conflicts. We believe that care transitions present a phenomenon for theorizing about barriers for interorganizational knowledge transfer in complex environments. Our research calls IS scholars to improve understanding of how HIT can enable knowledge senders and recipients to facilitate interorganizational knowledge transfer during care transitions and make significant contributions to reducing risk and vulnerability for patients during care transitions.

Supplemental Data

Supplemental data for this article can be accessed is on the publisher's website at http://dx.doi.org/10.1080/07421222.2015.1095013

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