

Healthcare Informatics: Supporting Collaborative Sensemaking in the Emergency Department

It is a busy day in the emergency room with the monitors beeping, the alarms blaring intermittently, the phones ringing, and the overhead paging system crackling at intervals with important messages. The nurses are running back and forth between the rooms, weaving around the patients on the hallway beds. The doctors are talking in groups while referring to the large overhead displays showing the status of patients. The charge nurse is poring over her computer screen, trying to find beds for waiting patients, while talking on the phone.

A paramedic walks up to one of the registration associates and asks, "Do you know what the trauma number is for the patient that just came in?"

The registration associate quickly glances through the list of patients on her computer screen and points to a record, "Is that the one? Came in about 30 minutes ago?"

The paramedic looks at the record and shakes his head, "No this just came in a few minutes ago. 17-year-old motor vehicle accident."

The registration associate looks through the list again, and shakes her head, "I don't see any other trauma patient in here."

The paramedic looks at her, frustrated, "I just brought this patient in. Now I can't find him." He walks away, looking for his patient.

– Field-notes from the emergency department at the Hershey Medical Center

PROBLEM MOTIVATION

Emergency Department Overcrowding

In the face of rising costs and growing demand, the healthcare industry is facing immense challenges today with respect to quality and efficiency of care delivery. This is reflected in the dismal state of the emergency departments of hospitals across the country. The emergency department (ED) provides care for acutely ill and injured patients 24 hours a day, 7 days a week. The ED also provides care to under-served populations who have no other options for medical care [1] and has thus been designated the 'safety net' of the healthcare system [2].

Over the past three decades, EDs have been facing an overcrowding problem and this has now reached crisis proportions [1, 3]. Between 1993 and 2003, ED visits went up by 23.6 million, while at the same time 425 EDs closed and hospital beds declined by 198,000 [5]. ED overcrowding manifests itself in many ways: "boarding" of patients in the ED, ambulance diversions, patients being treated in hallways, and patients leaving without treatment [1, 6]. Overcrowding leads to long wait times, increased medical errors, poor patient outcomes, high levels of stress among ED staff and decreased capacity of the nation's EDs to respond to mass casualty incidents [5].

In the healthcare field, research aimed at addressing the problem of ED overcrowding has fallen primarily into three categories – descriptive, predictive and intervention-oriented. Descriptive studies have focused on defining overcrowding [7], examining its causes and effects [8] and developing measures to quantify it [9, 10]. Predictive studies have focused on developing early warning systems for impending overcrowding episodes [11]. A third stream of research has focused on interventions to optimize available resources and processes, such as monitoring patient length of stay, and re-designing

processes and patient flows [12, 13]. Information and communication tools (ICTs) can play an important role in this line of research.

The Role of information and communication technologies

In the ED, ICTs have the potential to increase quality and efficiency of care by enabling information sharing, communication, collaboration, and coordination between care providers [5]. Tools such as the electronic medical record, the computerized provider order entry system, and the electronic bed tracking system can help ensure smooth flow of information and patients in the ED and between the ED and the rest of the hospital. Given the push in healthcare towards deployment of technologies to streamline processes, reduce medical errors, and provide better collaboration for providers, ICTs can help alleviate overcrowding of hospital emergency departments.

PRELIMINARY EXPLORATION

Research Question

I started exploring the role of technology in ED overcrowding with the following research question:

RQ1: "How can information and communication technology used in emergency departments be leveraged to alleviate levels of overcrowding"

Methods

I conducted a field study using ethnographic techniques including observations and interviews. The field research site was chosen to be the Penn State Hershey Medical Center (HMC). HMC is a 500-bed teaching hospital with nearly 50,000 ED visits a year. The ED at HMC is a level-1 trauma center and is serviced by a critical care transport service consisting of medically-equipped helicopters, a ground service comprising nine ambulances and a pediatric ambulance. HMC staff use an integrated electronic medical record that interfaces with lab, radiology, and pharmacy information systems and the computerized provider order entry system; they also use communication tools like pagers, radio, phones etc.

I conducted preliminary fieldwork from Jan – May 2007 aimed at understanding the nature of work in the ED. I focused on the roles and responsibilities of care providers, the patient flows, the information flows, the resource flows and the communication flows.

Preliminary results: Importance of collaborative sensemaking

At the end of my preliminary fieldwork I analyzed the data using a grounded theory approach [14] to identify interesting themes. A recurrent theme was the need for providers to understand dynamic situations in collaboration with other providers and using various paper and digital tools. This brought to the forefront the issue of *collaborative sensemaking* in the emergency department.

Sensemaking involves finding structure in a seemingly unstructured situation [15] and is an integral part of the work of care teams in the ED. *Collaborative sensemaking* occurs when multiple actors with different thoughts about the world engage in the process of understanding 'messy' data or information [16]. Providing care to patients in the ED

requires collaboration between physicians, nurses, technicians, special consults and administrative staff. Given the variety of patients coming to the ED, the time-criticality of action, the unavailability of information and the need for collaboration among providers with different backgrounds, collaborative sensemaking is an important aspect of work in the ED. An instance of this is shown by the vignette presented at the beginning of this paper.

In their work, care providers use information tools like paper patient charts, whiteboard, electronic medical records, computerized provider order entry system and communication tools like phones, and pagers. I found that different providers leverage these tools in different ways to support their sensemaking activities. At the end of my preliminary fieldwork, I re-focused my research question as follows:

RQ2: “How can information and communication tools used in the emergency department be leveraged to support collaborative sensemaking among healthcare providers?”

Sensemaking research

The process of how groups make sense collaboratively is not clearly understood. At the organizational level, Weick [17] characterized sensemaking as having seven characteristics – it is grounded in identity construction, retrospective, focused on and by extracted cues, enactive of sensible environments, social, ongoing, and driven by plausibility rather than accuracy. Russell et al. [18] define sensemaking as cyclic processes of searching for external representations and encoding information into these representations to reduce the cost of tasks to be performed. While some tools [19-21] have been developed to enhance sensemaking, there is little understanding of and technological support for the process of sensemaking in groups, specifically in time-critical situations such as emergency response.

PROPOSED DISSERTATION WORK

In my dissertation, I propose to a)examine the process of collaborative sensemaking, b)examine if and how currently used technologies and interfaces support collaborative sensemaking, and c)identify requirements for developing technologies to support collaborative sensemaking activities. Given these goals, I am interested in answering the following questions in the context of the emergency department through ethnographic observations, interviews, shadowing, and artifact collection.

- RQ 2.1 What are the aids and approaches used by groups for sensemaking?
- RQ 2.2 How do existing ICTs used in the ED support collaborative sensemaking?
- RQ 2.3 How can ICTs be designed to support collaborative sensemaking in time-critical work?

CONTRIBUTION

The proposed research has the potential to make significant contributions in three fields: medical and healthcare informatics, computer-supported cooperative work (CSCW), and human-computer interaction (HCI). The contribution to the healthcare informatics community will be in determining how ICTs can improve the quality and efficiency of

care in emergency departments. The contribution to the CSCW community will be in helping understand the processes and aids used in collaborative sensemaking, which can feed into design requirements for collaborative systems. Finally, the contribution to the HCI community will be in finding how information can be visualized and represented in interfaces of systems used for sensemaking.

CONCLUSION

In this paper I've highlighted my dissertation work in which I propose to tie research on computer-supported cooperative work (CSCW) to the real-world problem of overcrowding in hospital emergency departments. For long CSCW has studied how groups use technology in real-world settings and how technology can be better designed to support groups working in these work settings. In my dissertation I propose to examine a) the process of collaborative sensemaking in groups, b) how ICTs are used currently to support collaborative sensemaking, and c) how new tools can be designed to support collaborative sensemaking.

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