

# Collaborative Sensemaking during Emergency Crisis Response: How do ICTs help?

Sharoda A. Paul  
College of IST

Penn State University, UP – 16802.  
+001-(814)777-6797

[spaul@ist.psu.edu](mailto:spaul@ist.psu.edu)

Madhu Reddy  
College of IST

Penn State University, UP – 16802.  
+001-(814)863-6316

[mreddy@ist.psu.edu](mailto:mreddy@ist.psu.edu)

Joanna Abraham  
College of IST

Penn State University, UP – 16802.  
+001-(814)777-2254

[jabraham@ist.psu.edu](mailto:jabraham@ist.psu.edu)

## ABSTRACT

Sensemaking is the process of understanding an unfamiliar situation in order to act effectively. Crisis response requires emergency departments and emergency medical services teams to collaboratively make sense of an uncertain and unfamiliar situation. We conducted focus groups to examine how information and communication technologies help collaborative sensemaking across response teams. We found that communication of information was a key aspect of sensemaking and communication tools like the radio, phones, pagers, and paper were preferred to computer-based systems for sensemaking among teams. Our findings highlight the need to develop new information systems, or enhance existing ones, for supporting collaborative sensemaking among geographically-distributed teams engaged in time-critical work.

## Categories and Subject Descriptors

K.4.3 [Computers and Society], Organizational impacts, CSCW

## General Terms

Performance, Design, Human factors

## Keywords

Collaborative sensemaking, emergency crisis response, ICTs

## 1. INTRODUCTION & MOTIVATION

Sensemaking involves finding structure in a seemingly unstructured situation [1] and is an integral part of the work of emergency crisis responders. Response to crisis situations involving mass casualties is often characterized by inadequate, missing, and conflicting information. Emergency department (ED) and emergency medical services (EMS) teams are required to collaborate in this ‘messy’ information environment in order to provide transportation and care to a deluge of patients in a short period of time. *Collaborative sensemaking* occurs when multiple actors with different thoughts about the world engage in the process of making sense of ‘messy’ data or information which has a high degree of uncertainty [2]. ED and EMS teams need to share information and situational awareness, that is, engage in collaborative sensemaking, for effective response.

There is growing research into information and communication technologies (ICTs) for emergency response [3]. Most emergency departments now use an electronic medical record (EMR) and several computer-based systems have been proposed to help EMS

personnel track casualties and resources, and communicate with hospitals. Such technologies are expected to improve information sharing, resource allocation, communication, and collaboration among EMS and ED teams. However, there is little understanding of how proposed ICTs help geographically-distributed teams “make sense” under extreme time pressure. The goal of our study was to explore the research question “How do ICTs help in collaborative sensemaking between distributed teams during crisis response?”

## 2. METHODS

HMC is a 500-bed teaching hospital with nearly 48,000 ED visits a year. The hospital is serviced by a critical care transport service consisting of medically-equipped helicopters, a ground service comprising nine ambulances and a pediatric ambulance. HMC uses an integrated EMR that interfaces with lab, radiology, and pharmacy information systems and provides computerized provider order entry and clinical documentation. HMC personnel use communication tools such as cell phones, pagers and radios.

We conducted seven focus groups with physicians from the ED and ground and air paramedics from HMC’s EMS. Participants were presented the scenario of a train derailment involving leakage of hazardous materials. We progressively provided time-stamped events to mimic how information would become available during an actual incident. To examine how participants would make sense of the situation and other teams’ activities, for each event, we asked 1) what further information they would need to take action, 2) what action they would take, and 3) what ICTs they would use at that point. Here we highlight our findings with respect to how responders would use ICTs in their sensemaking activities.

## 3. FINDINGS

### 3.1 Paper is better than information tools

Paper, communication devices, and information systems were found to play different roles in augmenting sensemaking. Physicians felt “*the current IT system would be completely unworkable*” in our scenario and paper would instead be more useful and usable for inter-team sensemaking. One physician said, “*Paper is so much better than the computer... I want to write down on a piece of paper and staple that piece of paper to [the patient’s] chest and he moves on...so the next guy down the road knows what was done and what needs to be done now*”. Under normal operation of the ED, every patient’s information is entered into the EMR at triage. However, given a sudden deluge of patients, operations of the ED would switch to paper-based mode. One resident said, “*Once patients come in they will be assigned a*

Copyright is held by the authors/owner(s).

GROUP’07, Nov 4–7, 2007, Sanibel Island, Florida, USA.

Copyright 2007 ACM 1-58113-000-0/00/0004...\$5.00.

number and that's how you would take care of them until someone from registration will come around, get their name, and then get it into a computer." Another resident added, "You are not going to sit there and wait to register them. The nurses are going to take verbal orders." Thus, verbal and written communication of care-related information would take precedence over entering information into computers. EMS personnel were also skeptical about usefulness of technology since "things are happening on scene so quickly ...so if you take time to start playing with the PDA, you can lose track. Maybe paper would be quicker; you can jot notes, your short notes, short hand." EMS use casualty triage forms for noting patient details on scene and pass these forms to the ED staff later.

### 3.2 Communication tools more important than information tools

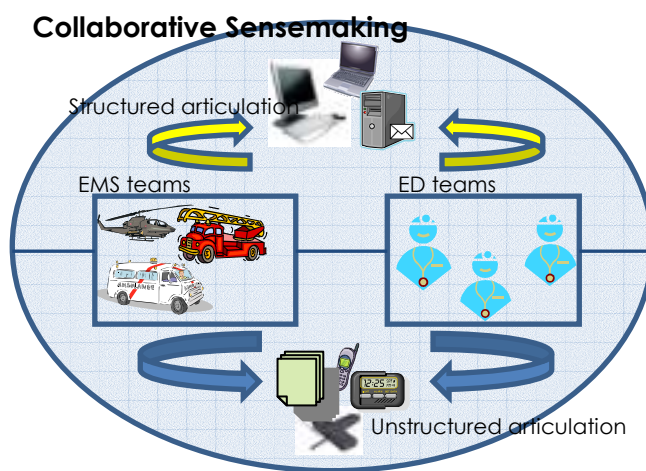
Communication of information was a key aspect of sensemaking between ED and EMS teams. EMS personnel felt that "Communication problem is half the problem or half the battle on most scenes." Both ED and EMS personnel rely mostly on pagers, cell phones, walkie-talkies and radios for communication. For paramedics, "the information is usually available on-site or through the communication center." The communications center passes information between the ED and EMS teams and relies mostly on the radio, cell phones, and pagers for this. They receive patient information from EMS and "page the trauma responses and put it up on the trauma recorder so all the trauma teams that respond ....call a certain number and listen to what's coming". EMS personnel use their radios to keep in touch with the communication center and the incident commander on scene to pass information about casualties. Interestingly, there was no mention of using information systems such as the EMR to communicate information; communication devices and paper were the prominent means for sharing information.

## 4. DISCUSSION & IMPLICATIONS

The key theme in our findings was the dichotomy between the use of computer-based systems on one hand and communication tools (such as cell phones, and two-way radios) and paper on the other hand. This can be explained on the basis of the centrality of articulation and communication in sensemaking. Communication is a central component of sensemaking [4] and this was strongly evident in our findings where extraction and communication of relevant information were very important for the collaborative sensemaking activities. What was interesting was the heavy reliance on communication devices and paper for communication, and hence sensemaking, while the EMR was relegated to a mere record-keeping tool.

Sensemaking is the process of being thrown into an unknown situation in search of answers to the question – "What is the story?" Answering this question in a collaborative setting requires articulation – "the social process by which tacit knowledge is made more explicit or usable."(p. 413, [4]). Paper and communication tools enable better articulation than information systems because of their 1) support for unstructured communication via natural language, and 2) flexibility for collaboratively shaping the articulation in real-time. On the other hand, information tools require conversion of information into

structured forms and do not enable actors to synchronously shape articulation. Figure 1 depicts this fragmentation of the collaborative sensemaking domain with respect to the use of information tools, and communication tools and paper.



**Figure 1: Role of information systems, communication devices and paper in collaborative sensemaking**

In collaborative sensemaking, there is the need to manage 'social knowledge' through communication and language [3] and current information systems were deemed by responders as too constraining, unusable, and ineffective for this purpose. This has important implications for design. While there has been research on enhancing individual sensemaking by supporting better information search and visualization in information systems, our study highlights the need to design tools that enable articulation and communication among distributed teams in time-critical work.

## 5. ACKNOWLEDGMENTS

We would like to thank Victor Pilewski for helping with data collection and the Penn State University for funding this research.

## 6. REFERENCES

- [1] Furnas, G. W. and Russell, D. M. 2005. Making sense of sensemaking. In *CHI '05 Extended Abstracts on Human Factors in Computing Systems* (Portland, OR, USA, April 2 - 7, 2005). CHI '05. ACM Press, New York, NY, 2115-2116.
- [2] Ntuen, C. A., Munya, P., and Trevino, M. An Approach to Collaborative Sensemaking Process. Available online at [http://www.dodccrp.org/events/11th\\_ICCRTS/html/papers/101.pdf](http://www.dodccrp.org/events/11th_ICCRTS/html/papers/101.pdf) Retrieved July 8th, 2007.
- [3] Chan, T. C, Killeen, J., Griswold, W., and Lenert, L. Information technology and emergency medical care during disasters. *Academic Emergency Medicine*, 11,11 (2004), 1229-1236.
- [4] Weick, K. E., Sutcliffe, K. M., and Obstfeld. Organizing and the Process of Sensemaking. *Organization Science*, 16, 4 (2005), 409-421.