

Asking Questions: Information Needs in a Surgical Intensive Care Unit

Madhu C. Reddy M.S.¹, Wanda Pratt Ph.D.², Paul Dourish Ph.D.¹, M. Michael Shabot M.D.³

¹Information and Computer Science Department, University of California, Irvine, USA.

²Division of Biomedical & Health Informatics and the Information School, University of Washington, Seattle, USA.

³Departments of Surgery and Enterprise Information Systems, Cedars-Sinai Medical Center, Los Angeles, USA.

Abstract

Even in the information-rich environment of hospitals, health-care providers face challenges in addressing their various information needs. Through a study of a patient-care team in a tertiary care Surgical Intensive Care Unit (SICU), we expanded our understanding of health-care providers' information needs in two important ways. First, the study focused on a patient-care team instead of individual health-care providers. Second, information needs were examined in a particular organizational setting, the SICU, which had not been previously studied. We found that organizational information was extremely important to SICU team members. Furthermore, the first resource that team members utilized was not electronic or paper but rather human: another team member.

Information Needs

Despite the increasing use of clinical information technologies, health-care providers still face difficulties in addressing their various information needs. Furthermore, their ability to address these information needs is effected by their organizational setting. For instance, the information needs of physicians in office practice^[1] are different than those in an academic medical center^[2]. Before medical informatics system designers can build appropriate technologies to support health-care providers' information needs, they need to understand not only the "the nature and scope of the actual information needs"^[3] but also the effects of the organizational setting on those needs.

Through a study of a patient-care team in an open Surgical Intensive Care Unit (SICU), we expanded our understanding of health-care providers' information needs in two important ways. First, the study focused on the information needs of health-care providers within a patient-care team rather than the typical focus on individual health-care providers. Although it is important to understand an individual's information needs, people rarely work independently in modern health-care settings such as hospitals. Instead, the dominant setting for most work in hospitals is interdisciplinary teams; people normally collaborate with others to accomplish their tasks^[4]. Despite the dominant role of teams in hospital work, little attention has been paid to the information needs of

patient-care teams. Second, our study examined information needs within a particular organizational setting, the SICU. The work activities and goals in the SICU created constraints that effected the information needs of the health-care providers within that unit.

Information Needs in Medicine

An important stream of medical informatics research has focused on investigating information needs of health-care providers. Covell et al.^[1] in their classic study of physician information needs discovered that physicians had their information needs met less than 30% of the time while interacting in the office with patients. As a way of investigating physician needs, researchers have focused on physician questions. Ely et al.^[5] studied the types of questions that primary care physicians asked during their interactions with patients. The researchers found that although physicians had a number of questions, they did not pursue the answers to the majority of these questions. Beside studying physicians, medical informatics researchers have also investigated the information needs of other health-care providers such as nurses. Lange^[6] found that nurses spent the majority of their time at the beginning of their shift finding medication related information. Yet, whether examining the information needs of clinicians, nurses, or other health-care providers, most researchers have focused on interaction between an individual information seeker and various information sources. Few studies have examined the information needs problem in the context of an interdisciplinary team consisting of various health-care workers. Forsythe et al.^[3] studied a patient-care team but focused on the information needs of only the physicians on the team and not the other health-care providers.

Organizational settings also can affect health-care providers' information needs. Medical informatics researchers have investigated information needs of physicians in a number of different clinical settings. Woolf and Benson^[2] found that the type of medical information required depended on the work setting. For instance, faculty required information for research while medical housestaff required information for diagnosis and patient management. However,

both groups depended on textbooks for information. In contrast, Dee,^[7] in her study of rural physicians, argued that they depended more on colleagues because rural physicians lacked access to electronic and other high-quality information sources. Few studies have focused on information needs in intensive care units. Forsythe^[3] did study the information needs in medical intensive care units but we have found no studies of information needs in a surgical intensive care unit.

Study Methodology

In this study, we describe the information needs of members of the SICU patient-care team. This examination of information needs is part of a larger research project, where we are investigating information seeking behavior of health-care providers in the SICU of a large, urban teaching hospital.

Subjects

The subjects included:

- Three surgical residents
- Two surgical fellows
- Surgical attending – A surgical faculty member headed the team.
- SICU Pharmacist
- Nurses – The team interacted extensively with each patient's nurse as they examined the patient.
- Medical Students – These were 4th year medical students who were doing a one month rotation in the SICU.

The primary goal of the SICU team is to stabilize patients as quickly as possible so they can be safely transferred out of the unit. Therefore, on a daily basis, physicians, nurses, and pharmacists must successfully coordinate their information seeking activities to ensure appropriate patient care.

Site

The SICU provides intensive-care monitoring for patients who require special attention after a surgical procedure. It consists of two 10-bed units, each of which has the same technologies, staffing, and physical layout. The SICU has a number of information resources including:

- Digital physiological monitors – Bedside monitoring devices that measure patient's physiological data.
- Electronic patient record (EPR) system – Contains patient physiological, medication and other data.
- Web-based applications – Contain digital images and data such as culture reports that are not in the EPR.

- Digital X-ray workstations – Contains the latest digital x-ray images of patients in the unit.
- Reference books – Various medical and nursing reference manuals and policy books.
- White board – Contains patient-bed information and on-call information.
- Paper-based patient record – Patient chart maintained along with the EPR record. Outside consultants write their notes in this record.
- Paper-based medication chart - Chart of medication orders kept by the patient's room.
- Health-care workers – This includes team members, outside medical consultants, patient's primary physician/team, respiratory therapists, physical therapists, and members of the SICU team.

Bed management is an important activity in the SICU. If all twenty beds in the SICU are full, non-emergency surgeries are often cancelled. Canceling surgeries has serious repercussions for the hospital in terms of lost revenue and anger from patients and surgeons. Therefore, a key organizational task of the SICU team is to ensure enough open beds in the unit for new patients.

Procedures

Our study employed observational techniques that were successfully used in other information needs studies^[3, 6, 8, 9]. Because the focus of the study was information needs of members of a patient-care team, we decided that the best way to gather the most useful data was to observe the team when they were all interacting together. Therefore, the first author went on morning rounds with the team over a three-month period. The investigator observed the subjects during the entire morning round period which lasted an average of 2.5 hours. During the round, the investigator documented: (1) who asked a question (2) the questions asked and (3) the resource used to answer the question. Obviously, with only one observer, we were unable to capture all the questions asked by team members during rounds. Still, we believe that we captured a large enough number of questions to be representative of the type of questions asked in the SICU.

During data analysis, we used grounded theory method^[10] to identify categories from the data.

Results: Questions Asked

During our observations, team members asked 1,584 separate questions during rounds. Questions were analyzed in three different ways. First, we categorized them by the type of question: Osheroff et al.'s categorization^[9] served as the basis of our categories. However, because we observed additional types of

questions we added categories, such as organizational that were not included in the original categorization. Second, we categorized the questions by the information source that team members used to answer the question. Finally, we categorized the questions by the information seeker. Due to the limited space, we do not describe our analysis of which information seekers used which information sources.

Question Categories

We identified seven major categories of questions (Table 1).

- Plan of Care – treatment plan for the patient e.g. – *What are you planning to do about the pelvis?*
- Patient Specific - information dealing with the patient e.g. – *What's he [patient] doing?*
- Organizational – policies, procedures, and bed management issues e.g. – *What is the protocol for doing an apnea test?*
- Medication – medication related issues e.g. – *Were we able to wean the drug down?*
- Teaching – training of the residents and medical students e.g. – *When is MI [myocardial infarction] most likely to strike post-operatively?*
- Further Details – These questions were asked to gain more detail than were initially given. e.g.– *Did you find out what that meant?*
- Misc – could not be categorized in any of the major categories e.g.- *Is that o.k. with you?*

Table 1. Categories of questions asked by SICU team members.

Question Categories	Questions (n=1584) 100%
Plan of Care	580 (36.6%)
Patient Specific	335 (21.2%)
Organizational	269 (17.0%)
Medication	204 (12.9%)
Teaching	162 (10.2%)
Further Details	18 (1.1%)
Misc	16 (1.0%)

Other studies have highlighted the importance of clinical questions^[9]. In our study, team members also had many clinical questions. However, we also uncovered a large number of organizational questions. We will come back to these questions in our discussion section.

Information Sources

The residents were the focus of most questions for two observable reasons (Table 2). First, they were directly responsible for patient care. Therefore, the residents closely followed their assigned patients and had the most recent information about their patients.

Second, as physicians-in-training, the residents were asked a number of teaching questions during rounds. Table 2. Information source and number of questions each source was asked

Information source	Number of Questions each source was asked (n=1584)
Residents	651 (41.1%)
Fellows	344 (21.7%)
Nurses	138 (8.7%)
Students	115 (7.3%)
Attendings	79 (5.0%)
General Team	65 (4.1%)
Pharmacists	58 (3.7%)
Unknown	43 (2.7%)
Patient	35 (2.2%)
Other Consultants	33 (2.1%)
Non-human sources*	15 (0.9%)
RT/PT/CP	6 (0.4%)
Patient's Family	2 (0.1%)

*Non-human sources include electronic and non-electronic sources.

Information Seekers

As we analyzed the data, we realized that although a SICU faculty member was always present during rounds, the fellows actually lead the rounds and initiated much of the discussion concerning patient and unit issues; hence, they asked most of the questions (Table 3).

Although the nurses and pharmacists were part of the SICU team, the physicians asked most of the questions. The nurses and pharmacists served primarily as information sources rather than information seekers. Most of the nurses' questions were medication related or confirmation of the plan of care decisions.

Table 3. Information seekers and number of questions they asked

Information Seekers	Number of questions asked (n=1584)
Fellows	739 (46.6%)
Attendings	326 (20.6%)
Residents	277 (17.5%)
Non Team Members*	120 (7.6%)
Nurses	67 (4.2%)
Students	31 (2.0%)
Pharmacists	24 (1.5 %)

* Non-team members include outside physicians, respiratory therapists, physical therapists and social workers.

Discussion

In this section, we briefly describe our use of observational data. We then discuss two findings that we believe are particularly important for the design of information technology in health-care.

Use of Observational Data

Although, the majority of information needs research in medical informatics have primarily used survey methodology, researchers have found that observational data helps provide important context for the information needs being studied. Forsythe^[3] used observational techniques to investigate the ways that that physicians express their information needs. Context played an important role in their study. As she stated, “The context of a message may affect or determine its meaning.” Other researchers including Gorman^[8], Osheroff^[9], and Ely^[5] have also used observational methods to capture physicians’ information needs. We used observational data in this study to capture the contextually rich interactions between team members.

Importance of Organizational Issues

During rounds, team members asked many clinically oriented questions dealing with plan of care, patient specific data, or medication questions. Not surprisingly, these three categories comprised 70% of the noted questions. However, there was a subset of questions categorized as “organizational” which we had not anticipated appearing as frequently as they did. This category includes questions such as:

- Who is the nurse for bed 2?
- Do we have a brain death protocol?
- Who’s got Homer’s chart?
- Did we get a bio[ethics] consult?
- Who is doing [round] notes?

All team members at one point or another asked organizational questions. The questions ranged from policies and procedures^[9] to interdepartmental information^[6]. Without the organizational information, the SICU team would have difficulty providing appropriate patient care. For instance, the question “Do we have a brain death protocol?” was an important policy question because the team could not implement the plan of care for the patient without an answer. They did not know whether they needed to continue to provide care for the patient or whether they could declare that the patient was dead.

Most organizational questions were clearly identifiable as such. Our organizational category included these easily identifiable questions. However, organizational issues encompass more than just questions about policies and procedures. Many clinical questions also had an organizational component. For in-

stance the question “She has to stay in the SICU?” had multiple meanings to the information seeker, an attending physician. Clinically, the physician was trying to find out what the team had decided for the patient’s plan of care. Organizationally, he wanted to ascertain whether her problems were serious enough to keep her in the ICU. Underlying many of the clinical questions was the bed management issue. The team constantly had to evaluate the patients’ conditions against the need for beds.

Although we identified organizational aspects of clinical questions, we still listed these questions in the relevant clinical categories because the questions were identified as primarily seeking clinical information. Thus, the organizational category in Table 1 could have included a much larger number of questions than it currently contains.

Organizational information is essential for the SICU team to function effectively. The effective care for the patient requires that team members not only coordinate their own work activities but also the work activities of numerous consultants and other health-care providers. Organizational questions and organizational features of clinical questions acted as the “glue” allowing team members to accomplish their work and keep the SICU functioning smoothly.

Informal Information Sources

Medical work especially in the SICU is highly collaborative^[11]. To provide appropriate patient care, health-care providers must interact frequently with each other. During rounds, team members used a wide variety of information resources to answer questions. Yet, we observed that the first resource that they utilized was not an electronic or paper but rather a human or “informal”^[3] source: another team member. In a team setting, this is not unusual because various team members bring their particular expertise and perspective^[4] to a question. For instance, residents were expected to know about all the medical issues concerning their patients even if they did not always know what was causing these conditions. Therefore, the fellows or the attending would first direct many of their patient care questions to the resident. Similarly, nurses were also important information sources because they maintain close contact with the patient, the patient’s family, and the patient’s other health-care providers. They often acted as information conduits between these different caregivers and the SICU team.

As part of their work, the SICU team must coordinate all the activities of a patient’s numerous health-care providers. Therefore, team members want to know not only know what was done but why it was done. Often, this *context* is not written down rather it is in the minds of the individuals who were involved

in the situation. For example, a physician might verbally tell a nurse about a medication but not write the rationale for it in the chart. Therefore, only the physician and nurse could provide information about why the medication was given. More "formal" sources, such as the patient record, would not contain this information. In a complex, fluid work environment such as the SICU, individuals play an important role in providing contextual information

Informal sources are essential for supporting the SICU team's information needs especially during rounds. Team members usually turn to each other for information before accessing other resources. Furthermore, individuals usually are much better than more formal sources in providing context for an event.

Study Limitations

There were two major limitations to our study. First, we focused on verbal questions. Therefore, most of the questions were naturally directed to human information sources. Although focusing on verbal questions limited our ability to fully capture all the information needs of the SICU team, it did allow us to capture the rich interaction among team members.

Second, the questions were collected only during morning rounds. Obviously, information needs arise throughout the day and not just during morning rounds. For instance, a physician or nurse could have questions during the implementation of the round plan that did not come up when the plan was developed. However, as we stated in the procedures section, we examined morning rounds because the patient-care team members were physically co-located together and verbally interacted with each other.

Designing for Work

Information needs in a team-oriented environment such as the SICU are different than those in other organizational settings. We found from our analysis of the questions that organizational issues play a prominent role in allowing the SICU patient-care team to successfully carry out their work activities. The questions asked by SICU team members often contained both a clinical and organizational component. We believe that these findings have a direct implication for medical informatics system designers

First, to build effective clinical systems, designers must consider how people work together to find and use information in their daily work. Clinical systems are more than mere repositories of patient data; they also support various activities of a patient-care team including information seeking activities.

Second, medical informatics system designers must recognize the *organizational* nature of the work. By this, we mean understanding the relationships that

exist between the clinical care of the patient and the day-to-day work necessary to keep a unit such as the SICU functioning.

Finally, understanding the collaborative nature of teamwork is essential to build systems that truly support the work activities of the health-care providers in a busy, fluid work environment such as the SICU.

Acknowledgements

We thank the SICU physicians, nurses, pharmacists and other staff members for allowing us to observe and interview them. This work was supported by a grant from the Center for Research in Information Technology and Organizations at the University of California, Irvine.

References

1. Covell, D.G., G.C. Uman, and P.R. Manning. *Information needs in office practice: are they being met?* Annals of Internal Medicine, 1985. **103**: p. 596-99.
2. Woolf, S.H. and D.A. Benson. *The medical information needs of internists and pediatricians at an academic medical center.* Bulletin of the Medical Library Association, 1989. **77**(4): p. 372-80.
3. Forsythe, D.E., B.G. Buchanan, J.A. Osheroff, and R.A. Miller. *Expanding the concept of medical information: An observational study of physicians' information needs.* Computers and Biomedical Research, 1992. **25**(2): p. 181-200.
4. Cicourel, A.V., *The Integration of Distributed Knowledge in Collaborative Medical Diagnosis,* in *Intellectual Teamwork,* J. Galegher, R.E. Kraut, and C. Egido, Editors. 1990, Lawrence Erlbaum Associates: Hillsdale, NJ. p. 221 - 242.
5. Ely, J.W., J.A. Osheroff, P.N. Gorman, et al. *A Taxonomy of generic clinical questions: classification study.* BMJ, 2000. **321**: p. 429-432.
6. Lange, L. L. *Information Seeking by Nurses During Beginning-of-Shift Activities.* In *AMIA.* 1993; p. 317-321.
7. Dee, C. and R. Blazek. *Information needs of the rural physician: a descriptive study.* Bulletin of the Medical Library Association. 1993. **81**(3): p. 259-264.
8. Gorman, P.N. *Information Needs of Physicians.* Journal of the American Society for Information Science, 1995. **46**(10): p. 729-736.
9. Osheroff, J.A., D.E. Forsythe, B.G. Buchanan, R.A. Bankowitz, B.H. Blumenfeld, and R.A. Miller. *Physicians' information needs: analysis of questions posed during clinical teaching.* Annals of Internal Medicine, 1991. **114**(7): p. 576-81.
10. Strauss, A. and J. Corbin, *Basics of Qualitative Research: Grounded Theory Procedures and Techniques.* 1990, Newbury Park, CA: Sage Publications.
11. Baggs, J.G., S.A. Ryan, C.E. Phelps, J.F. Richeson, and J.E. Johnson. *The association between interdisciplinary collaboration and patient outcomes in a medical intensive care unit.* Heart Lung, 1992. **21**(1): p. 18-24.