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Peri-operative Communication Patterns and Media Usage — Implications for Systems Design

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Abstract

Inter-hospital communication amounts for a great deal of clinicians' work time. While communication is essential to coordinate care, it can also be time consuming and interruptive, and breakdown in communication is an important source of medical errors. One contributor to the interruptive nature of communication is the use of synchronous media, and there is clearly a potential for novel technologies. To assess communication patterns and media usage we performed an ethnographic field study in the peri-operative environment at a Norwegian hospital, as well as interviews with nurses. We analyze the results with regards to choice of media, characteristics of the conversations taking place and meta-messages, and account for addressing, obtrusiveness and information richness in the message exchanges. We find a relative high degree of interruptiveness in communication, and ascribe it to 1) a lack of situational awareness between locations in the peri-operative domain, as well as 2) use of synchronous media. This suggests that design of novel technology for intra-hospital communication should aim at supporting sender-receiver awareness and signaling of availability.

Keywords:

Communication, Hospital communication systems, Qualitative research

Introduction

The amount of time spent communicating in health care is vast and still expanding [1, 2]. While communication is essential to coordinate care, it can also be time consuming and interruptive [3, 2], and breakdown in communication is an important cause of medical errors [4]. Contributing to the interruptive nature of the communication are the use of synchronous media, such as telephone and pager, and the lack of situational awareness (i.e. sender is not aware of where the receiver is or what she is doing).

For the purpose of this paper we broadly divide intra-hospital communication into two main categories: 1) clinical problem solving, and 2) coordination. (Of course, the communication serves several other more social and play related purposes, less directly work related but not necessarily less important.)

We use clinical problem solving to denote communication regarding diagnoses and treatment plans. Aimed at problem solving and decision making, this form of communication often go on for an extended period of time, and is sometimes iterative in nature (i.e. diagnoses can be changed, new treatments tested). While less rigid, this process is similar to scientific inquiry, and communicative challenges are related to sharing of complex information, documenting the clinical reasoning process, negotiating and supporting organizational memory [5].

While clinical problem solving is a ubiquitous process, which might occur anytime (it is not uncommon, for instance, that surgeries reveal physical findings which prompt new diagnoses), given the scope of this study we are more concerned with communication related to coordination. This form of communication is usually more immediate, and the need for support of organizational memory, documentation and storing of information is less pronounced. However, coordination-related communication brings its own set of challenges: due timing of messages; level of obtrusiveness; and sender-receiver awareness and feedback.

Our study is concerned with the communication patterns in the so-called peri-operative domain. Peri-operative refers to three phases: pre-operative, intra-operative, and post-operative. It starts when a decision is made to operate on the patient, and terminates with the resolution of the surgical sequelae [6]. Through a qualitative analysis, we aim to characterize the communication patterns in the peri-operative domain, and to identify areas where novel communication technologies can play a role, as well as central requirements for design of such technologies.

Background and framework

Coordination and articulation work

Coordination can be viewed as the problem of managing interdependencies between activities performed to achieve a goal [7]. The resulting joint activities are in a sense "created from the goal backwards" [8].

For each actor to be able to plan and perform his actions optimally he needs to know his team members' goals and actions. In aviation the concept of *situational awareness* has been used

to analyze accidents and improve safety, and in later years the concept has been adapted in health care. Simply put, situational awareness is the shared understanding of what is going on now, as well as what is going to happen next [9]—a prerequisite for successful coordination. To achieve an acceptable level of situational awareness each actor must ensure that his actions and plans are shared with other members of the team, and he must ensure that he himself obtains relevant information about the plans of others. This *articulation work* [10] increases when the cooperative work lacks a well-defined point of control, which is usually the case in hospital work, where the participants must themselves ensure that their combined efforts result in the desired outcome. Each participant's actions must be articulated, communicated and negotiated with the other participants (*ibid.*). Managing the distributed nature of cooperative work, in short, takes a lot of work.

Media use and communicative strategies

The nature of health work necessitates complex communication, using different media. Often the communication is characterized by a high degree of cognitive complexity, and the communicative process itself might represent several challenges (time constraints, changes during the conversation, dependency on feedback). Te'eni [11] presents several proposals about communicative strategies and choice of media in different situations. Harr and Kaptelini [12] provide an analytical tool for analyzing interruptions in social contexts and show how interruptions often spread in organizations with a ripple effect.

Communication as social action

In addition to the obvious practical reasons for intra-hospital communication, any use of language also acts on a social level. This dimension also impacts the more instrumental uses of language and needs to be accounted for, for instance with regards to choice of media, i.e. how much bandwidth a media has for this contextual information.

Conversation analysis and interactional sociolinguistics perceive language as socially structured, with set patterns, independent of the linguistic content. Pauses, overlappings, tone of voice, and gestures—meta-messages—are seen as highly relevant aspects of a conversation which must be considered in addition to the pure linguistic exchange [13].

Analytical framework

Reflecting a hierarchy of granularity, we distinguish between three types of communicative acts.

- Conversations
- Messages
- Meta-messages and cues

Our framework draws from discourse analysis, which itself encompasses a variety of analytical approaches (*ibid.*). While our definitions of conversation and message might overlap with existing concepts, they are here defined in a way we deemed useful for the analysis of this particular domain. Our definition of meta-messages is congruent with its use in pragmatics [14].

Conversations constitute the macro level, the on-going message exchange that takes place in intra-hospital coordination and medical problem solving. In principle, a conversation could span anything from seconds to years, but in our case we focus on the more immediate conversations with a shorter time span.

Messages are the building blocks of the conversation and are associated with some media used for exchange (i.e. telephone, face-to-face encounters, email). Messages are exchanged in a typical turn-taking fashion, where sender and receiver alternate between interpreting and constructing messages.

Meta-messages and cues (ibid.) are any contextual information that adds meaning to the messages and conversation. Meta-messages can be purely linguistic (i.e. an ironic email), or they can be extra-linguistic and conveyed through tone of voice, gestures, facial expressions, etc.

In addition we have identified three aspects of particular interest in message exchange in health care:

- *Addressing.* Strategies used to find and deliver the message to the right person, group or role.
- *Obtrusiveness.* The degree to which the sending of a message interrupts the receiver.
- *Information richness.* The degree of contextual information associated with a message. Ideally, the message should convey enough information to enable the receiver to interpret it without having the spend time asking for clarification or consulting other sources, but not so much information that the receiver have to filter out superfluous information.

Materials and methods

Study design and setting

We conducted a non-participatory qualitative observational study at a Norwegian University hospital in the winter of 2009. Three observations were performed over different days, for 16 hours taken together. Two of the observations were performed in the operating theatre, while one was conducted as a shadowing of the patient in the peri-operative environment. This involved following the patient from preparations done in the ward, through to surgery and admission to the recovery.

The observations were based on ethnographic methods adjusted for requirements engineering for IT systems—so called *rapid ethnography* [15]. This involves more structured and focused observations than in traditional ethnography (*ibid.*). Data from the observations were recorded using free text notes. In addition to the observations we performed two semi-structured interviews with operating nurses, which each lasted about half an hour.

The observations were performed by one of the authors. To ensure a correct understanding, the clinicians were inquired for clarifications when appropriate during the observations. We also presented some of our preliminary interpretations during the interviews to ensure their validity.

Ethical considerations

The study design was approved by the Norwegian Regional Committees for Medical and Health Research Ethics, and the Norwegian Social Science Data Services. To protect the participants in the study, the data was de-identified and stored securely. Informed consent was collected from the participants.

Results

The peri-operative domain

Our observations are limited to the different procedures during the day of an operation—i.e. they do not necessarily cover the full length of the pre- and post-operative phases, which might extend outside the realms of the hospital and for a period longer than a day. The pre-operative phase corresponds to preparations done to the patient at the ward (typically physical examinations, confirming that the patient has not eaten, and premedication for anesthesia). The inter-operative phase starts when the patient is moved to the operating room, and the post-operative phase starts when the patient is moved to the recovery ward.

As we see, the phases have spatial boundaries that involve moving the patient to different locations in the hospital. At the hospital where we conducted our observations, the wards, the operating room and the recovery ward were located in separate places in the building and on different floors. This contributed to reducing the spatial awareness of the peri-operative process as a whole, as well as to the use of communication media like telephone and intercom to facilitate coordination.

Typically, an operation would have its immediate center of control in the operating room. Surgeries were scheduled with date and time, so each of the three locations corresponding to an operative phase (ward, operating room, and recovery ward, respectively) would have an idea of what would take place when, and this facilitated what we might call implicit coordination.

The transition between the operative phases still had explicit markers. Staff at the operating room would notify the ward when it was time to pre-medicate the patient, and when the surgery was about to end the staff would likewise notify the recovery ward that the patient would soon arrive. The phases were further distinguished by handovers between the different locations: Before surgery, staff from the ward transported the patient to the operating ward; after surgery, staff from the operating theatre transported the patient to the recovery ward.

Conversations, messages and meta-messages

Conversations in the peri-operative domain were predominantly concerned with coordination. Communication regarding medical problem solving did still occur, though, in one of two ways: 1) Either as informal information exchange between clinicians regarding patients they were responsible for, as when one operating surgeon inquired the assisting surgeon about the condition of a patient who had been operated the previous day, or 2) arising as a consequence of an unexpected medical event. During one of the surgeries a bile leak occurred, prompting the clinicians to engage in conversations regarding the cause, as well as conversations coordinative in nature to correct the condition.

In general though, the conversations were of a coordinative nature, with content of limited complexity, and of short duration. Often conversations consisted of no more than notifications or prompts—one message and its acknowledgement, as when one of the operating nurses called the ward to ask them to pre-medicate the patient. The level of meta-messages was in these cases restricted by the medium—telephone or intercom—leaving only the speech pattern and tone of voice to convey emotions.

Not surprisingly, the use of meta-messages was much more pronounced in the face-to-face communication, which took place inside the operating theatre. In this setting, the coordination was highly dependent on non-verbal cues, such as what personnel was in the room, where equipment was placed, etc. Many actions were carried out without being explicitly called for. In one instance, the surgeon entered the operating room and was dressed in his operating coat by a nurse before both of them proceeded to prepare equipment—without a word having been exchanged. The verbal communication had been replaced by a set of subtle cues related to their position in the room, bodily gestures and placement of objects.

Another occasion illustrates the importance of meta-messages in addition to verbal communication. When a piece of equipment broke down, a discussion between one of the nurses and one of the surgeons arose regarding the cause. Their opinions differed, and the nurse—while not willing to give in—softened the potential aggressiveness in her insistence using several meta-messages, such as self-directed irony and smiling (in all probability also reflecting the authority gradient between nurses and surgeons).

Addressing, obtrusiveness, and information richness

Communication between the different locations in the hospital was in general characterized by unspecific and what we shall call relayed addressing. In the pre-operative phase, personnel in the operating room usually communicated with the ward where the patient resided using telephone. This involved calling the coordinating nurse at the ward, whereupon he would relay the message to the personnel concerned. By assigning a nurse to the role of coordinator other staff members were alleviated from some articulation work, but a more direct addressing scheme would be technologically feasible and could free up personnel for more direct medical work.

Incoming messages to personnel in the operating room usually came through the intercom, broadcasting the message to all personnel in the room, while the anesthesia nurse usually was the one to reply since he was the one nearest to the intercom.

Lack of information richness was to a little degree perceived as a problem in this particular domain, which should not come as too big of a surprise given the relatively straightforward and simple messages exchanged. In conversations dealing with medical problem solving, adequate information richness in

messaging would be a more important requirement.

Our general impression was that the tolerance for obtrusive communication was high. Not uncommonly, the receiver of a message was interrupted in her work and had to use time to reengage in it. The media mostly used for communication—telephone and intercom—added to the problem of interruptions. Given the synchronous nature of these media, they are often convenient for the sender, who gets immediate feedback on her request—but correspondingly interruptive for the receiver.

The interviews with nurses confirmed the problems resulting from situational awareness. A common complaint was that they lacked an awareness of what was going on in other locations, and that agreements about handovers could lead to waiting and delays.

The lack of team situational awareness between sender and receiver in a conversation also added to the problem when using synchronous media. For instance, when telephoning there is no way for the sender to know whether she will interrupt the receiver. In some cases messages were delivered personally, in the sense that personnel entered the operating theatre to engage in conversations with the surgeons. While in one sense obviously intrusive, these occasions enabled the surgeons to signal their degree of availability, and this awareness enabled sender and receiver to negotiate and adjust the form of communication literally on the spot. Even though the degree of interruptions was high, this seemed to be integrated in the work routine and a taken for given.

Discussion

As our observations were restricted to the peri-operative environment, they cannot be generalized to intra-hospital communication as such. Still, there is reason to believe the coordination problems of the peri-operative domain, and the message exchanges it prompts, are common also in other areas of the hospital. The peri-operative domain represents a scarcity of resources (rooms, equipment, and personnel), and work must be prioritized and coordinated so as best to utilize the resources available. This is similar to the situation in other domains in the hospital, like the emergency room or when using equipment and personnel for diagnosing (for instance X-ray examinations). However, the peri-operative domain is less representative of the medical problem solving communication, which is characterized by more complex conversations over longer periods of time.

To summarize our main findings:

- Physical dislocation results in lack of situational awareness in the peri-operative phase.
- The lack of situational awareness contributes to interruptions, since there is a lack of sender receiver awareness in message exchange.
- Addressing is often unspecific and relayed through several instances.
- Use of synchronous (i.e. interruptive) media is convenient for the sender, but often interrupts the receiver.
- The interruptive nature of communication seems to be accepted and integrated in the work process.

Reflecting on these findings, we think there is a potential for improving communication in the peri-operative (and similar) domains through use of novel communication technology. Problems regarding addressing and interruptions to a large degree stems from a lack of situational awareness. This could be alleviated either by enhancing awareness through changing procedures or the physical space, or by integrating a larger degree of sender-receiver awareness in communication technologies. Also, we believe that more asynchronous communication means could potentially be utilized to reduce interruptions. This is in accordance with earlier findings and recommendations [16- 18]. Again, a larger degree of sender-receiver awareness could potentially provide some of the current benefits of synchronous media also in asynchronous media. Lastly, one should keep in mind the importance of meta-messages in conversation, and we would caution against replacing information rich media or face-to-face communication with technologies that do not support the same bandwidth to covey meta-messages.

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