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Managing variations from surgical care plans: Challenges for coordination

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ABSTRACT

Introduction: In surgical work there is a need for 'continuous planning' among staff to handle the frequently occurring variations from the planned patient treatment. In this paper, we present how three hospital information systems have support for three common patient trajectory variations.

Purpose: Highlight how deviations from a plan cause different information needs and implications for design of awareness supporting computer systems.

Methods: Participant observations and semi-structured interviews with stakeholders involved in peri-operative work.

Results: When trajectories progress according to plan, information needs of staff seem to be minimal, as everything is "running to plan". However, when variations occur the information need increases. In order to provide better support for variations, awareness-support systems need to inform colleagues and other stakeholders about deviations from the plan. Plans and trajectories also need to be connected by projecting estimations of incidental time of ongoing relevant events. Additionally, end-users should have the option to switch between information-sparse and information-rich computer support.

1. Introduction

Due to the spatial organization of medical work and the ever increasing specialization of medical services, hospital work can be characterized by mobility and a strong division of labor. Effective coordination of work is crucial to ensure quality and effectiveness. However, several studies illustrate troublesome aspects concerning coordination and communication of hospital work [1–10]. ICT-support is often suggested as a means to improve coordination and collaboration in hospitals [6,11–13].

One approach to support coordination and collaboration in hospitals is to design 'awareness-creating systems' [12] wherein hospital staff are provided with information about what is going on in their work environment, and the resulting awareness enables them to decide on further actions. In 2008, we started a nationally funded research project in order to explore awareness as a tool for clinical process support, called Co-Operation Support Through Transparency (COSTT). The main research question in this project is how hospital staff maintains control of their environment, both by staying informed about what is going on and by assessing the impact of possible changes in plans.

The point of departure for our discussion is that clinical work by nature is unpredictable [2,14,15]. This makes the organization of clinical work correspondingly challenging, leading

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to breakdowns such as delays, waste of resources and cancelations on the day of surgery. The proportion of elective surgeries canceled on the day of surgery ranges from 10% to 17% across Norway, the United States, New Zealand, Great Britain and South Africa [16]. A study from a major Australian referral hospital found that up to 60% of these cancelations are avoidable [17]. In a similar vein, a Danish study showed that 67% of pre-scheduled operations were changed during the day of surgery, arguing the need for '*continuous planning*' to handle the changes [1].

Similarly, Hendrich et al. [18] found that hospital nurses spent more than three-quarters of their time on nursing practice, of which care-coordination (communication regarding the patient) was one of three categories of activities. On average 86 min (10 h shift) per day was spent on care coordination. This is also reflected in Tucker's study [19] of the impact of coordination failures where she found that 44 min (8 h shift) were spent directly on *failure resolution*-activities.

In order to enable flexible coordination in the dynamic clinical environment, health care workers must be provided with means to update themselves on what has actually happened, in contrast to what was planned to happen. A useful representation of clinical reality could be derived from the concept of a patient trajectory.

2. Background

The concept of an illness trajectory [9], first introduced by medical sociologists such as Strauss and others, is a deliberately broad view on what has actually happened to a hospitalized patient. The trajectory concept is understood and used slightly different across disciplines. However, a commonality is the emphasis on the enormous complexity of the organization of medical work from the initial phase of a patient's disease to its final phase, or more confined; from the patient's admission to the hospital through to discharge. In order to operationalize the rich, but ambiguous concept of a patient trajectory, we simplify the concept referring to the 'log' of events that is registered during a patient's hospital stay. In that respect, the concept of a trajectory must be clearly distinguished from that of a plan. As suggested by Suchman [20], work practices are formed pragmatically during the situation as it unfolds, rather than managed by plans. A plan has an orientation toward the yet unrealized future and can either prescribe or at least steer clinical work. This distinction opens up for an interesting discussion about the relation between plans and trajectories [21], but we are more interested in the question of how such a representation of a log of historical events can be used to coordinate work.

The understanding of the activities of others in the context of one's own activity is by Dourish and Belotti [22] termed awareness. This passive understanding of the notion has later been extended beyond synchronous collaboration by Dourish [23] and is widely accepted, but also discussed in several micro-perspective analyses in, among others, Computer Supported Collaborative Work (CSCW) research. The term has been found both ambiguous and unsatisfactory, often being used in combination with different adjectives, such as 'distributed awareness' [22], 'passive awareness' [24] and 'workspace awareness' [23]. Schmidt [25] addresses the issue of ambiguity regarding the concept in the article 'the problem with awareness', claiming that the contradictory use has decreased the utility of the notion of awareness as a basis for empirical research.

Tjora [26] suggests that the term *attention* should be used as an alternative to emphasize on an operator's active interpretation of, and engagement in, his colleagues ongoing activities in terms of *focused* and *overall attention*. Sharing information of work context and tasks, as well as observing the work of others are primary mechanisms essential for sustaining and enhancing mutual awareness in shared collaborative work. Heath and others call these mechanisms *displaying* and *monitoring* [27].

Awareness can make coordination of tasks more dynamic and helps minimizing interruptions [25] by enhancing the transparency of the overall flow of work. However, in some circumstances awareness can also be a source of interruptions, disrupting ongoing activities on behalf of one part for the benefit of another [12,28,29]. Bardram et al. [12] discusses three types of awareness when it comes to the flow of work. *Social awareness* – enhances the awareness of the work tasks, *spatial awareness* – enhances the awareness of *where* the work will be performed, and *temporal awareness* which enhances knowledge of what has been done and what is planned. Such temporal aspects were also the focus of Reddy, Dourish, and Pratt in their study of work in Surgical Intensive Care Units [30].

Ren et al. [6] studied multiple group coordination in and around hospital operating rooms (ORs) and consider 'trajectory awareness' to be one of the critical factors to success in this type of coordination. They focused on coordinating multiple trajectories and paid special attention to critical incidents where coordination was interrupted or stymied. Ren et al. uses Strauss et al.'s [9] concept of trajectory to focus their observations and interviews; defining a trajectory as; '*the sequence of activities and paths which people, resources and groups move*'. Further, Ren et al. describe a typical surgical patient trajectory as '*arriving at the hospital, getting ready in the preoperative holding area, moving to a room to receive surgery, staying at the postanesthesia care unit, and being discharged*' [6]. Ren et al. acknowledges the need for tight coupling of multiple trajectories cross group boundaries and stresses the importance of a good integration with the existing information systems.

We find a similar example of the use of the trajectory concept in Xiao et al.'s [31] attempt to develop visualizations of projected trajectories in operating rooms. Their aim was to display OR trajectories, including information on past events, current status and a projection of future status of the OR. Here, the concept of a patient trajectory is used more indirectly. Through the proposed visualization, patient trajectories would be displayed through the status of the room. Thus through being informed about the status of the OR, health personnel may anticipate the status of the patient, too. As such, the use of the *patient trajectory* concept to support coordination, as explained by Xiao et al. and Ren et al. are highly representative of what can be found in the literature.

In this paper we look at three specific information systems that are used by health care workers in the peri-operative domain (i.e. before, during and after surgery) in order to keep