Reconceptualising Clinical Handover: Information Sharing for Situation Awareness

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ABSTRACT

Clinical handover, associated with the transfer of responsibility for patient care, is usually regarded as a single point of transition. Drawing on data from ethnographic studies of handover undertaken across a range of clinical settings, we suggest it may instead be useful to reconceptualise handover as a process that occurs over a period of time. We discuss the implications of this view and how it is compatible with construing the purpose of the information sharing that generally accompanies handover as being to promote good situation awareness in the distributed cognitive system of the clinical setting.

Keywords

Handover, situation awareness, distributed cognition.

ACM Classification Keywords

K.4.3 [Computers and Society]: Organizational Issues – Computer-Supported Collaborative Work.

1. INTRODUCTION

A common characteristic of many work systems, particularly many critical systems, is that of continuous operation. Work must continue twenty-four hours a day, every day of the year. This requirement for continuity necessitates a series of transitions between the human operators who are responsible for specific roles in the system, for example, the transitions of responsibility that occur between controllers in the domain of air traffic management.

For the last few years we have been investigating continuity of work in the healthcare domain. In this case, the concern is continuity in the provision of patient care across transitions in responsibility. Effective transitions are reported as contributing to a safe patient journey; or, from another perspective, poor transitions have been implicated in incidents of poor patient outcomes, patient harm and ineffective work [7] [17].

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It is in hospital settings that care transitions are most evident. Care for patients in hospital is provided by complex, dynamic and often unpredictable distributed cognitive systems that include people, information technologies, equipment and procedures. Care transitions are most evident here because hospital patients generally require frequent monitoring and regular treatment interventions. These continue across boundaries of time (the transitions of responsibility that occur as healthcare professionals change shift) and boundaries of space (the transitions of responsibility that occur as the patient progresses from one clinical setting to another, for example from Accident and Emergency (A&E) department to admitting ward). However, taking a holistic view, care transitions actually occur across a person's lifetime, in both hospital and community settings.

The transfer of responsibility for patient care at each of these points of discontinuity in time and space is commonly referred to as clinical handover (but see discussion in section 4). Clinical handover is generally regarded as a single point of synchronous transition, where responsibility for the system is simultaneously relinquished by one party and accepted by the other. An implication of this is that all information necessary for continuous safe care is passed and received at that point in time. In practice, this has been manifest in the staff who are handing over (primarily medical and nursing staff) preparing a handover document and/or giving a verbal summary to the receiving staff. The recent proliferation of work on "minimum data sets" for handover, i.e. the minimum information that should be communicated at every handover, has tended to reinforce this view of handover as "passing the baton". Our aim in this paper is to revisit this view and suggest that it is time to consider an alternative. Drawing on some of our recent studies, we propose a reconceptualisation of clinical handover as a process and suggest that the challenge of improving handover can then be construed in part as one of improving situation awareness.

2. BACKGROUND

For many years, clinical handover attracted relatively little attention from either healthcare professionals or researchers and, while transitions of responsibility obviously occurred, the practice of handover varied considerably. This has changed. Clinical handover and its contribution to patient safety have attracted substantial interest over the last few years, not least because of investigations such as [7] where poor handover was reported as a serious shortcoming. The importance of effective handover is also suggested by studies such as [9] which reported an increase in adverse events during cross-coverage (where a patient is temporarily assigned to a covering doctor who is not

primarily responsible for their care) due to poor information transfer and [8] in which a survey at two teaching hospitals revealed that trainee doctors perceived problems with handover as the reason for 15% of mistakes. A further impetus to focus on handover has been changes in the organization of healthcare work: both the increased specialization of medical work and the increase in shift work resulting from the reduction in working hours for junior doctors in the UK and elsewhere have led to more frequent transfers of patients. These changes mean more handovers and greater cross-coverage.

While continuity of care across transitions in responsibility is the primary goal of handover, this does not necessarily mean that the care is unchanged: a patient may be transferred to another setting precisely in order to enact change in their care. Handover has also been reported as achieving other important outcomes beyond the continuity of care for individual patients. For example, Wears et al [13] reported how shift changes in the Emergency Department can be a time for identifying problems in care provision and recovering from failure, while we previously discussed how handover provided an opportunity for developing treatment plans, checking that work had been completed, educating junior staff and promoting social cohesion [14].

Much of the current focus is on shift handovers, on the information communicated at handover and on improving handovers through standardization using mechanisms such as minimum data sets and standard operating protocols. For example, the Royal College of Physicians (RCP) in the UK undertook a review of published work on medical record keeping standards and a substantial consultation exercise, resulting in a suggested minimum set of data items to be included in medical documents for handover [11]. Other work, recognizing that what may be suitable for one setting is not necessarily appropriate for another, has tried to define the content and structure of handovers at a higher level. For example, the Australian Commission for Safety and Quality in Healthcare recommended the ISOBAR protocol (Identification of Identify, Observations, Background and History, Assessment and Actions, Responsibility and Risk management) in its recent guide [1]. The form and use of artefacts (e.g. see Figure 1) to support handover have also been examined through studies of current practice [10], [12]. However, a recurrent, implicit assumption in all this work seems to be that handover is a single, clearly defined episode in time.

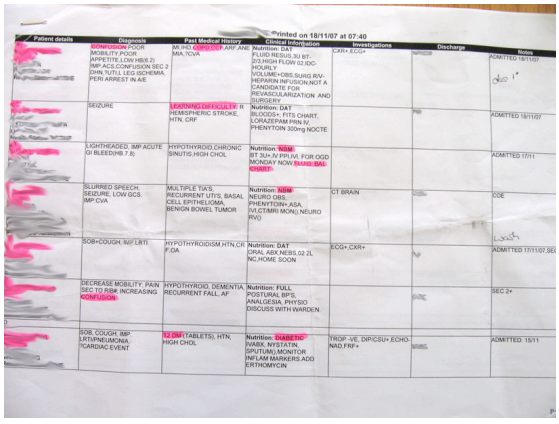

Figure 1: Example artefact to support handover: a "handover sheet"

3. HANDOVER AS IT HAPPENS

We have undertaken substantial, ethnographic field studies of clinical handover in hospital settings over a two year period and these are still ongoing[1]. We have studied different kinds of handover, primarily involving nursing and medical staff: nursing shift handovers, medical shift handovers (including to night teams), temporary delegations of responsibility and transfers between settings.

In this paper, we draw on data collected in six of our field studies undertaken in varied hospital settings in the UK. The six field studies are summarized in Table 1. Two of them were undertaken in a District General Hospital (DGH): an Emergency Assessment Unit (EAU) where patients are transferred temporarily from A&E prior to either discharge or transfer to a specialist ward and a general medical ward where patients under the care of physicians stay on a longer term basis. The other four studies were undertaken in large, inner city teaching hospitals: a relatively small paediatric surgical ward which looks after children before and after elective and emergency surgery; a specialist ambulance transport service which transfers critically ill children from local hospitals to paediatric intensive care units; a high-dependency unit which looks after patients who require continuous electronic physiological monitoring (telemetry) and a Medical Assessment Unit (MAU) which is a short stay unit for patients arriving from A&E or EAU who are to be admitted to other wards. The studies took the form of non-participant observations recorded as field notes, audio recording of verbal communications and informal interviews with staff. We gathered examples of artefacts used to support handover and took photographs of the settings. In total, we undertook 660 hours of study in these six settings. Research Ethics Committee approval was obtained for this project and informed written consent was obtained from all staff and patients.

These studies have yielded a corpus of data distinguished by its breadth and depth. It is informing our work on understanding current practice in handover and the design of technology to support handover. We analyzed the data (as summarized below) to understand handover as it happens at present. However, it is not the purpose of this paper to report these results; rather to reflect on how undertaking the analysis caused us to face a number of questions about handover.

Following the data collection, a "cognitive landscape" was written for each setting. This was a narrative account of the setting, describing the physical environment, people, organisation and processes of work and, importantly, the cognitive artefacts that supported the work. Following this, a qualitative data analysis tool was used to index the data, identifying all handovers that were observed. The data for each setting was then analysed individually using a grounded theory approach so as to allow themes that were unique to each setting to emerge from the data. The field notes and audio transcripts for the handovers were firstly read and then coded. We paid particular attention to what was occurring and in what order, what was being accomplished and what strategies were used to achieve this. We identified the types of handover, duration, location, participants, artefacts, information communicated, structure, purposes and strategies. Differences across settings and types of handover became apparent.

[1] Hence the field studies reported here are not necessarily the same as those in other reports of this work.

Table 1: Summary of six handover field studies

	Hours of field study	Handover types	Unit description
Emergency Assessment Unit (EAU)	172	Medical shift handovers Nursing shift handovers Transfers	28-bed, short stay ward in District General Hospital (DGH) Patients transferred in from A&E or by direct referral from a General Practitioner (GP). Patients transferred out to appropriate wards or discharged.
General Medical Ward	104	Nursing shift handovers Transfers	20-bed general medical ward in District General Hospital (DGH). Mostly elderly patients.
Paediatric Surgical Ward	92	Medical shift handovers Nursing shift handovers Transfers	11-bed paediatric ward in large teaching hospital, catering for elective and emergency surgical patients. Patients under care of a range of surgical teams (e.g. orthopaedic, neurology).
High Dependency Unit	29	Medical shift handovers Nursing shift handovers	13-bed ward in large teaching hospital, for patients who require continuous telemetry monitoring and coronary care patients.
Ambulance Transport Service	111	Transfers	Service staffed by medical and nursing teams, transferring critically ill children from DGHs to paediatric intensive care units in other hospitals.
Medical Assessment Unit	152	Medical shift handovers Nursing shift handovers Transfers	28-bed, short stay ward in large teaching hospital. Patients admitted from A&E or EAU prior to transfer to another ward.

This process led us to question what we meant by "handover" through confronting questions such as "where are the handovers?", "when does the handover commence and when does it end?" and "what information is shared?" and ultimately to reframe our definition of handover in order to arrive at a definition that encompassed and adequately characterized all the episodes that we might intuitively consider to be handover.

4. CLINICAL HANDOVER: A REFRAMING

The field studies highlighted the extent to which episodes referred to as "handover" by healthcare staff differed from one setting to another. The term "handover" was generally used to refer to a collaboration between two or more people, accompanying a transfer of responsibility, in which information was communicated in verbal and/or written form. People would talk about "taking" or "giving" the handover. Handovers were responsive to the context in which they occurred. They varied in terms of structure, information content, supporting artefacts, participants, location, duration etc. Local practice, while informed by guidelines and standard protocols, has generally evolved to satisfy local needs. Even within a given setting, the handovers varied depending on contingent circumstances. For example, when a patient was transferred into the EAU from A&E, the standard practice was for the A&E nurse to pass information directly to the EAU nurse who was assuming responsibility. However, if the EAU nurse was unavailable for any reason, the A&E nurse did not have time to wait and would instead pass the information to another EAU nurse who would later pass it on to the responsible nurse.

Yet this everyday sense of handover as a collaboration, reflected also in much of the literature, does not altogether match the more formal definitions. A widely accepted definition of handover offered by the British Medical Association in collaboration with the National Patient Safety Agency in the UK [4] equates it with the transfer of responsibility: "The transfer of professional responsibility and accountability for some or all aspects of care for a patient, or group of patients, to another person or professional group on a temporary or permanent basis". The Australian Medical Association has adopted the same definition [2]. In contrast, the definition of handover given in [5] emphasizes the exchange of information as being the defining characteristic of handover ("handoff") while limiting the scope to information exchanges where there is also a change in control or responsibility: "the exchange between health professionals of information about a patient accompanying either a transfer of control over, or of responsibility for, the patient".

4.1 A Process

As a starting point, and as mentioned in the introduction, we consider handover to occur when there is a transfer of responsibility for some aspect of patient care on a permanent or temporary basis. This means that we do not consider there to be a handover when one healthcare professional updates another without any change in responsibilities, but we do include temporary delegation of responsibility and resumption of responsibility.

We view clinical handover as a process that occurs when there is a transfer of responsibility for some aspect of patient care from one party to another (and note that many healthcare professionals may have responsibility for a patient at any point in time, each responsible for a specific aspect of care). This view distinguishes "handover" from "transfer": it is not the transfer of responsibility itself, but the process within which responsibility is transferred.

The handover process occurs over a period of time. It is not a single point of transition. For example, while there was a formal handover meeting at medical shift change in several of our settings, the outgoing doctors may well start to update the oncoming staff on a less formal basis prior to the meeting and continue to do so afterwards. Likewise, oncoming staff might read handover documentation or medical notes prior to a handover meeting, as is evident in this excerpt from field notes for the general medical ward:

> *The outgoing nurse says that the patient is 'for echo' but the oncoming nurse disagrees. The outgoing nurse says that the patient is for 'repeat echo' but still the oncoming nurse disagrees. To resolve the issue, they get the*

patient's medical record out of the trolley. In it, the Specialist Registrar has written a note saying that they have agreed that a repeat echo is not needed. The oncoming nurse knows this from having looked through the medical notes before the handover.

(Field notes, General Medical Ward, nursing evening shift handover)

In some cases, the duration of the handover process may be very short (for example, in our studies, the handover process that occurred when a patient was transferred into the EAU from A&E was generally brief); in others it may be more prolonged (for example, in the ambulance transport service, the handover from a local hospital started with a phone call to the service and later continued when the ambulance team arrived at the hospital to collect the patient).

This reframing of handover as a process arose from the fact that, having set out to study handover, we were often confronted with the questions of when a handover had occurred and whether a particular information exchange was a handover at all. Rather than seeking an explicit identification of a moment at which the baton of responsibility was passed, which was almost inevitably not the same moment at which information was communicated, we concluded that it was more appropriate to look at the overall process within which both responsibility and information were transferred and define this as the handover.

4.2 Components of the Handover Process

Secondly, we conceive this handover process as consisting of three components:

- The passing of responsibility
- The acceptance of responsibility
- The sharing of relevant information

4.2.1 Passing and Accepting Responsibility

We distinguish handover from other collaborations in the clinical setting by the fact that there must be a transfer of responsibility as part of the handover process. This transfer consists of the passing and acceptance of responsibility.

The transfer of responsibility in our settings was often implicit in the organization of the work. For example, at shift change one person would leave work and another would start, without any communication or other token exchange between them. When a patient was transferred by a porter from one ward to another, the patient's departure from one location and arrival in the other denoted the relinquishing and acceptance of responsibility. In these situations, the transfer of responsibility occurred irrespective of whether or not there was any additional, explicit indication. Sometimes the change in responsibility was less apparent (at least to us as observers). For example, when the ambulance service arrived at a DGH, they received information from the local medical staff about the patient and started to care for him/her. It was unclear whether responsibility had now passed to the ambulance service or whether this only happened when the patient was moved into the ambulance, their "space". It seemed that, in practice, there was a gradual passing of responsibility, with the ambulance clinical team starting to accept responsibility while the patient was still in the care of the DGH and its clinicians.

In other situations, particularly in more critical and rapidly changing situations, there was more visible flagging of the passing of responsibility, usually through verbal and/or written communication between the two parties. At nursing shift change on the general medical ward, an outgoing nurse would give a handover to the oncoming nurse and then leave the ward, with responsibility automatically transferring to the oncoming nurse. On the paediatric surgical ward, a written document with details of all patients on the ward, the "doctors' list", was passed at medical shift change. This was accompanied by a verbal update that usually covered just those patients who might need to be seen or for whom there were outstanding tasks to be done.

[On call Senior House Officer] only tells [night Senior House Officer] about one [paediatric surgical] patient… bloods need to be chased… [On call Specialist Registrar] handed over one [paediatric surgical] patient - the patient with the distended tummy.

… [On call Senior House Officer] hands over the [paediatric surgical] patients. This takes about thirty seconds. He looks at the doctors' list for the paediatric surgical ward and says "There wasn't anything really. [Patient name]'s orthopod. Orthopaedic patient, liver patient, nothing for us to do" (as he points at the different names on the list). When she comes back, [night Specialist Registrar] asks what she has missed. [On call Senior House Officer] says about [ward name], there's nothing to do.'

(Field notes, Paediatric surgical ward, medical shift handover from on-call to night staff)

Perhaps surprisingly, the relinquishing and acceptance of responsibility is not always a clear, synchronous transition. There was sometimes an ambiguous intermediate state where responsibility was temporarily passed to a person or persons who would not ultimately be responsible for this aspect of patient care. For example, we observed nursing shift handover meetings where an outgoing nurse would 'handover' information for his/her patients to the oncoming team as a whole but responsibility for individual patients would only be assigned to staff at the end of the meeting.

In identifying the passing and acceptance of responsibility as two distinct components of the handover process, this reframing explicitly acknowledges the role of the person receiving handover. In current practice, the recipient is sometimes a passive participant in the process, particularly with regard to the acceptance of responsibility. We found little observable evidence of the acceptance of responsibility: as described above, the acceptance of responsibility at shift change and in inter-setting transfers was largely enshrined in the work practice. An exception was the ambulance transport service, where the consultant physician had to agree that the transfer could go ahead before the patient could be moved from the DGH into the full care of the service. This is an area that warrants further work to investigate mechanisms for more explicit acknowledgement of the acceptance of responsibility and their impact on safe patient care. In contrast, the recipient of a handover was more frequently an active participant in the sharing of information. Verbal handovers were not merely a one-way passing of information, they were dialogues where the recipients played an active role in ensuring they had acquired sufficient information to enable them to care for the patients. For example, in this excerpt from a shift handover we see the oncoming nurse not just accepting the information but asking questions of the outgoing nurse in order to connect disjoint pieces of information and form a bigger picture of the situation:

Outgoing nurse: he's had a CT scan, I thought we'd stopped his clexine, yep, and he is to go for a bronchial scope today.'

Oncoming nurse: 'That's why he's nil by mouth?'

Outgoing nurse: 'Yeah, nil by mouth for that because um [consultant] cancelled his clinic for the scopes yesterday

so he's got all of yesterday's patients and whatever's built up today, so it could be anything up to 10 o'clock.

(EAU, nursing shift handover)

This was active participation in information sharing was particularly striking in the case of the ambulance transport service: the handover of information from the DGH would begin with the DGH doctor providing an overview of the case, but would gradually progress to the doctor and nurse from the ambulance service asking questions:

Ambulance doctor: What's the blood pressure?

DGH Anaesthetist: The last one, nineteen four over sixty three, the previous one I saw was one oh five systolic. Er his capillary refill is still sluggish.

Ambulance doctor: Alright.

DGH Anaesthetist: But better I think than it was.

Ambulance doctor: How much? Two? Or three?

DGH Anaesthetist: I couldn't quantify it…

(Ambulance transport service: handover from anaesthetist at DGH to ambulance service)

4.2.2 Information Sharing

The third component of the handover process is information sharing. This fits with practitioners' everyday sense of clinical handover and yet is not mentioned in the definition given in [4]. In some cases, the information sharing may be minimal even (in current practice) non-existent, though it is not at all clear that this is desirable in any situation.

As mentioned earlier, recent literature tends to promote a view of clinical handover as a distinct event and seeks to identify the set of information that should be shared at that point. This is particularly evident in the work on minimum data sets. Our field studies revealed that while the information sharing that occurs as part of the handover process does sometimes happen this way, it also frequently occurs in a variety of other ways and there are a number of (mainly practical) reasons for this. There was variation in when information was shared and what information was shared.

The information sharing may be removed in time from the transfer of responsibility. It sometimes occurs in advance, as in the case of patient transfers from the EAU where the sharing of information happened by phone and in advance of the patient being physically transported to an admitting ward. Alternatively, information may be shared some time after the passing and acceptance of responsibility. For example, on the general medical ward, no passing of information from the ward medical team to the on-call or night team was observed but those teams implicitly accepted responsibility for the patients when they came on shift. If a member of the on-call or night team was called to the ward, one of the nursing staff would provide information about the patient.

This example also highlights that in some situations there was no sharing of information. Transfers of responsibility to on-call teams were an obvious example but there were other cases as well. In the medical shift handovers in the EAU and paediatric surgical ward, information would be shared about only those patients that were likely to deteriorate or for whom there were tasks to be done. However, responsibility was assumed at the beginning of the shift for all patients, regardless of whether or the staff had received information about them. Doctors may be called to see a patient whom the outgoing doctor did not give them information about. Alternatively, doctors might not, during their shift, come into contact with patients that they had been given information about.

Another variation on information sharing was evident in the ambulance transport service: in this case, there was explicit sharing of information, but it happened in stages. The service would receive an initial handover of information about the patient during a first telephone referral from a DGH. This was followed by a face-to-face handover when they arrived at the DGH and information may also be shared at other points as it became available.

As regards what information was shared, the details of this varied considerably depending on the setting which was related to factors such as how much was known about the patient, the nature of their complaint, what had been done so far and what needed to be done, the staff and their experience etc. As has been reported previously [3] [14], the information shared during the handover process is not just about specific patients but more generally about the status of the work system, e.g. the medical shift handover to the night team on the EAU would highlight the patients to be seen and the order in which they should be seen, while the nursing shift handovers that we observed on the paediatric surgical ward always began with a discussion of staffing issues before progressing to sharing information about individual patients and concluding with a summary of anticipated admissions. It was also common to share information about possible future changes to the status of individual patients or the system as a whole:

Having gone through the patients, [outgoing charge nurse] tells them about the expected admissions. She gets this information from the ward book. 'You've got two coming in but you've got one bed.'

(Paediatric surgical ward, nursing evening shift handover)

Finally, we deliberately use the term "sharing" to connote that the information flow in the handover process is not just one-way, a fact also reported by others such as [3]. We observed incidents where a person receiving a handover appeared to know as much about the patient as the person giving it:

Outgoing nurse: 'category not stated… slept quite late last night, about half past one, because she said she slept all day.'

Oncoming nurse: 'I think that leg looks horrific… she needs dermatology review.'

Outgoing nurse: 'They stopped IV fluid… they did a blood culture… she's going to a nursing home.'

Oncoming nurse: 'On Saturday.'

…

The outgoing nurse says the name of the next patient on the list, to which the oncoming nurse responds, 'I can't believe he's still here. He was in tears. How was he Monday night?... Have you seen his toes? They're black on both feet.'

(General medical ward, nursing shift handover)

[Oncoming Specialist Registrar] says that the patient has periods of vomiting/diarrhoea but [outgoing Senior House Officer] says he didn't know anything about this.

(Paediatric surgical ward, medical shift handover)

Information is distributed around the cognitive system of the clinical setting, in external cognitive artefacts and in the heads of the staff (and patients). In some cases, the information sharing that happens during the handover process is a "push" as those passing responsibility proactively bring some of this

information to the attention of those accepting responsibility for patient care: they highlight the information they judge the accepting party will require. In other cases, the information sharing is a "pull" as staff assuming responsibility seek out the information they require. Mostly it is a combination of the two. The information push or pull may happen before or after the passing of responsibility or both; it may happen verbally during a handover meeting or by reference to external cognitive artefacts or both. Either way, the sharing is impeded when the information captured in these artefacts is incomplete, out-of-date or inconsistent, and this happens frequently. This should not be surprising when one considers how effortful it is to maintain artefacts such as nursing and medical notes. It can be difficult to know where to locate information across the range of different artefacts and there are often gaps: some information is simply not captured in a tangible form, for example information about the setting as a whole or about social issues such as what the family have been told or that a patient is upset or aggressive.

In summary, we do not equate handover with just the transfer of responsibility or just the sharing of information; instead we define it as a process that comprises both elements. Reworking the phrasing in [4]: "Clinical handover is the process by which professional responsibility and accountability for some or all aspects of care for a patient, or group of patients, is relinquished by one person or professional group, accepted by another on a temporary or permanent basis, and in which relevant information is shared between the two parties". This conception of handover allows us to limit our analysis to just those episodes where there is a relinquishing and acceptance of responsibility irrespective of how protracted they are and whether or not there is a sharing of information.

5. IMPLICATIONS

Reframing handover as a process offers a more holistic view of the role handover plays in the distributed cognitive system. The process view removes the emphasis from a single communication of information. Instead, we see the communication of information as an ongoing process of information sharing that promotes situation awareness.

We previously reported a study of medical shift handover [14] [16] in which we suggested that, in preparing for handover, doctors were creating their own mental representation of the "state-of-the-ward". In the subsequent handover meeting, the doctor giving a verbal summary would use this representation to pass on the information he or she judged to be relevant – the information that would enable oncoming staff to create their own representation of the state-of-the-ward. We identified that one impediment to effective handover was the lack of a readily available, up-to-date physical representation of the state of the ward. Consequently, medical staff preparing for handover would have to glean the information from a variety of sources including colleagues, ward whiteboards, medical notes, previous handover documents etc. Extending this in line with the process view of handover offered here, we consider that clinicians have an ongoing awareness of the state of the system, including the patients for whom they are caring. If those assuming responsibility in the handover process have a good ongoing awareness of the state of the system, there is less onus on one point of information assimilation and transfer. Likewise, if those passing responsibility have ongoing awareness, preparations for transfer will be less effortful.

These ideas fit with the concept of situation awareness as used to describe the state of knowledge that workers have of the dynamic environments in which they operate and which support their decision making [6]: "Situation awareness is the perception of the elements in the environment within a volume of time and space, the comprehension of their meaning, and the projection of their status in the near future." In the handover process, clinicians perceive visual and verbal elements in the environment, comprehend what they mean for individual patients in terms of their status and what they mean for the setting as a whole, and project how things might change. They use this situation awareness to organize and prioritize their work. It is a basis for making decisions about practical issues (such as bed management, staffing and transfers) as well as contributing to care and treatment plans for individual patients. This was particularly evident in the Medical Assessment Unit where a "board round" in front of a ward whiteboard was a forum for passing on information and making these kinds of decisions.

Considering the purpose of the handover process as being not just to transfer responsibility but also to promote good situation awareness, we take two implications for our work. Firstly, we suggest there is an opportunity for removing the reliance on a single point of information sharing during the handover process. In at least some clinical settings there are opportunities for the information sharing and construction of situation awareness to take place over a longer period of time. Second, we believe that the first part of the definition of situation awareness points to one of the primary obstacles for healthcare staff establishing good situation awareness: the difficulty they experience in perceiving relevant elements in the environment.

5.1 Technology Implications

Finally, we conclude that this reframing has implications for the design of work practice and supporting systems, including IT systems, to support the handover process. The work of the clinical setting needs to be captured on an on-going basis and made visible in a way that is accessible to those who will eventually assume responsibility. Healthcare staff need to be able to produce and consume this awareness in a non-effortful way.

This is not just an issue for the handover process. Our observations across the varied field settings consistently showed that, outside of specific interventions with patients, healthcare staff spend a vast amount of their time maintaining their own and others' situation awareness: by asking questions, by answering questions and by "telling" each other things. The following snippet from a handover to the night team on the paediatric surgical ward gives a sense of the importance of verbal communication for the work:

> *… [On call Specialist Registrar] handed over one patient - the patient with the distended tummy - saying that the [ward] Senior House Officer came and asked him to see the patient but then he got called to A&E so he didn't go. He says that the paediatric consultant has been to see the patient but he doesn't know the outcome - he tells [night Specialist Registrar] to check the notes and see if the consultant wants anything done, although he says that the consultant would probably have called if he did.*
>
> *(Paediatric surgical ward, medical shift handover to night staff)*

Much of this maintenance of situation awareness is achieved through verbal communication, which is easy for those concerned to accomplish but which leaves no trace for others to benefit from. The information does not persist other than in the heads of those who heard it and this is therefore one factor that makes it difficult for others to perceive relevant elements of the environment. Other factors connected to with external cognitive

artefacts have already been mentioned (incompleteness, inconsistencies and inaccuracies).

Because handover has been seen as a passing of the baton, much of the recent work on providing support for handover has been concerned with either general guidelines (e.g. hold handover meetings in a dedicated space, at fixed times, with no bleeps), or with providing specific templates to capture the data sets [11] that should be passed on. This is reflected also in the IT systems to support handover, many of which are implemented to support local practice and have evolved from paper-based systems. They support the construction and sharing of a data set but have not been designed to promote ongoing situation awareness, although healthcare staff do sometimes use them in this way, referring to them and updating them outside of the handover process.

In previous work [15], we described a research intervention to introduce a large projected display into a handover meeting in order to improve information sharing. However, while this was a shared representation, its role was to support a relatively short-lived process: information sharing and decision making within the immediate setting of the meeting. In line with the reconceptualisation offered here, we are now looking at how technology can support handover as a process and how shared displays have a role in this. This is particularly relevant when the handover process is protracted, as in the case of the ambulance transport service, or when there is the opportunity for staff to build up situation awareness over a period of time, as on the general medical ward where the throughput of patients is slower than in the other settings that we studied. We are now developing these ideas in collaboration with the ambulance transport service. Our aim is to develop an technology intervention that supports information sharing between the distributed team: the clinical staff who travel in the ambulance to a DGH to stabilize and move the patient; the more senior clinical staff who generally remain at the base and, ultimately, the intensive care unit who will receive the patient. We have identified two distinct aspects of situation awareness that are important in this setting: knowledge of the current status of retrievals (e.g. where the ambulance team is at any point in time) and knowledge of the medical status of individual patients. Our system aims to capture this information on the fly, with minimal effort on the part of the ambulance team, because it is apparent that the significant effort required to create some external cognitive artefacts is a major factor impacting their utility. The information is then distributed to the staff at the base and the intensive care unit where shared displays make it readily available. Our expectation is that this will improve information sharing across the work as a whole, altering how information is shared in specific handover episodes and promoting better situation awareness. We have already collected baseline data and post-intervention evaluation studies will commence in the near future to investigate these issues.

6. SUMMARY

Drawing on substantial data from studies of handover across six varied healthcare settings, we have suggested a reframing of clinical handover as a process that occurs when there is a transfer of responsibility for some aspect of patient care. We have identified the relinquishing of responsibility, the accepting of responsibility and the sharing of information as distinct components of this process. All three should be considered in endeavours to improve handover. While we have not attempted to develop a detailed model of clinicians' situation awareness, and this is something that could be explored in future work, it has been fruitful to view the purpose of the information sharing in the handover process from this perspective. Finally, the goal of improving information sharing in a non-effortful way across the handover process is driving our current work on investigating technology for the handover process.

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