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The ConStratO Model of Handover: A Tool to Support Technology Design and Evaluation

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Handovers are a specific kind of multidisciplinary team meeting. Shift handovers and transfers are both regular features of hospital work but there is currently great variation in how such handovers are conducted, presenting a challenging for those seeking to develop technology to support handover. This paper presents the ConStratO model of handover, which captures aspects of the context that influence how the handover is conducted, a range of different handover strategies relating to different aspects of the handover, and possible outcomes of handover. The model is based on detailed data collection in a range of clinical settings. We present the model as a tool for developing and evaluating technology support for handover.

Keywords: Handover, healthcare, case study, design, evaluation

1. Introduction

Handover is a process that involves the passing and acceptance of responsibility for some or all aspects of care for a patient, or group of patients, and the sharing of relevant information (*reference removed for blind review*). Sharing of information typically, though not always, happens through a verbal handover. Handovers, especially verbal handovers, are a specific kind of multidisciplinary team (MDT) meeting. They differ from many MDT meetings because the main focus is not decision making about patient care, although such decision making can take place within a handover.

Shift handovers and transfers are both regular features of hospital work, shift handovers taking place between oncoming and outgoing staff when there is a shift change and transfers occurring when a patient is moved from one ward or hospital to another. Qualitative studies of handover emphasise their situated nature, the form and content responding to the local context, such as the clinical specialty (Kerr 2002), the condition of the patient (Nemeth et al. 2006), the current workload (Nemeth et al. 2006; Philibert 2009), the participants' place within the professional hierarchy and their level of responsibility (Ekman and Segesten 1995; Manias and Street 2000), and whether or not the person receiving the

handover has previously cared for the patient (Kerr 2002). Such variation raises the question of how we can design technology to effectively support the collaborative work of handover.

We have conducted a multi-site case study of handover. We have reported the methods of our study and how handover happens within the various settings elsewhere (*references removed for blind review*). Here, we draw together the findings in order to present a model of handover. The ConStratO model highlights variations in handover practice, in terms of the strategies used for sharing information, features of the context within which handover takes place, and what handover achieves. Our motivation was to develop a model that would provide insight into the collaborative activity of handover and that could also be used as a tool to support the design and evaluation of technology for handover, guiding the requirements process and highlighting areas for attention during evaluation. In the following sections, we briefly describe the methods of our study and then present the model. The paper concludes by discussing how the model might be used to support design and evaluation of handover tools.

2. Methods

A multi-site case study design was used. Observations and interviews were conducted in eight settings, across four NHS hospital Trusts (providers): a general medical ward, an emergency assessment unit (EAU), a medical admissions unit (MAU), a high dependency unit (HDU), a paediatric surgical ward, a paediatric acute retrieval service (which transfers seriously ill children from local hospitals to paediatric intensive care units), a postnatal ward and a long-term ventilation service. Data collection involved observation and, where appropriate, audio recording of handovers, as well as time spent in the setting in order to understand how handover fits within the ongoing work. The handovers observed included medical, nursing and multidisciplinary handovers at shift change and transfer. The data

offered a compelling insight into local handover practice, showing variation between settings and types of handover.

3. A model of clinical handover

The findings from our studies of handover led us to conceptualise handover as a process that involves the passing and acceptance of responsibility for some or all aspects of care for a patient, or group of patients, and the sharing of relevant information (*reference removed for blind review*). Building on this, and again driven by the data, we have developed the ConStratO model of handover (see Figure 1 for a graphical representation of the model). The model is descriptive, capturing variations in practice as evident in our data, and then linking these variations to advantages and disadvantages. There are three distinct aspects to the model. Firstly, there are many different *strategies* used for sharing information in handover. We group the strategies according to the aspect of the process that they are concerned with: location, participants, structure, timing, content, order of content, artefacts and communication. The strategies are described in Section 3.1. Secondly, the process of handover occurs within a range of different *contexts*. Elements of the context impact how the process of handover occurs and elements of the context may constitute challenges to effective handover. The context and the challenges it presents are discussed in Section 3.2. Finally, while the goal of handover can be characterised as creating awareness in order to support continuity of care (*references removed for blind review*), handover can also achieve a number of *secondary goals*. Some strategies for the sharing of information enable these secondary goals better than others. What handover achieves is described in Section 3.3.

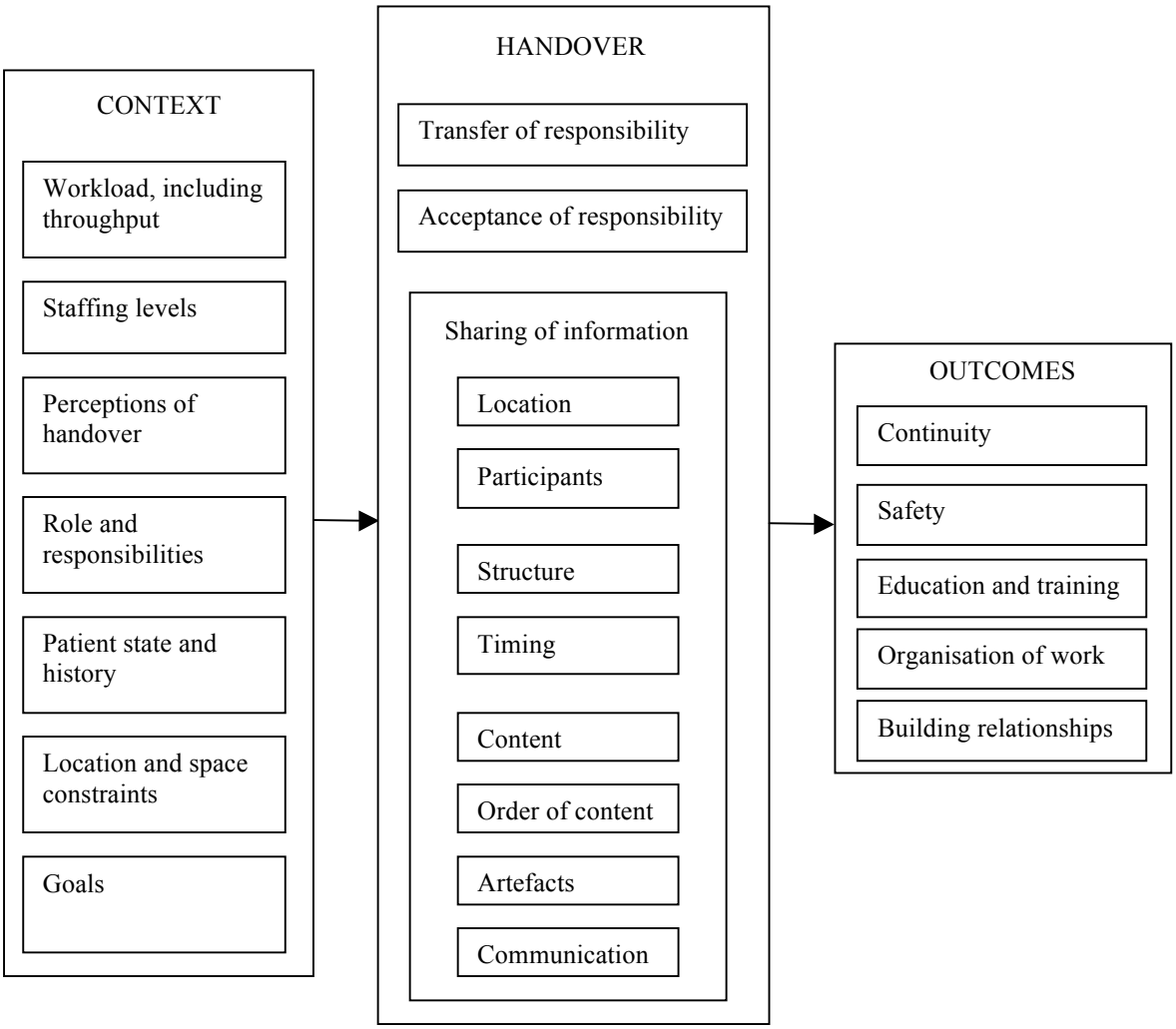

Figure 1: The ConStratO model of handover

3.1 Strategies for information sharing

3.1.1 Strategies for location

The handovers that were observed took place in a variety of locations, such as at the nurses' station and in the staff room. Here we discuss three strategies in regard to location of the handover that appeared to offer certain benefits to participants: having the handover at the bedside, flexibility regarding the location of the handover, and having the handover via the telephone.

In half of the settings, part of the nursing shift handover happened at the patient's bedside, as did the handovers that took place when the paediatric acute retrieval service transferred a patient. Bedside handovers provide an opportunity to introduce staff to the

patient, they provide an opportunity for patients and their relatives to ask questions, and they enable the patient to be a participant in the handover, contributing information, a strategy discussed further below. Another advantage of the bedside handover is the information resources that it provides access to, such as the drug chart and observations chart and any monitoring equipment and infusion pumps that the patient is attached to. Relevant features of the patient's appearance, such as rashes or swellings, can be looked at as they are discussed.

A disadvantage of bedside handover is the potential threat to patient confidentiality, with patients in other beds able to hear what is being said, thus limiting what can be discussed. Additionally, there may be information that staff do not want the patient to hear. There is also the risk of interruptions. In the paediatric surgical ward, this limitation was overcome to some extent by preceding the bedside handover with a handover in the staff room. For some types of handover, a bedside handover is not practical because the patients being discussed are physically dispersed around the hospital. It may also be less necessary in settings where there is less movement of patients, as staff members are more likely to already be familiar with patients.

While the location of the handovers in most settings is consistent, this was not the case for medical shift handovers in the EAU. They often took place at the EAU nurses' station, but they were not restricted to this location and staff handed over wherever they met each other or wherever the outgoing staff member was when the oncoming staff member was ready to receive the handover, e.g. in the corridor or the resuscitation room. This strategy ensures that if, at the time when handover is expected, the outgoing staff member is engaged in a task, the handover will still be able to happen. It also reflects the doctors' roles, in that they are not restricted to one location, e.g. the ward cover teams cover all medical wards. However, there are disadvantages to such an approach, one being the possibility of oncoming and outgoing staff being unable to locate each other.

Nursing and medical shift handovers are predominantly face to face, as are many transfer handovers. This allows staff to look through documentation associated with the patient together, as we discuss below. However, in all case sites, telephone handovers were also observed. There are significant limitations to telephone handovers; those receiving the handover cannot see the patient or the documentation associated with the patient and there is a gap between receiving the verbal handover and receiving the patient and their documentation. However, a telephone handover can save time. This is particularly important for nurses in the busy environment of the EAU where there is frequent movement of patients, as it removes the need to escort the patient to the ward.

3.1.2 Strategies for participation

We also observed variation in who participates in the handover. While in some settings, such as nursing shift handovers and transfer handovers in the paediatric surgical ward, there was consistency in who participated in the handover, in other settings we observed flexibility both in terms of who participated in the handover and the order and extent of their participation. In the EAU, we observed flexibility in who participated in handovers associated with the transfer of patients into and out of the ward. The EAU is a busy ward with frequent movement of patients into and out of the ward and efficient transfer of patients is essential. As a result, when a patient is to be transferred into the ward from Accident and Emergency (A&E), if the nurse who will be looking after the patient is busy or away from the ward, another nurse will receive the handover, later passing on the information to the nurse responsible for the patient. Having flexibility in terms of who participates in the handover balances the needs of staff to either give or receive a handover with the demands of the ongoing work and speeds up the flow of patients. However, by adding an additional link in the flow of information, an extra opportunity for information to be missed or reported inaccurately is created. It can create a delay in staff receiving information about the patients

that they are responsible for. By not directly participating in the handover when a patient is transferred into the ward, staff do not have the opportunity to ask questions of those who have been looking after the patient.

A further variation concerns flexibility in the order in, and extent to, which different people participate in handover. For example, we observed that sometimes all relevant participants were present for all of the handover, other times there were multiple small handovers between different participants, while on other occasions participants moved in and out of the handover as they responded to interruptions such as bleeps. The disadvantage of such a strategy is that it does not create the redundancy of information that is achieved when all receiving staff members are present for all of the handover.

As noted above, a bedside handover can allow the patient or their relatives to become participants in the handover. The patient can contribute information to the handover, compensating for breakdowns in information flow that result from frequent movement of patients and heavy workload. Obviously the ability of the patient to contribute information can vary greatly and the need for patients to contribute to the handover is reduced in settings where movement of patients into and out of the ward is not so frequent or where the ward is not so busy.

3.1.3 Strategies for structure

Two strategies for structuring handover stood out across the handovers that we observed, and we discuss these here: having a multi-part handover and allocating patients to staff after a shift handover.

In some cases, handover can usefully be considered as composed of multiple parts. For example, in the EAU, the nursing shift handover involved first a handover from the outgoing nurses to the oncoming nurses, concurrent with a handover from the outgoing coordinator to the oncoming coordinator, and this was followed by a handover from the

oncoming nurses to the oncoming coordinator. In the paediatric surgical ward, the outgoing charge nurse handed over to the oncoming nurses in a room off the ward and this was then followed by a one to one bedside handover between the outgoing and oncoming nurse for each patient. Similarly, in the paediatric acute retrieval service, details of patients to be transferred are received by the retrieval team in stages: first with a telephone call and then with a face-to-face handover when they arrive at the local hospital. These multi-part handovers provide receiving staff with multiple opportunities to gather information. In the paediatric acute retrieval service, we observed several instances of the receiver of the handover 'reading back' the information that they had been given in the earlier part of the handover in order to confirm that information.

Secondly, in the nursing shift handover in the paediatric surgical ward, the outgoing charge nurse gave details of all patients to all the oncoming nurses and only after this did the oncoming charge nurse assign nurses to patients. During the handover from the outgoing charge nurse, the oncoming nurses make notes on all the patients, as they do not yet know which patients they will be responsible for. The result of this is the creation of redundant information, with all nurses having some knowledge of all patients on the ward.

3.1.4 Strategies for timing

Transfer handovers take place as required, either prior to or following the physical transfer of the patient. In contrast, all our case sites had set times for shift handovers in order to coincide with shift times. However, in a number of the settings we observed occasions when the shift handover did not occur at the set time and instead happened when the outgoing staff were ready to handover, either shortly before or after the expected time. Again, this is a strategy that balances the need of outgoing staff to handover to oncoming staff with the demands of the ongoing work.

3.1.5 Strategies for content

Variation in the detailed content of handovers is to be expected due to variation in clinical settings and professional roles. However, we were able to identify some useful broad strategies relating to the content of the handovers that cut across clinical settings. In nursing shift handovers across all the case sites, all patients were discussed. In contrast, there was flexibility regarding which patients were discussed in medical shift handovers. Generally, information was given for only those patients where there were tasks to be carried out, or where it was likely that the oncoming doctor would be called to see the patient. By only discussing certain patients, it could be argued that staff members reduce the risk of information overload. The time taken to handover is also reduced, and keeping the handover brief can again be seen as a way of balancing the need to handover with the need to continue with the work of patient care. However, there is the risk that the oncoming staff will be asked to see a patient about whom they have received no information.

In the nursing shift handovers, while all patients were discussed, the information given about each patient varied and tended to focus on problems and tasks to be carried out, resulting in significant variation in the amount of information given about individual patients. Again, it could be argued that flexibility in content allows staff to focus on the most important information, reducing the risk of information overload. The disadvantage of such flexible content is that important information may be missed without those receiving the handover being able to detect its absence.

In addition to strategies regarding what information to include, strategies concerning the nature of the information to be handed over were identified. In the nursing handovers, we observed the tendency to hand over an assessment of the data rather than the raw data when discussing patient observations. Such assessments are typically brief, e.g. saying that the patient observations are ‘fine’. When the patient state is stable, such an assessment provides brevity. However, such an approach is not suitable for more acutely ill patients. For example,

for the paediatric acute retrieval service, the handovers contained much 'raw data' about the patient's state.

Across the case sites, but most notably in the paediatric acute retrieval service, staff explained the reasons for actions and decisions. It could be argued that, in explaining their reasoning, those giving the handover attempt to provide not only information but understanding. It appears that this is important for the handover of acutely ill patients. However, such explanations may not be necessary when reporting on more standard care plans. In the handovers in the paediatric acute retrieval service, details about who did and said what are given. In doing so, they make visible the collaborative nature of the work and also make visible accountabilities for various aspects of the patient's care. This appears particularly relevant for patients who may have been looked after in multiple hospitals and whose care has involved numerous clinical specialties.

3.1.6 Strategies for order of content

In all the nursing shift handovers that were observed, patients were discussed in the order they appeared on the nursing handover sheet and this was in bed number order. The handovers of individual patients at transfer tended to have a more standard format and content than shift handovers. Such consistency could be said to support effective handover as it enables those receiving the handover to anticipate what information will be given next and to detect when information is missed.

In the handovers in the paediatric acute retrieval service, the majority of the information was presented chronologically, giving details of the patient's state and treatment given, with reference to key points in the patient's journey such as the point of admission and when the retrieval team arrived at the hospital. By presenting the information chronologically, those receiving the handover can build up a picture of how the patient's condition has progressed. This is clearly important in a context where patients are acutely ill.

However, it would appear less relevant for patients in other settings, such as a general medical ward.

3.1.7 Strategies for artefacts

In nearly all settings where there were shift handovers, electronic handover sheets providing a summary of all patients were used to support the handover. These were Word documents with information organised within a table, typically updated once each day towards the end of the day shift. Copies were printed out before the handover and given to the oncoming staff members. These handover sheets provide oncoming staff with a summary of all patients on the ward, reducing the amount of information that needs to be written down during the handover. For the medical shift handovers, it means that even if only one patient is discussed, the oncoming doctor has some information about all patients. During handovers, members of staff annotate these sheets, adding additional information about patients and listing tasks to be completed. Staff members fold the sheets up and carry them with them during the shift, referring to them as necessary. However, staff expressed concern over the risk to patient confidentiality when sheets get left lying around. Another disadvantage is that the information on both the printed and electronic versions can quickly become out of date and the printed sheets can easily become inconsistent with the electronic versions.

In the EAU, the nurses created their own handover sheets for each shift, writing down patient details during the shift handover. It is felt that it would not possible to keep an electronic document up to date because of patients frequently being moved in and out of the ward. Handwritten sheets have the same benefits of mobility but present the same risks to patient confidentiality.

In the nursing shift handovers across the case sites and in the face to face transfers in the general medical ward, the EAU and the paediatric acute retrieval service, both those giving and receiving the handover often looked together at written information about the

patient while the person giving the handover provides a verbal account. This enables those who are receiving the handover to clarify any misunderstandings regarding the written information that is handed over and to identify any discrepancies between the verbal and the written information.

3.1.8 Strategies for communication

A number of strategies relating to the nature of the verbal communication within the handovers were also observed. The first of these was the asking of questions by those receiving the handover, although the nature and extent of the questioning varied according to the setting. With the exception of handovers in the paediatric acute retrieval service, the asking of questions seemed greater in shift handovers than in handovers associated with the transfer of individual patients. We have already noted that the handovers of individual patients tended to have a more standard format and content; this may mean that the necessary information is covered and so efforts to gather information are not required. However, questions do not only assist the gathering of information. We observed instances where questions were asked to highlight discrepancies in the written information and to question the decisions that had previously been made.

Another communication strategy was the way in which those receiving the handover would sometimes provide information about patients. For example, in the paediatric surgical ward, on call and night medical staff often had some knowledge of paediatric surgical patients if they had been on the ward for some time. Similarly, in the general medical ward, the movement of patients through the ward was not frequent, so that oncoming staff would already have some knowledge of patients if they had worked on a recent shift. In this way, handover enables the person giving the handover to receive information and enables the person receiving the handover to demonstrate their knowledge of patients. On occasion, this

knowledge enabled the person receiving the handover to correct the person giving the handover.

3.2 Context and challenges of handover

All handovers occur within a specific context. The context may limit the strategies for handover that are practicable and may present challenges to effective handover which require certain strategies as a response. Elements of the context have been mentioned in describing the strategies and their benefits and disadvantages but here we consider them more fully.

A key element of the context is the *workload*. For medical shift handovers, many of the strategies appeared concerned with managing this challenge, such as flexibility in the location of the handover. For the nursing handovers in the EAU, a particular challenge was the level of patient throughput, resulting in strategies such as flexibility of participants, the handwritten handover sheet and telephone handovers.

Workload is naturally linked to *staffing levels*. Where the number of members in a team is small, there is increased likelihood that handovers will be interrupted, as there is no one else available to respond to problems.

Perceptions of handover appear to affect the strategies used for sharing information and also appear to be linked to *roles and responsibilities*. While nursing has a strong tradition of handover, amongst medical staff there was sometimes the sense that formal approaches to handover are not necessary. However, it is not just the perceptions of those involved in a handover that affect how the handover happens. While nursing shift handovers are traditionally seen as protected time, medical shift handovers are not, leading to handovers starting late because staff were attending to patients and then to interruptions during the handover.

Roles and responsibilities also determine what information the person receiving the handover needs. For example, nursing shift handovers contain information absent in the

medical handovers about hygiene needs and nutrition needs, as washing and feeding are part of the nurse's role but outside the scope of the doctor's role. In the paediatric surgical ward, medical shift handovers were largely concerned with tasks such as chasing blood results and preparing TTAs ('to take away' medications) for patients, reflecting the role of the junior doctors within that ward.

We see that *patient state* can impact the content of handover as, for some shift handovers, information is only given about patients who are likely to deteriorate. Similarly, certain strategies appear more relevant for acute patients, e.g. chronological ordering of information and explaining reasoning, and for patients who have been looked after by multiple clinical groups, e.g. explaining roles.

Location of participants affects where and how the sharing of information takes place, e.g. if teams are physically distributed, handover by telephone is necessary and this in turn affects which artefacts are accessible. Location also affects the likelihood of a handover being interrupted, with staff more likely to be interrupted if the handover takes place on the ward where they are visible to colleagues, patients and patients' relatives.

Choice of strategies for sharing information is also affected by the participants' *goals*, e.g. giving positive feedback when trying to build a relationship with those giving the handover. What handover achieves is discussed further below.

3.3 What handover achieves

In discussing the strategies for handover that we have observed, we highlighted a range of outcomes that particular handover strategies can achieve. Obviously continuity of care is necessary for *safety*. However, handover can contribute to safety in other ways, by creating redundancy of information and identifying errors. Not only can handover provide an opportunity for the person receiving the handover to identify error but it can also be an opportunity for the outgoing staff to reflect and, through doing so, identify error.

We also see the *education and training* aspect of handover. For example, medical shift handovers appear to act as an educational opportunity when the consultant is present.

We have described how handover can provide an opportunity to identify tasks to be carried out and in this way handover contributes to the *organisation of work*. By focusing on problems and tasks in both medical and nursing shift handovers, and highlighting them within the handover sheets, staff pass on details of not just patients but also jobs to be done.

Handover can be seen as important to *building relationships*, both amongst staff and between staff and patients. For example, in medical shift handovers, the discussion was often informal and chatty, and handover seemed to be a chance to share experiences and complain about the workload. Thus handover can be an opportunity for getting support. Some of the strategies that were observed can be seen as contributing to the health care professional-patient relationship, with handover providing an opportunity to introduce oncoming staff to patients and providing patients and relatives with an opportunity to ask questions.

4. Discussion

Handover processes occur within a variety of contexts and support a variety of goals. The context and the goals influence which strategies for the sharing of information are desirable and appropriate. Similarly, they influence what technology for supporting the handover is appropriate. Thus, the ConStratO model of handover, by capturing the context, strategies and outcomes, frames a design space for handover technology.

Our model can guide the gathering of requirements. Firstly, designers need an understanding of current practice in terms of the different categories of strategies. The categories of the model can be used as questions to guide data collection: Where does the handover take place? Who participates in the handover and to what extent? How is the handover structured? When does the handover take place? What information does the handover contain? How is this content ordered? What artefacts are currently used to support

the handover? What is the nature of the communication? The answers to these questions can then be translated into requirements and possible design ideas to be explored with the intended users. For example, if the location of the handover varies, a mobile technology may be necessary. Is the technology intending to support all participants or particular participants, such as those who are typically unable to be present for the duration of the handover? If the content of the verbal handover contains not only information about individual patients but also ward level information, e.g. staffing issues, maybe the technology should support the transfer of such information as well. If the content of the verbal handover is ordered chronologically, should the information provided by the technology be similarly structured? How will the technology fit in with the artefacts currently used to support handover?

It is important to know not only what strategies are used but why they are used and to consider how the technology could help to overcome some of the limitations associated with particular strategies. For example, if the nursing shift handover takes place at the bedside because it is important for staff to have access to the patient observations when handing over but the nurses are concerned about patient confidentiality, the technology could provide electronic access to the patient observations, allowing the nurses to have the handover away from the bedside if they wished. Designing technology for handover can be an opportunity for change. The model can capture current practice and, through its account of advantages and disadvantages, can support reflection on that practice and whether it might be opportune to change it.

An understanding of what handover achieves is also required, as a technology that focuses on purely sharing information, without considering how the other goals will be supported, could have a negative impact on work practice and may be rejected by users. An understanding of the context, in terms of the features that we describe, is also important. This might not necessarily highlight requirements but it will reveal challenges that the handover

participants experience which are likely to influence how any technology to support handover will be used.

Similarly, the model can be used to guide data collection when evaluating technology to support handover. Again, the categories of strategies can be used as questions to guide data collection, to compare practice before and after the introduction of the technology. As well as considering how practice has or has not changed, what is achieved by the handover both before and after the introduction of the technology can be considered. An understanding of the context can help to provide explanations for why the technology is used in the way that it is.

5. Conclusion

Drawing on data from a multi-site case study, we have developed the ConStratO model of handover. The model articulates a set of key dimensions or categories for describing handover and its variations. The main focus of the model is on articulating a range of strategies relating to different aspects of handover. In addition, it captures aspects of the context that influence how the handover is conducted and possible outcomes of handover. The model is a useful tool for describing and encouraging reflection on current practice in handover and the ways in which context and goals shape that practice. Furthermore, we see a role for the model as a tool for developing and evaluating technology support for handover.

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