

Information environments for supporting consistent registrar medical handover

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Abstract

This study was two-fold in nature. Initially, it examined the information environment and the use of customary information tools to support medical handovers in a large metropolitan teaching hospital on four weekends (i.e. Friday night to Monday morning). Weekend medical handovers were found to involve sequences of handovers where patients were discussed at the discretion of the doctor handing over; no reliable discussion of all patients of concern occurred at any one handover, with few information tools being used; and after a set of weekend handovers, there was no complete picture on a Monday morning without an analysis of all patient progress notes. In a subsequent case study, three information tools specifically designed as intervention that attempted to enrich the information environment were evaluated. Results indicate that these tools did support greater continuity in who was discussed but not in what was discussed at handover. After the intervention, if a doctor discussed a patient at handover, that patient was more likely to be discussed at subsequent handovers. However, the picture at Monday morning remained fragmentary. The results are discussed in terms of the complexities inherent in the handover process

Key Words (MeSH):

Hospital Communication Systems; Physician's Practice Patterns; Medical Staff, Hospital; Medical Records

Supplementary keywords:

Computer Supported Cooperative Work; Medical Handover; Information Tools

Introduction

This research focused on the information environment surrounding handovers between medical staff in hospitals. Specifically, it reports on a study conducted at the Alfred Hospital, a 335-bed tertiary referral hospital in metropolitan Melbourne, Australia. The information tools and sources used by registrars during inter-shift handover were investigated, and the impact of a set of paper-based information tools designed to support handover were observed. The goals of the study were to (a) better understand the nature of medical handovers and the information environment in which they take place, and (b) to examine the potential for information tools to support handover.

Handovers (also called signovers, sign-offs, or handoffs) occur in many critical and non-critical environments (e.g. air traffic control, indus-

trial process control, and healthcare). Generally speaking, handovers between shifts aim to preserve the flow of activities, ideally so that the incoming persons can act and interact as if they had been present and engaged in all the previous activities (Patterson & Woods 2001).

Shift work is not a new phenomenon, particularly for allied health professionals and nurses. Handovers may occur between care providers from different disciplines (e.g. ambulance to medical staff), between staff in the same disciplines (e.g. between nurses); and recently in Australia, due to new safe working hours regulations, handovers between doctors have become increasingly common. While nursing handovers have been studied for some years (Hopkinson 2002; Lally 1999; Sexton et al. 2004), studies of handovers between medical staff are relatively new, with patient care over time now relying on

a 'sequential team' of doctors, and handovers the main means of transferring information and responsibility for continuity of care. Information failure has been estimated to be responsible for 30% of the A\$4 billion cost of adverse events in healthcare in Australia in 2004.¹ Thus, there is a clear need for further study of medical handovers.

Functions of medical handover

Handovers between doctors occur in many contexts: from one shift to the next (Laine et al. 1993; Lee, Levine & Schultz 1996; Perry et al. 2005; Petersen et al. 1994; Petersen et al. 1998; Van Eaton et al. 2004; Watters et al. 2004; Wilson, Galliers & Fone 2005); between wards or institutions (Wachter 2004); from inpatient to outpatient settings (Moore et al. 2003); and within emergency wards (Behara et al. 2005; Perry 2004; Perry et al. 2005; Wears et al. 2003). The purpose of a medical handover, however, goes beyond the simple transfer of information from an outgoing to an incoming doctor; it transfers responsibility and authority (Behara et al. 2005; Patterson et al. 2004; Perry et al. 2005; Wears et al. 2003; Wilson et al. 2005). Ideally, it should be a moment where the incoming and outgoing staff build a common understanding of the situation.

Handovers can be sources of failure or sources of recovery (e.g. reassessment can result in problem discovery or the 'correction' of wrong judgment – see Patterson et al. 2004; Wears et al. 2003). Because handover information is compressed in a non-standardised way, contextual and narrative information can be lost. The incoming doctor needs to re-create coherence. This can lead to a mismatch between the 'story', the situation, and the information received. Handover poses a potential source of failure but also an opportunity for recovery from failure.

Discontinuity of care increases the potential for medical error (Brennan & Zinner 2003). Brennan and Zinner claimed that a tired doctor may be no more dangerous to a patient than cross-coverage with an increased number of handovers. Charap (2004) claimed that patient care does not benefit from a reduction in doctors'

(in his case, residents') work hours, and that work hour reduction that results in increased medical handovers may even have a detrimental effect on patient care. The Joint Commission on Accreditation in Healthcare (JCAHO 2002) has reported that breakdown in communication (with or between physicians), exacerbated by multiple handovers, contributed to discontinuity of care across settings and shifts and led to delays in treatment. JCAHO has recommended the implementation of face-to-face interdisciplinary change-of-shift debriefings and processes and procedures for improving staff communication. Another study (Laine et al. 1993) found a relationship between restricted working hours and a delayed ordering of tests and increased in-hospital complications, but no statistically significant differences in more serious outcomes such as in-hospital mortality, transfer to intensive care unit, discharge disposition, or length of stay. Petersen et al. (1994) found that preventable adverse events were associated with staff not being familiar with the details of the patient's case; and concluded that the outcome of work-hour reform needs to be carefully monitored because an increase in shift work (and medical handovers where there is incomplete transmission of information) may lead to more errors of judgment. Roughton and Severs (1996) found that junior doctors saw a need for formal handovers, and they believed that current handover practices should be improved; the authors concluded that there is a need for guidance and standards for clinical handovers.

Handovers may also provide positive opportunities for incoming medical staff to review a case with fresh eyes, resulting in fruitful discussion between outgoing and incoming medical staff, with potential errors being avoided (Patterson et al. 2004). Brandwijk et al. (2003) argued that handovers are 'conversations' rather than 'reports'. Perry (2004) conceptualised handovers as dynamic and fluid and recommended that these more spontaneous elements be enhanced rather than formalised and controlled. It has also been suggested that handovers are an efficient way to communicate. Brandwijk et al. claimed that handovers conform to Grice's maxims (quantity, quality, relation, and manner); that

¹ Data presented by Dr. Bruce Barraclough, Chair of Australia's Safety and Quality Council, based on the National Expert Advisory Group on Safety and Quality in Australian Health Care report, 'Commitment to quality enhancement' produced in July 1998.

more critical patients or those with higher uncertainty levels will be discussed more thoroughly.

Clearly, the function of handovers is greater than the mere transfer of information and responsibility, and a major danger in designing systems to support handover lies in strengthening one function (e.g. information transfer from outgoing to incoming doctor), while simultaneously weakening other functions (e.g. reviewing the patient and treatment regime or the learning function), which may have disastrous consequences for patient safety.

The aim of the present study was two-fold: (a) to observe handovers between doctors to better understand information-sharing aspects of the process, as a precursor to (b) designing and testing information tools to support handover. Specifically, we wanted to determine what information was discussed and within what context; what information tools were used in discussion; and the effect of modest information interventions. The significance of items discussed or clinical consequences of any discussion was beyond the scope of the study.

Method

Design of study

The study consisted of two phases:

- **A pilot survey**, in which we observed handovers on the general medical ward and in the emergency department (ED) of the Alfred Hospital in order to:
 - develop an understanding of the context in which handovers take place (i.e. the function and content of the handover and the information support used);
 - derive research propositions for subsequent testing in the general area of information support for handover; and
 - identify a clinical champion for the study. (A senior consultant was needed to assist in the study design and in the engagement of the registrars for the study).
- **A case study**, in which we observed weekend handovers both with and without an intervention, testing research questions based on Phase 1 of our research, which

demonstrated that information tools were not used to a large degree in either ED or general medical ward handovers. We designed a set of information tools to support registrars' handover and to study the impact of these tools on the handover, investigating:

1. *What data, information, and context are transmitted during a sequence of handovers in a medical ward? Specifically, is continuity of communication improved as a result of an instrument that tracks which patients are discussed through a sequence of handovers?*
2. *Do registrars on Monday morning have an improved sense of each patient's condition, as a result of the Monday morning registrar handover, if they are using more comprehensive information transfer supported by a specific information tool (i.e. a patient information sheet containing a one-page summary for each patient)?*

We selected the general medical ward for the case study, primarily because of the presence of a highly respected senior consultant happy to champion our study. We also had support from the director of the general medical ward as well as support from one senior registrar of that ward. Given we were interested in continuity of communication over a series of handovers, the general medical ward was a more appropriate environment to study than ED, where patients often do not remain for longer than one shift.

Setting and focus

In settings for computer-supported teamwork, computers can act as an information intermediary or actively support workflows. However, in this study the face-to-face exchange of information between medical staff was considered most important, and our principal approach was to study information environments in which handovers occurred. We were seeking modest interventions with simple information tools that would not distract from the principal form of information sharing. In particular, we did not wish to start with significant technology interventions such as a shared plasma screen, a tablet, or even a PDA or prompting. Technology, while potentially valuable, was regarded as secondary.

Emergency department

At the time of the study (May 2005), the Emergency and Trauma Centre (ED) of the Alfred Hospital was the larger of the two major receiving hospitals for trauma patients in Melbourne. The Centre had 41 treatment bays (38 with full bedside monitoring) and was treating approximately 37,000 emergency patients per year, with an expected substantial increase in the following year. More than 60% of the patients presenting at ED required admission to hospital, and 50% had serious problems reflected by a triage category of 3 or above. Approximately 297 (3.2%) required immediate resuscitation, this being the highest percentage for hospitals throughout Victoria. The Centre had 11 specialist emergency physicians, 12 registrars, and 6 junior medical staff. Another 6 registrars worked for the Centre, but on rotation to other departments at the Alfred or at nearby hospitals. There were three doctors' shifts in ED per day. Formal handovers occurred at 7am, 3pm, and 11pm. Morning and afternoon handovers were plenary handovers, with junior and senior doctors, nurses, medical students and other staff attending, whereas at night, the outgoing registrar handed over to an incoming registrar on a one-on-one basis. The plenary handover took place in a seminar room in ED, whereas night handovers took place in the staff station area in the centre of ED.

General medical ward

At the time of the study, the general medical ward of the Alfred hospital was subdivided into two sub-wards (A and B) and a special unit (R) for the rapid assessment of patients. Patients leaving ward R could be admitted to A or B for a longer stay. The average length of stay was 7.8 days and 9.89 days for wards A and B, respectively. However, some patients stayed on ward A or B for weeks or months. Patients were supposed to leave the rapid assessment ward within 48 hours of being admitted, and the average length of stay at the time of the study was 1.85 days.

During weekdays, there was one senior registrar in charge each of A, B, and R Wards from 8am until 5pm. Another registrar was on duty from 2pm until 9pm, and was mainly responsible for admitting new patients (admitting registrar), but was also responsible for ward patients from 5pm until 9pm. On weekends,

during daytime, one registrar handled new admissions from 8am until 9pm, and all three of A, B, and R Wards. There was an additional ward registrar from 2pm until 9pm. Overnight (from 9pm until 8am) a single registrar was responsible for A, B, and R, as well as any other general medical issues in the hospital, both on weekdays and at the weekend. One of the two most senior registrars was normally on duty during the day on Sundays, which aimed at guaranteeing continuity of care over the weekend. Table 1 summarises the shifts on the ward.

Table 1: General medical ward shifts

	WEEKDAY	WEEKEND
Day shift	8am – 5pm (3 registrars)	8am – 9pm (1 registrar)
	2pm – 9pm (1 registrar)	2pm – 9pm (1 registrar)
Night shift	9pm – 8am (1 registrar)	9pm – 8am (1 registrar)

Formal handovers occurred at the two shift changes (i.e. 8am and 9pm); however, there was no formal handover or other planned communication process between the admitting and the ward registrar(s) in the afternoon.

The nature of handovers was different for day and night shifts, and on weekends. In weekday morning handovers (8am), the night registrar handed over patients who had been admitted overnight, as well as particularly sick patients, to the three registrars in charge of the A, B, and R wards. This team handover included care coordinators, interns and medical students. In addition, on Monday morning, the senior registrar who was on duty on Sunday handed over all patients who have been admitted over the weekend. On weekend mornings, the night registrar handed over to the incoming day registrar new admissions and patients about whom they were particularly concerned. However, this handover had no other participants except, occasionally, one or more consultants and/or an intern or a resident. At night (9pm) on any day, the admitting registrar handed over to the incoming night registrar. Again, it was expected that new patients should be handed over so that the incoming registrar knew the patients for whom each ward was responsible.

Materials and procedure

In both the pilot investigation and follow-up case study, we had permission from the senior consultant of the general ward to take notes of what we observed but not to use tape or video recording devices. We consequently took structured and unstructured notes, all directed at the information environment and information exchanges. All observation sheets, patient information sheets, event sheets, and patient lists used in the study were collected and stored securely at the Alfred Hospital. Information that would identify the patients was deleted before analysis of the data.

We focused on handovers between registrars (i.e. doctors who have completed at least two, often three, years of post-graduate medical training and have been accepted by a College for their continued training) (Australian Medical Association 2003). While the main focus was on handovers between medical staff on a general medical ward, we also observed handovers at the Alfred’s Emergency Department as part of the pilot survey. Moreover, we engaged in a number of informal discussions with two medical staff actively involved in improving handovers in their respective hospitals in Victoria (one in Geelong and one in Western Melbourne). In our discussion with these two staff, we were interested in the handover sheet that they have designed for the purpose of improving handover and the minimum required data that they felt needed to be transmitted at handover,

Senior clinicians interviewed expressed significant concerns about the flow of information at weekends. In any sequence of medical handovers, they queried whether information was reliably passed on from one medical attendant to another; and whether specific concerns about particular patients and the facts of each case were passed on or doctors relied on medical records and events during their own shifts to determine action.

Case study structure and tools.

The case study was conducted over four weekends and covered all handovers from Friday night until Monday morning (see Table 2). Overall, we observed 24 handovers, each of which (with one exception) was observed by two observers, who used an observation sheet (Appendix A) to record their findings. We

observed on two consecutive weekends without intervention, and on a further two consecutive weekends we provided a set of three information tools to the registrars:

- A patient information sheet giving a structured one-page summary of the patient’s main information (Appendix B)
- an event sheet (Appendix C) listing every patient mentioned during weekend handovers, when they were mentioned, and why
- a patient list, printed from one of the hospital’s patient information systems, broken up according to the patient location; wards A, B, and R each had separate lists. It is important to note that on the fourth weekend, we modified this list, by highlighting patients who had already been mentioned during a prior handover on the same weekend.

In order to design the patient information sheet, we met several times with both the senior registrar and the consultant to present suggestions and develop new versions using their feedback. The final version had headings for patient demographics, patient profile, presenting complaint, active issues, sample issues, other issues, management plan, investigations (relevant, pending/ordered, to be ordered), and progress over the weekend. (See Appendix B for a sample patient information sheet.). There was resistance to including a measure of ‘sickness’; there was no agreement that we have recorded as to whether a patient was acutely ill or stable. Some staff felt that, *prima facie*, all patients are ill so it was inappropriate to record this information, and they were not clear what values would apply.

Table 2: Handovers observed per weekend

HANDOVER NUMBER	DAY	TIME
1	Friday	9pm
2	Saturday	8am
3	Saturday	9pm
4	Sunday	8am
5	Sunday	9pm
6	Monday	8am

All of the registrars’ weekend handovers, with the exception of those held on Monday morning, were 1:1 handovers between the incoming and the outgoing registrar. They took place in the

hospital residents' lounge, away from the ward and a relaxation area for the doctors. Often, other doctors were in the lounge during the handover and, occasionally, one or more consultants would participate (mainly on Saturday mornings). The Monday morning handover took place in a seminar room on the general medical ward, and had an average of 15 to 20 participants. After handovers, we interviewed the care coordinators for the three wards to find out whether anything unusual had happened during the weekend.

Case study data-gathering

During the two weekends without intervention, we observed handovers using the observation sheet (Appendix A) to mark which patients were mentioned and, for each patient, what types of information were discussed. For example, if the outgoing registrar began the handover of one patient by saying 'Mrs Smith is a 78-year-old lady', we would tick the patient's name, age, and sex. If the registrar continued 'from a nursing home – a really lovely old lady with a very supportive daughter', we would tick the patient profile.

During the two weekends with intervention, a registered nurse (from the Alfred Hospital's Quality and Patient Safety unit) compiled the patient information sheets for each patient on the ward on Friday afternoon; these sheets were sorted alphabetically and placed in a folder. We also included several blank sheets for the patients who would be admitted over the weekend. A copy of the folder was stored on the ward. Immediately before the Friday night handover, we gave an up-to-date copy of the patient list to both registrars, so that they could use it during the handover if they wished. Again, we observed the handover using our observation sheet; this time, we also recorded on an event sheet (Appendix C) which patients were mentioned and why. This sheet was then copied and placed topmost in the folder. After the handover we explained the contents of the folder to the incoming registrar, handed her the original folder (including the event sheet), and asked her to fill in a patient information sheet for every patient admitted during her shift and advised that she could update any patient information sheet in the folder, if she wished. During the remaining weekend handovers, we continued to explain the folder to the incoming registrars

if they had not seen it before, and to update the event sheet to trace all patients mentioned during prior handovers. Immediately before handover, we provided copies of the current patient lists to both registrars, and on the fourth weekend we also highlighted patients who were already on the event sheet in this list. We ensured that the updated folder and event sheet were given to the incoming registrar after handover, we copied the folder contents (for backup reasons), and handed the folder to the incoming registrar.

During the third week, we had observed that registrars rarely referred to the patient information sheets or to the event sheet; they tended to use the patient list and their hand-written notes to jog their memories. It seemed unlikely that there would be a change in pattern in terms of who would be mentioned in handover. For this reason the modified patient list was provided, this being a list of patients, highlighting those mentioned at some time during the weekend.

Results

Phase 1: Pilot survey

In the initial phase of our study, we observed 15 medical handovers, 6 on the general medical ward, and 9 in the emergency department. We noted (a) the information environment and exchanges, (b) the information tools used, and (c) the functions of handover.

Information environment and exchanges

Handovers on the general medical ward occurred either in a 1:1 setting (i.e. one outgoing registrar handing over to one incoming registrar), or in a plenary setting (i.e. one outgoing registrar handing over to several incoming registrars). In the latter case further staff, including residents, interns, and nursing staff would also be present. In both cases, the interaction during handover centred on the outgoing registrar presenting a brief summary of the patient and the incoming registrar(s) asking questions to clarify their understanding of the case and to identify potentially unrecognised problems. Generally, a patient's length of stay determined the amount of information communicated about them. If the patient was newly admitted, a quick (or sometimes detailed) brief of the case was provided. However, if the patient had been in the

ward for a while, they would only be mentioned if the outgoing registrar was worried about them, envisaged problems, or if the incoming registrar explicitly asked about that patient.

In the emergency department (ED), handovers occurred either as a 1:1 handover between doctors, similar to the 1:1 handover on the general medical ward, or as a plenary handover, with nurses, interns, residents, registrars, and consultants participating. In contrast to the general medical ward's plenary handover, the style of the ED's equivalent was very formal. The outgoing doctor was expected to present information about their patients briefly and concisely to the whole room, and 'grilling' questions were asked if the handover was not deemed to be sufficient. Junior doctors, who had not been trained in this type of professional communication, were expected to learn quickly how to hand over.

During ED handovers, all patients currently in ED were discussed, as there was a high turnover and a short period of stay; often, half or more of the patients would be gone from one shift to the next. However, patients could spend weeks or months in the general medical ward, so these handovers focussed mainly on new admissions.

Information tools observed

In Phase 1, we also looked closely at what information tools and information sources were used during handover. In both the general medical ward and the ED handovers, very few information tools were used. We found that in both the ED and the general medical ward handovers, outgoing registrars mainly used handwritten notes, either on patient lists (mainly in ED) or on blank sheets of paper (mainly on the general medical ward). The information documented was often used as a 'memory trigger' and much additional information, related to the trigger, would then be presented during the handover. In both wards, incoming registrars either took similar notes during handover or, sometimes, took no notes at all.

On the general medical ward, registrars often used a patient list printed from one of the hospital's patient information systems. The list contained: the patient name; the patient's identification at the hospital (i.e. the Unit Record Number [URN]); the patient's location (bed and ward numbers); the name of the consultant

allocated to the patient; and the diagnosis on admission. However, instead of using this list, the outgoing registrars often used their own handwritten notes, with the notes for several patients on the same sheet of paper. This sheet usually had patient identification stickers, showing the patient's demographics, which subdivided the sheet. Emergency Department staff used a patient handover list printed from another patient information system. The document listed each patient's URN, name, age, sex, current cubicle number, triage number (1 to 5), length of stay (LOS), consultant name, reason for visit, patient's insurance status and the ward or unit to which they might be transferred.

In the general medical ward handovers, the incoming registrar often took few, if any, notes during handover; in contrast, incoming ED registrars tended to document more comprehensive notes of the patients allocated to them during handover. In ED, between 20 and 40 patients typically were mentioned during handover, as opposed to about 3 to 10 (on average) during general medical ward handovers. On both wards, handover notes were often not kept after the registrar's shift finished, although they constituted a memory of what the registrars had discussed and agreed upon during the handover.

Medical records were not used during handovers in either ED or the general medical ward: although registrars told us that the history of patient admission assists them to gain a more complete patient picture, its written form is not used as an information source during handover. However, registrars (as we observed mainly on the general medical ward) often remembered patients who had been under their care before, and this information was used in handover. There was no guarantee that a registrar would remember, or would even have been on the ward during a patient's previous admission, because (junior) registrars only stayed on a ward for about three months. However, nursing staff often stayed on a ward for years, and thus represented a much better long-term 'ward memory'.

Functions of handover observed

We observed multiple, closely interwoven functions of handover. One major function (but by no means the only one) was the transfer of information about patients from the outgoing

Table 3: Patient numbers

	NUMBER OF PATIENTS		CURRENT	NON-ADMITTED	ADMISSIONS	CURRENT
	IN UNIT		PATIENTS	PATIENTS	RE-DISCUSSED	PATIENTS
	ON MONDAY	ADMISSIONS	DISCUSSED	DISCUSSED	RE-DISCUSSED	RE-DISCUSSED
Week 1	33	12	5	6	9	1
Week 2	28	11	3	7	7	2
Week 3	27	7	6	5	7	0
Week 4	31	8	3	0	7	3

to the incoming registrar. However, this was not a one-way street: the incoming registrar would often ask questions, suggest treatment alternatives, or prompt the outgoing registrar about specific patients, especially if familiar with them from a previous shift. Given that a major function of handover appeared to be geared towards the incoming registrar getting a sense of which patients needed to be seen first, and which ones would probably need attention, this was not surprising. The two-way discussion at handover seemed to serve the function of enabling incoming doctors to identify important information or gaps that would affect the priority they assigned to tasks and patients, and how they interpreted and acted upon information. This

aligns with observations made by Wilson et al. (2005) in the UK.

Another explicit function of handover is that of transferring responsibility to the incoming registrar. Once the handover was completed, the incoming registrar had taken over responsibility from the outgoing registrar; we did not observe the outgoing registrar stay on after handover. Handovers also provided the opportunity for registrars to reflect on their own performance and for learning from other doctors. The handovers we observed, particularly those in the ED, exhibited strong power discrepancies; technically, everybody had a say in the discussion, but in reality only the registrars, consultants, and senior nurses provided input.

Table 4: Categories of information discussed during handover

INFORMATION CATEGORY	WEEK 1	WEEK 2	WEEK 3	WEEK 4	DIFFERENCE
Patient name	93%	82%	84%	86%	-5%
Patient sex	84%	84%	67%	62%	-38%
Patient age	63%	52%	44%	55%	-16%
Ward/location	34%	24%	24%	17%	-16%
Admitting registrar	19%	28%	29%	10%	-9%
Patient profile	53%	39%	41%	30%	-20%
Date and time of presentation	15%	13%	27%	25%	24%
Presenting complaint	66%	69%	69%	58%	-8%
Management plan	47%	58%	47%	39%	-19%
Active issues	56%	60%	57%	43%	-15%
Relevant investigations	40%	48%	34%	48%	-5%
Investigation pending/ ordered	18%	9%	9%	29%	11%
Investigation to be ordered	9%	22%	6%	23%	-2%
Other issues	24%	25%	21%	33%	6%
Progress	22%	15%	24%	10%	-3%
Patient history	16%	45%	27%	43%	10%
Status	21%	24%	24%	46%	26%

Differences of at least 20% are highlighted

Figure 1: Patients discussed during handovers

Week 1: Patients discussed in handover

Handover #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	■	■	■	■													
2	■		■		■												
3						■	■	■	■				■				
4						■			■	■	■	■	■				
5														■	■	■	■
6					■						■			■	■	■	

Week 2: Patients discussed in handover

Handover #	1	2	3	4	5	6	7	8	9	10	11
1	■	■	■	■	■						
2	■	■	■			■	■	■			
3								■	■	■	
4								■	■	■	■
5								■		■	■
6											■

Week 3: Patients discussed in handover

Handover #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	■	■	■	■	■	■	■	■											
2	■	■		■					■	■	■	■							
3										■	■	■	■	■	■				
4												■	■						
5													■	■		■			
6													■				■	■	■

Week 4: Patients discussed in handover

Handover #	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	■													
2	■	■	■	■	■									
3	■		■	■		■								
4	■		■	■		■	■	■	■					
5	■					■	■	■	■	■	■			
6	■	■	■		■		■	■	■		■	■	■	■

New patients	■
Patients admitted prior to the weekend	■

Phase 2: Case study of weekend handovers on a general medical ward

For each of the four weekends, we recorded at each handover the time, the registrars involved, which patients were discussed, what was discussed, and any extra observations. Determining what was discussed was sometimes difficult. The recorders of handovers were non-medical observers who could not judge the importance of what was discussed. It was not always clear to what the detail of the discussion referred. To assist, hospital staff suggested a set of categories, some simple (e.g. name of patient or time of admission referred to), while others required judgement (e.g. status of patient or test results mentioned). Consequently, these recordings were treated as indicative rather than definitive, and we looked for patterns in observations rather than particular values.

Having completed observations of a total of 24 handovers over four weekends, we first captured information that told us about the continuity of information transfer. Figure 1 shows the results for new patients and patients admitted prior to the weekend for each of the four weekends. There was no great difference in number or type of patients over the four weekends, and this was backed up by our discussions with the registrars and nurses after the Monday handover. Handover 6 corresponds to Monday handover and represents the end-point of the weekend. Table 3 summarises the number of patient in the ward, the number of admissions and the number of patient discussed at handover for each weekend.

The data presented in Table 3 are not able to be determined from Figure 1. For example, there is no direct correlation between admitted patients and patients being discussed. Patients from other wards, or potential admissions, were also discussed; the number was listed to ensure that the number of discussions at each handover was captured.

Table 4 shows the categories of information discussed during handovers on the four different weekends (e.g. under the 'Patient name' category, the percentages show that the name was mentioned for 93% of the patients discussed in any of the six handovers of that weekend). Differences of at least 20% are highlighted.

On average, 275.5 instances of information categories for patients were discussed over the course of each weekend (278, 282, 272, 270). There is little variation in number of information items mentioned, and this intervention did not make a large difference to the number of things discussed. While we do not have accurate times for the handovers overall, there did not appear to be a large difference in time taken.

In relation to the second research question, the Monday morning handover is Session 6 in each of the four graphs in Figure 1. We see that 4 out of 17 and 1 out of 11 patients who were discussed at some stage over the weekend were discussed in Monday morning handovers during the first two weeks (no intervention). In Weeks 3 and 4, four out of 19, and 11 out of 14 patients, respectively, were re-discussed on Monday morning. On the face of it, this is a large difference. However, this handover was a minor prelude to the ward round where every patient was assessed afresh. It appeared that the key role of the Monday handover was to hear about exceptions and assign responsibilities for the day.

Right after the Monday handover we asked the incoming registrars their sense of the status of the patients after the weekend. They tended to use only their first-hand knowledge of the patient when assessing the status of patients for whom they had assumed responsibility. They were reluctant to deduce anything from the handover or to categorise patients as stable or otherwise. It is possible there was improved awareness of what was happening in the ward but there are no data to support this. In conclusion, there was no evidence that our intervention had a significant impact on the Monday handover.

However, it is possible to calculate the likelihood of a patient being discussed in a handover after having being discussed at a previous handover. Analyses can be provided for two categories of patients: those who are admitted over the weekend and those discussed for any other reason (e.g. the patient may be about to be discharged, or not responding well to treatment, or may now be stable). Table 5 shows that by Week 4, after the revised intervention, there was a substantial increase in these probabilities.

Table 5: Probabilities of patients being re-discussed

PATIENT CATEGORIES	WEEK 1	WEEK 2	WEEK 3	WEEK 4
Patients just admitted	0.75	0.64	1.00	0.88
Current patients	0.20	0.67	0.00	1.00

It is also possible to analyse the data a second way, by asking what proportion of patients who have been discussed at some previous handover are discussed at the current handover. If every patient who is discussed at some point in the weekend stays ‘on the radar’, this figure would be 1. If patients are discussed at most once over a weekend, this figure is zero. Table 6 shows the results for all 4 weekends.

Table 6. Proportion of patients re-discussed at handover across 4 weekends

HANDOVER	WEEK 1	WEEK 2	WEEK 3	WEEK 4
2	0.50	0.60	0.38	1.00
3	0.00	0.13	0.17	0.60
4	0.20	0.36	0.13	0.67
5	0.00	0.23	0.12	0.56
6	0.29	0.07	0.06	0.73
Average	0.22	0.28	0.17	0.71

Week 4 shows a substantial increase in continuity measured in this way, supported by the data in Table 5. At a crude level, we can conclude that continuity of patient discussion was increased given our interventions. But what might have caused this? We had summaries for each patient, a tracking sheet showing which patient was discussed and, in the fourth week, we also had the highlighted patient list.

In Week 3 (the week in which our intervention first took place), the pattern of discussion was very similar to Weeks 1 and 2. We observed that the patient information sheet was used by a number of registrars, not only for recording the new admissions, but also during the discussion at handover. We also noticed during week 3 that the summary sheet showing which patients were discussed during a previous handover, while being made available to the registrars, was not used during handover. A survey at the end of the study showed that some of the registrars were not even aware of this second tool. We noticed that the point of attention of the registrars was on

the patient information sheets for the new admissions. Based on this observation, in week 4 we used the existing patient list that the registrars print at the start of their shift, and highlighted the names of those patients discussed in previous handovers. We observed this list being used, but did not interview registrars to determine whether or not the highlighting was a trigger, as this would have compromised the study.

Week 4 data showed a substantial change of pattern in terms of continuity of discussion. Most of the patients mentioned in handovers during Week 4 are mentioned subsequently. Patient 1 in Week 4 was discussed on Friday night and again at every handover until Monday morning. Patients 7, 8 and 9 were mentioned first on Sunday morning, and then continuously mentioned until the Monday morning handover.

Discussion

Further research is required to characterise the features that underlie the change in pattern that emerged from our analysis. There are several environmental factors that could have influenced this change. Those we considered were: patient and current treatment mix, registrars involved, our information tools, and observer effects.

The first factor is difficult to rule out without larger studies. Upon questioning, staff indicated that none of the four weekends was ‘unusual’. The second factor is whether the registrars involved varied; the study was designed to run over a set of weekends when the pool of registrars was largely settled. The registrars involved in the fourth weekend were involved in the other three weekend handovers, so the evidence seems to indicate that the registrars did not appear to be the source of the variation. The final effect could have been that the registrars had an increased desire to ‘perform well’ with regard to handover. In an attempt to control for bias, we did not inform registrars about the hypotheses we were testing, and we made it clear that no element of registrar performance would inform the outcome of the study. Registrars may also have tried to be more careful as a result of our presence. However, any observer effect would have been expected to reduce as the weekends progressed, rather than increase, as the presence of the observers during handover became less of a novelty. We believe the

most likely explanation for the variation in the data is our information tool interventions.

The fourth week was substantially different from the third week, and the difference in the information environment in the fourth week was an information tool using an existing, useful and familiar tool (e.g. the patient list augmented by highlighting the patients discussed at previous handovers). This provides tentative support for the proposition that researchers need to exercise caution when intervening in an information environment in which two people are conversing face-to-face. A new information source/tool can get in the way, or alternatively, be ignored if not perceived to be of value. Reusing and augmenting an existing and useful tool might be a better alternative.

Another aspect of the study was to assess whether the intervention led to any substantial change in the way the patients were discussed. As indicated, there was no substantial variation, and no pattern that allowed us to conclude that there was a change in the nature of the discussion.

Our interventions led to greater continuity in *who* was discussed, but not to a great change in *what* was discussed. It is important to note that our analysis did not take into account correct or appropriate levels of continuity in handover discussion; for instance, if a patient had been discharged or died over the weekend, there would have been no need for continued medical handover. Other processes are in place in hospitals to deal with these events. Some patients clearly need higher levels of discussion than others. Nor does our study attempt to assess the clinical outcomes of this intervention.

Root-cause analysis of failure in patient care is often attributed to information failure, but we know of no study that links lack of continuity of medical handover to poor clinical outcomes. Human conversations are complex, and the nature of discourse between medical practitioners cannot be characterised purely by numbers. Nevertheless, the authors have seen many cases in which patient care that might be relevant to a subsequent registrar is discussed at one time over a weekend, but not carried forward to the next handover. This raises the question: Does an enhanced information environment get in the way of sophisticated medical conversation, or can

it help ensure greater coverage so that a patient who needs tracking does not get overlooked? This clearly needs further investigation as improved handover practice may save lives.

Conclusions

Medical handover is considered an important part of continuity of care. It augments patient notes, nursing handover and ward rounds, yet we have observed that its information environment is quite sparse. There is no reliable method of determining, after a sequence of handovers, which patients are of concern or the nature of relevant concerns. This raises the issue of whether it is possible to augment the information environment in a way that ensures more reliable transfer of information, without interfering with the rich and direct discussion that takes place between registrars.

We have investigated who and what were discussed, episodically or systematically, over a period of four weekends and whether, by Monday morning, a strong sense was conveyed of what had happen in the ward over the weekend. Not all of our interventions in the handover process (i.e. our information tools) were used substantially; in particular, the high information-yielding tools were not used.

Our findings show that handover is a complex activity and that even simple information tools for supporting handover may have a substantial impact. We believe that tools for supporting medical handover should be carefully designed to avoid weakening some complex functions of handover that could lead to poorer clinical outcomes. However, a carefully designed and well-researched tool has the potential to produce a reduction in information failure, a common cause of medical error.

The clinical relationship between the nature and level of the handover and associated discussions was beyond the scope of this study. We attempted to show that changing the information environment can have an effect on the nature of handover discussions. Despite the limitations of the present study, we believe there is a potential benefit in providing information that offers a more complete picture of patients at handover time, and that simple information tools can help. We advocate further investiga-

tion into what information, in what form, and as part of what process, can enable an incoming registrar to benefit from the observations of both the outgoing and preceding registrars, thereby decreasing the reliance of an incoming registrar on the insights of a single outgoing registrar.

Most studies in Computer Supported Cooperative Work deal with situations where the information environment is more central or more intrusive. This study's contribution, specifically an information-environment approach, is a practical investigation which has demonstrated how the information environment is distinctly less important than face-to-face engagement and how it needs to augment face-to-face interactions without distraction.

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Appendix A. Handover Observation Sheet

Observation Sheet							
Date:							
Handover: 8am 9pm							
Outgoing reg:							
Incoming reg:							
Patient ID							
Patient name							
Patient sex							
Patient age							
Ward/location							
Admitting reg							
Patient profile							
Date and time of presentation							
Presenting complaint							
Actives issues							
Other issues							
Patient history							
Relevant investigations							
Investigation pending/ordered							
Investigation to be ordered							
Management plan							
Progress							

Appendix B. Handover Summary Form.

<i>PGMU Handovers, 8.4.05 – 11.4.05</i>						
Patient: Name, age, sex, URN or sticker	Friday 9pm	Saturday 8am	Saturday 9pm	Sunday 8am	Sunday 9pm	Monday 8am
Smith, Jane ___ years F 1234567890	new	worried			very sick	
Blogg, Joe ___ years M 0987654321		new				

Appendix C. Handover event sheet

[Sticker to go here]

For: 21:00 21/01/05 Handover

6502121 Mr P Patient ♂ Bed 6 – 3W Unit: PGMU-A Date & time of admission: 20/01/05 22:15
 A: 71 Consultant: Dr C Consultant Admitting registrar: Dr R Registrar

Patient profile:
 A 71 year old male living in a supported residence.

Presenting problems and background Hx:
 Fall injuries – bruising, no broken bones; left leg ulcer.

Active issues:
 Acute on-chronic renal failure secondary to dehydration
 Left leg ulcer may be infected etc.

Other issues:
 Appears not to have much family support.
 Need to look at nutritional status and current dietary needs
 Need to liaise with RDNS to assess coping abilities at home

Relevant investigations:

Investigations pending/ordered:

Investigations to be ordered:

Management plan:
 Check hydration
 Consider fluid restriction
 Refer to dietician, wound management consultant and renal
 Exclude diabetes
 Strict FBC, daily weigh, 4/24 obs

Progress over the weekend:
 Date:time: Shortness of breath, low urine output, pain relief required 4 hourly

ompleting a