Quality improvement of doctors' shift-change handover in neuro-critical care

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ABSTRACT

Background Clinical handover is a necessary process for the continuation of safe patient care; however, deficiencies in the handover process can introduce error. While the number of handover studies increases, few have validated implemented improvements with repeated audit.

Objective To improve the morning handover round on a busy critical care unit and assess sustainability of improvement through repeated audit.

Design/Methods A quality improvement process based on prospective observational assessment of the doctor's shift-change handover was carried out, assessing the content of clinical information and effects of distractions, location and timing. The effect of a training session for the junior doctors with the introduction of a standardised handover protocol was assessed.

Results The content of clinical information improved after the training session with introduction of a standardised protocol, but returned to baseline with a new cohort of untrained doctors. Distractions were associated with increased handover times for individual patients and for total handover time. Overall, handover time was shortest in the coffee room compared with ward and lecture theatre handovers. Individual patient handover time was positively correlated with clinical content scores. Four indices of critical illness all positively correlated with increased handover time.

Conclusions Early specific training is vital for quality clinical handover. Distractions during handover cause inefficiency and can adversely affect information transfer. Changing handover location according to local environment can yield improved efficiency, structure and ease of management. Adequate time must be allocated for clinical handover especially when dealing with very sick and complex patients.

Clinical handover between shift changes is a necessary process to ensure seamless continuity of patient care. However, deficiencies in the handover process can introduce error. The accurate transfer of a necessary amount of clinical information to allow the continuation of safe care and, in addition, bring fresh intelligence to clinical problems, requires an efficient, clear and comprehensive system of communication.

Despite awareness that handover systems were inadequate as long ago as 1996 in the UK,[1] it has taken several years for action to be taken, prompting the production of guidelines for handover.[2]

Despite the large number of handover studies conducted in the past two decades (table 1; refs[3–53]), few have carried out audits with quantitative measures, implementing improvements and validating these with repeated audit. While academic and practical quality improvement agendas rarely overlap,[3] Davidoff and Batalden[54] have provided guidelines for reporting quality improvement work to encourage its publication, and to increase completeness and transparency. Additionally, Hearnshaw *et al*[55] have clarified guidance for using audit as a quality improvement tool.

We wished to improve the morning handover round on our 21-bed Neurosciences Critical Care Unit (NCCU), a busy unit with a bed occupancy rate of approximately 90%, caring for neurosurgical/neurology and general patients requiring intensive care. Our specific aim was to improve the quality of the whole process. We felt that a good-quality handover would use the most appropriate setting, where the environment enhanced information transfer in addition to maximising the time utilised so that pertinent and complete clinical information was presented and discussed without unnecessary elaboration, leading to the initiation of necessary clinical action. However, some internal tensions exist in these criteria—for example, the environment should reduce distractions but not useful discussion, and time efficiency should not lead to omissions in the clinical information presented. In initiating this quality improvement work, we were conscious of the complex nature of handover; however, we hoped that by following a planned approach, we would discover a way to improve the handover process in our unit, in addition to understanding more of the intricacies of the process itself.

SETTING

The round is large, typically including the night-time junior doctor and a sizeable group of oncoming staff. This amounts to more than 20 people on most mornings, primarily led by the NCCU consultant for the day, with neurosurgical consultants taking individual interest in certain patients. The original structure was a walk round of neurosurgical patients first before handover of the general patients between NCCU staff members only. The round is the only time when all interested clinicians are present to receive up-to-date information as the evening handover only involves the late-shift junior doctor and their oncoming counterpart. Before this project, the round normally took approximately 40 min to complete and functions mainly as a "business round" where information is presented, condition is verified and plans are made. While this is planned to start promptly at 8:00, frequently this would be delayed by the absence of key team members. Family members may be present at bedside and input information

Table 1 Summary of literature

Article (first author)	Methodology	Findings and conclusions
Gandhi[3]	Case study of errors	Multiple handoffs can lead to diffused responsibility, necessitating clear lines of responsibility
Vidyarthi[4]	Case and commentary	Discontinuity in hospitals is inevitable, especially with shifts. "Sign-out" should be standardised
Horn[5]	Survey of UK anaesthesia handover practice	Little formalisation, differing opinions on key considerations. Guidelines, standardisation and documentation would help
Kerr[6]	Observation and interviews of nurse handover—sociotechnical perspective	Handover is complex, with social and educational aspects
Manias[7]	Ethnographic study of nursing handover	Identified practices within handover, including tyranny of busyness, tyranny of tidiness and need to identify sense of finality
Lally[8]	Observational study	Team building was a stronger theme than transfer of patient information during nursing handover
Sherlock[9]	Observational study	Handover is complex, with variable quality of information, lack of organisation and standardisation. Teaching and documentation are required
Skeoch[10]	Commentary	Issues raised in handover of neonates from transport
Sexton[11]	Audio-taping of nursing handovers	84.6% of information discussed could be found elsewhere. Streamlining could improve quality and reduce time
Thakore[12]	Questionnaires for those involved in handover of patients from ambulance to resuscitation	Identified a need for training to improve quality
Patterson[13]	Observation study to identify strategies for handover in different industries	Different strategies used in different industries have different consequences for failure
Leonard[14]	Commentary	There is a need to standardise communication in clinical practice
Bomba[15]	Observation, questionnaire and interviews	Doctors' handover was unstructured, informal and error prone. Formalisation and computerisation would help
Nemeth[16]	Observation and conversation analysis	Expertise depends on the ability to prioritise information; formal training in handover may benefit patients and clinicians
Coiera[17]	Observation in emergency department	There is a need for training in communication. Interruptions disrupt memory processes. Most information exchanges are informal
Alvarez[18]	Observation in intensive care unit	There is a high burden of interruptions on communications in the intensive care context
Berens[19]	Review	Noise levels in the paediatric intensive care unit are sufficiently high to be of concern
Barenfanger[20]	Interventional behavioural study in laboratory context	Introducing "readback" into communication procedures reduces errors
Australian Council for Safety and Quality in Healthcare[21]	Review on system, organisational culture and individual factors influencing handover	There is a need for protocols and training in handover
Solet[22]	Observational study of four different junior doctor handovers	Four major barriers to an effective hand-off were (1) physical setting, (2) social setting, (3) language barriers and (4) communication barriers. Precise, unambiguous, face-to-face communication is best. Standardisation and education are required
Hopkinson[23]	Phenomenological study (semistructured interviews)	Handover is a forum for expressing opinions and feelings as well as patient information
Strange[24]	Ethnographic observational study	Ritual of handover serves valuable psychological, social and protective functions
Odell[25]	Review of communication theory applied to nursing shift handover	Handover should be constantly reviewed to maintain efficiency. Theory can help develop staff and the handover process
Anwari[26]	Observation to develop a scale to assess quality of handover	Scale incorporated quality of verbal information, patient condition, professional behaviour and nurse's satisfaction with handover
McKenna[27]	Description of process for change	Handover times were successfully reduced, allowing more efficient working
Kelly[28]	Questionnaires+description of process for change	Changing handover location can be achieved by careful management
Watkins[29]	Description of process for change	Changing handover location can be achieved by careful management
Williams[30]	Description of process for change	Changing handover location can be achieved by careful management
Miller[31]	Review article	Regular reviews, written guidelines and preprepared handover sheets help maintain efficiency
O'Connell[32]	Observational study+semistructured interviews (five nursing acute care setting handovers)	No particular style was superior. Handover helps to debrief, clarify and educate
Kennedy[33]	Observational study+interviews	Nursing care plans can replace oral handovers and are more efficient
Wallum[34]	Description of process for change	Nursing care plans can replace oral handovers
Meißner[35]	Questionnaire survey	Handover frequently causes irritation, often due to organisational problems
Borowitz[36]	Prospective questionnaire survey	Important information is often missed
McCann[37]	Questionnaire survey	Clinical problems were attributed to poor handover. Set location, standardised handover sheet and training were recommended
Ye[38]	Observational study+questionnaire survey	Important information is often missed, leading to adverse effects. Standardisation, use of IT, feedback, quality assurance and education were suggested
Bhabra[39]	Observational study	Printed handout sheets improved retention of information
Catchpole[40]	Observational study	Introduction of handover protocol (based on motorsport/aviation) reduced technical errors, omissions and handover time
Fenton[41]	Audit	Use of a handover guide may improve structure and information content

Continued

Table 1 Continued

Article (first author)	Methodology	Findings and conclusions
Ferran[42]	Audit	Use of a proforma increased quantity of information transferred
Pothier[43]	Observational study	Printed handout sheets improved retention of information
Wayne[44]	Observational study, focus group discussion+various surveys	Simplification and standardisation of handoff instrument led to increased accuracy, completeness and reduced tasks transferred
Talbot[45]	Observational study	Structuring verbal handover did not improve information retention by receiving staff
Singh[46]	Study of closed malpractice claims	Handoff problems are associated with medical errors involving trainees
Wilson[47]	Technical report	A clinical handover appliance can support safe handover
Hertzum[48]	Questionnaire study, observational study+interviews	Use of an electronic patient record increased clarity about work tasks and reduced omissions at handover
Wong[49]	Case study	End-users must be involved in the development of electronic support tools for handover
Chaboyer[50]	Quality improvement project (location change, practice guideline and competency standard)	Quality improvement agenda for handover improves safety, efficiency, teamwork and senior support
Kassean[51]	Description of process for change	Changing handover location can be achieved by careful management
Wilson[52]	Review	Assessing feasibility of IT tools for improving handover
Bruce[53]	Experience reporting, qualitative interviews	Difficult or "non-ideal" handovers characterised by complicated care situation

on occasion; however, they are rarely involved in decision-making. Only a minority of patients were able to participate in the round while it took place on the ward, the rest being too ill.

METHODS

The project was planned according to human factors and clinical audit principles. Initial data on the handover process were collected through semistructured interviews performed by a human factors expert (ML). The six NCCU consultants (the most senior clinicians on the unit medical staff) provided this information on the current practice of handover and how this deviated from their expectations of the ideal process. From these interviews, two checklists (for "human factors" (see Appendix A) and clinical content) were prepared to assess the morning handover round in a repeatable fashion. The clinical content was defined on the basis that "if an item was mentioned, even briefly, then this was judged as covered". Using these, a clinical score was calculated by giving one mark (or credit) for each of the seven clinically relevant information items: name, age, diagnosis, overall management goals, important developments overnight/in the previous 24 h, present problems and problems anticipated in the next 24 h. Distractions were noted on a human factors checklist as occurring events that were viewed as "potentially causing distraction".

The checklists were used to audit the handover in the NCCU for 10 mornings selected opportunistically over a 1-month period (baseline group). This also included timing the handover of individual patients, delays between patients and the length of the whole session.

These initial 10 sessions took place in two locations, as the normal practice of bedside handover had to be stopped after three sessions because of an outbreak of *Acinetobacter*. The handover then took place in the unit coffee room for the remaining seven sessions.

The authors then undertook a single educational session drawing on the literature review, the audit and the consultants' views. The junior doctors were involved in a facilitated brainstorming exercise to support the development of a protocol (see figure 1) for handover, for their own use. The protocol headings were introduced into the daily handover sheet, prepared by the night-shift junior for the oncoming staff.

A re-audit of 10 mornings within the next month was then undertaken while the educated team of junior doctors was still working on the unit (post-training group), which also coincided with a further change of location, to a small lecture theatre just outside the unit. A final audit of 10 sessions took place when the post-training group had left the unit, to identify if the new process had been passed onto the next group of junior doctors (no-training group). The same observers were used for all stages.

To investigate any correlation between clinical scores/handover times and validated critical illness scoring systems, the Intensive Care National Audit and Research Centre (ICNARC) data (APACHE2 score, APACHE2 mortality prediction, APACHE3 score and MPM 24 mortality prediction) were compared for all patients handed over during the project.

The overall plan and execution of the study is given in figure 2.

RESULTS

Timing

Timing data were collected by each observer, which showed strong inter-rater reliability (Pearson's $r=0.998$, $p<0.001$). Timing results for the handover of individual patients, whole handover sessions and gaps between individual patient handovers are shown in table 1.

The differences in timing for "handover of each patient" over the three phases were not significant ($\chi^2=2.97$, df=2, Kruskal–Wallis=0.23). However, there was a significant difference associated with location, as the coffee room was quicker ($\chi^2=18.02$, df=2, Kruskal–Wallis<0.001).

The timing for the whole handover session is shown in table 1; the Kruskal–Wallis test showed no significant difference by group ($\chi^2=1.81$, df=2, Kruskal–Wallis=0.40) or location ($\chi^2=3.75$, df=2, Kruskal–Wallis=0.15), although the coffee room location was tangibly shorter in practice.

The timing of gaps between each patient handover was significantly different from one phase to the next ($\chi^2=128.05$, df=2, Kruskal–Wallis=0.001). The differences between all the groups were also significant (baseline group/post-training group: Mann–Whitney U=10,079.5, $p<0.001$; post-training group/no-training group: Mann–Whitney U=8708, $p<0.001$). There was also a significant difference in gaps between locations (χ^2 121.51, df=2, Kruskal–Wallis<0.001).

Clinical content

The differences in clinical content over the phases were significant ($\chi^2=21.2$, df=2, Kruskal–Wallis<0.001). The differences

HANDOVER PROTOCOL

Ensure all handover participants are present and listening!
(Explain handover process to any new participants)

* * *

For each patient:
BED NUMBER
NAME
AGE
DIAGNOSIS: Presenting complaint / condition (1 sentence)

HISTORY:
Brief history of presentation
Date of admission to hospital / NCCU
Pathway to NCCU
Reason for current admission to hospital / NCCU
Previous relevant medical problems
Previous interventions

LAST 24 HOURS / OVERNIGHT
Significant events / change
Results of investigations received
Information from specialties
Active interventions undertaken
Discussions with family

CURRENT ISSUES
Present problems
Indicate investigations expected

NEXT 24 HOURS
Outstanding issues
Plans for transfer
Investigations required
Planned therapy / surgery
Specialties to be contacted
Discussions with family

CONFIRM INFORMATION HAS BEEN RECEIVED AND OFFER OPPORTUNITY TO ASK QUESTIONS – "anything else?"

CONFIRM END OF PATIENT HANDOVER

* * *

For the unit:
BED ALLOCATION
PATIENT TRANSFERS
PATIENTS EXPECTED

Figure 1 Handover protocol.

were found between the baseline group and the post-training group (Mann–Whitney U=12 759, p<0.001), and the post-training group and the no-training group ((Mann–Whitney U=15 168.5, p<0.001), but not between the baseline group and the no-training group (Mann–Whitney U=16077, p=0.77).

Interviews with consultants	Baseline group	Interviews with junior doctors	Post training group	No training group
	10 mornings		10 mornings	10 mornings
	Ward	Coffee room	Lecture theatre	
	3 mornings	8 mornings	19 mornings	

Figure 2 Study protocol.

For location, this was also significant (χ^2=12.63, df=2, Kruskal–Wallis<0.002), with differences between ward and coffee room (Mann–Whitney U=2620, p<0.002), and ward and lecture theatre (Mann–Whitney U=7108.0, p<0.001), but not the coffee room and lecture theatre (Mann–Whitney U=25 207, p<0.988).

Overall, there is a significant correlation between clinical content score and handover time (Pearson r=0.17, p<0.01, two-tailed).

There were no significant correlations between ICNARC scores and the clinical score (two-tailed significances of r=0.43, 0.74, 0.98 and 0.62 for APACHE2 score, APACHE2 mortality prediction, APACHE3 score and MPM 24, respectively). Correlations between ICNARC scores and patient handover time are shown in table 2.

Distractions

Examining the range of distractions, the correlations between handover time and distractions are shown in table 3. Looking at the distractions in relation to clinical content score, there were significant relationships as shown in table 4.

Further details on the statistical information can be obtained from the corresponding author.

Context

Weaknesses in the handover clinical content and distractions from the two environments were evaluated once the baseline group had been audited. Results were discussed with the NCCU consultants with a view on instigating change. The outcome was a set of local recommendations. First was keeping the handover round off the ward, initially in the unit coffee room and then into the lecture theatre; second, there was a need for a training session for the junior doctors; third, a protocol-driven format was developed; last, management of distractions was performed.

DISCUSSION

Size and location

There must be a trade-off of the advantages and disadvantages of each environment. The length of the gaps between patient presentations was substantially longer on the ward because of the time taken moving from one patient to the next. However, clinical content was lower on the ward, implying that the change in location off the ward made an improvement in information transfer, perhaps because of the change in distractions. The findings with ward-based handover round could easily be likened to rounds of similar size where a major factor in failure of information transfer is the number of people involved. When assessing these rounds, the observers were inevitably on the periphery, making it difficult to hear the central participants against competing noise.

The changes in location allowed a number of lessons to be learnt concerning handover practice. The ward had the advantages of allowing doctors to see and speak to the patient, family members and attending nurse, and to consult patient notes. The coffee room allowed for rapid handover but did not allow radiological viewing. The introduction of this in the lecture theatre increased handover time in a beneficial way, promoting clinical discussion. The low transfer time between patients in the coffee room and the lecture theatre helped to make the round more efficient. The pattern of interruptions changed between locations, with less conversation off the round in the coffee room and lecture theatre. The use of these locations also preserved round structure better. Additionally, the risk of

Table 2 Handover times (seconds) for individual patients, whole handover session times (minutes), delay in overall start times (minutes), time gaps (seconds) between patient handovers, and clinical content scores with respect to group and location

Handover times (seconds) for individual patients	Mean (SD)	n
Baseline group	99 (61)	166
Post-training group	115 (80)	197
No-training group	116 (92)	197
Ward	120 (64)	53
Coffee room	87 (54)	133
Lecture theatre	118 (88)	374
Whole handover session times (minutes)	**Mean (SD)**	**n**
Baseline group	36.6 (11.6)	10
Post-training group	43.0 (13.2)	10
No-training group	41.6 (13.5)	10
Ward	46.6 (15.3)	3
Coffee room	31.7 (6.9)	8
Lecture theatre	43.1 (12.9)	19
Delay in start of handover session (seconds)	**Mean (SD)**	**n**
Baseline group	328 (156.3)	10
Post-training group	230 (126.7)	10
No-training group	332 (146.8)	10
Ward	334 (101.3)	3
Coffee room	309 (174.6)	8
Lecture theatre	285 (145.8)	19
Time gaps (seconds) between patient handovers	**Mean (SD)**	**n**
Baseline group	12.0 (28.7)	156
Post-training group	8.6 (38.0)	187
No-training group	4.8 (21.5)	187
Ward	20.7 (34.9)	50
Coffee room	8.5 (28.4)	125
Lecture theatre	6.4 (30.1)	355
Clinical content scores	**Mean (SD)**	**n**
Baseline group	5.91 (1.15)	166
Post-training group	6.38 (0.79)	197
No-training group	6.0 (1.0)	197
Ward	5.51 (1.35)	53
Coffee room	6.15 (0.94)	133
Lecture theatre	6.17 (0.93)	374

infection from a large group walking around the unit was negated. Moving the round from the bedside to the lecture theatre represents the best environment for handover to take place, given the improvements in efficiency, clarity and ease of management.

Table 3 Correlation between Intensive Care National Audit and Research Centre data and patient handover time

		Patient handover time
APACHE2 score	Pearson correlation	0.083
	Significance (two-tailed)	0.057
	n	525
APACHE2 mortality	Pearson correlation	0.151*
	Significance (two-tailed)	0.001
	n	524
APACHE3 score	Pearson correlation	0.080
	Significance (two-tailed)	0.063
	n	540
MPM 24	Pearson correlation	0.099†
	Significance (two-tailed)	0.026
	n	502

*Correlation is significant at the 0.01 level (two-tailed).
†Correlation is significant at the 0.05 level (two-tailed).

Table 4 Pearson correlations between distractions and handover time (individual and grouped)

Distractions/extra tasks involved	Correlation with patient handover time and individual distractions	Correlation between number of distractions by type and whole session time
Background conversation between people who are involved in the handover	0.39*	0.59*
Background conversation between people who are not involved in the handover	−0.01	0.03
Doors opening	0.26*	0.23
Staff from outside the handover talking to those who are	0.06	−0.1
People walking through the handover	0.05	−0.26
Phone ringing near the handover	0.04	0.26
Phone conversation occurring near the handover	0.03	0.05
Mobile phone call involving someone who was involved in the handover	0.37*	0.54*
Bleep going off during the handover	0.31*	0.4*
Other alarm	0.05	0.08
TV noise	−0.03	−0.12
Current patient interrupting	−0.02	0.07
Other patient interrupting	0.01	0.07
A patient's family member interrupting	0.02	0.06
People making coffee near the handover	0.03	−0.18
People washing up near the handover	0.02	−0.18
Computer noises near the handover	−0.01	−0.3
Clinical-related noises (suction noises)	0.05	0.29
Non-clinical-related noise (ice-making machine)	0.09†	0.14
Patient examination	−0.04	0.78
Patient communication	−0.04	0.21
x Ray viewing	0.24*	0.36
Total distractions	0.45*	0.59*

*Correlation is significant at the 0.01 level (two-tailed).
†Correlation is significant at the 0.05 level (two-tailed).

Timing

There was a marked decrease in individual patient handover time and whole-session time in the coffee room. This whole-session time saving equates to at least an hour and a half over the course of a week; however, the extra time taken in the lecture theatre allowed the viewing of radiological investigations, prompting increased, richer clinical discussion.

Training

The change in clinical score between the baseline group and the post-training group was not sustained with the no-training group, suggesting that the educational session was the key aspect to improving the quality of handover. These data emphasise the need for education in handover practice at the start of the job. While this finding may seem intuitive, its importance cannot be overemphasised.

Correlations to indices of critical illness

There was no significant correlation between the ICNARC data and the clinical score, possibly reflecting the design of the clinical scoring scale used. Longer handover times were associated with

Table 5 Pearson correlation between distractions and clinical content score

Distractions/extra tasks involved	Correlation between clinical score of patient handover and presence of individual distractions
Background conversation between people who are involved in the handover	0.02
Background conversation between people who are not involved in the handover	−0.09†
Doors opening	0.08
Staff from outside the handover talking to those who are	−0.02
People walking through the handover	0.02
Phone ringing near the handover	0.004
Phone conversation occurring near the handover	0.03
Mobile phone call involving someone who was involved in the handover	0.06
Bleep going off during the handover	0.02
Other alarm	−0.06
TV noise	−0.04
Current patient interrupting	−0.13*
Other patient interrupting	−0.05
A patient's family member interrupting	−0.13*
People making coffee near the handover	0.05
People washing up near the handover	−0.01
Computer noises near the handover	0.02
Clinical-related noises (suction noises)	−0.05
Non-clinical-related noise (ice-making machine)	0.04
Patient examination	0.04
Patient communication	0.12*
x Ray viewing	−0.02
Total distractions	0.02

*Correlation is significant at the 0.01 level (two-tailed).
†Correlation is significant at the 0.05 level (two-tailed).

higher clinical scores. More interestingly, the ICNARC data were universally correlated with handover time, with two scales (APACHE2 mortality prediction and MPM 24) that achieved statistical significance, most likely linked to the complexity of such patients' clinical histories. In the division of resources, of which handover time is one, correct time allocation is surely a marker of quality.

Distractions

The overall pattern of distractions correlated with the handover time, for individual patients and the whole session. Results relating to background conversation, mobile phones and bleeps with regard to handover time strongly suggest that direct interruptions cause loss of time and must be avoided for efficiency and quality. Several aspects were seen to negatively correlate with clinical score (table 4). A clinician communicating with a patient showed a positive correlation, indicating that, at least in this context, this was a proactive action to ensure correct information rather than an interruption. Many of the distractions listed in tables 3 and 4 are easy to view as having a negative impact.

Limitations

There were several limitations to this work. There is no guarantee that the checklists are reliable for use by other observers, with the clinical score being quantitative, rather than qualitative, reflecting clinical quality. The study was not blinded and the observers may have "seen and recorded" an improvement that they expected. Also, there may have been "observer effects", where the trained junior doctors performed better once the presence of the assessors and their purpose were revealed. The role of patients and family members was not included in the study. The standard deviations are often high and thus statistical power is limited, and the large influence of extraneous factors, such as type of clinical environment, experience, culture of leadership, technology and local policies, cannot be underestimated. Common sense should be applied to interpretation of these data.

CONCLUSION

This experience has been significant as a hypothesis-generating study on ensuring quality improvement in handover, with substantial learning from a variety of sources being brought together in practice to improve quality. While an organised structure for protocol contributed to improvement, this study demonstrates the substantial influence of handover training, which ideally should be introduced as a vital part of education early in junior doctor postings. Distractions during handovers cause inefficiency and adversely affect information transfer. They must be managed to an absolute minimum. Changing handover location according to local environment can yield improved efficiency, handover structure and ease of management. Lastly, the relationship between time taken and clinical quality is not well understood; at each extreme, there are risks of lengthy meandering that adds no clinical benefit or working with time constraints that are too restricted to cover the necessary clinical issues. Adequate time must be allocated for clinical handover especially when dealing with very sick and complex patients.

Most importantly, it is intended that this article be used as a guide for a process of quality improvement that identifies solutions consistent with local needs, rather than as a recommendation of the solutions identified within this local context. One generic recommendation would certainly be to instil the need for a "living improvement process" and ensure that the process can continue to improve in the absence of specific project-driven goals. The handover process should incorporate a means of reminding staff that they may initiate change at any opportunity. This itself is an artefact of a safe culture, empowering staff to control any distractions, including those created by the handover participants.

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APPENDIX A
HUMAN FACTORS CHECKLIST

Who initiates/lead the handover?
Use of handover notes/protocol
Use of readback with handover?
Delay in providing information
Use of patient notes
View *x* rays
Initiate communication with current patient
Current patient interrupts
Other patient interrupts
Patient relative/carer interrupts
Patient assessed during handover
Active intervention on patient
Doors opening/closing
Other staff walk through the round
Other staff interrupt the round
Background conversation outside the round
Background conversation between people on the round
Desk phone
Mobile phone
Bleep
Alarm
Suction noise
Computer noise
Fire alarm
Power cut
Teaching during round
Social discussion during round
TV noise
Coffee machine noise
Ice maker noise
Washing (noise from sink)