

Improving postoperative handover from anaesthetists to non-anaesthetists in a children's intensive care unit: the receiver's perception

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INTRODUCTION The efficiency of postoperative handover of paediatric patients to the children's intensive care unit (CICU) varies according to institutions, clinical setup and workflow. Reorganisation of handover flow based on findings from observational studies has been shown to improve the efficiency of information transfer. This study aimed to evaluate a new handover process based on recipients' perceptions, focusing on completeness and comprehensiveness of verbal communication, and the usability of a situation, background, assessment and recommendation (SBAR) form.

METHODS This was a prospective interventional study conducted in the CICU of KK Women's and Children's Hospital, Singapore. It comprised four phases: (1) evaluation of the current handover process through an audit and opinion survey; (2) development of a new handover process based on the opinion survey and hospital personnel feedback; (3) implementation; and (4) evaluation of the new handover process. The new handover process was based on a PETS (pre-handover, equipment handover, timeout and sign out) protocol with a 'single traffic communication' flow and a new SBAR handover document. It included relevant patient information, and the options 'not applicable' and 'none', to increase compliance and reduce ambiguity.

RESULTS Significantly more recipients indicated that the new SBAR form was the most important handover tool and provided more useful information. Recipients' perceptions indicated improvement in information sufficiency and clarity; reduction of omission errors; and fewer inconsistencies in patient descriptions in the new process.

CONCLUSION Dual customisation of the handover process, PETS protocol and SBAR form is necessary to meet the workflow and information demands of the receiving team.

Keywords: handover process, opinion survey, paediatric, PETS protocol, SBAR form

INTRODUCTION

Postoperative handover from the operating theatre (OT) to intensive care unit (ICU) is a key process to ensure patient safety and continuity of care.⁽¹⁾ Information communicated in the handover process should include perioperative anaesthetic and surgical issues, as well as recommended postoperative management.⁽²⁾ The challenge is further increased in a setting where paediatric patients have complex surgical and medical issues, and interdisciplinary communication occurs between the outgoing anaesthetic team and incoming paediatric intensive care team.⁽³⁾

Over the years, various handover techniques have been established to provide continuity of patient care during change of shift,⁽⁴⁾ interdisciplinary referral,^(4,5) postsurgical care from the OT to ICU⁽⁶⁾ and ward transfer of a patient.⁽⁷⁾ Techniques such as narrative face-to-face communication,^(3,8) standardised protocols,^(1,2,5) and written documents^(1,2) have been used in the handover process. In many institutions worldwide, handover documents have been shown to be a useful tool in the process, as they maximise communication during the handover.^(1,2,6) The handover document also serves as a quick reference for pertinent perioperative information by providing a succinct summary

of the patient's perioperative anaesthetic care.^(2,6) Optimal efficiency for patient safety has been achieved by adopting communication mnemonics such as SBAR (situation, background, assessment, recommendations) for handover documentation and communication patterns.^(8,9)

At KK Women's and Children's Hospital (KKH) in Singapore, handover from the OT, by outgoing anaesthetists to the paediatric intensivists (PIs) and nurses in charge of the children's intensive care unit (CICU), comprises verbal face-to-face communication and an SBAR handover document. Upon arrival in the CICU, the anaesthetist discusses the intraoperative events that are significant for initial management of the patient in the CICU, the surgeon provides surgical details and advice on patient care, while the anaesthetic unit nurse passes on the patient's particulars to the CICU nurse. The SBAR handover document is completed by the anaesthetic team prior to the transfer. However, issues regarding completeness, efficiency, clarity and accessibility of information pertaining to the current handover process and SBAR form have been raised by receivers from the CICU. As a response, we conducted a study to improve the current handover process and SBAR handover document. The objective of this present study was to evaluate the new handover process against the current

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process based on the recipients' perceptions, with the focus on the completeness and comprehensiveness of verbal communication and usability of the SBAR document.

METHODS

After procuring Integrated Regulatory Board approval, we conducted a prospective interventional study from October 2011 to December 2012 at the CICU of KKH, a 830-bedded hospital for women and children. The hospital's CICU is a 16-bedded unit that serves over 700 patients a year, with onsite attention for medical, general, trauma, plastic, neurological and cardiovascular surgery. The main caregivers include PIs, comprising seven paediatric consultants, rotating registrars, medical officers and 70 skilled nurses. A total of 52 CICU personnel participated in the study: eight PIs (seven paediatric consultants and one rotating paediatric registrar) and 44 nurses working in shifts.

The study was conducted in four phases: pre-intervention, intervention, implementation and post-intervention (Fig. 1). The pre-intervention phase refers to the pilot evaluation of the handover protocol, while the post-intervention phase was an evaluation of the new handover process and used identical

methodology with the pre-intervention phase. All paediatric surgery patients who underwent surgery in the OT during the recruitment period were included. All PIs and registered nurses working in the CICU were approached to participate in the study and completed two surveys (i.e. at the pre- and post-intervention phases, respectively). Participation was voluntary and the responses were kept confidential. The surveys used self-administered questionnaires, and recipients were strongly encouraged to independently complete the questionnaire within two months and return it anonymously to the investigating team via a designated mailbox. The survey questionnaires were designed and validated by a panel of anaesthetists, ICU paediatricians, nurse supervisors and epidemiologists.

A new handover protocol, PETS (pre-handover, equipment handover, timeout and sign out), was created to meet the end-users' requirements as reflected in the pre-intervention survey (Table I). Each component ensures the preparedness of the team for handover, as well as the smooth and complete transfer of information. The components of PETS were designed by the authors of the study, and were evaluated and approved by the respective heads of department (Paediatric Anaesthesia, CICU and Nursing) prior to its implementation.

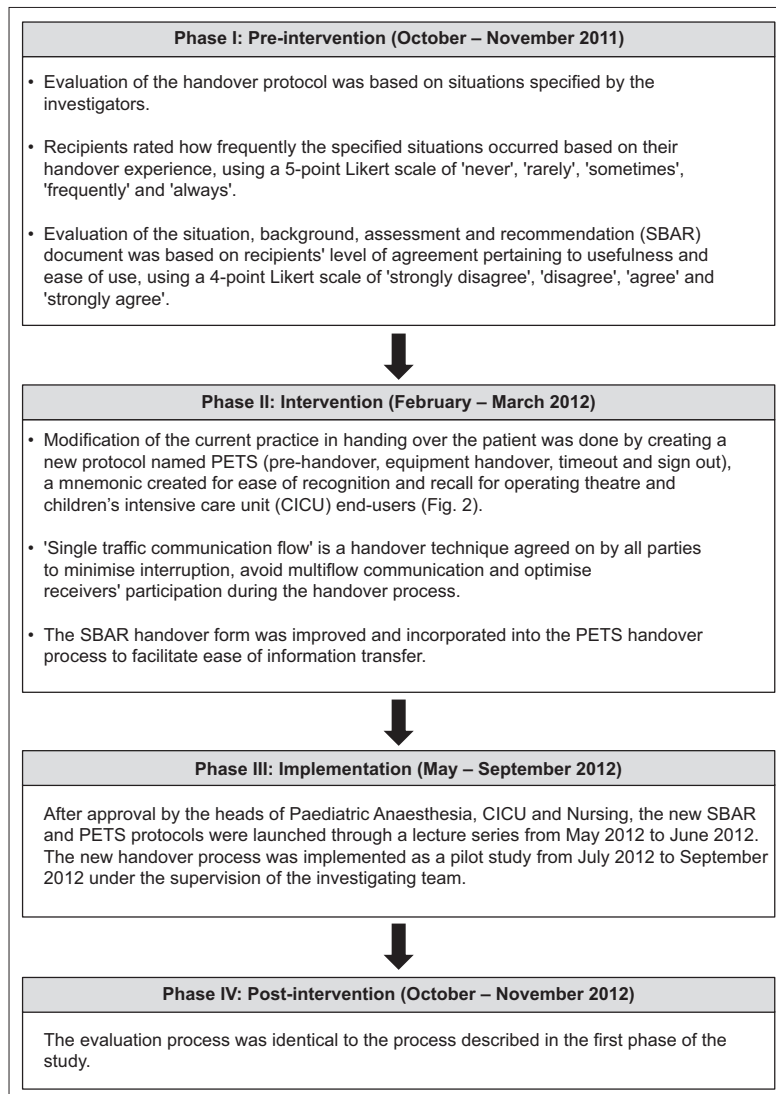


Fig. 1 Flowchart shows the methodology of the study.

To improve the usability of the original SBAR handover document (Appendix 1), the investigative team outlined the following drivers: increase the rate of completion of the document; reduce unnecessary information; and increase ease of accessibility of items ranked highly by the recipients. In order to improve handover documentation, the aforementioned characteristics, which addressed the concerns of both teams, were integrated into the original SBAR handover document to create a new SBAR handover document (Appendix 2).

Data pertaining to situational items in the handover protocol on a 5-point Likert scale was reclassified into three categories: 'rare' ('never'/'rarely'); 'sometimes'; and 'frequent' ('frequently'/'always'). Similarly, data pertaining to the utility of the SBAR documents on a 4-point Likert scale was dichotomised as follows: 'disagree' ('strongly disagree'/'disagree'); and 'agree' ('agree'/'strongly agree'). All data was recategorised to facilitate statistical comparison of the recipients' opinions before and after the new handover process was implemented. Frequencies and proportions were used to summarise the data, as all the variables were categorical in nature. Fisher's exact test was used to evaluate associations in each item between the current and new handover processes. Differences in proportions, with corresponding 95% confidence intervals (CIs) based on the Newcombe method,⁽¹⁰⁾

were used to compare the two handover processes, based on recipients who selected 'frequent' and 'agree' for the recategorised situational and utility items, respectively.

The statistical significance level was set at 5%. All tests were two-sided. Data was analysed using R software, 2013 (R Foundation for Statistical Computing, Vienna, Austria; available at: <http://www.R-project.org>).

RESULTS

Table II shows the participants' characteristics and their perceptions of the pre- and post-intervention handover process. A total of eight PIs and 44 nurses participated in both the pre- and post-intervention opinion surveys. There was no change in the participating PI group, unlike the nurses group, who worked in shifts, between the pre- and post-intervention surveys. 25% of the PIs ($n = 2$) and approximately 31% of the nurses (pre-intervention $n = 14$; post-intervention $n = 13$) had more than ten years of experience working in the ICU. There was no significant difference in the perceived handover duration between the pre- and post-intervention phases for both the PIs ($p = 1.000$) and nurses ($p = 0.3998$).

Fig. 2a shows the frequency of occurrence of the situational items, as perceived by the nurses, before and after implementation

Table I. Pre-handover, equipment handover, timeout and sign-out (PETS) protocol from operating theatre to children's intensive care unit.

PETS handover protocol	Description
Pre-handover	<ul style="list-style-type: none"> • Situation, background, assessment and recommendation (SBAR) form completed towards the end of the operation prior to transfer. • Children's intensive care unit notified during closure of surgery. The information to pass on (via phone call) must include the following: <ul style="list-style-type: none"> • Patient's name • Diagnosis • Operation performed • If intubated, ventilator settings • Monitors, drains and drips prepared in intensive care unit (ICU) bed <ul style="list-style-type: none"> • Monitors must be placed according to the location designated by ICU • If intubated, orotracheal tube level (nose or lips) must be noted, and all ventilation support prepared • Medication drips must be properly labelled, including the diluent used, and should have two signatories as the label requires • All medication and equipment lines must be tidied up with as little crisscrossing as possible • No blood products handed over using a syringe except for those for infusions or blood bags
Equipment and monitor handover	<ul style="list-style-type: none"> • Upon arrival, the consultant anaesthetist (CA) hands over care of the ventilation to the ICU specialist and or medical officer (MO), if the specialist is attending to another patient • Simultaneously, the registrar/fellow/MO/CA together with the anaesthetic unit nurse hands over the monitors, drains and drips to the ICU nurses • The CA checks the equipment, and that the patient is appropriately ventilated/monitored and is stable • The receiving doctor and nurse in charge are identified and confirm their readiness
Timeout	<ul style="list-style-type: none"> • The CA calls 'Timeout for handover' <ul style="list-style-type: none"> • Mentions the patient's name and identity card number • Discusses the SBAR handover form • Using the anaesthesia record, the CA discusses blood pressure and heart rate trends during the operation • The receiving doctor and nurse should stand beside the CA discussing the SBAR form, see to it that all information has been obtained and ask appropriate questions after the timeout • The surgeon gives the operative details at the end
Sign out	<ul style="list-style-type: none"> • The receiving physician calls 'Sign out for handover' • Together with the surgeon and CA, the receiving physician: <ul style="list-style-type: none"> • Confirms plans for the patient • Identifies anticipated problems • Discusses anticipated recovery

Table II. Participants' characteristics and perceptions of the pre- and post-intervention handover process.

Characteristic/perception	PIs (n = 8)		Nurses (n = 44)	
	Pre-intervention	Post-intervention	Pre-intervention	Post-intervention
Length of time working in the ICU (yr)				
< 1	2 (25.0)	2 (25.0)	2 (4.5)	4 (9.1)
1–5	2 (25.0)	2 (25.0)	20 (45.5)	19 (43.2)
6–10	2 (25.0)	2 (25.0)	8 (18.2)	8 (18.2)
11–15	1 (12.5)	1 (12.5)	12 (27.3)	11 (25.0)
> 15	1 (12.5)	1 (12.5)	2 (4.5)	2 (4.5)
Most challenging clinical handover				
Inter-hospital	5 (62.5)	5 (62.5)	5 (11.4)	12 (27.3)
From children's emergency	3 (37.5)	3 (37.5)	10 (22.7)	6 (13.6)
From labour/general ward	0	0	6 (13.6)	2 (4.5)
From operating theatre	0	0	23 (52.3)	24 (54.5)
Time to complete handover process (min)				
≤ 10	8 (100.0)	7 (87.5)	34 (77.3)	39 (88.6)
> 10	0	1 (12.5)	10 (22.7)	5 (11.4)
How useful do you find information given during handover in prioritising care for high-risk patients?				
Not useful at all	0	0	1 (2.3)	0
Slightly useful	0	0	3 (6.8)	0
Useful	5 (62.5)	4 (50.0)	17 (38.6)	5 (11.4)
Very useful	3 (37.5)	4 (50.0)	13 (29.5)	32 (72.7)
Extremely useful	0	0	10 (22.7)	7 (15.9)
Opinion: which tool is the most useful in the handover process?				
Verbal information	1 (12.5)	0	6 (13.6)	2 (4.5)
SBAR handover document	1 (12.5)	7 (87.5)	15 (34.1)	28 (63.6)
Medical notes	0	0	1 (2.3)	4 (9.1)
Anaesthetic records	3 (37.5)	1 (12.5)	14 (31.8)	9 (20.5)
Postoperative surgical records	1 (12.5)	0	5 (11.4)	1 (2.3)
My own checklist	2 (25.0)	0	3 (6.8)	0

Data presented as no. (%). PIs: paediatric intensivists; SBAR: mnemonic for situation, background, assessment, recommendations

of the PETS handover protocol. After the implementation, there was a significant increase in the proportion of nurses who indicated that information transfer during verbal face-to-face handover was frequently ('frequently' or 'always') sufficient, as compared to the pre-intervention phase (95.5% vs. 31.8%; difference: 63.7%; 95% CI 51.4%–81.8%; $p < 0.0001$). Similar trends were observed for the following situational items: 'The information conveyed was concise and clear' (difference: 70.5%; 95% CI 59.5%–88.4%; $p < 0.0001$); and 'There was a standout leader during the handover' (difference: 36.4%; 95% CI 21.1%–54.0%; $p < 0.0001$). Following the intervention, there was a significant increase in the proportion of nurses who indicated that they rarely ('never' or 'rarely') encountered the following undesirable situations: 'Having to look elsewhere [for information]' (difference: 38.6%; 95% CI 23.8%–54.9%; $p < 0.0001$); 'Having no opportunity to ask questions and clarify' (difference: 29.5%; 95% CI 12.4%–49.8%; $p = 0.001$); and 'Description of the patient received in handover did not match subsequent patient clinical assessment' (difference: 43.2%; 95% CI 28.3%–61.4%; $p < 0.001$). The perceived frequency of the situational item 'Error of omission' among nurses was similar in the

pre- and post-intervention phases (22.7% vs. 20.4%; difference: –2.3%; 95% CI –19.4% to 14.8%; $p = 0.393$).

The frequency of occurrence of the situational items pre- and post-intervention, as perceived by the PIs, are detailed in Fig. 2b. Except for the items 'Error of omission' and 'Having to look elsewhere [for information]', which were significantly reduced in frequency in the post-intervention phase, there was no significant change in the PIs' perceptions in the pre- and post-intervention phases. None of the PIs indicated that omission errors frequently occurred in both phases. 100.0% and 12.5% of PIs indicated that omission errors 'sometimes' occurred in the pre- and post-intervention periods, respectively (difference: 87.5%; 95% CI 40.1%–99.3%; $p = 0.001$). None of the PIs indicated that they rarely looked elsewhere for information in the pre-intervention phase, as opposed to 62.5% in the post-intervention phase (difference: 62.5%; 95% CI 38.7%–108.0%; $p = 0.026$).

Overall, the perceived usefulness ('very useful' or 'extremely useful') of the SBAR handover document for prioritising care in high-risk patients during handovers significantly increased by about 33.0% (95% CI 15.0%–53.0%; $p = 0.0004$). All the PIs

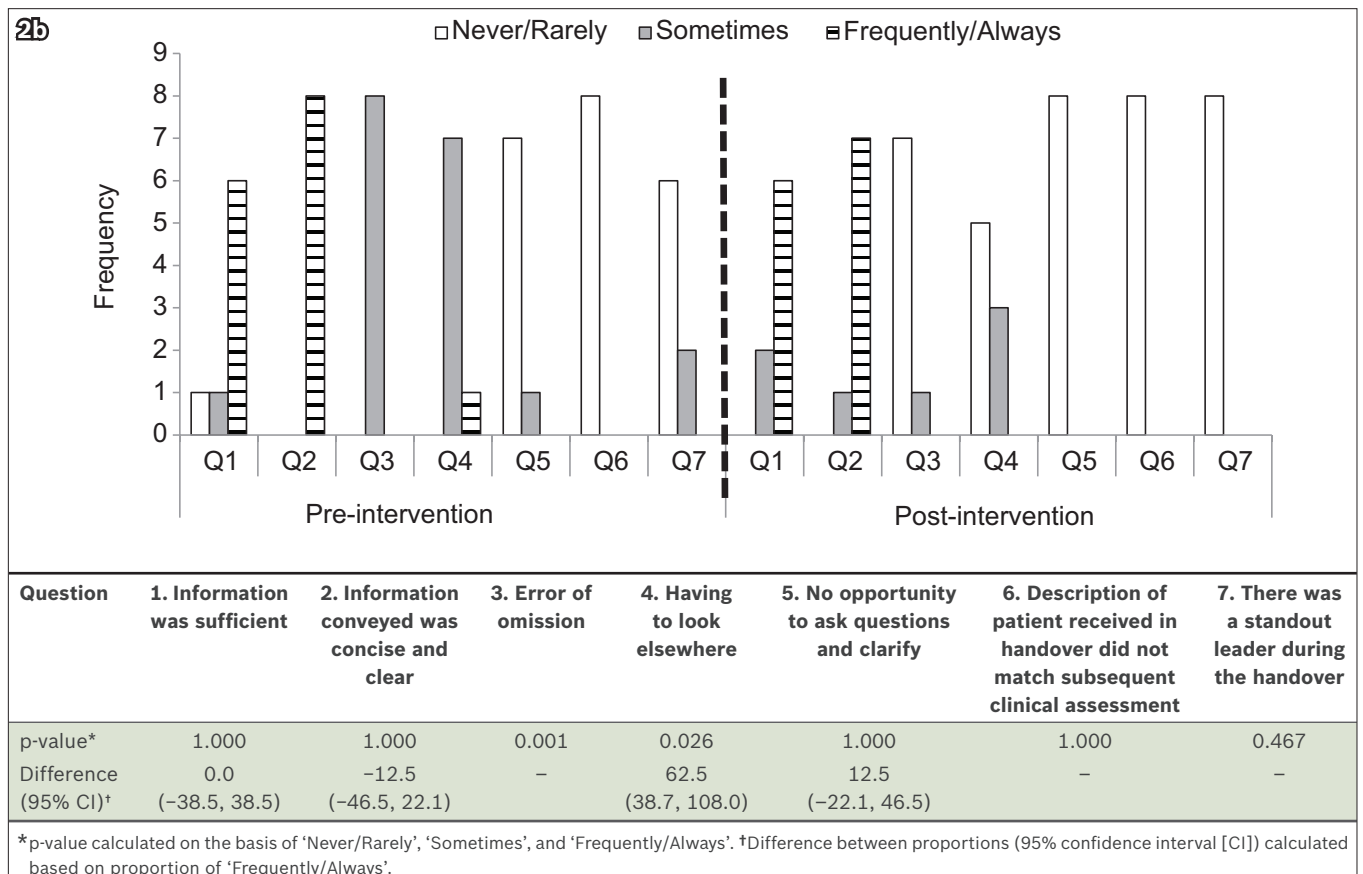
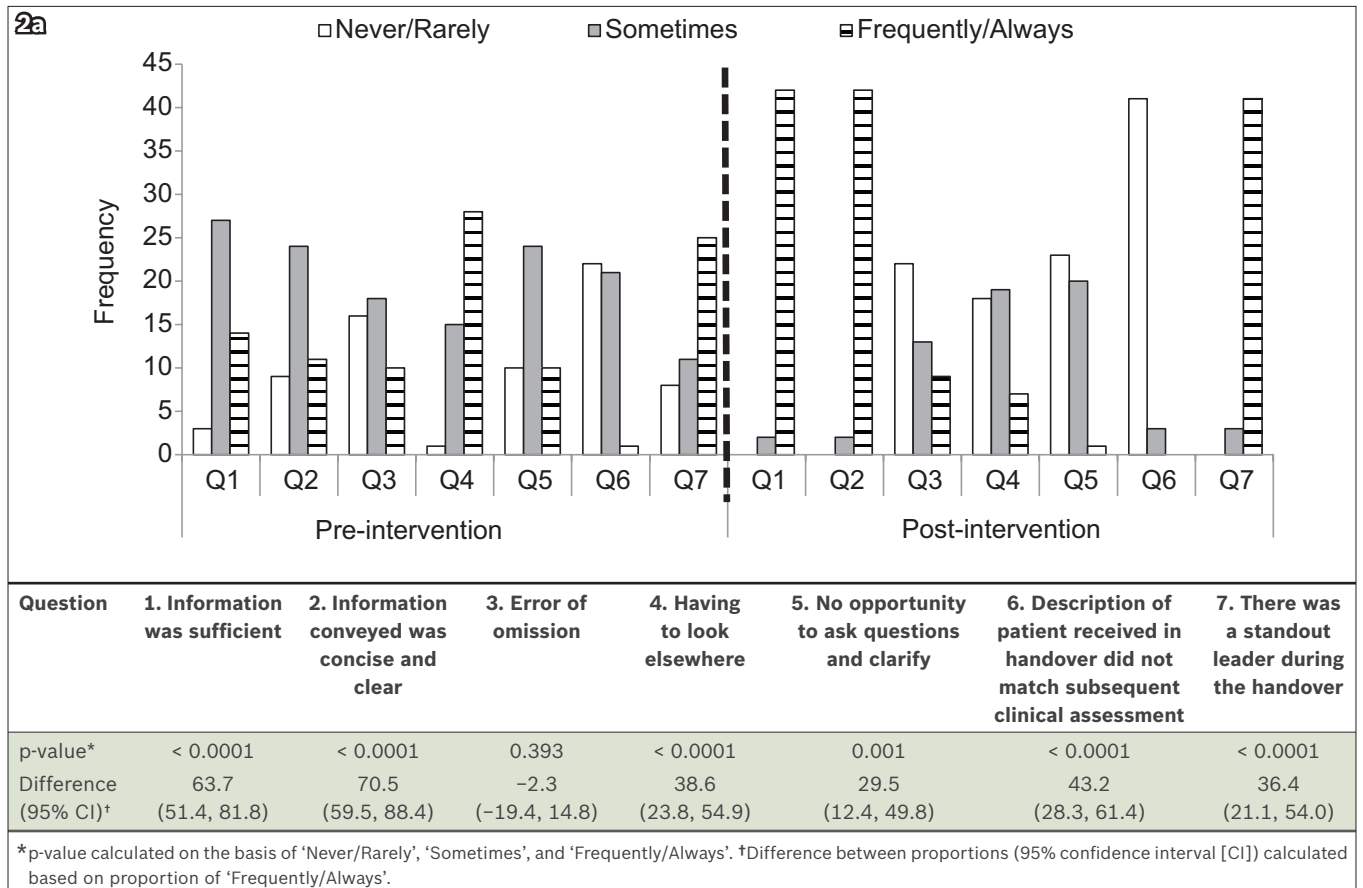


Fig. 2 Graphs show the assessments of children's intensive care unit (a) nurses and (b) paediatric intensivists of the pre-handover, equipment handover, timeout and sign out handover process in the pre- and post-intervention surveys.

indicated that the information provided in the SBAR handover document for both the pre- and post-intervention phases was 'useful' or 'very useful' (Table II). However, significantly more nurses found the information provided by the SBAR handover document to be 'very useful' or 'extremely useful' in the post-intervention than the pre-intervention phase (88.6% vs. 52.2%; difference: 36.4% (Table II); 95% CI 17.3%–55.5%; $p = 0.0002$).

The nurses' and PIs' assessments of the SBAR handover document in the pre- and post-intervention phases are shown in Figs. 3a and b, respectively. The proportion of nurses who agreed ('agree' or 'strongly agree') that the SBAR handover document was useful in immediate patient management was higher in the post-intervention phase (93.2% vs. 77.3%; difference: 15.9%; 95% CI 1.0%–31.0%; $p = 0.068$). The level of agreement among the nurses significantly increased for the item 'Sufficient amount of information' (difference: 27.3%; 95% CI 11.8%–44.0%; $p = 0.003$) and significantly decreased for the item 'Difficult to differentiate important data from the non-important' (difference: –29.5%; 95% CI –49.2% to –12.8%; $p = 0.006$) (Fig 3a). Hence, in the post-intervention phase, more nurses found that the SBAR handover document was important, relevant and contained sufficient information for patient management. This was in line with data derived from the post-intervention survey, which indicated that significantly more CICU personnel, especially the nurses, viewed the SBAR handover document as the most important tool in the handover process (Table II).

The proportion of PIs who agreed ('agree' or 'strongly agree') that the SBAR handover document was their first point of reference increased in the post-intervention phase (75.0% vs. 37.5%; difference: 37.5%; 95% CI 7.7%–84.2%; $p = 0.315$; Fig. 3b). Changes in the PIs' perceptions on other utility items were negligible. It is possible that the PIs were either satisfied with the utility of both the current and new SBAR handover documents (i.e. found them useful, easy to use, easy to differentiate important information), or dissatisfied with the utility of both documents (i.e. information was insufficient). The item that demonstrated the least change in all the recipients' post-intervention perceptions was 'The form is easy to read', indicating that the new SBAR handover document improved utility without increasing complexity.

To evaluate the accessibility of the most informative items, recipients were asked to rank the categories of items based on perceived clinical significance. The rank assigned to a category by most of the recipients (i.e. the mode of each item's rank) was considered its overall rank. The nurses ranked 'patient identification' as their top priority, followed by 'diagnosis and type of surgery' and 'clinical alerts and allergy'. PIs, on the other hand, considered 'patient identification', 'intraoperative problems/issues/blood loss/abnormal bloods' and 'surgical issues' to be the more essential information. This difference in ranking between the PIs and nurses reflects their differing perceptions on the amount of information required at the initial management of patients. Henceforth, relevant patient information can be directed and highlighted in the handover document.

DISCUSSION

In the present study, most of the recipients relied on PETS and indicated that the SBAR handover document was the most important handover tool due to (but not limited to) the increased usefulness of the handover information passed from anaesthetists to recipients. This shows that the new PETS handover protocol was able to address the needs of CICU recipients.

Dual customisation of the handover process (i.e. PETS and SBAR) to meet the workflow and information demands of the receiving team is key to improving the interdisciplinary communication process and delivery of vital information, so as to optimise patient care upon arrival in the CICU. The timeout to call attention of all members of the handover team and sign out to allow the receiving team to question the handover team are essential aspects of the verbal communication during the handover process. Moreover, the addition of a 'none' or 'NA (not applicable)' option for an information item in the handover document facilitates differentiation between an omission error and absence of information and therefore helped to reduce anaesthetists' noncompliance in document completion.

Studies evaluating handover techniques have shown variations among healthcare centres and providers.⁽¹¹⁻¹⁴⁾ It has been suggested that communication flow during handover should be tailored to suit the structure of an institution and is dependent on processes such as provider transitions and trainee change of rotation.^(13,15) Furthermore, anaesthetists and nurses often have different expectations regarding the content and timing of information transfer.⁽¹⁶⁾ Anwari et al's study found that nurses often perceived anaesthetists' handovers to be unstructured with variable communication processes; in 14.0% of handovers, anaesthetists failed to provide any of the key information set by the study.⁽¹⁷⁾

Even in standard face-to-face handover systems, communication challenges can still occur if the transfer of care is not smoothly executed.^(3,8,18,19) Many studies that evaluated handover processes reported that interruptions, environmental factors (e.g. noise, crowding) and specific patient care requirements for both groups of staff involved in the handover resulted in an unstructured and error-prone handover process;^(9,15,20) this is similar to the findings of the present study. Furthermore, based on our new PETS handover protocol, while all the PIs indicated that there was rarely a standout leader during handover, 93.2% of the nurses indicated otherwise, thus showing that perception of the existence of a handover leader may depend on the type of CICU personnel. This study followed Nagpal et al's recommendation to involve surgeons during handover.⁽²¹⁾ For the PIs, the information relayed by the anaesthetists and surgeon during the 'single traffic communication' handover is equally important; thus, the anaesthetists and surgeon were seen to share the leadership role.

The World Health Organization timeout and sign-out system provided simple and efficient measures to prevent intraoperative errors.^(4,5) Adapting this system to the PETS handover protocol led to an increased perception among both nurses and PIs that

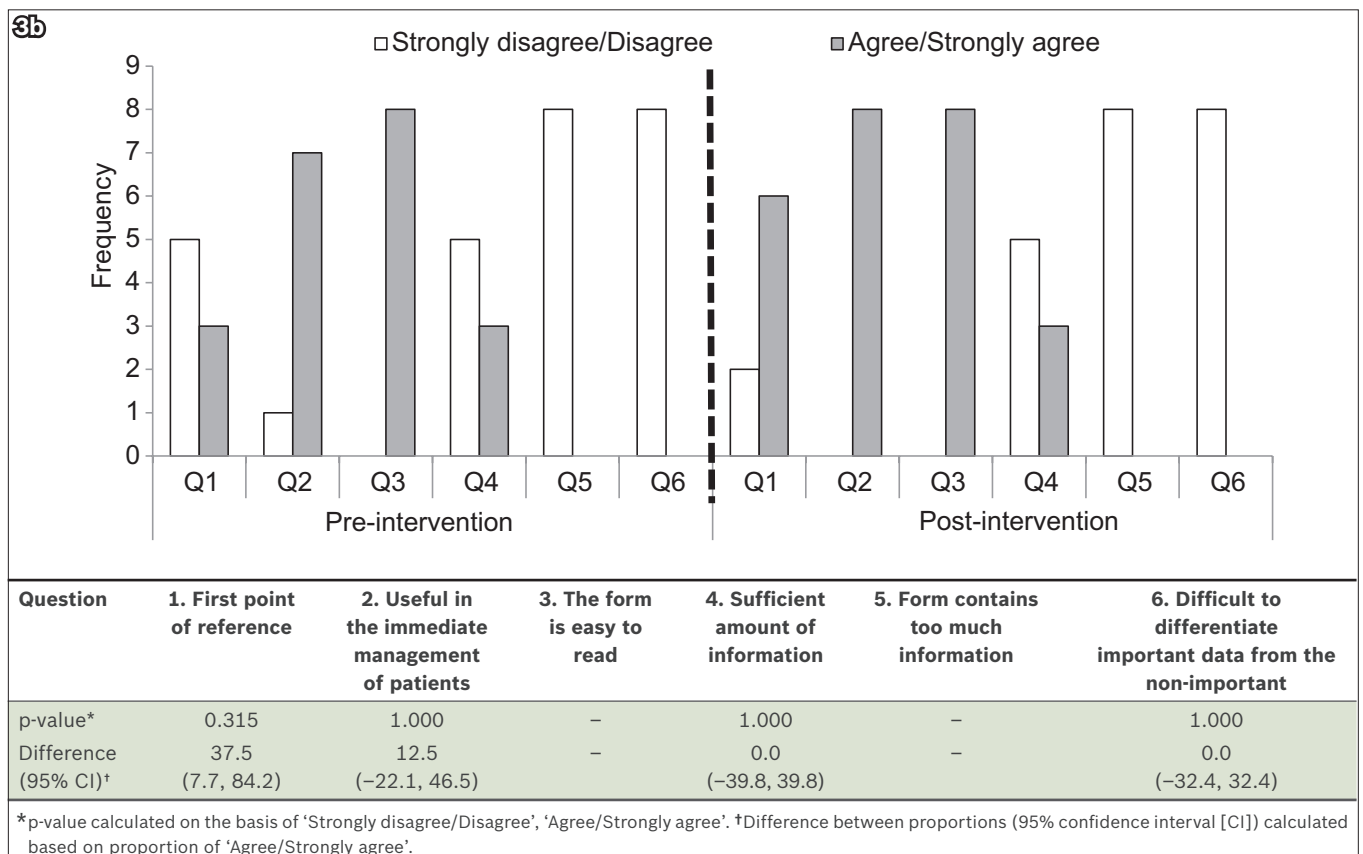
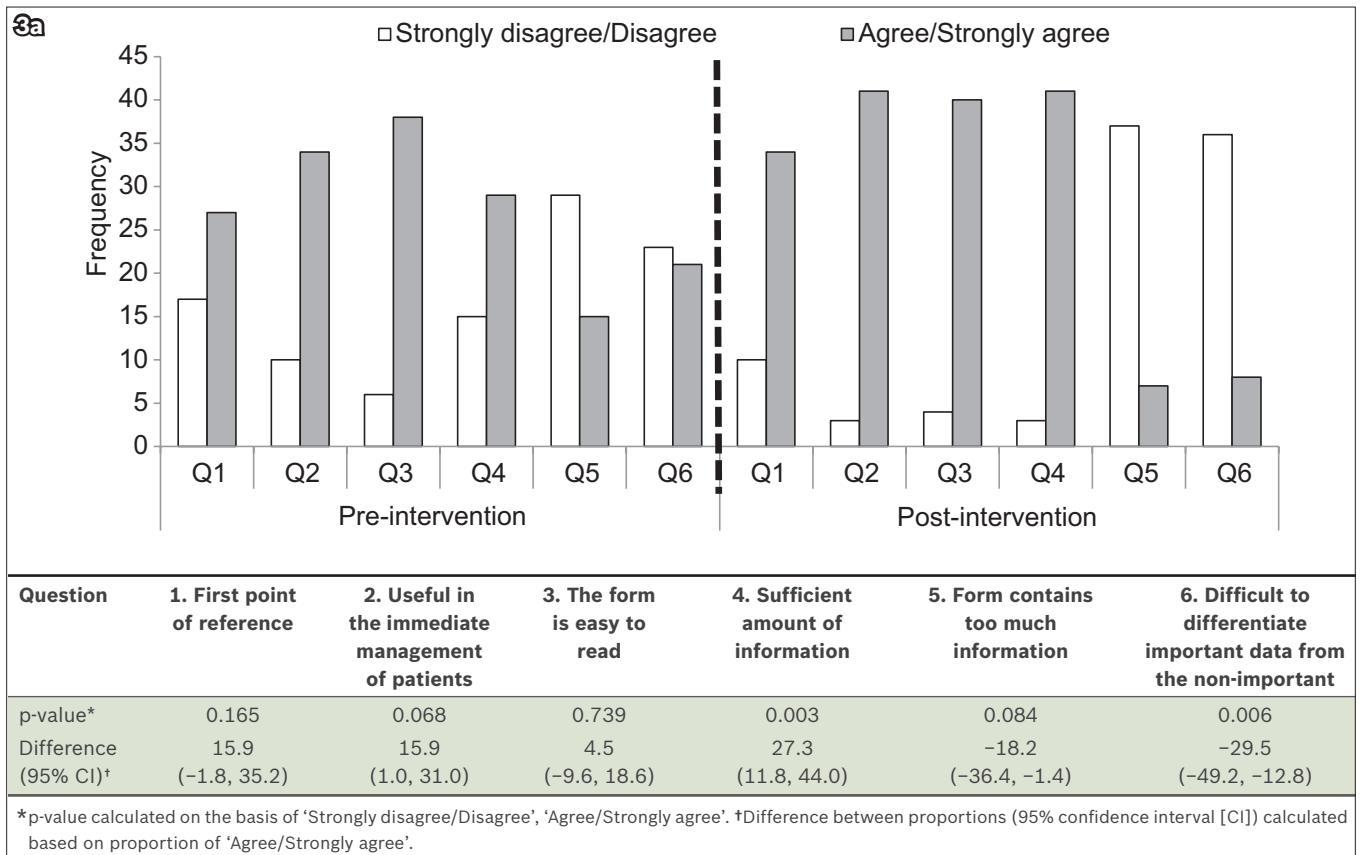


Fig. 3 Graphs show the assessments of children’s intensive care unit (a) nurses and (b) paediatric intensivists of the situation, background, assessment and recommendation handover document in the pre- and post-intervention surveys.

the new protocol ensured ease in prioritising the management of high-risk patients. The timeout component of the PETS handover protocol called to attention the PIs and nurses in charge of the patient, which minimised interruptions during handover, thus improving the perceived quality and content of the communication delivered by the anaesthetists. The sign-out system was designed to provide opportunities for the CICU receivers to close the loop of information transfer by raising any questions or clarifications.

Catchpole's Formula 1 and aviation handover technique was used as a template in the PETS protocol for clearing equipment, lines and drain tangles during pre- and actual handover.⁽¹⁾ Although they had been trained on equipment handover, during the post-intervention survey, 18 (40.9%) nurses indicated that the equipment section of the PETS protocol required improvement, 15 (34.1%) felt that it had improved and 11 (25.0%) opined that there was no change. The investigators inferred that the following reasons could account for the nurses' perceptions: (a) in-service talks were inadequate to effect change; (b) handover of critically ill patients who required immediate transport could have resulted in disorganised equipment handover; and (c) the primary concern of the operating theatre team was ensuring safety in transport, and thus the organisation of lines, monitors and drains was not prioritised.

Despite the overall perceived improvements in the post-intervention phase, participants did not perceive an increase in the time required to transmit information. More than 80% of the CICU recipients noted that a handover lasted approximately ten minutes, which is on par with that reported by other studies.^(2,17)

The SBAR handover document was reformatted to clear up ambiguity, carry optimal information (as expressed by end-users during the pre-intervention survey) for the initial management of patients, and promote ease of use for better compliance. Major changes made to the SBAR handover document to optimise transmission of information included: (a) addition of information on the patient's weight, antibiotics given and time of administration, the latest electrolyte and haemoglobin level, and ventilator setup for intubated patients; (b) recommendations were shortened and required the minimum essential data based on the pre-intervention survey results; and (c) creation of a single document that can be used for both cardiac and non-cardiac surgery (previously separate documents).

The previous SBAR handover document consisted of open-ended sections for each component, which the anaesthetists had to complete before handover. 23.0% of the end-users commented that the open-ended sections were left blank most of the time. It was thus unclear whether the blank sections indicated no clinical data to hand over or lack of compliance of the team handling the information. This scenario could be due to senior PIs' preference for conveying patient information at a face-to-face handover instead of via written communication, and points to the need for a communication form that guarantees compliance even among senior staff.^(8,21)

Communication improved not only as a result of changes in the content of the SBAR handover document, but also in the use of the document during face-to-face handover to relay its content

('timeout'); the latter was a requirement of the new PETS handover protocol. Therefore, our results differed from Joffe et al's,⁽²²⁾ as our recipients appreciated the use of the SBAR handover document as a format for face-to-face verbal handover and as a reference for other CICU caregivers who did not participate in the actual handover. This shows that receivers' perceptions of the quality of handover are institution-dependent.⁽¹⁷⁻²⁰⁾

The present study had some limitations. There may have been some recall bias among the survey participants. The recipients' perceptions may have been influenced by their level of experience and the number of critical incidents they previously handled. Furthermore, conformity and fear of administrative identification may have also induced bias in the recipients' perceptions; however, the anonymity of the study design and survey forms reduced the possible impact of the risk of bias.

The present study showed that dual customisation of the handover process (PETS protocol and SBAR documentation) was necessary to meet the workflow and information demands of the receiving team. These changes were essential to improving interdisciplinary communication and delivery of vital information so as to optimise patient care upon arrival at the CICU. Variation in information demands between nurses and doctors must be taken into consideration in the handover process and SBAR handover document. Providing options such as 'none' and 'NA' reduces ambiguity and facilitates differentiation between an omission error and a lack of information. The PETS handover protocol introduced in this study was individualised from the KKH-CICU team's demands, perceptions and opinions. However, this protocol can still be adapted by other centres or units (e.g. emergency room, surgical ICU or neonatal ICU) that have the same set of requirements for handover. In addition, we suggest that further investigations be conducted to determine the efficiency of the PETS handover protocol and the efficacy of the SBAR handover document for long-term use in practice. Other research designs, such as a metric target observational study or reciprocal survey involving anaesthetists who are handing over the patient, can be used to close the loop.

REFERENCES

1. Catchpole KR, de Leval MR, McEwan A, et al. Patient handover from surgery to intensive care: using Formula 1 pit-stop and aviation models to improve safety and quality. *Paediatr Anaesth* 2007; 17:470-8.
2. Salzwedel C, Bartz HJ, Kühnelt I, et al. The effect of a checklist on the quality of post-anaesthesia patient handover: a randomized controlled trial. *Int J Qual Health Care* 2013; 25:176-81.
3. Patterson ES, Roth EM, Woods DD, Chow R, Gomes JO. Handoff strategies in settings with high consequences for failure: lessons for health care operations. *Int J Qual Health Care* 2004; 16:125-32.
4. Australian Commission on Safety and Quality in Health Care. OSSIE Guide to Clinical Handover Improvement. Available at: <http://www.safetyandquality.gov.au/wp-content/uploads/2012/01/ossie.pdf>. Accessed September 12, 2014.
5. National Patient Safety Agency, NHS Modernisation Agency, British Medical Association. Safe handover: safe patients: Guidance on clinical handover for clinicians and managers. Available at: <http://www.bma.org.uk/-/media/files/pdfs/practical%20advice%20at%20work/contracts/safe%20handover%20safe%20patients.pdf>. Accessed April 8, 2012.
6. Beckett CD, Kipnis G. Collaborative communication: integrating SBAR to improve quality/patient safety outcomes. *J Healthc Quality* 2009; 31:19-28.
7. Riesenber LA, Leitzsch J, Little BW. Systematic review of handoff

- mnemonics literature. *Am J Med Qual* 2009; 24:196-204.
8. Thompson JE, Collett LW, Langbart MJ, et al. Using the ISBAR handover tool in junior medical officer handover: a study in an Australian tertiary hospital. *Postgrad Med J* 2011; 87:340-4.
 9. Erickson JI. Enhancing handover communication with SBAR. In: *Caring Headlines* [online]. Available at: http://www.mghpcs.org/News/CaringHeadlines/Documents/2013/April_4_2013.pdf. Accessed June 8, 2013.
 10. Newcombe RG. Interval estimation for the difference between independent proportions: comparison of eleven methods. *Stat Med* 1998; 17:873-90.
 11. Ilan R, LeBaron CD, Christianson MK, et al. Handover patterns: an observational study of critical care physicians. *BMC Health Serv Res* 2012; 12:11.
 12. Hatten-Masterson SJ, Griffiths ML. SHARED maternity care: enhancing clinical communication in a private maternity hospital setting. *Med J Aust* 2009; 190(11 Suppl):S150-1.
 13. Manser T, Foster S. Effective handover communication: an overview of research and improvement efforts. *Best Pract Res Clin Anaesthesiol* 2011; 25:181-91.
 14. Craig R, Moxey L, Young D, Spenceley NS, Davidson MG. Strengthening handover communication in pediatric cardiac intensive care. *Paediatr Anaesth* 2012; 22:393-9.
 15. Segall N, Bonifacio AS et al. Redesigning the OR-to-ICU Handover: Effects on information Omissions, Duration, Interruptions, and Team Behaviours. ASA abstract number A042. Available at: <http://www.asaabstracts.com/strands/asaabstracts/abstract.htm?jsessionid=D866850595A288DC9FBBB9835311F822?year=2012&index=15&absnum=4944>. Accessed October 8, 2012.
 16. Smith AF, Pope C, Goodwin D, Mort M. Interprofessional handover and patient safety in anaesthesia: observational study of handovers in the recovery room. *Br J Anaesth* 2008; 101:332-7.
 17. Anwari JS. Quality of handover to the postanesthesia care unit nurse. *Anaesthesia* 2002; 57:488-93.
 18. Agha RA. Handover in Trauma and Orthopaedic Surgery - A Human Factors Assessment. *Ann Med Surg (Lond)* 2012; 1:25-9.
 19. Lingard L, Espin S, Whyte S, et al. Communication failures in the operating room: an observational classification of recurrent types and effects. *Qual Saf Health Care* 2004; 13:330-4.
 20. Abraham J, Nguyen V, Almoosa KF, Patel B, Patel VL. Falling through the cracks: information breakdowns in critical care handoff communication. *AMIA Annu Symp Proc* 2011; 2011:28-37.
 21. Nagpal K, Arora S, Abboudi M, et al. Postoperative handover: problems, pitfalls, and prevention of error. *Ann Surg* 2010; 252:171-6.
 22. Joffe E, Turley JP, Hwang KO, et al. Evaluation of a problem-specific SBAR tool to improve after-hours nurse-physician phone communication: a randomized trial. *Jt Comm J Qual Patient Saf* 2013; 39:495-501.

APPENDIX 1

Pre-intervention SBAR Handover Form (Cardiothoracic)

1. Situation (<i>What's the main diagnosis requiring surgery?</i>)		
Admitting Diagnosis:		
Operation Performed:		
2. Background (<i>Pertinent past medical, anaesthesia and operation issues</i>)		
Past Medical History of Note	<input type="checkbox"/> No <input type="checkbox"/> Yes, handed over as per preop assessment sheet	
Allergy	<input type="checkbox"/> No <input type="checkbox"/> Yes, specify:	
Complications during anaesthesia/line settings		
Complications during operation		
Airway	ETT size / length	
	Difficulties encountered	
Respiratory	OT Ventilator settings	
	Ventilation Issues	
Bypass Details	CPB time <i>(any circulatory arrest involved?)</i>	
	Aortic Cross Clamp Time	
Cardiovascular Concerns	HR	
	BP	
	CVP	
	Others (eg: ? TEE done)	
Intake/Output	Fluids	<input type="checkbox"/> Handed over
	Blood products	<input type="checkbox"/> Handed over
	Blood loss	<input type="checkbox"/> Handed over
	Urine output	<input type="checkbox"/> Handed over
2. Background Cont'd (<i>Pertinent past medical, anaesthesia and operation issues</i>)		
Temperature Control Concerns		
Pain/sedation status	Paralysis reversed?	
	Pain/Sedation meds	
	Pain team involved?	
Neurology	Any concerns?	
IV infusions		
Drains/Tubes/Lines	For surgeon to pass and in notes	
3. Assessment (<i>Anything we should look out for postoperatively?</i>)		
Post-op concerns	Respiratory/Ventilation	
	Cardiovascular	
	Renal	
	Metabolic/Electrolytes	
	Haematology	
	CNS	
Others		
4. Recommendations (<i>Anything we should follow up on and any recommendations?</i>)		
Issues requiring follow-up		
Orders requiring follow-up		
Pending tests/histology		

Handed over by:
Anaesthesia Team

Handed to:
ICU Team

APPENDIX 2

Post-Intervention SBAR Handover Form



KK Women's and
Children's Hospital
SingHealth

Patient's weight: _____

Discipline: _____

SBAR Anaesthesia Handover Form

Patient's name label

Preoperative Handover

Postoperative Handover

Situation (What's the main diagnosis requiring surgery?)

Admission diagnosis:

Operation performed:

Background (Pertinent past medical, anaesthesia and operation issues)

Past medical history:

None

specify pertinent medical history:

Allergy:

None

Yes, specify:

Airway:

NA

ETT size: _____ Uncuff / Cuff (cuff pressure: _____ cmH₂O)
Anchored at _____ cm at lips / nostrils Right Left

Easy / Difficult

Others: (e.g. tracheostomy, CPAP)

OT ventilator settings:

NA

Settings: _____ PIP: _____ PEEP: _____ RR: _____ FiO₂: _____

Issues: None Yes, specify: _____

Lines:

NA

Peripheral/s: _____

Arterial: _____

CVP: _____ cm _____ fr

Complications during setting: None Yes, specify: _____

Complications during anaesthesia:

None
 NA

Yes, specify:

Cardiovascular concerns:
Please indicate the range

HR: _____ BP: _____ CVP: None Have: _____

(Please refer to the anaesthesia record for hemodynamic TRENDS: for post op handover)

Arrhythmias: None Have: (specify) _____

Others:

Ongoing IV infusions (Inotropic support, blood products, etc.):

None

Yes: specify,

For CTS cases:

Non-CPB

CPB time: _____ Aortic cross clamp time: _____

NA

Any Circulatory arrest involved? : No Yes

MUF : No Yes

Intake

None

Fluids given

None

Blood products given

Output

NA

Estimated blood loss

NA

Urine output

Background Continued (Pertinent past medical, anaesthesia and operation issues)		
Temperature control issues:	<input type="checkbox"/> None	<input type="checkbox"/> Yes, specify:
Concerns for neurology:	<input type="checkbox"/> None	<input type="checkbox"/> Yes, specify:
Antibiotics given in the OT	<input type="checkbox"/> None	<input type="checkbox"/> Yes, specify (please include the time of last dose)
Anaesthetic and pain concerns:	Paralysis reversed?	<input type="checkbox"/> NA <input type="checkbox"/> No <input type="checkbox"/> Yes
	Pain/Sedation medication (infusion):	<input type="checkbox"/> None <input type="checkbox"/> Yes, specify:
	On acute pain service	<input type="checkbox"/> No <input type="checkbox"/> Yes (PCA / Epidural)
Surgical site:	<input type="checkbox"/> Head <input type="checkbox"/> Neck <input type="checkbox"/> Thorax <input type="checkbox"/> Upper abdomen <input type="checkbox"/> Lower abdomen <input checked="" type="checkbox"/> Back <input type="checkbox"/> Pelvic <input type="checkbox"/> UL <input type="checkbox"/> LL	
Complications during surgery:	<input type="checkbox"/> None <input type="checkbox"/> NA	<input type="checkbox"/> Yes: (For surgeon to pass)
Surgical drains/tubes:	<input type="checkbox"/> None <input type="checkbox"/> NA	<input type="checkbox"/> Yes: (For surgeon to pass)
Assessment (Any pre/postoperative concerns we should look out for?)		
Respiratory/ventilation:	<input type="checkbox"/> None	<input type="checkbox"/> Yes, specify:
Cardiovascular	<input type="checkbox"/> None	<input type="checkbox"/> Yes, specify:
Renal, metabolic and electrolytes	<input type="checkbox"/> None	<input type="checkbox"/> Yes, specify:
	Most Recent	Na:_____ K:_____ Ca:_____ BE:_____ Gluc:_____
Haematology	<input type="checkbox"/> None	<input type="checkbox"/> Yes, specify:
	Most recent	Hb:_____ Hct:_____
	Available remaining blood products:	
CNS	<input type="checkbox"/> None	<input type="checkbox"/> Yes, specify:
Others	<input type="checkbox"/> None	<input type="checkbox"/> Yes, specify:
Recommendations (Anything we should follow up on and any recommendations?)		
Issues and/or orders requiring follow-up :	<input type="checkbox"/> None	<input type="checkbox"/> Yes, specify:
Pending tests/histology	<input type="checkbox"/> None	<input type="checkbox"/> Yes, specify:
Handed over by (Anaes)	Dr. _____ <small>Name and Signature</small>	MCR: _____
	Date: _____	Time: _____
	Contact number: _____	
Handed over to (ICU)	Dr. _____ <small>Name and Signature</small>	MCR: _____
	Date: _____	Time: _____
63850-Form-0004 (Jul 2012)		