



Bedside handover with structured and relayed forms in a postanesthesia care unit: A pre- and post-implementation study

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ABSTRACT

Background: Early postoperative patients are vulnerable. Poor communication between health care professionals may seriously damage patients' wellbeing. There is a risk of information loss when bedside handover is performed.

Objectives: To investigate whether the implementation of structured and relayed forms to shift-to-shift bedside handovers improve the frequency of appropriate handover elements and reduces the incidence of adverse events and postoperative length of stay for patients in a postanesthesia care unit.

Methods: This quality improvement project was conducted in a postanesthesia care unit of a tertiary stomatological hospital in China. The study population was patients under surveillance in the postanesthesia care unit for >12 h. A pre- and post-implementation approach was employed. The pre-implementation of unstructured bedside handovers and the post-implementation of bedside handovers with structured and relayed forms were compared. The indicators measured were appropriate handover elements, adverse patient events, and postoperative hospital stay.

Results: There were 387 and 395 morning handovers observed pre- and post-implementation of bedside handovers with structured and relayed forms, respectively. Of the 21 elements that should be delivered, 17 elements were noted to be improved. No improvement was found in the incidence of adverse events and postoperative hospital stay.

Conclusions: Bedside handovers with structured and relayed forms increased the incidence of appropriate handover elements. The use of structured and relayed forms did not affect on the incidence of adverse events and postoperative hospital stay. Individualized relayed handover forms may be developed and implemented according to the characteristics in which they are administered.

1. Introduction

Handover is the transfer or shift of some or all of the information, responsibility, and accountability for the care of patients to another health professional or professional group (Anderson et al., 2015; Loeffgren Vretare & Anderzén-Carlsson, 2020). Shift-to-shift nursing handovers occur at overlapping times between shifts. Furthermore, nursing handovers may be conducted between nursing units or between organizations (Bergs et al., 2018). Information is probably misrepresented, misinterpreted, or omitted when handover is organized inappropriately (Spoonster et al., 2016; Streeter & Harrington, 2017). Communication errors that occur during handovers were associated

with adverse patient outcomes. Miscommunication may lead to a variety of situations like patient falls, reportable events, length of hospital stay, mortality, medical errors, and nosocomial infections that may harm patients (Mardis et al., 2017).

Bedside handover is the process by which nurses transfer information and the obligation at patients' bedsides. In addition to the nurses of the two shifts, the patients are involved in the process (Forde et al., 2020). Research findings on whether bedside handovers improve patient safety were inconsistent (Bukoh & Siah, 2020; Hada & Coyer, 2021). There is a risk of information omission in bedside handovers. Previous findings showed that about 20 %–47 % of the information transferred was remembered by incoming nurses (Drach-Zahavy et al., 2017; Randmaa

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et al., 2015). Additionally, new patients would decrease the quality of the handover because more detailed information was called upon to meet the incoming nurse's expectations (Streeter & Harrington, 2017). Therefore, a question to be explored is how to improve information retention and persistence of the incoming nurses.

Structured or standardized handover is the use of a relatively fixed structure and content in a verbal handover (Methangkool et al., 2019). The SBAR (Situation-Background-Assessment-Recommendation) technique is the most commonly used structured handover tool (Abbaszade et al., 2021). There is several available evidence of the efficacy of SBAR checklists administration on patient outcomes (Abbaszade et al., 2021; Müller et al., 2018). However, checklists do not ensure accurate and adequate exchange of information, as they merely provide a framework for communication. During the handover process, outgoing nurses are often driven to recall information relevant to essential elements of clinical care (Spooner et al., 2016). As vehicles for documenting patient information, handwritten or electronic notes are often used in handovers. Handwritten notes with different formats, contents, and markings are challenging for others to implement (Timmerman et al., 2021).

Early postoperative patients undergoing general anesthesia were part of the most vulnerable groups. There were numerous studies on handover from the operating room (OR) to the postanesthesia care unit (PACU) or Intensive Care Unit (ICU) (Jelacic et al., 2021; Keller et al., 2020; Lillibridge et al., 2017; Randmaa et al., 2015). Some studies had indicated that the application of structured communication tools or formal reporting methods in patient handover enhances nurses' satisfaction and the quality and safety of patient transfer between the OR and the PACU/ICU (Leonardsen et al., 2019; Nagpal et al., 2013; Talley et al., 2019). Nevertheless, there are comparatively few studies focusing on the handover within the PACU/ICU in the early postoperative period. Additionally, some patients overflowing from the ICU had made the handover between PACU nurses more challenging (Kiekkas et al., 2021).

The purpose of this study was to investigate whether the implementation of structured and relayed forms to shift-to-shift bedside handovers improves the frequency of appropriate handover elements and reduces the incidence of adverse events and postoperative length of stay for patients in a PACU.

2. Methods

2.1. Setting

This quality improvement project which employed a pre- and post-implementation design was conducted in a PACU of a university-affiliated tertiary stomatological hospital in China. This PACU provides intensive care services in addition to anesthesia recovery. Patients undergoing free tissue flap reconstruction of maxillofacial defects were usually surveillance in this PACU for one night before being transferred to the ward. Such patients were either tracheotomized or with tracheal intubation overnight. The tracheal tube was removed the next morning. One hour after, patients with stable vital signs were discharged and transferred to the ward. Patients with tracheotomy were also discharged at this time. During the study period, there were eight beds and 14 full-time nurses in this PACU, which provide care for about 1600 such patients each year. Nurses were scheduled into three shifts: shift A, 8 am to 4 pm; shift P, 4 pm to 12 am; and shift N, 12 am to 8 am. Such patients usually experienced two to three handovers in this PACU.

2.2. Study processes and patients

The theoretical framework of this study was Lewin's theory of Planned Change (Shirey, 2013). Three basic steps were unfreezing, movement, and refreezing. Thus, there were three consecutive phases in this study. The first was the pre-implementation observation and planning. The second was designing and staff education. And the third was the implementation and evaluation. The timeline and tasks of the three

phases could be found in Fig. 1.

Phase 1, unfreezing: Pre-implementation observation and planning of the study.

The typical way of previous bedside handover was conducted verbally. Some of these were carried out with unstructured handwritten notes. In previous observations before this study, we had noticed that there were several reasons why a quality improvement program should be introduced, and why a new handover model was desired to be implemented in this PACU. Content and order of handovers varied from nurse to nurse. The pertinent information might not be retained after several handover cycles, and therefore, patient care might be disjointed and uninformed. Critical information about patients might be omitted or incorrect after several handovers. Omission or error of information might diminish patient care and even result in serious adverse events. So, after the recording sheet and other tools were designed (see 'observers and measurement tools' part below), researchers observed and evaluated the quality of morning handover for four months.

Phase 2, movement: Designing the handover form and staff education.

A handover form was developed by the investigators of this study in discussion with two senior nurses. The form was constructed based on the handover characteristics of this PACU, and the tools reported in the relevant literature (Shah et al., 2019; Spooner et al., 2018; Starmer et al., 2017). Guided by the SBAR (Situation-Background-Assessment-Recommendation), the blank forms were expected to be completed by the nurses in either fill-in-the-blank questions or multiple-choice questions, or text descriptions. Information technology staff typed the designed blank handover form files into all the 12 stationary or movable computers in the PACU. The content a nurse filled in the handover form on any of the computers could be accessed on all computer screens simultaneously. Outgoing nurses held either a portable device or a paper version of the forms printed out during handover. The main content of the handover form was shown in Fig. 2.

Once a patient was transferred from the OR, the PACU nurse was responsible for completing the Situation and Background sections of the form based on the patient's condition documented on the medical record. Assessment and Recommendation sections were completed by the nurse currently on duty depending on what happened to the patient and surveillance priorities that may affect the patient in the following shift. Nurses documented the handover form when there were changes in patients' conditions or when they identified that certain conditions require attention. It was required that the nurses complete the form in a clear, concise, and legible manner. It was accepted to highlight but avoided applying non-universal symbols.

When the current duty nurses left work, the forms would be used during the handover and passed to the oncoming nurses, who would then fill out the forms according to what happened to the patients during their shift until the patients were discharged and transferred to the ward. The forms were then printed and employed to transfer their duties to ward nurses.

The handover form would be available when a patient was transferred to the PACU. Nurses on all shifts could document this form. Nurses on the latter shift were able to read the records of nurses on the previous shifts. Nurses on the latter shift were allowed to make additions to the notes from previous shifts nurses. Therefore, we termed this handover form as relayed form.

Relayed forms were flexible and holistic. PACU nurses could write it down at any time. They would record immediately after a recordable event happened. They documented anything that needed to record according to their judgment. They were authorized to add additional content to what other nurses had noted, except for modifying the information already recorded by others. In addition, items could be

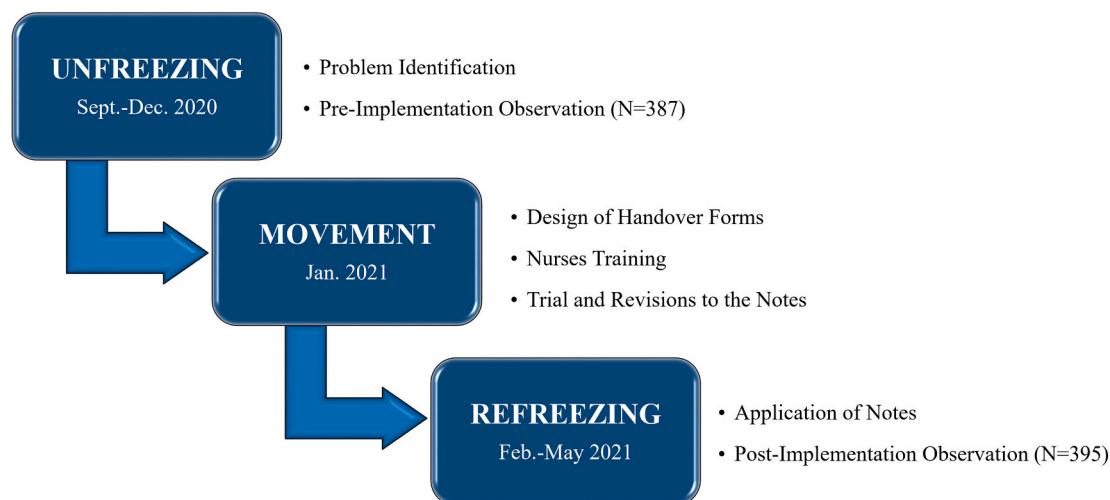


Fig. 1. Timeline of the study.

inserted or subtracted following the change of attention in the handover.

The first and third authors of this paper trained on the content of the form and how to complete it. All the 14 shift nurses participated in any of the three training sessions that took place during one week. Nurses had a right to pick any of the training sessions depending on their shift. The training was made up of a 30-min slide presentation and a 30-min simulated completion of the form and a Q&A session. Training details covered the meaning of SBAR, how to complete each item of the initially designed blank form, and where and how to write in the form for particular situations. After the training, a 3-week trial run was performed. Three rounds of feedback were solicited on the content of the form. Based on 15 comments collected, researchers decided whether changes were necessary. The pre-final version was formed after three revisions. The content of the pre-final version of the form was reviewed by five nurses with more than ten years of experience in this PACU and surgical ward, who agreed that the form contained the appropriate elements.

Phase 3, refreezing: Implementation and evaluation of the structured and relayed forms.

Nurses began to utilize structured and relayed forms in bedside handovers. Morning handovers were observed and evaluated.

The study population was patients undergoing maxillofacial surgery with free flap reconstruction who was under surveillance in the PACU for >12 h. They had experienced two or three bedside handovers in this PACU. Patients who experienced significant alterations were excluded, including the vascular crisis in the free flap requiring emergency surgery, severe medical conditions, and other situations patients could not be discharged from the PACU after the morning handover.

The patients were selected through convenience sampling. Morning handovers for these patients from September to December 2020 (Phase 1) and from February to May 2021 (Phase 3) were included as pre- and post-implementation groups, respectively. Approximately 100 such patients were admitted to this PACU every month. Considering that possibly some patients would be excluded, it was estimated that there will be 360 patients in each group.

2.3. Observers and measurement tools

Two authors of this paper observed and evaluated the quality of morning handovers. Both acted as observers only, without participating in handovers. Only one observer was present at each handover. The handovers were audio-recorded during the observation period. To evaluate the consistency of the two observers, both of them observed 20

patients' handovers concurrently. Two observers would be present on the first Wednesday of every 2 months. If there were less than five patients on that day, the two observers continued on Thursday. Correlations between two observers' recordings, or inter-rater reliability were 0.92. All nurses in handovers were aware of the observers' attendance. The general information about nurses in this PACU was collected at the beginning of the study. These included age, gender, year of professional work, and educational background.

The authors of this study designed a recording sheet to capture a certain patient's demographic and surgery-related data, and the time and content of the handover. The recording sheet was designed according to the characteristics of the patient in this PACU. The demographic and surgery-related data included patients' age, gender, type of free flap, ASA class, PACU duration, and early postoperative airway management approaches (tracheal intubation or tracheotomy). These were recorded by the observers according to the hospital information system before the handover was performed. The handover time started from the arrival of both shifts at the patient's bedside until the end of the handover of the patient. The content of the handover was split into 21 elements. The handover content part of the recording sheet was reviewed by five nurses with >10 years of PACU nursing experience at the initial stage of design. They consistently agreed that the sheet covered the indispensable elements of handovers. For the main details of the recording sheet, please see [Table 1](#).

The observer filled in the recording sheet during the handover to record any omissions in the items. Afterward, the audio recording was played to determine the accuracy of the handover with the patient's electronic medical record system. Both observers listened to all the audio recordings and accomplished all recording sheets together. For objective items, those that were handed over verbally and correctly were considered appropriate handover elements, while those that were not delivered or not correctly delivered were considered inappropriate handover elements. Subjective items, such as suggestions and recommendations for the next shift outgoing nurses pointed out, were considered appropriate as long as they were mentioned in the handover course. For each patient's handover course, the observers spent about 15 min exploring whether the elements present were appropriate.

In addition, the incidence of adverse events was estimated, which include unplanned reoperations, and reportable pressure injuries, which meant all types of pressure injury except stage 1. The length of post-operative hospital stay of patients was counted. The data above was retrieved from the hospital information system.

Situation and Background

Name: _____ Gender: M / F Age: _____ Y/M Record ID: _____ Admission time: _____
 Diagnosis: _____ Allergies: _____
 Past history: _____ Abnormal values of pre-operative lab results: _____
 Operation: _____ Intraoperative abnormal events: _____
 Intraoperative fluid volume: _____ Bleeding: _____ Urine volume: _____

Assessment

Abnormal vital signs: _____ Airway: tracheal intubation / tracheotomy
 Wound indwelling: Drainage strip, Y / N (amount and location), iodine strip Y / N (amount)
 drainage tube, Y / N (amount and location) others, (type, amount and location)
 No head movement allowed: Y / N (maintaining position) Nasogastric tube Y (length) / N
 Urinary catheter: Y / N, (urine color), (urine volume) removal the next day, Y / N
 Skin condition: (sacral-caudal / nasal ala / others), require special support, Y / N (support type)
 Anesthetic drug administration: (drug name and speed) End time: _____
 Surgical site: (bleeding, swelling, circulation, others, and their dynamic changes)
 Flap: (color, texture, temperature, others, and their dynamic changes)
 Intake and output volume: (Infusion, blood transfusion, others / urine, bleeding, drainage, others)
 Pain management: (location, level, treatment, effectiveness, patient controlled analgesia, others)
 Nausea and vomiting: (frequency, volume, treatment, effectiveness)
 Others:

Unexpected situations or events and treatment (for example, 'SpO₂ will drop below 90% during deep sleep', 'Very slow heart rate for a while').
 Abnormal clinical test results in the PACU.
 Special medical advice (for example, 'Systolic pressure should be maintained at about 120 mmHg').
 Other special requirements.

Recommendations

Recommendations and suggestions on patient care for the next shift.

Fig. 2. Main content of handover form.

2.4. Data analysis

All statistical analyses were performed with the SPSS 26.0 statistical software (Armonk, NY, USA). Descriptive statistics were adopted to summarize the demographic and surgery-related data of the patients and PACU nurses, appropriate handover elements observed, the incidence of adverse events, and postoperative hospital stay. Descriptive data were summarized using means and standard deviations (SD) or median and interquartile range (IQR) for continuous variables, and counts and percentages for categorical variables. Statistical inferences were analyzed using two-tailed, unpaired Student's *t*-tests or Pearson *chi-square* tests to compare the characteristics of patients, handover duration, appropriate elements, the incidence of adverse events, and postoperative hospital stay before and after implementation of structured and relayed forms.

2.5. Ethical consideration

This project was deemed exempt for review by the Institutional Review Board based on being a quality improvement program. The project was approved by the head of the unit in which it was conducted. Verbal permission to participate was gained by all nurses and patients involved. Audio recording materials were destroyed after transcription was completed. All written observation records did not include the names of nurses and patients.

3. Results

3.1. General information of nurses in the PACU

During the period when the study was carried out, there were 14 nurses in the PACU involved in handovers and no demographic changes.

Table 1
The main content of the handover recording sheet.

Handover elements	Presence	Appropriate
1. Patient's name	Y/N	Y/N
2. Patient's age	Y/N	Y/N
3. Patient's record ID	Y/N	Y/N
4. Allergies and allergens	Y/N	Y/N
5. History of disease and surgery prior to this admission	Y/N	Y/N
6. Preoperative laboratory and ancillary tests findings	Y/N	Y/N
7. Current surgical procedures	Y/N	Y/N
8. Intraoperative situations and events	Y/N	Y/N
9. Urinary catheters, drainage tubes, arterial/venous tubes and other lines	Y/N	Y/N
10. Patient's condition change and therapeutic interventions during the shift	Y/N	Y/N
11. Current vital signs and variations during the shift	Y/N	Y/N
12. Intake and output volume	Y/N	Y/N
13. Surgical site and tissue flap condition, such as color, surface texture, temperature, etc.	Y/N	Y/N
14. Skin condition, like pressure injuries	Y/N	Y/N
15. Surgical site pain and analgesics (include patient-controlled analgesia)	Y/N	Y/N
16. Bleeding and blood loss	Y/N	Y/N
17. Nausea and vomiting	Y/N	Y/N
18. Results of tests performed in PACU such as blood gas analysis	Y/N	Y/N
19. Systemic diseases (e.g., hypertension, diabetes) and medical treatment during the shift	Y/N	Y/N
20. Respiratory management, such as tracheal tube or tracheotomy	Y/N	Y/N
21. Recommendations and suggestions on patient care for the next shift	Y/N	Y/N

The nurses were 24–44 years old and with 3–22 years of nursing experience when the study began. The general characteristics of PACU nurses are presented in [Table 2](#).

3.2. General characteristics of patients and morning handovers in the PACU

A total of 403 patients were admitted to the PACU before the implementation of structured and relayed forms between September and December 2020, of which 16 cases were not observed due to the morning handover had canceled or being too complicated (nine cases for discharge ahead of schedule, six back to the operating room for re-operation, and one unexpected systemic condition). Eventually, 387 morning handovers were observed. After the implementation, 417 patients were admitted from February to May 2021, and 22 cases were not observed (14 cases discharge ahead of schedule, seven back to the operating room for re-operation, and one unexpected systemic condition). Finally, 395 morning handovers were observed.

[Table 3](#) presents a comparison of the general conditions and surgical characteristics of patients before and after the implementation of handover with structured and relayed forms. The average handover time before and after the implementation was 4.03 min and 3.97 min, respectively.

Table 2
General information of nurses in this PACU.

General information	PACU nurses N = 14	
Age, median (IQR)	35.0	(6.3)
Year of professional work, median (IQR)	12.0	(5.5)
Education background, (n, %)		
Associate	3	21.4%
Bachelor	11	78.6%

Abbreviations: IQR, interquartile range; PACU, Postanesthesia Care Unit.

Table 3
General characteristics of patients experiencing morning handovers.

General characteristics	Pre N = 387		Post N = 395		Chi-square or t-value	P
Mean age (SD)	54.5	(12.9)	55.2	(12.4)	0.73 ^a	0.441
Gender (n, %)					0.05	0.826
Male	199	51.4%	200	50.6%		
Female	188	48.6%	195	49.4%		
Free flap type (n, %)					6.43	0.093
Radial forearm free flap	80	20.7%	95	24.0%		
Anterolateral thigh flap	109	28.2%	96	24.3%		
Fibula flap	145	37.4%	167	42.3%		
Iliac crest flap	53	13.7%	37	9.4%		
ASA class (n, %)					0.23	0.892
I	15	3.9%	18	4.5%		
II	333	86.0%	338	85.6%		
III	39	10.1%	39	9.9%		
PACU Duration (hours), mean (SD)	14.5	(2.9)	14.7	(2.6)	1.02 ^a	0.312
Airway Management (n, %)					0.17	0.677
Tracheotomized	109	28.2%	106	26.8%		
Intubated	278	71.8%	289	73.2%		
Handover duration per patient (minutes) mean (SD)	4.03	0.51	3.97	0.49	1.68 ^a	0.088

Abbreviations: ASA, American Society of Anesthesiologists; PACU, Post-anesthesia Care Unit; SD, standard deviation.

^a t-value.

3.3. Appropriate handover elements

Before the implementation of the bedside handover with structured and relayed forms, a total of 5234 handover elements were observed. Of these, 4554 were appropriate handover elements. After implementation, these numbers were 7728 and 7597. The comparison of the appropriate elements before and after implementation of the structured and relayed forms showed improvement in all except four elements, which included allergic condition, name of current surgery, bleeding and blood loss, and skin condition. The appropriate elements before and after the implementation of the structured handover are shown in [Table 4](#).

3.4. Incidence of adverse events and postoperative hospital stay

Before and after the implementation of the structured and relayed forms, there were 17 and 21 unplanned reoperations, and 11 and 9 reportable pressure injuries, respectively. No statistical significance was found for the incidence of unplanned reoperations and pressure injuries, and the length of postoperative hospital stay before and after implementation of the structured handover. See [Table 5](#).

4. Discussion

The results of this study indicated that bedside handovers with structured and relayed forms increased the appropriateness of most handover elements that should be delivered. It suggested that this pattern improved the quality of handover. Bedside handover with structured and relayed forms was positive for avoiding handover errors and improving the quality of care. This was closely related to the promoting role of the relayed forms.

Compared with checklists used in other studies, the structured forms we employed contain concrete contents of bedside handover ([Abbaszade et al., 2021](#); [Jelacic et al., 2021](#)). PACU nurses can use the forms as reminders to make handovers more efficient. They probably do not have to spend a lot of time recalling and checking nursing records and other documents before and during the handover process ([Spoonner et al.,](#)

Table 4
Appropriate handover elements pre- and post-implementation.

Handover elements	Pre N = 387		Post N = 395		Chi-square value	OR	95%CI	P
	n	%	n	%				
Name	125	32.30 %	378	95.70 %	342.35	15.73	9.83–25.17	<0.001
Age	94	24.29 %	382	96.71 %	430.42	23.00	13.44–39.38	<0.001
Record ID	342	88.37 %	374	94.68 %	10.08	2.19	1.33–3.60	0.002
Allergies	356	91.99 %	375	94.94 %	2.79	1.58	0.92–2.73	0.095
History	200	51.68 %	376	95.19 %	190.73	10.05	6.40–15.77	<0.001
Pre-operative lab results	177	45.74 %	212	53.67 %	4.92	1.17	1.02–1.35	0.027
Surgeries	350	90.44 %	362	91.65 %	0.35	1.14	0.73–1.79	0.555
Intraoperative events	140	36.18 %	379	95.95 %	312.90	15.76	9.69–25.61	<0.001
Tubes, lines, and drains	270	69.77 %	374	94.68 %	83.51	5.69	3.65–8.86	<0.001
Condition changes	148	38.24 %	377	95.44 %	289.88	13.55	8.57–21.43	<0.001
Vital signs	199	51.42 %	374	94.68 %	186.83	9.14	5.95–14.03	<0.001
Intake and output	125	32.30 %	346	87.59 %	249.52	5.46	4.16–7.16	<0.001
Surgical site and flap	166	42.89 %	358	90.63 %	201.52	6.10	4.43–8.38	<0.001
Skin condition	366	94.57 %	372	94.18 %	0.06	0.932	0.53–1.66	0.810
Blood loss	371	95.87 %	387	97.97 %	2.92	2.04	0.88–4.71	0.087
Nausea and vomiting	125	32.30 %	378	95.70 %	342.35	15.73	9.83–25.17	<0.001
Tests in PACU	312	80.62 %	375	94.94 %	37.54	3.83	2.39–6.14	<0.001
Pain management	197	50.90 %	366	92.66 %	169.03	6.69	4.64–9.63	<0.001
Systemic diseases	66	17.05 %	320	81.01 %	319.91	4.37	3.55–5.38	<0.001
Airway management	347	89.66 %	372	94.18 %	5.38	1.78	1.08–2.91	0.020
Recommendations	79	20.41 %	359	90.89 %	394.03	8.73	6.37–11.97	<0.001

Abbreviations: CI, confidence interval; ID, identity document; OR, odds ratio; PACU, postanesthesia care unit.

Table 5
Incidence of adverse patient events and length of postoperative hospital stay pre- and post-implementation of structured handover.

	Pre N = 387		Post N = 395		Chi-square or t-value	OR	95 % CI	P
	Cases	%	Cases	%				
Unplanned reoperations cases, %	17	4.39	21	5.31	0.36	1.01	0.98–1.04	0.548
Pressure injuries cases, %	11	2.84	9	2.28	0.25	0.99	0.97–1.02	0.617
Postoperative length of stay days, mean (SD)	7.3	(1.3)	7.2	(0.9)	1.25 ^a			0.211

Abbreviations: CI, confidence interval; OR, odds ratio; SD, standard deviation.

^a t-Value.

2016). Structured forms are easier for nurses to communicate with each other than unstructured notes (Timmerman et al., 2021). Writing as clearly as possible and preventing the use of non-universal symbols make the forms accessible to subsequent nurses during the relay process. Doing so may not stress the nurses out to read and continue filling out the form.

The handover time, compared to the unstructured bedside verbal handover, did not change significantly with the use of the structured forms, despite the content integrity of the handover having been significantly improved. This is consistent with the findings of related studies (Gardiner et al., 2015; Malfait et al., 2018). This may be connected to the fact that with the use of structured and relayed forms, there are sufficient procedural and informative tips for the outgoing nurses, which caused an increase in the fluidity of handovers. Unlike unstructured handovers, which were full of individualization, structured handovers made the process more predictable and efficient by reducing unnecessary changes (Methangkool et al., 2019).

Some studies have contended that the handover notes contain private or sensitive information (Tobiano et al., 2017). However, many studies found that the information in the handover was mainly about the patients' physical symptoms (Forde et al., 2020). This study confirmed the findings of Forde et al. (2020). There was not much patient privacy involved in the structured and relayed forms. Most of the contents of the form were descriptions of the patients' physical symptoms. Similar to other findings, these elements make up the majority of the handovers (Halterman et al., 2019).

The results of this study suggested that structured bedside handovers in the PACU may not be associated with decreased adverse events and postoperative hospital stays. This is consistent with the results of a large sample study conducted in Belgium and the conclusions drawn from a systematic review, though inconsistent with the results of some other studies (Bukoh & Siah, 2020; Hada & Coyer, 2021; Malfait et al., 2019). Patient safety is influenced by various factors. The results of this study seem to suggest that improvements in some factors, such as more accurate access to patient information, may not effectively lead to improvements in patient safety.

4.1. Strengths and limitations

Although numerous studies described whether certain elements were delivered during the handover, most studies did not consider whether the content of that handover was accurate (Graan et al., 2016; Starmer et al., 2017). With significant effort, this study examined whether the elements of the handover were accurate or appropriate. The sample size of this study was sufficiently copious.

This study was conducted in a relatively small postoperative care unit and may have questions of representativeness. The time required for recording handover forms does not appear in this paper, which is one of the limitations. This study does not report the analysis of the content of the forms PACU nurses filled out. Patients' engagement and their satisfaction with the handover were not investigated in this study. This was mainly related to the characteristics of the patients involved in this

study. After hours of major surgery, the patient was weak. Tracheotomy or retained tracheal intubation, and postoperative sore throat restricted their verbal communication with others. As a result, patients' participation in handovers may be more limited in the PACU than in the medical-surgical wards. It is difficult to obtain the patients' opinion on whether the content of the PACU handover is appropriate.

5. Conclusions

Our findings showed that bedside handovers with structured and relayed forms increased the incidence of appropriate handover elements. Structured and relayed forms contributed to the improvement of handover quality. Nevertheless, this intervention did not reduce the incidence of adverse events in patients and the length of postoperative hospital stay. Since the elements of handover varied from one nursing unit to another, we suggest that individualized handover forms should be prepared.

CRediT authorship contribution statement

Guoyong Yang: Conceptualization, Methodology, Data Curation, Supervision, Formal Analysis, Writing - Original Draft, Writing - Review & Editing.

Xianxian Zang: Conceptualization, Methodology, Writing - Original Draft, Writing - Review & Editing.

Caiyun Li: Methodology, Data collection, Writing - Original Draft.

Ping Bai: Data collection, Project Administration, Writing - Original Draft.

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Declaration of competing interest

None.

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