

Handoffs in the Postoperative Anesthesia Care Unit: Use of a Checklist for Transfer of Care

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Information loss can occur during all phases of care. The transfer of care (handoff) from the operating room to the postoperative anesthesia care unit (PACU) is an especially susceptible time. Information loss can lead to an increase in medication errors, sentinel events, and poor patient outcomes. High-reliability organizations, such as the aviation industry, use checklists to decrease errors and improve safety. As the healthcare industry becomes more complex, it is in the interest of patient safety to develop, validate, and use similar objective procedures as those used in high-reliability organizations. The purpose of this research was to

determine if the utilization of a formulated checklist with objective measures during the handoff from the operating room to the PACU decreased information loss, the need for information clarification, and anesthesia providers' time spent in transfer of care, with improved adequacy of the handoff. Specific metrics were monitored before and after implementation to assess for information loss, information clarification, anesthesia providers' time, and to rate the adequacy of the report.

Keywords: Checklist, handoff, information loss.

Healthcare, especially during the perioperative period, has become complex. This increasing complexity helps to create additional opportunities for errors to be made. The risks associated with administering an anesthetic do not end when the patient emerges from anesthesia; the potential for complications continues during the transfer of care from the operating room to the postoperative anesthesia care unit (PACU). On arrival to the PACU, a transfer of care occurs between the anesthesia provider and the PACU registered nurse (RN). The handoff is usually completed at the patient's bedside, with the anesthesia provider verbally reporting to the PACU RN. Important details related to the patient's medical history, intraoperative events, and postoperative plan are detailed in the discussion. The PACU RN then assumes care of the patient. This information, exchanged between providers, is vulnerable to content loss and miscommunication. The Joint Commission estimates that 80% of medical errors are due to communication failure during the handoff process.¹ Handoff communication is defined as the "transfer of information with authority and responsibility during transitions in care across the continuum for the purpose of ensuring the continuity and safety of the patient's care."² A handoff includes the exchange of pertinent medical information and occurs throughout all phases of care, including transfers from one institution to another.³ During a handoff, information is at risk of degradation and miscommunication.⁴ Information loss and misunderstanding are contributing factors linked to an increase in sentinel events, medication errors, and poor patient outcomes.⁵ Communication errors have also

been associated with a decrease in patient satisfaction and increased length of hospital stay.⁶ The Joint Commission has recommended improvements to the handoff process as a national goal to improve patient safety.⁷

To improve the handoff process, institutions have made efforts to decrease the number of handoffs for each patient. Limiting the number of handoffs is a difficult task in the hospital setting, however. Nursing shifts, operating room schedules, and resident work hours require multiple patient handoffs. The Accreditation Council for Graduate Medical Education guidelines on resident physicians' duty hours have required institutions to limit the work hours of residents.⁸ The effort to decrease errors associated with fatigue and sleep deprivation have resulted in an increased number of handoffs. This is especially evident in the operating room, where the anesthesia provider who starts the case may not be the same provider who finishes the case and transports the patient to the PACU. Information is particularly vulnerable to degradation during frequent handoffs, as is often seen in these cases of multiple providers.

In addition to the problem of multiple providers, communication styles can also alter or affect the information exchanged. Communication styles vary among providers and affect how the information is exchanged. The tone, volume, and speed of the communication can affect the handoff. The provider may not deliver all the pertinent information, or the receiver may misunderstand the message.⁹ A lack of standardization, coupled with varied communication styles, further compounds the issue.

The environment in which the handoff exchange occurs plays an important role in the process. Distractions and ex-

cessive noise can contribute to difficulty in hearing the information.⁹ Noise levels in a PACU can exceed the recommended standard of the National Institute for Occupational Safety and Health.¹⁰ This may make it difficult to hear the information correctly. The culture of an institution can also contribute to communication difficulties. In an institution where increased productivity is highly valued, allowing the time necessary to complete a handoff may be problematic. Production pressure can create a sense of urgency, causing the handoff process to be hurried so that the providers can immediately leave the PACU to begin the next case. Hierarchical divisions between nurses and physicians may influence the ability to question information among staff.¹¹ According to the American College of Surgeons closed claims database, breakdowns in verbal communication account for 85% of adverse events.¹² Clear communication is necessary to decrease information loss and prevent unfavorable outcomes.

Another contributing factor to communication error is the lack of standardization in the handoff process. Lack of standardization increases the risk of information loss by depending on the communication abilities of the providers exchanging the information.¹³ The anesthesia provider must recall all the pertinent information of the patient's operative course, and relay this information in a concise manner. It is difficult for an anesthesia provider to perform this task reliably each time. Human factors contribute to the inability of an individual to function without error. A systems approach can help provide a mechanism for the provider to relay information accurately in a standardized fashion.¹⁴ A systems approach focuses on the entire process, not just the provider. In high-reliability organizations, such as the aviation industry, checklists, repeating the information received, and communication strategies are used to increase safety.¹⁵ This, however, is not the standard in most PACUs, which rely predominantly on subjective verbal communication as the means to transfer information and do not routinely use checklists and other communication strategies that could improve accuracy.

The purpose of this research was to determine whether utilization of a formulated checklist, with the objective measures we developed for the handoff in the PACU, decreases information loss, improves adequacy of the handoff, decreases the need for information clarification, and decreases time spent in transfer of care.

Materials and Methods

Our research protocol was first submitted to the institutional review board (IRB) for approval according to the hospital standards. IRB determined that the research project met the criteria of a quality improvement project. Approval was then obtained from the anesthesiology departmental chairperson and was confirmed by the IRB.

- **Creation of Checklist.** A checklist (Figure 1) was

ASSESS READINESS Are you ready for report?

YES → **TIME OUT**

NO ⇒ **STOP**

Both parties ask for a time-out for information exchange.

START HANDOFF

- **IDENTIFYING INFORMATION**

- ✓ Patient name
- ✓ Verify name on ID band
- ✓ Procedure
- ✓ Surgeon

- **MEDICAL HISTORY**

- ✓ Past health conditions
- ✓ Past surgeries
- ✓ Allergies

- **ANESTHESIA**

- ✓ Type of anesthesia
- ✓ Airway management/concerns
- ✓ Antibiotics
- ✓ Vascular access: size/location
- ✓ Invasive monitoring

- **INTRAOPERATIVE COURSE**

- ✓ Anesthetic events/treatment/concerns
- ✓ Analgesics
- ✓ Antiemetic
- ✓ Neuromuscular blockade/reversal
- ✓ Surgical events/concerns
- ✓ Intake/output/EBL
- ✓ Blood products Yes/No
- ✓ Labs

- **POSTOPERATIVE**

- ✓ Patient status
- ✓ Airway/O₂/Ventilator settings
- ✓ Infusions
- ✓ Postoperative analgesic/sedation plan
- ✓ Postoperative antiemetic plan
- ✓ Disposition

CLARIFICATION: Do you have any questions?

END HANDOFF

Figure 1. Handoff Checklist

Abbreviations: EBL, estimated blood loss; ID, identification; labs, laboratory tests; O₂, oxygen.

created by a workgroup that included input from the PACU RNs, a team of Certified Registered Nurse Anesthetists (CRNAs), and members of the patient safety committee. After the checklist was created, it was laminated into a card that the anesthesia provider received before the start of the case.

Then, face and content validity of the checklist was performed in a pilot study, in which 29 PACU RNs and 29 CRNAs were asked to evaluate the clarity and representativeness of various key contents. Key content included identifying information, medical history, anesthesia, intraoperative course, and postoperative information. All the participants reported that the information on the checklist was clear, representative, and easy to use. They also reported that the checklist highlighted key elements necessary for postoperative patient care.

- **Research Hypotheses.** We hypothesized that the use of a standardized and formulated checklist during handoff would improve communication between the anesthesia provider and the receiver (eg, RN), resulting in reduced information loss during report, higher adequacy of report, lower rate of callbacks for information clarification, and reduced time in the PACU for the anesthesia provider.

- **Randomization.** A computer-generated list of random numbers was used for participant allocation in a 1:1 ratio on the day of surgery to 2 groups. In group 1, the anesthesia provider performed the PACU handoff using the formulated checklist. In group 2, the anesthesia provider performed the PACU handoff without using the checklist.

All anesthesia providers were instructed on how to use a checklist but were blinded to the content of the real checklist (see Figure 1) until they were enrolled in the checklist group (group 1). In the morning, each anesthesia provider participating in the study received a sealed envelope that contained a randomized group assignment, and the checklist was given only to those assigned to the checklist group. The checklists were collected immediately after the handoff occurred to prevent circulation into the nonchecklist group. All PACU nurses assigned to the adult inpatient and outpatient areas were eligible to participate as receivers in the study.

Depending on group assignment, the anesthesia provider delivered a verbal report either with a checklist or without a checklist after the patient arrived at the PACU. After the handoff was completed, a sealed data collection sheet (Figure 2) was given to the PACU RN. The PACU RNs were prompted at the beginning of each shift, during morning rounds, to complete the data collection sheets. The data collection sheet was filled out immediately after the verbal handoff occurred and was collected by the data collector every hour. Patient-identifiable information was removed before data analysis, and medical record numbers were kept on an encrypted hospital computer.

- **Sample Size Justification.** An a priori power analysis was performed to determine the needed sample size. From a previous pilot study, we estimated that receivers (ie, RNs) during handoff from the nonchecklist anesthesia provider group had a success rate of 67% (4 of 6*100%) of correctly identifying 6 key elements of the checklist. A sample size of 26 per group was estimated to have 80% power to detect a difference of 28% (ie, those receiving from the checklist anesthesia provider group would have a success rate of 95%) at a 2-sided significance level of .05. To account for 10% missing data, we enrolled and randomized a 60 anesthesia providers (30 per group) into the study.

- **Data Collection.** The following sections highlight the 4 measures or components recorded in the data collection sheet (see Figure 2).

To be completed by the PACU RN receiving report

PATIENT MRN:

Report with Checklist? YES /NO

KEY ELEMENTS

Please circle yes or no if the information listed was given in the handoff:

1. Patient identified: YES / NO
2. Patient allergy information given: YES / NO
3. Antibiotic information given: YES / NO
4. Intake and output: YES / NO
5. EBL information: YES / NO
6. Pain management discussed: YES / NO

HANDOFF QUESTIONS

1. Did you need to clarify information or call back the provider after the anesthesia provider completed the handoff? YES / NO
2. Was the handoff adequate: YES / NO

To be completed by the data collector

Information score:
Clarification/Callback: Yes (1)/No (2)
Report adequate: Yes (1)/No (2)

Time in PACU:
Anesthesia End:
TOTAL TIME:

Figure 2. PACU Data Collection Sheet

Abbreviations: EBL, estimated blood loss; MRN, medical record number; RN, registered nurse; PACU, postanesthesia care unit.

1) **Information score:** The PACU RN attempted to recall 6 key elements of the handoff after a report was given. A numerical rating score on a scale of 0 through 6 was calculated, with 0 representing that none of 6 key elements was correctly recalled and 6 being the highest score, wherein all 6 key elements were correctly recalled. The 6 key elements were defined as follows:

- Patient identification using the patient’s name band
- Patient allergy information
- Antibiotic information
- Intake and output
- Estimated blood loss
- Pain management

2) **Handoff adequacy:** The PACU RN rated the handoff as adequate or inadequate in a yes or no question format. Definition of an adequacy rating was discussed in a staff meeting with the PACU nurses and managers present. An adequate report was defined as a verbal report that allowed the PACU RN to begin direct patient care without having to look up additional information. This included performing a clinical assessment, administering medications, and patient positioning. All PACU RNs received instructions orally as well as by written communications sent electronically through the hospital email system.

3) **Information clarification:** The rate of callbacks for information clarification was determined by the PACU

Outcome	Checklist (n = 26)	No checklist (n = 26)	P value ^b
Score rating ^c			
6	24 (92)	14 (54)	.0039
< 6	2 (8)	12 (46)	
Median (interquartile range)	6 (6-6)	6 (5-6)	.0015
Median provider time in PACU (min, interquartile range)	6 (6-8)	5.5 (4-7.8)	.13
Handoff adequacy			
Yes	26 (100)	22 (85)	.11
No	0 (0)	4 (15)	
Need to clarify information/callback			
Yes	0 (0)	18 (69)	.0042
No	26 (100)	8 (31)	

Table. Results of Handoff Study at Yale-New Haven Hospital^a

^a Data are presented as median (interquartile range), or count (%).

^b Fisher exact test or Wilcoxon rank sum test.

^c A numerical score rating on a scale of 0-6, with 6 representing that all 6 key elements (see Figure 2) were correctly identified.

RN receiving the report. A callback was defined as the need to clarify with the anesthesia provider any information after the handoff process was completed. The RNs were instructed in staff meetings how to document yes or no for callbacks.

4) **Time:** At the end of each case, a chart review was completed for data collection regarding “Time In” to PACU and “Anesthesia End,” from which each provider’s time in the PACU was computed.

• **Statistical Analysis.** For the statistical analyses, a 2-sided *P* value of 5% was used to test for statistical significance and was performed using SAS version 9.3 software (SAS Institute). We calculated descriptive statistics (ie, median and interquartile range, number, and percentage) for all the available outcomes. The comparisons of the binary outcomes, including the rate of correctly recalling all 6 key elements in a report and handoff adequacy between the checklist and the nonchecklist group, were compared by using the Fisher exact test. The numerical rating score for the recall as well as providers’ time in the PACU were compared between both groups using the Wilcoxon rank sum test.

Results

Among 60 randomly assigned anesthesia providers (ie, 60 handoffs), 52 participants finished the study, and their data were included in our analyses (Table). Data from 8 participants were not available for analyses because the PACU RN was unable to fill out the questionnaire in the allotted time. A total of 24 of 26 RNs (92%) in the checklist group (median score = 6; interquartile range = 6-6) successfully recalled all 6 key elements of the report, whereas 14 of 26 RNs (54%) in the nonchecklist group (median score = 6; interquartile range = 5-6) successfully recalled all the elements (*P* = .0039, Figure 3, Table).

The use of the checklist by an anesthesia provider

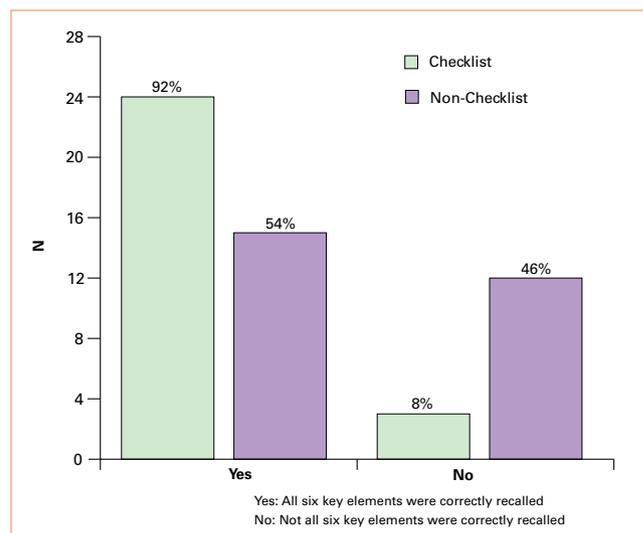


Figure 3. Participants Who Correctly Recalled All Six Key Elements versus Who Did Not (Checklist vs Nonchecklist Group)

lowered the rate of callbacks for information clarification for RNs by a degree that was statistically significant (0% vs 69%, *P* = .0042). The use of the checklist also led to a higher adequacy rating of the handoff by RNs than in the nonchecklist group; however, the difference was not statistically significant (100% vs 85%, *P* = .11). There was no statistically significant difference regarding the anesthesia providers’ time in the PACU between the checklist and nonchecklist group (median = 6 minutes vs 5.5 minutes; interquartile range = 6-8 vs 4-7.8; *P* = .13, see Table).

Discussion

In this study, we showed that the use of a checklist during a handoff could help providers correctly exchange information and increase the adequacy of the handoff for

nurse receivers. The ability of providers in the checklist group to identify all 6 key elements of the report was statistically significantly higher than that in the non-checklist group. There was also a decrease in the need for information clarification because the rate of callbacks was significantly lower in the checklist group. The PACU RNs were more likely to rate the handoff as adequate when it was given using a checklist, compared with the handoff without a checklist. All 26 reports received with a checklist were considered adequate (100%) compared with 22 (85%) in the group that received the report without a checklist. Furthermore, using a checklist did not appear to affect provider time in the PACU.

There are a few limitations of our current study. The anesthesia residents did not participate in the pilot study. This may have affected the overall information scores based on provider experience. CRNAs in the study had a minimum of 1-year experience as an anesthesia provider. This may have influenced their ability to give a report based on experience, affecting the initial score when no checklist was used.

Another limitation was that of the PACU RNs' ability to rate the report as adequate or inadequate. The PACU RNs were trained at a staff meeting, with follow-up written communication, regarding the adequacy score. This rating was subjective, and the nurse's experience level may have influenced the overall adequacy rating. The level of experience for the PACU nurses ranged from new graduates to more than 30 years' experience. This subjectivity was difficult to control and therefore identified as a limitation to this study.

Last, the provider time in PACU from "Time In" to PACU to "Anesthesia End" might not be accurately measured, because of the large variation among practitioner documentation practice. For example, some CRNAs closed out the electronic medical record while giving the handoff, and others preferred to wait until the handoff was completed.

Conclusion

The use of a checklist during a handoff can help providers correctly exchange information and thereby increase the adequacy of the handoff. Use of a checklist does not increase the length of time a provider is in the PACU exchanging information during a report. The time spent using a checklist for handoff does not appear to affect turnover time, yet improves accuracy of the report. The use of a checklist did decrease information loss and the need for clarification among providers. Although this improved the communication among providers, it was not in the scope of this study to assess whether or not a checklist improved patient outcomes. Larger-scale studies are needed to assess the effect of improved communication using a checklist for handoffs on patient outcomes. The potential to decrease errors related to miscommunication

is a potential benefit of implementing a checklist for the transfer of care in the postoperative setting.

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DISCLOSURES

The authors have declared they have no financial relationships with any commercial interest related to the content of this activity. The authors did not discuss off-label use within the article.