

An Evaluation of CA-1 Residents' Adherence to a Standardized Handoff Checklist

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Abstract

Background: Poor-quality handoffs are a significant cause of preventable medical errors and adverse events. Handoff checklists improve handoffs but adherence to these tools is often inconsistent. In our study we aimed to investigate the effects of simulated handoff workshop and clinical instruction on resident handoff quality.

Methods: A three-week pre-education intervention observation period of handoffs was conducted to assess the deficits, variability, and common practice in handoffs at the University of Minnesota Fairview Hospital. An institution specific handoff tool was then created by expert anesthesiologists at the University of Minnesota. A prospective observational assessment was then performed one year later to evaluate CA-1's adherence to the content of a standardized handoff checklist in the intraoperative and post-anesthesia care unit environment after exposure to current educational techniques.

Results: With introduction of a handoff checklist tool, CA-1 residents included 70.70% ($\pm 0.11\%$) of handoff checklist information in their handoffs during the pre-workshop phase. Following a 2-hour simulated workshop on standardized handoffs, CA-1 residents still only included 70.00% ($\pm 0.02\%$) of handoff checklist information in their handoffs. CA-1 residents included 43.50% ($\pm 0.12\%$) of handoff checklist information in their handoffs at 6 months following the workshop. A one-way analysis of variance revealed a significant difference between the groups $F(4, 135) = 18.83, p < 0.05$.

Conclusions: The current method of education for handoffs does not ensure resident adherence to a standardized handoff technique. We propose that the inclusion of a written or electronic handoff checklist should be enforced and refresher courses should be administered early and frequently.

Key words: Checklist, Intraoperative handoff, Transfers of care, Handoff, Anesthesiology handoff, Handoff checklist, Handoff education, Simulation education, Resident handoff education

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Introduction

An estimated 400,000 patient deaths occur each year as a result of medical errors and 80% of these are attributed to errors in communication.¹ Specifically, communication failures during transfers of care are a significant contributing factor to patient harm.² Handoffs occurring in the perioperative setting are inevitable in anesthesiology as care for a patient often extends over shifts. Studies suggest that handover of anesthesia care is associated with a greater risk of in-hospital morbidity and mortality.² In fact, each anesthesia handover increases a patient's risk for postoperative mortality and serious complications by 8%.³ However, while intraoperative and postoperative handoffs are a critical component of anesthesiologists' practice, they have received far less attention in literature and reform than intensive care unit handoffs.^{4,5}

Many anesthesia providers agree that the current handoff protocol at their institution is insufficient and that the standardization of this process would improve patient care.^{6,7} The high-risk handoff presents an opportunity to evaluate patient care practices and reduce adverse events. In 2006, the Joint Commission on Hospital Accreditation made the implementation of standardized handoffs a national patient safety goal.⁸ Similarly, the World Health Organization made communication during patient handoffs one of its "High five" patient safety initiatives in 2007.⁹ Many institutions have templates or checklists in place for handoffs and research has shown that the reliability of handoffs is improved when these modalities are utilized.^{10,11} Further, patient care is improved with the standardization of practices.¹² Despite these facts, standardized handoffs are not consistently incorporated into everyday practice.

The most notable existing handoff tools used to standardize transfers of care are I-PASS (Illness, Patient summary, Action list, Situation awareness and contingency planning, Synthesis by receiver) and SBAR (Situation, Background, Assessment, Recommendation). However, these tools are not specific to anesthesia handoffs. In 2014, UCSF introduced an anesthesia-specific handoff called the Anesthesia Resident Handoff Checklist (ARCH) to standardize the intraoperative handoff process.¹³ Two other anesthesia handoff checklists exist in the literature that are similar in core content and format.^{10,12}

The Accreditation Council for Graduate Medical Education (ACGME) recognizes the importance of handoffs and requires that ACGME-accredited programs train residents to be competent in handoff communications.¹⁴ Recent studies suggest that incorporation of handoffs into residency curriculum reduces medical errors and preventable adverse events.¹⁵ Techniques for doing so include didactics alone, didactics with role-playing, Web and video-based teaching models, and simulation.^{4,16} Simulation-based education provides a unique learning environment for the identification of patient safety threats and resolution of such threats of in a no-risk educational environment¹⁷ and is effective in the transfer of knowledge and skills to the clinical environment.¹⁸ Ultimately, studies suggest that handoff teaching through simulation-based education may improve handoff skills.^{19,20}

There is a need to evaluate the effectiveness of simulation-based education methods in improving residents' handoff competency. In the present study we investigated the efficacy of

current handoff practices in the intraoperative and postoperative environment and aimed to evaluate the short and long-term effectiveness of simulation-based education methods in improving clinical anesthesia year 1 (CA-1) residents' handoff competencies. Further, we sought to characterize the pattern of deteriorating long-term adherence to a handoff checklist and to identify the optimal timing of a handoff refresher course.

Methods

Institutional IRB considered the presented study exempt from IRB review, due to the educational nature of the study.

Assessment of Handoffs

A three-week pre-educational intervention observation period was conducted by a medical student in 2014 and early 2015 to assess the deficits, variability, and common practice in communication during transfers of care at the University of Minnesota Fairview Hospital. Individuals observed included anesthesiology residents at all levels of training as well as Certified Registered Nurse Anesthetists (CRNAs). All observations were CRNAs receiving the handoff. For each handoff, the medical student noted how long the handoff lasted and whether a variety of content was included in the handoff. Specifically, the medical student noted whether or not the handoff included the patient's history of present illness, surgery performed, weight, allergies, past medical history, past anesthesia history, home medications, preoperative laboratories, airway exam, induction, maintenance sedation, vasopressors administered, narcotics administered, intravenous access sites and infusions, intraoperative vitals and laboratories, urine output, estimated blood loss, antibiotics administered, and stage of surgery. The observer also noted whether the person performing the handoff mentioned their concerns or plans for the patient and the staff medical doctor as well as asked the incoming provider if he or she had any further questions.

Survey

Following the pre-educational intervention observation period, CRNAs and CA-1, CA-2, and CA-3 residents in the graduating classes of 2015, 2016, and 2017 respectively were administered a survey to assess attitudes on current handoff practices (Fig. 1). We created internally constructed paper and pencil survey questionnaire. Our respondents were anesthesiology providers in a single institution. We gathered information from all anesthesiology providers working in the operating room in a specific week. The questionnaire was constructed of structured dichotomous questions and non-structured open-ended questions based on Trochim's Survey Research Methods.²¹ We administered the survey to a few potential respondents and gathered their feedback to ensure that questions meant the same thing to different people. The response rate was 68%. The survey queried residents' opinions of handoff importance, handoff adequacy, optimal handoff location, current handoff practices, and need for adoption of a systematic intraoperative handoff.

Development of Handoff Checklist

The handoff checklist utilized for the present study was adapted/created by expert anesthesiologists at the University of Minnesota. The checklist was designed to mimic the “H&P” format and to contain the items thought to be most essential to the intraoperative handoff. Following creation of the handoff tool, the checklist was shown to anesthesiology physicians at multiple institutions (academic and private) in the Minneapolis/Saint Paul metro area. Feedback from experts was taken into consideration and the tool was modified. The handoff checklist was ultimately confirmed for content validity by anesthesiologists at the University of Minnesota and expert anesthesiologists in the Twin Cities Metro Area (Fig. 2).

Introduction of the Checklist to CA-1 Residents

The handoff checklist was introduced to Clinical Anesthesia Year 1 (CA-1) residents in the graduating class of 2018 during a 2-hour simulation education session that took place on July 2, 2015. Eight of the eight CA-1 residents in the University of Minnesota Anesthesiology Residency Program attended the workshop. During the workshop, CA-1 residents were given a patient scenario and asked to hand off the patient in a high fidelity simulated environment while filming themselves with their personal smart phones prior to any handoff education. Debriefing on their performances was given to all residents individually. Residents were then introduced to the handoff checklist. CA-1 residents reviewed, discussed, and practiced using the checklist. The residents were then given a second patient scenario and asked to again hand off the patient while filming themselves without specific instruction regarding the use or non-use of a physical copy of the handoff checklist. The video recordings of each resident were collected. In the following days/weeks, CA-1 residents received the traditional “in the operating room” education from their senior residents and attending anesthesiologists. The researchers did not try to influence that educational process in any way.

Observation of Checklist Usage

There were five rounds of handoff observation: pre-workshop (round one), immediately post workshop (round two), 2 weeks post workshop (round three), 8 weeks post workshop (round four), and 6 months post workshop (round 5). The first and second rounds of observation involved watching and evaluating residents’ smart phone recordings of handoffs from the workshop. The third, fourth, and fifth rounds of observation occurred in the post anesthesia care unit (PACU) and various operating rooms at the University of Minnesota Fairview Hospital.

Handoff observations occurring in the clinical environment occurred between July 2015 and January 2016. Permanent and temporary transfers of care involving CA-1 residents were identified from the operating room dynamic schedule. Permanent transfers of care occurred in the PACU between CA-1 residents and PACU nurses. Temporary transfers of care occurred in the operating room between CA-1 residents and CRNAs.

For permanent transfers of care in the PACU, the handoff observer observed the transfer of care from a discrete location. For temporary transfers of care in the operating room, the handoff observer traveled to the operating room of a CA-1 resident with the CRNA assigned to temporarily relieve that CA-1 resident.

The CRNAs were aware of the purpose of the observer's presence. Residents were told at the beginning of their residency that they may be studied at some point during their training but were not told when this may occur. In the operating room, the observer introduced herself as a medical student observer and did not indicate in any way to the CA-1 resident that she would be observing and evaluating the handoff.

None of the information in the study is intended for use for evaluation of resident progress and will not be used for evaluation by the residency program director, Clinical Competency Committee, or anyone within the residency. This was purely a study to document the success or lack of success of an educational intervention in order to improve current teaching practices. The purpose of the study was not to evaluate residents.

The observer used a small copy of the handoff checklist to assess handoffs. The start time, stop time, and location of the handoff were noted as well as the content included in the handoff that was relayed without prompt from the PACU nurse or CRNA assuming care of the patient.

Statistical Analysis

There were five rounds of handoff analysis that followed each round of handoff observation. ANOVA was used to compare the frequencies of information transfer between each round. P values <0.05 were considered statistically significant. Basic statistics was used to compare the average time and location of handoffs in each round.

Results

Pre-intervention Observation

We observed 57 intraoperative handoffs between December 2014 and January 2015. Of the handoffs observed, 26 were residents intraoperative handoffs, 30 were CRNA intraoperative handoffs, and 1 was a student registered nurse anesthetist (SRNA) intraoperative handoff. Eighty-two percent of the handoffs observed were for breaks. The remaining 18% were for second-breaks and end-of-shift transfers of care. The average time for all handoffs was 143 seconds.

With regard to handoff content, the items most often included were patient info (91.2%), access/sites/infusions (89.5%), surgery performed (87.7%), past medical history (78.9%), and airway/mask (78.9%). The items least often included were total fluids/blood given (26.3%), home medications (21.1%), pre-op labs (21.1%), urine output/estimated blood loss (19.3%), allergies (19.3%), weight (8.8%) and past anesthesia history (8.8%).

Survey

We received 30 surveys from residents and CRNAs. Respondents rated the importance of the anesthesia handoff (on a scale of 1 to 10) an average of 9.4. Eighty percent of survey respondents thought that the University of Minnesota Fairview Hospital should adopt a systematic intraoperative handoff approach. Survey respondents considered the biggest obstacle to

incorporating a formal intraoperative handoff in their daily routine to be staff resistance and compliance.

Resident Handoffs

We assessed 140 handoffs performed by CA-1 residents between July 2015 and January 2016. One subject was excluded from round one and round two assessments and a second subject was excluded from round two assessment due to video recording problems. Seven of the 140 handoffs were performed during the simulation handoff workshop prior to introduction of the handoff checklist. Six of the 140 handoffs were performed during the simulation handoff workshop following introduction to the handoff checklist. Of the remaining 127 handoffs, 41 were observed over a two-week period at two weeks following the workshop, 43 were observed over a two-week period at two months following the workshop, and 43 were observed over a two-week period at six months following the workshop.

The average handoff time was 207.14s ($\pm 37.21s$) for round one, 191.67s ($\pm 51.50s$) for round two, 98.66s ($\pm 37.82s$) for round three, 115.81s ($\pm 44.99s$) for round 4, and 98.37s ($\pm 47.48s$) for round 5 (Fig. 3). With regard to location of handoffs, 36.59% of handoffs observed were intraoperative and 63.41% were in the PACU for round three, 9.30% of handoffs observed were intraoperative and 90.70% were in the PACU for round four, and 58.16% of handoffs observed were intraoperative and 41.84% were in the PACU for round five.

CA-1 residents included 70.70% ($\pm 0.11\%$) of handoff checklist information in their handoffs during the pre-workshop phase. Following the 2-hour simulation education and practice of the standardized checklist, CA-1 residents still only included 70.00% ($\pm 0.02\%$) of handoff checklist information in their handoffs. No resident chose to use the written form to assist them in the handoff process. CA-1 residents included 43.04% ($\pm 0.13\%$) of handoff checklist information in their handoffs at 2 weeks following the workshop, 53.49% ($\pm 0.10\%$) of handoff checklist information in their handoffs at 8 weeks following the workshop, and 43.50% ($\pm 0.12\%$) of handoff checklist information in their handoffs at 6 months following the workshop. A one-way analysis of variance revealed a significant difference between the groups $F(4, 135) = 18.83$, $p < 0.05$. Fig. 4.

Discussion

Communication between medical providers is essential for patient safety.²² Checklists improve communication through the standardization of handoff processes which results in reduced mortality, fewer complications and overall improved quality of patient care.²³ We developed and introduced a simple and standardized handoff checklist to CA-1 residents using simulation education methods. Adherence to the content of this checklist was then evaluated in intraoperative and postoperative transfers of care. The present study illustrates that the current method of education for handoffs is insufficient for CA-1 residents to become proficient in a standardized handoff technique.

Short-Term Adherence to the Checklist

Prior to introduction to the handoff checklist, residents included 70.07% of the content on the checklist in their handoffs. Immediately following the 2-hour simulation education workshop, residents still only included 70.00% of handoff checklist content in their handoffs. This suggests that short-term memorization of the form did not work and the 2-hour simulation education workshop was not effective in increasing the average amount of pertinent information that residents include in their handoffs. Results may have been different if the residents had been involved in creating the checklist or if they had more time to practice using the checklist.¹⁹ Furthermore, residents may have done better if the use of a written or electronic form was specifically emphasized which we did not do because our intent was to document the results of the current practice.

Long-Term Adherence to the Checklist

Following the handoff workshop CA-1 residents were observed while performing handoffs in the intraoperative and postoperative environment. Over the course of the following six months we observed long-term deterioration of the handoff checklist content. The biggest change in handoff quality occurred within the first 2 weeks, when residents included 43.04% ($\pm 0.13\%$) of checklist content into their handoff. This would imply that concentrating effort on educational activities related to handoffs in those first 2 weeks may lead to better outcomes. Six months after the handoff workshop, residents included only 43.5% of checklist content in their handoffs. The deterioration in adherence to the content of the handoff checklist may be from the effects of memory deterioration, factors related to the content of the checklist such as duplication with existing checks, or environmental effects such as rush, lack of emphasis on handoffs, or the hidden curriculum of senior anesthesia providers giving more or less importance to the handoff process.²⁴ Whether concentrated effort within the first 2 weeks could overcome the later effects of clinical environment remains to be determined.

Utilization of the Written Checklist

None of the CA-1 residents chose to use a written copy of the handoff checklist even though it had been made available to them. This is surprising given that the field of Anesthesiology places patient safety as a top objective²⁵ and use of a written cognitive aide has been shown to improve handoff communication.²⁶ Potential barriers to utilization of a written copy of the handoff checklist include lack of emphasis on the written handoff checklist or lack of perceived need for the use of a memory aid. Further research is necessary to better identify and understand why residents failed to consistently access and utilize a written copy of the handoff checklist.

Simulated vs. Real Environment

Resident's handoffs differed between the simulated and real clinical environment in many ways. Handoffs were longer and a larger proportion of checklist information was included in the handoff in the simulated environment as compared to the real clinical environment. In the simulated environment, residents were aware that their colleagues and mentors were observing them. They were therefore more likely to change their behavior to adapt to the perceived expectation.²⁷

Limitations

Our study had several limitations. First, the single institution nature of the study and number of residents is a potential limitation. Second, there is a potential that the Hawthorn effect influenced the results of the study.²⁷ Every effort was made to hide the true purpose of the handoff observer from the CA-1 residents, but it is possible that residents deduced the purpose of the handoff observer's presence. Third, the checklist created for the purpose of this study was imperfect. Following interpretation of the results of this study, we reexamined the checklist and found that "anticipatory guidance" was on the checklist twice. If we were to repeat the study we would strive to make the "Situational Awareness/ Contingency Planning" section of the checklist more succinct to prevent ambiguity of the checklist from being a barrier to adherence.²⁴ Fourth, residents tended to tailor their handoffs to existing checklists. A handoff checklist exists for the use by nurses in the PACU at the University of Minnesota. Residents tended to tailor their post-op handoffs to this checklist that varies in content and format from the checklist taught during the handoff workshop. The duplication of the handoff checklist with existing checks may have interfered with adoption of the handoff checklist.²⁴ Ultimately, the degree to which these inconsistencies affected adherence to the standardized checklist is unclear.

Conclusion

Teaching of the handoff checklist using simulation education techniques was not associated with more reliable inclusion of essential information. The study indicates that concentrated effort within the first few weeks of training, with emphasis on the importance of specific components of handoffs, might increase adherence to the structure handoff. Results from the present study also suggest that there is a need to push for the use of cognitive aids in resident handoffs during transfers of care. Human memory has limitations that we are reluctant to admit. As Edward Albee said: "I think you remember everything ... you just can't bring it to mind all the time."

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FIGURES, TABLES AND GRAPHS

PATIENT SUMMARY

PREOP

HPI/Case info

Weight

Allergies (with reactions)

PMHx (significant)

Meds (pertinent ie BB/opioids/statins)

PAHx (complicated, uncomplicated)

Preop Vitals/Labs (pertinent)

INTRAOP

Airway/Induction

Anesthesia Maintenance plan (paralytic OK?)

Pressors/Pain

-

Access (sites)/infusions

Fluids/Blood products

UO/EBL

-

Vitals/EKG/Lab (pertinent, time)

ABX (given/dose/next due)

ACTION LIST

(To do list)

SITUATION AWARENESS/CONTINGENCY PLANNING

Stage of surgery/anticipatory guidance (specific surgeon requests, plan for what might happen)

Biggest concern/next plan/anticipatory guidance
if to PACU - PONV plan, post-op block ok?

Staff Anesthesiologist

?’s

SYNTHESIS BY RECEIVER

Receiver asks questions

Receiver summarizes what was heard, restates key action list

Figure 1. The final version of the handoff checklist developed by anesthesiologists at the University of Minnesota with input from anesthesiologists in the Minneapolis and Saint Paul metro area.

Name:

Title/Position/Year in training:

Thank you for taking the time to complete this questionnaire. Your input is invaluable and is greatly appreciated. All answers are confidential.

How important do you consider intraoperative hand-offs (on a scale from 1 to 10)?

Do you ever feel that you "should have" remembered to add something important, and if so, can you highlight what it was?

How long do you think your intraoperative hand-offs take?

How long do you think intraoperative hand-offs *should* take?

How do you remember what to include in your intraoperative hand-off?

Do you have a specific order or grouping you follow?

Please describe what you include in your daily intraoperative hand-offs.

What do you consider the most important part of an intraoperative hand-off?

Would you be interested in adopting a systematic intraoperative hand-off approach?

List reasons for not wanting to adopt a systematic intraoperative hand-off.

What would be the biggest obstacle to incorporating a formal intraoperative hand-off in your daily routine?

Additional comments:

Figure 2. The survey administered to CA-1, CA-2, and CA-3 residents as well as CRNAs at the University of Minnesota.

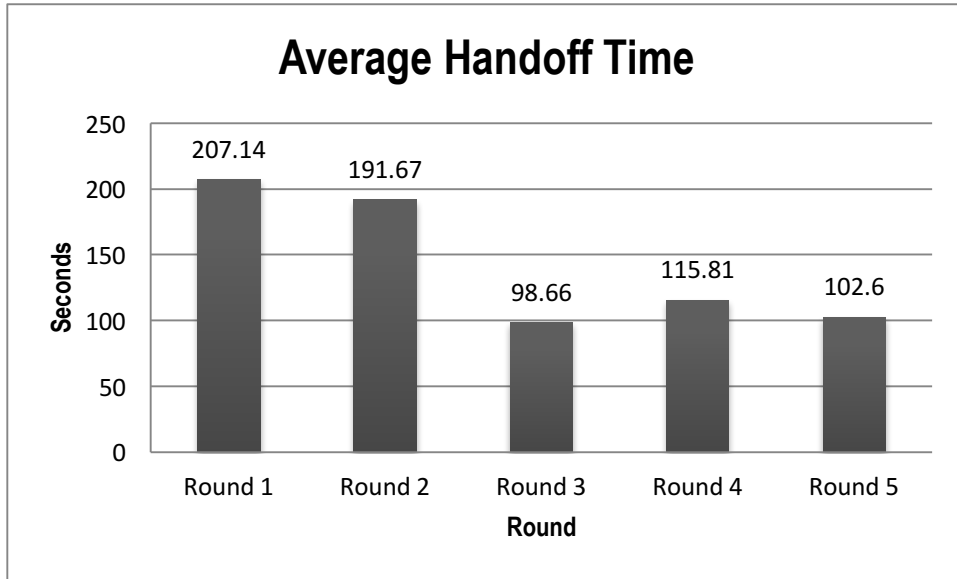


Figure 3. Handoff time measured in seconds.

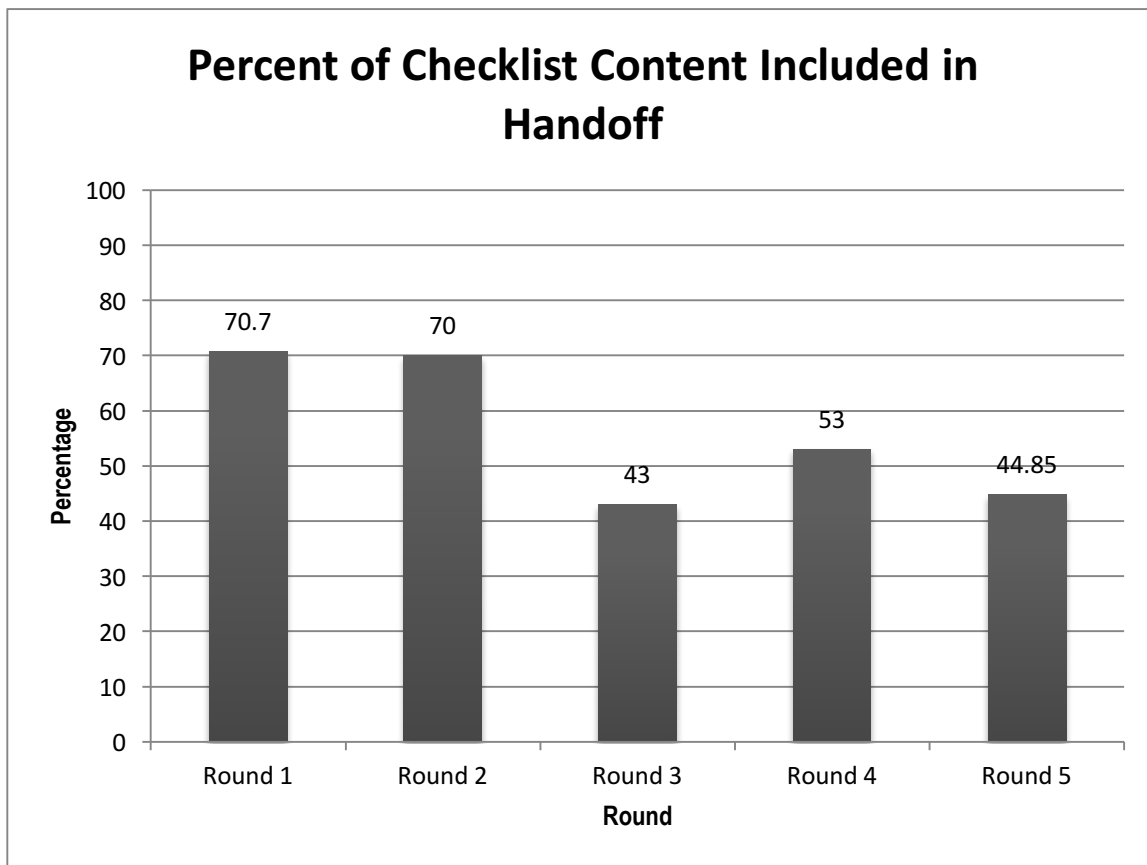


Figure 4. Amount of handoff checklist content included in intraoperative and post anesthesia care unit handoffs represented as a percentage of total handoff checklist content.