IMPROVING THE RELIABILITY OF THE CLEMENTS UNIVERSITY HOSPITAL OR TO CV-ICU PATIENT HANDOVER OBSERVER TRAINING PROGRAM

By

Neela D. Thangada

DISSERTATION

Presented to the Faculty of the Medical School
The University of Texas Southwestern Medical Center
In Partial Fulfillment of Requirements
For the Degree of

DOCTOR OF MEDICINE WITH DISTINCTION IN QUALITY IMPROVEMENT & PATIENT SAFETY

The University of Texas Southwestern Medical Center
Dallas, TX

ACKNOWLEDGMENTS

Very sincere thank you to the ECHO-ICU collaboration team and the office of quality improvement and patient safety for their support and guidance with this project.

ABSTRACT

IMPROVING THE RELIABILITY OF THE CLEMENTS UNIVERSITY HOSPITAL OR TO CV-ICU PATIENT HANDOVER OBSERVER TRAINING PROGRAM

NEELA D. THANGADA
The University of Texas Southwestern Medical Center, 2017
Supervising Professor: Philip Greilich, M.D.

OR to CV-ICU patient handovers reflect high risk clinical scenarios where providers must transfer patient care responsibilities in the safest possible way. These post-sternotomy handovers are error prone, as providers must exchange patient information in a busy and chaotic environment while simultaneously stabilizing the often tenuous patient who requires hemodynamic and cardiopulmonary support. At UT Southwestern's University hospital, patient handoffs and transitions of care have less than a 50% approval rating per HSOPS data, suggesting a serious need for improving patient handovers. The Clements University Hospital (CUH) OR to CV-ICU observer training program was developed to train a cohort of clinicians who can evaluate post-sternotomy handovers and subsequently make recommendations for improving these handovers. The aim of this project is to improve the reliability and user satisfaction of the existing CUH OR to CV-ICU patient handover observer training program by January 2017. The performance results of the six observers who underwent the first iteration of the observer training program were reviewed. All six observers achieved greater than 80% agreement with the faculty expert, or master key, in their evaluation of handover scenarios from the training videos, suggesting an adequate understanding of how to evaluate a OR to CV-ICU handover. However, observers did not achieve a sufficient inter-rater reliability, with a suboptimal average Fleiss' kappa of 0.65. Since sufficient percent agreement and inter-rater reliability are both required to deem observers appropriately trained, these six observers did not meet the criteria to become 'trained observers.' To understand observers' challenges and overall satisfaction with the training program, a focus group analysis was performed. Elements critical-to-quality for the observer were identified, which included better teaching of handover best practice requirements so observers can more confidently evaluate the handovers.

TABLE OF CONTENTS

INTRODUCTION

Background information:

A handover is the transfer of professional responsibility and accountability for some or all aspects of patient care to another person or professional group on a temporary or permanent basis (Canberra, 2006). While this appears simple in concept, challenges arise because the team transferring the patient must continue monitoring the patient while simultaneously educating the receiving team about a patient's health status in a chaotic ICU or ward setting. A myriad of other features can explain why handovers prove challenging and high risk, including: the absence of structured handover processes at many hospitals and institutions, the lack of formal handover training for providers, and the loss of important information verbally or electronically during the transfer (Johnson JK, 2009). Per the Joint Commission for Transforming Healthcare, miscommunication during handovers leads to approximately 80% of serious medical errors. Suboptimal handovers, driven by ineffective communication between providers, pose serious consequences for patients. An incomplete understanding of the patient situation after the handover can explain provider confusion immediately after the handover (Ye K, 2007). This confusion often leads to the new team performing unnecessary repeated assessments, as well as laboratory and imaging studies (Bomba DT, 2005). Ultimately, this results in delay of necessary interventions or treatments for the patient which prolongs the hospital course and increases costs (Apker J, 2007).

Improving handovers is a multifactorial process. Since miscommunication accounts for the majority of medical errors related to handovers, many hospitals have implemented handover bundles and cognitive aids, which are tools providing a framework for providers to consistently conduct handovers. These tools not only standardize handovers but also improve communication between providers. After the introduction of handover bundles at Boston Children's Hospital, the rate of medical errors decreased from 34% to 18% and preventable adverse events decreased from 3.3% to 1.5% (AJ Starmer, 2013). This data suggests that standardizing handovers and improving communication between providers remains central to achieving high quality patient handovers.

In addition to handover bundles and cognitive aids, improving handovers requires trained observers who can evaluate real-time handovers and provide objective and subjective feedback for all parties involved in the handover. Trained observers play an important role in quality improvement initiatives across multiple dimensions of healthcare. They are routinely utilized to monitor hospitals' hand hygiene adherence, and ultimately help shape the handwashing policies in place across hospitals (Joint Commission CMHH Project, 2009). Trained observers have also been used for unconventional projects, such as evaluating a multi-hospital bioterrorism exercise during which the observers used an evaluation tool that ultimately improved the hospital's bioterrorism protocol (KR Klein, 2005). Lastly, trained observers remain integral to evaluating and improving patient handovers. They have been used in projects assessing the efficacy of patient handovers performed by PGY-1 residents, a study which found that while 99.5% of interns conduct proper face-to-face handovers, this information exchange is wrought with interruptions 41.3% of the time (R Habicht, 2016). This reiterates the general theme that patient handovers are improving, however, the process is far from becoming error free.

Observer training is a process in which individuals learn to observe and assess the quality of clinical services, such as a patient handover, with competency and adequate inter-rater reliability. Establishing competency and inter-rater reliability prove challenging as trainees must not only learn to evaluate clinical scenarios identical to the judgement of a faculty expert but also learn to achieve sufficient agreement or homogeneity in assessment amongst themselves. Both components can be accomplished with a robust observer training program that prepares trainees to understand the diversity of clinical scenarios they may encounter as well as how to properly use their measurement system, the evaluation tool. While observer training programs remain specific to the clinical scenarios the trainees must evaluate, the general structure remains similar: an introductory didactic session, practice sessions where trainees learn to assess the clinical service with the evaluation tool, and a wrap-up quiz or test where trainees are deemed competent to independently evaluate.

Local problem:

UT Southwestern's Clements University Hospital (CUH) faces many of the same challenges with patient handovers observed in hospitals across the United States. The Agency for

Healthcare Research and Quality's (AHRQ) Hospital Survey on Patient Safety (HSOPS) data reveals that handovers and transitions of care have less than 50% clinician approval ratings nationally, one of the lowest ratings among patient safety culture composites (see Figure 1). At UT Southwestern, handover and transitions of care approval ratings in 2011 and 2013 were 46% and 44%, respectively; both values were comparable to the 2012 national hospital approval rating of 45% for handovers and transitions. Shift changes and transfer of patients between units or services, such as from the OR to the ICU remain the highest risk components of handovers both at UT Southwestern and across hospitals nationally (see Figure 2).

The Enhanced Communication for Handovers from the OR-to-ICU (ECHO-ICU) pilot project was designed in 2000s to improve OR to CV-ICU handovers at UT Southwestern's university hospital. The project specifically focuses on patients undergoing sternotomy surgeries, such as valve replacements and coronary artery bypass grafting, and their subsequent transfer from the OR to the CV-ICU. These OR to CV-ICU handovers pose additional challenges for providers. First, these handovers prove very high risk since post-sternotomy patients require minute-to-minute intensive monitoring (Li P, 2011). Second, providers must stabilize labile patients during the handover leading to frequent interruptions in the communication of vital information (V Arora, 2005). Third, the multidisciplinary nature of OR to CV-ICU handovers— involving anesthesiologists, intensivists, cardiothoracic surgeons, respiratory therapists, and multiple nurses— makes it difficult to adapt a shared mental model (Apker J, 2007). In addition to implementing handover bundles and cognitive aids specific to the OR to CV-ICU handover, training observers to evaluate and make recommendations for improving handovers remains integral to ensuring high quality transfers of care at UT Southwestern.

Aim statement:

To improve the reliability and user satisfaction of the CUH OR to CV-ICU patient handover observer training program by January 2017.

Intended improvements:

1. To ensure that graduates of the observer training program can reliably evaluate handovers

2. To ensure that graduates of the observer training program not only remain satisfied with the program but also feel confident evaluating non-staged handovers
3. To continually collect feedback from graduates and implement improvements in the observer training program

A robust and reliable CUH OR to CV-ICU patient handover observer training program will provide the framework for the long term goal of reducing unintended events following OR to ICU handovers

METHODS

Ethical issues:

The ECHO-ICU pilot study received IRB approval from the UT Southwestern Medical Center. The six individuals who underwent the CUH OR to CV-ICU observer training program willingly volunteered to participate in this project. The data collected in this project remained confidential and was viewed exclusively by members of the ECHO-ICU pilot study. No direct conflict of interest or ethical issues were encountered during this project.

Setting:

UT Southwestern's CUH is a 460-bed tertiary care academic hospital with a robust cardiothoracic surgery service that performs over 600 cases annually. The large volume of cases ensures ample opportunities to observe, critique, and improve OR to CV-ICU patient handovers. Patient handovers at CUH involve healthcare staff with varying levels of experience including: medical students, nurses, resident physicians, and attending physicians. Moreover, because CUH is an academic teaching hospital where nurses, resident physicians, and attending physicians frequently change services, the issue of turnover presents the challenge of continually educating providers on proper handover techniques. The above factors establish the necessity of a reliable observer training program.

Planning the intervention:

To achieve the aim of this project and to implement the intended improvements, two Plan-Do-Study-Act (PDSA) cycles were developed. PDSA cycle #1 centered around educating observers about handover best practice requirements and training observers to reliability evaluate handovers (see Figure 3). Planning the intervention for PDSA cycle #1 required assessing the current state of the observer training program and developing a measurement system to determine observers' agreement and reliability during the training program.

<u>PDSA cycle #1- Observer training program</u>

The observer training program is an approximately 15-day course where trainees – ranging from medical students to nurses to attendings—learn handover best practice requirements and obtain the skills required to reliably evaluate OR to CV-ICU patient handovers. The course is largely self-paced with a few mandatory sessions with a faculty expert, an

individual who has significant experience and training with OR to CV-ICU handovers. The course material includes: an introductory powerpoint, one sample OR to CV-ICU handover video, four training OR to CV-ICU handover videos, and a handover evaluation tool. All of the handover videos are staged, using actors who emulate real clinical scenarios seen in handovers. The handover evaluation tool is a check-list device that observers use while watching the training videos to determine whether or not the team performing the handover in the video adheres to handover best practice requirements.

Figure 4 illustrates a process flow diagram of the steps in the observer training program. The course begins with trainees reviewing an introductory powerpoint which orients them to the steps of the observer training program and teaches them handover best practice requirements. Trainees then watch the sample handover video and practice using the handover evaluation tool. They then meet with the faculty expert and review the content in the introductory powerpoint. After this session, they begin round #1 of observer training in which they watch all four training videos while filling out an evaluation tool for each video (see Figure 5). Upon completing round #1, trainees meet with the faculty expert to debrief, review their round #1 experience, and address any additional questions. The trainees then finish rounds #2-4, becoming trained observers after completion of the course.

A. Training Videos

One sample video and four training videos A-D were filmed by the ECHO-ICU team. Despite the videos using actors, the staged handovers in the videos reflect clinical scenarios commonly encountered in OR to CV-ICU transfers of care. The videos illustrate dialogue that typically occurs between the anesthesiologist, cardiothoracic surgeon, intensivist, coordinating nurse, receiving nurse, and respiratory therapist during the handover. These individuals are expected to be present and involved in all OR to CV-ICU patient handovers at CUH.

In terms of content, each video shows providers adhering to handover best practice requirements at varying levels. In Video A, providers adhere to nearly all of the handover best practice requirements except for the intensivist forgetting to state the handover social contract and the coordinating nurse forgetting to state the length of handover during the final wrap-up. In Video B, providers also address most of the

handover best practice requirements except for the coordinating nurse forgetting to establish a sterile cockpit, the anesthesiologist not mentioning how to stabilize the patient, and the entire team forgetting to mention the greatest concern in patient safety during the wrap-up. Both Video A and Video B were designed to illustrate features of a high quality handover where providers adhere to almost all of the best practice requirements.

Video C demonstrates a non-ideal handover for a variety of reasons, with the main issues being: providers never state the patient name at the start of the handover and the cardiothoracic surgeon never comes to the handover, forcing the anesthesiologist to substitute as surgeon and provide intraoperative details that she does not clearly understand (see Figure 6). Other issues include: omission of readback after vital steps such as transfer of monitors and ventilator, and inadequate discussion of patient's past medical history. Video D also exemplifies a non-ideal handover characterized by poor-teamwork as the anesthesiologist and intensivist attempt to conduct the handover alone, excluding the remaining team members (see Figure 6). Video C and D were designed to illustrate that the quality and safety of patient handovers suffer when providers do not adhere to best practice requirements.

B. Handover Evaluation Tool

The handover evaluation tool is a reliable measurement system for non-expert observers to rate OR to CV-ICU handovers in an accurate and reproducible fashion (see Figure 7). The tool was developed by a multidisciplinary team – including: nurses, cardiac anesthesiologists, cardiothoracic surgeons, behavioral scientists, and research experts— that compiled a list of handover best practice requirements based on extensive literature review and personal experience in the CV-ICU during transfers of care. The evaluation tool functions as a check-list that details all of the handover best practice requirements relevant to OR to CV-ICU handovers. While viewing a handover, the observer can mark the check-list based on whether or not the providers adhere to the requirements. Observers have the option of using a hardcopy version of the evaluation tool or electronic version available on REDcap.

The check-list contains 5 sections that emulate the flow of information transfer in a real OR to CV-ICU handover, starting with patient arrival in ICU, equipment hook-up, team introductions, handover report, and handover wrap-up. The ICU arrival questions address requirements such as presence of the entire team during handover, a proper patient introduction by the anesthesiologist, and anesthesiologist approval for initiating monitor and ventilator hook-up. The hook-up questions address requirements such as read back after successful transfer of monitors and ventilator, determination of patient stability at the time of handover, and use of visual cognitive aid by entire handover team. The handover report questions address requirements such as patient condition (ie: stable versus instable), critical concerns, surgery performed, appropriate background history, hemodynamic parameters, bleeding concerns, airway management, and renal/metabolic/endocrine issues. The wrap-up questions address requirements such as identification of on-call provider, review of CTQ items, review of action items, and a final acknowledgement by ICU team that patient has been successfully transferred into their care.

In addition to the objective check-list, the evaluation tool also has a subjective, open-ended portion where the observers can comment on communication between providers, teamwork, and leadership (see Figure 8). There is also a place for observers to note effective/ineffective components of the handover and how specifically the handover can be improved.

C. Video Randomization & Restrictions on Round Pacing

To minimize bias in the observer training program, trainees watched the videos in a randomized order and were instructed to wait at least 3 days before advancing rounds. The randomization and round pacing restrictions ensured that trainees independently evaluated the videos each viewing, and simply did not remember the handover content from a previous round or because videos were consistently viewed in the same order. Before starting the program, each trainee received the randomized order in which they must view the videos.

PDSA cycle #2- Observer satisfaction and feedback

PDSA cycle #2 was designed to determine observer satisfaction with the training program and collect observer feedback. The results of PDSA cycle #1 played an instrumental role in identifying problems with the training videos, ambiguous questions on the evaluation tool, and observer comprehension of the steps and rules of observer training program. The content of the feedback survey and focus group analysis, both designed to collect observer feedback, was largely based on PDSA cycle #1 results.

A. Creating a feedback survey

In order to solicit individual observer's feedback about their observer training program experience, a three-part survey with a total of 34 questions was constructed. Part 1 of the survey asked questions about observer understanding of the logistics and steps of the training program (see Figure 9). In addition to asking observers whether or not they followed all of the steps in the program, part 1 of the survey assessed if observers watched the videos in a randomized order and if observers adhered to the round pacing restrictions. Observers were also asked if they felt confident evaluating non-staged handovers after completing the training program. Part 2 of the survey asked questions about observer experience with the evaluation tool (see Figure 10). These questions not only identified areas of the evaluation tool that observers found ambiguous but also assessed observers' core understanding of handover best practice requirements. Part 3 of the survey asked questions about the training videos (see Figure 11). These questions assessed video accessibility, audiovisual quality, and observer ability to discern specific events in the handover (ie: connection of ventilator) and specific individuals in handover (ie: respiratory therapist versus supporting nurse). Parts 1-3 also had a question about whether or not trainees knew who to contact if they had questions about the training process, evaluation tool, and training videos.

B. Focus group analysis

The survey was administered to the observers in a focus group format. This entailed a one-on-one meeting with each observer where a moderator would review each survey question with the observer. Most of the questions on the survey are in a yes-or-no format; however, after the observer provides the 'yes' or 'no', the moderator can probe the observer for additional subjective feedback. This method was chosen because a one-

on-one meeting, compared to administering the survey via email, can lend more insight into observer attitudes about the training program and circumvents the issue of nonresponse bias.

RESULTS

A. PDSA #1- Observer training program

Figure 12 displays all six observers' percent agreement for videos A-D for all four rounds of observer training. Video A and B, which reflect ideal handover scenarios that adhere to best practice requirements, have the highest percent agreement at 90% and 89%, respectively. Video C, which reflects a non-ideal handover scenario, had the lowest percent agreement at 82%. Overall, the six observers performed similarly in their evaluation of videos A-D, as their percent agreements fell within a tight range of 85-88% (see Figure 13).

Figure 14 illustrates the average percent agreement for videos A-D and the inter-rater reliability for each round of observer training. The average percent agreement for videos A-D varied minimally between rounds of observer training with percent agreement at 84% for round #1, 85% for round #2 and #3, and 84% for round #4. The observers' inter-rater reliability for the four rounds of observer training ranged from a Fleiss' kappa of 0.6-0.7, falling below the 0.8 threshold for adequate homogeneity between observers.

No clear theme was identified in terms of the nature of questions observers' routinely missed; however, the majority of these questions came from information rich sections such as the handover report and wrap up. Missed questions were defined as questions where observers received less than 80% agreement with the master key across four rounds of observer training for videos A-D. Of the five sections in the handover evaluation tool – ICU arrival, equipment hook-up, team introductions, handover report, and handover wrap-up—the handover report section had the most missed questions, followed by the wrap-up section (see Figure 15). The handover report section and the wrap up section had 5 and 4 questions, respectively, with less than 80% agreement compared to the master key. A Pareto analysis of the missed questions from the handover report and wrap-up sections revealed that 12 questions from the handover report and 6 questions from the wrap-up sections contributed to 80% of the cumulative defect (see Figure 16 & 17). These problematic questions, which the majority of observers struggled to answer correctly, are shown in Figure 18.

B. PDSA #2- Observer satisfaction and feedback

The observer satisfaction survey and focus group analysis highlighted multiple flaws in both observers' comprehension of training program instructions and observers' compliance with training program rules. Figure 19 illustrates a Pareto analysis of the observers' comprehension of training program instructions. Four out of six items from this part of the survey contributed to 80% of the cumulative defect. These problematic items were: (1) observers were unaware they must record the time required to complete each round, (2) observers were unclear on when to give credit for information discussed by the "wrong" team member, (3) observers were unsure whether or not the training videos can be paused, and (4) observers waited at least 3 days before advancing to next round of training. While the above instructions remained ambiguous to the observers, the survey revealed that 83% of observers knew they must record round number on the evaluation tool and 100% of observers knew they must watch the videos in a randomized order.

Figure 20 illustrates a Pareto analysis of observers' compliance with steps of observer training program. Over 80% of the cumulative defect is a result of observers not attending the mandatory debriefing session after round #1 of observer training. Subjective feedback from the observers revealed that many were unaware that this step even existed. Aside from this step, observers were relatively compliant with the remaining steps of the observer training program.

Observers had a range of opinions about their experiences with the training videos. 100% of trainees felt that the audiovisual quality of the training videos was adequate. However, 50% of trainees noted significant difficulty accessing the videos online via OneDrive, stating they would prefer to access the videos on a thumbdrive. Figure 21 illustrates a Pareto analysis of observers' experience with the training videos. Three issues contributed to 80% of the cumulative defect: (1) observers were unable to identify the cognitive aid in the videos, (2) observers could not identify specific team members in the videos, and (3) observers could not complete an entire round of observer training without taking a break. Notably, 67% of observers also reported remembering the content of the videos after the first round of observer training.

In terms of overall satisfaction with the observer training program, 67% of observers enjoyed the training program, citing it as a positive educational experience. However, 100% of observers noted the need for improving the evaluation tool and the observer training didactics. Moreover, observers found it challenging to navigate through the questions on the tool while simultaneously watching the handover video. 100% of trainees felt confident using the evaluation tool before round #1; however, after round #1 they recognized that using the tool to evaluate the handovers was challenging. Subjective feedback from observers about this issue suggested that they would benefit from additional instruction on handover best practice requirements and more guidance on how to use the evaluation tool during the introductory session. Figure 22 illustrates a Pareto analysis of observers' overall experience with the training program. Three issues contributed to 80% of the cumulative defect: (1) observers lost confidence in using the evaluation tool after round #1, (2) observers did not feel the evaluation tool was user friendly, and (3) observers found the training videos inaccessible. Despite observers enjoying the training program, only 67% felt that the observer training program sufficiently prepared them to evaluate real time, non-staged handovers.

DISCUSSION

The six observers' overall percent agreement for the observer training program fell within a tight range of 85-88%, suggesting that the quality of the didactic material and instruction was consistent. The range of teaching modalities in the program— the sample video, introductory powerpoint, and face-to-face sessions with faculty expert – sufficiently accommodated for observers' different learning styles. Despite observers' obtaining greater than 80% average percent agreement, their inter-rater reliability was below the 0.8 kappa threshold. A low inter-rater reliability suggests discord between the six observers' assessment of the videos whereas a low percent agreement suggests discord between the individual observer and the master key. The low inter-rater reliability may stem from multiple factors, including: (1) observers lacking a unified understanding of handover best practice requirements, (2) observers interpreting and utilizing the evaluation tool in different ways, and (3) observers not following all the steps of the training program or adhering to the program rules.

A comparison of percent agreement scores for each video revealed that observers struggled with video C, only receiving an average of 82% agreement with the master key. In contrast, observers performed better on videos A and B, receiving 90% and 89% agreement, respectively. Compared to videos A and B, video C reflected a chaotic handover where providers do not adhere to handover best practice requirements. For this reason, it may have been more difficult for observers to discern which requirements were being followed, causing them to misinterpret the scenario and mark the incorrect answer on the evaluation tool.

Revising the didactic component of the observer training program may improve observers' percent agreement, inter-rater reliability, and their ability to evaluate chaotic handovers. In its current state, the observer training program is largely self- paced and self-driven. Observers must master handover best practice requirements by attending the introductory session and reviewing the powerpoint. Moreover, they must appropriately recognize these best practice requirements in a clinical scenario after watching only one sample training video. This may not be enough guidance or instruction for the observers, who come from clinical backgrounds ranging from medical students to attendings, and who may or may not be familiar with handovers.

While no clear theme could be identified in the terms of the most frequently missed questions, the majority of problematic questions came from the handover report and wrap up sections of the evaluation tool. These two sections are rich with multi-part questions that require observers to quickly interpret the content in the videos and apply it the evaluation tool. Moreover, providers often interchange roles during the handover report and wrap up sections of the video, making it challenging for observers to discern whether or not providers are adhering to best practice guidelines. Several questions in the handover report section also require observers to exert clinical judgment when evaluating the handover. For example, question 12_1 asks if the anesthesiologist appropriately discusses the patient's pertinent past medical history. The interpretation of what constitutes pertinent past medical history is observer dependent, and may explain why observers often disagreed with the master key on questions requiring clinical judgement.

Addressing issues with the handover report and wrap up sections of the tool requires: revisiting the evaluation tool to examine for areas of ambiguity in wording and teaching observers how to use the evaluation tool in a step-by-step manner. Moreover, to prevent observers from becoming overwhelmed by the fast paced information-rich handovers in the videos, they should be reminded to pause the videos as needed, and take scheduled breaks between videos to improve stamina and focus.

The observer satisfaction survey and focus group analysis revealed elements critical-to-quality (CTQ) for observers undergoing the training program. Despite 67% of observers being satisfied with the training program, there is still room for improvement. Based on the voice of the customers, the following CTQs were identified. First, observers stated the need for breaks during a round of observer training, as they found completing an entire round without breaks too cumbersome. Second, the observers requested additional clarification regarding the identification of all the providers in the training videos and the cognitive aid. Third, the observers were not confident with handover best practice requirements at the end of the program and believed they would benefit from more directed instruction during the introductory session. Fourth, the observers wanted a more user friendly evaluation tool. Fifth, the observers found it difficult to access the training videos online, stating they found loading the videos too challenging. Sixth,

the observers requested an easy access frequently asked questions (FAQ) resource. Seventh, observers wanted more than just a debriefing session after round #1. Observers believed they would benefit from a midpoint feedback session where they can learn their percent agreement scores and identify their frequently missed questions with the ultimate goal of improving their scores in future rounds.

CONCLUSION

A. Observer training didactics

Improving the didactics of the observer training program requires restructuring the steps of the observer training process and adopting a more hands-on approach during the introductory session. Figure 23 demonstrates a process flow for the new 2017 observer training program. While many of the steps remain the same, two major changes were implemented. A midpoint feedback session was added after round #2 of training. During this session, observers will receive their percent agreement scores from round #1 and #2 of training, and then have the opportunity to discuss with the faculty expert why they may have missed certain questions. The goal of this session is to identify areas of the evaluation tool that observers find ambiguous or a general clarification of handover best practice requirements that observers may find confusing. Additionally, the debriefing session after round #1 of training will occur by phone call instead of a face-to-face conversation with faculty expert. Due to schedule conflicts, observers found it challenging and impractical to meet the faculty expert face-to-face. Therefore, conducting this session via phone call may not only improve observer compliance with this required step but also improve overall satisfaction with the training program.

The introductory session with the faculty expert will also include direct teaching of the handover best practice requirements. Previously, observers were expected to self-learn these best practice requirements from the introductory powerpoint and additional outside resources. This, however, proved inadequate as observers failed to achieve a unified understanding of the requirements, evidenced by an insufficient inter-rater reliability and lower percent agreements on the more challenging videos C and D. Observers must fully understand the features of a high quality handover before they can evaluate poor quality handovers, such as those demonstrated in videos C and D, with accuracy.

B. Evaluation tool

After revisiting the evaluation tool, several modifications were made to the tool's overall structure and individual question content and wording. The new tool, illustrated in Figure 24, continues to have a five section format. The sections, however, now better reflect the flow of a patient handover: ICU arrival, hook up, sterile cockpit, handover report, and wrap up. The introduction section, present in the previous version of the tool, was removed because team

introductions almost always happen during ICU arrival and observers found the introduction section redundant. Moreover, questions pertaining to the sterile cockpit such as – coordinator RN and ICU MD establishing a distraction-free environment, assessment of patient stability prior to starting handover report, and presence of cognitive aid—were scattered throughout the hook up and introduction section of the tool. Observers found this grouping unintuitive and confusing, so a new sterile cockpit section was created. Questions with ambiguous or redundant wording were also revised. For example, observers noted that Q12_5, "anesthesiologist discusses lines/tubes/drains," was ambiguous because "discussion" could mean anything from chest tube and drain output to the specific placement location of the tubes and drains. Since Q12_5 was targeted to elicit information about the placement of lines/tubes/drains, the wording was revised to reflect that.

To address the issue of observers exerting differing clinical judgement to evaluate the handovers, the introductory session will now include a part where the faculty expert and observers review the sample video together and practice using the evaluation tool for the sample video. This additional step will allow the faculty expert to coach observers on how to use the evaluation tool with an example handover and to review handover best practice requirements. Additionally, the faculty expert can highlight questions on the tool requiring clinical judgement and discuss how clinical judgement should be exercised in context of post-sternotomy OR to CV-ICU handovers. Since the observers come from varying clinical backgrounds, this becomes an essential step in standardizing their approach to evaluating these handovers. If observers have additional questions about using the tool after the introductory session, they can refer to the new introductory powerpoint. Figure 25-29 illustrate slides from the new introductory powerpoint. These slides teach observers how to use each section of the evaluation tool and highlight the handover best practice requirements relevant to that section. The purpose of these detailed slides is to serve as reference should observers need a review or have questions about the tool.

C. <u>CTQ elements for observers</u>

Figure 30 summarizes the CTQ elements identified through the focus group analysis, and the subsequent action items proposed to address these CTQs. To address observers' request for a break during a given round, a two-hour break was scheduled into each round of training. These two hours may be divided as they observer wishes; however, the break may not extend beyond

two hours in order to keep the training experience standardized between observers. To circumvent the problems with accessing the videos online via OneDrive, observers will all be provided with a thumbdrive containing the videos. An FAQ resource was also added to the end of the introductory powerpoint, highlighting common questions about the rules of the observer training program (see Figure 31).

In summary, the reliability and user satisfaction of the CUH OR to CV-ICU observer training program was improved by the following deliverables: (1) new design and format of observer training program with emphasis on CTQ elements for trainees, (2) new introductory powerpoint, (3) new user-friendly handover evaluation tool, and (4) feedback survey for graduates of observer training program.

LIST OF FIGURES

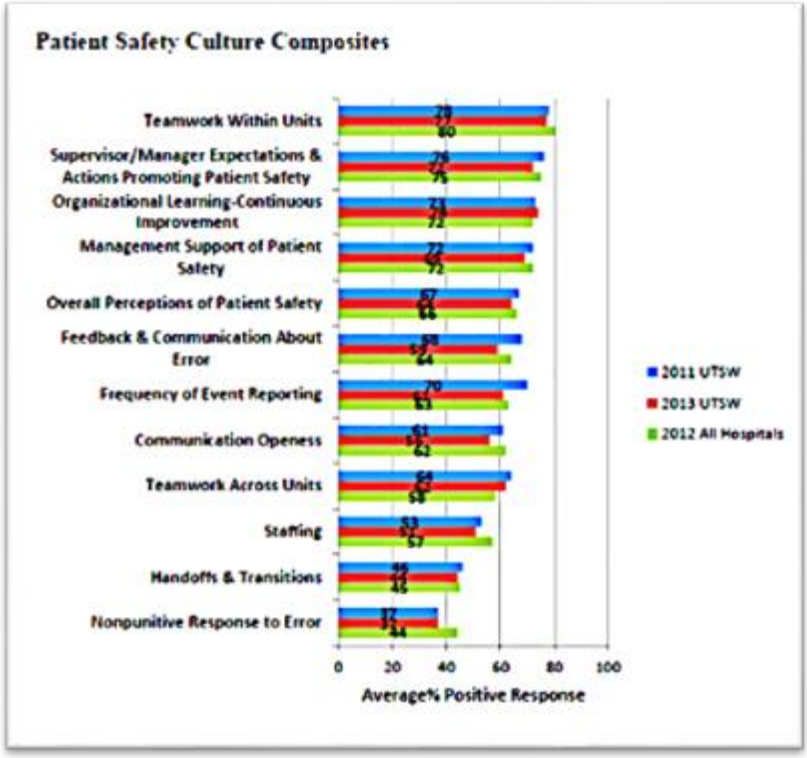

Figure 1- AHRQ's Hospital Survey on Patient Safety illustrates that handoffs and transitions have a 46% and 44% approval rating at UT Southwestern in 2011 and 2013, respectively. These approval ratings are comparable to 2012 all-hospital national approval ratings for handoffs and transitions which was 45%.

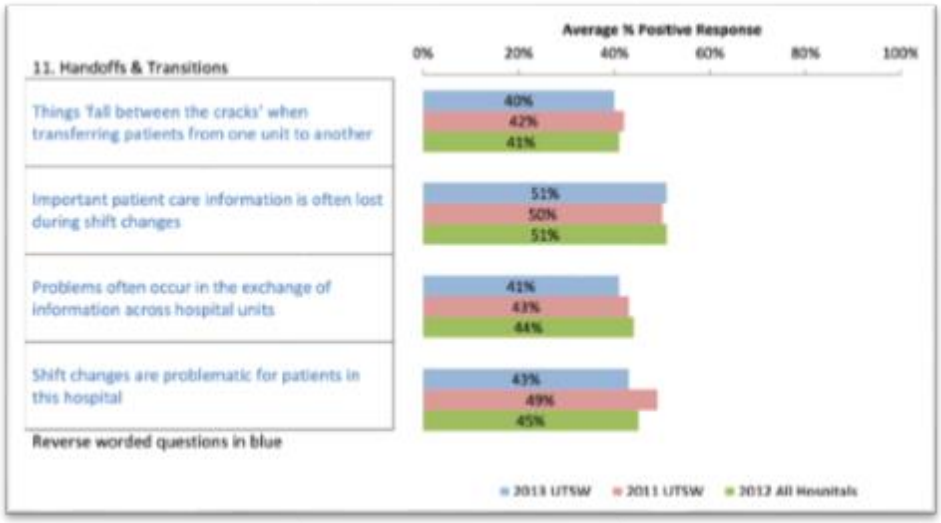

Figure 2- AHRQ's Hospital Survey on Patient Safety subsection on handoffs and transitions illustrates that shift changes and transfer of patients between units prove problematic at UT Southwestern and nationally across hospitals in the United States, as approval ratings for these issues are at 51% and below.

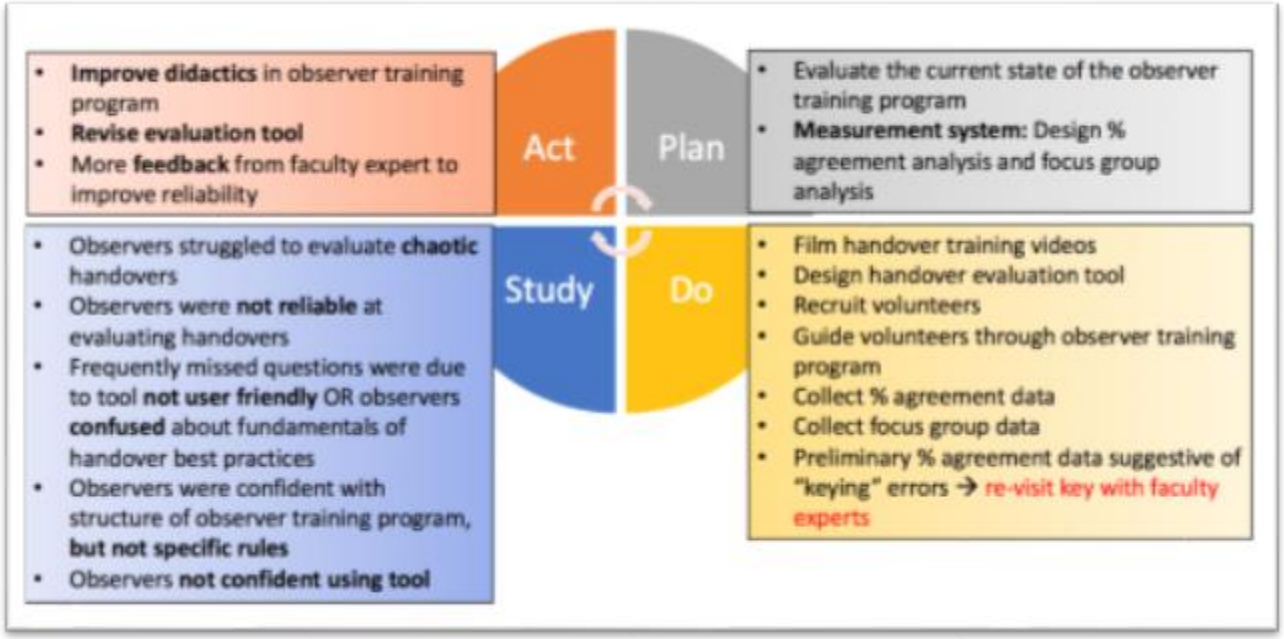

Figure 3- A schematic overview of PDSA cycle #1.

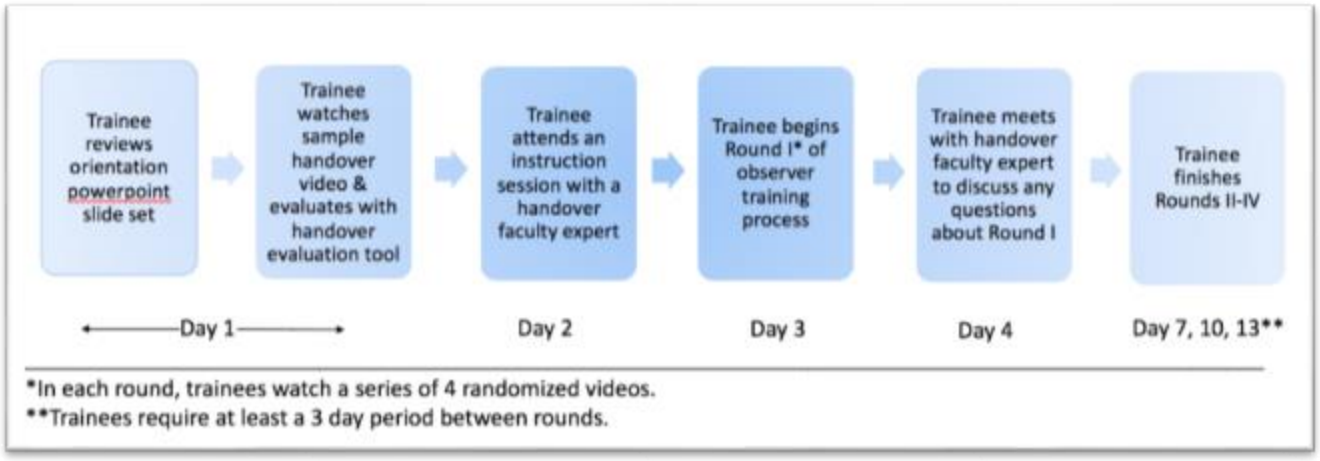

Figure 4- Process flow diagram of the steps required to complete the observer training program. Upon completion of these steps, trainees are deemed trained observers for evaluating OR to CV-ICU handovers.

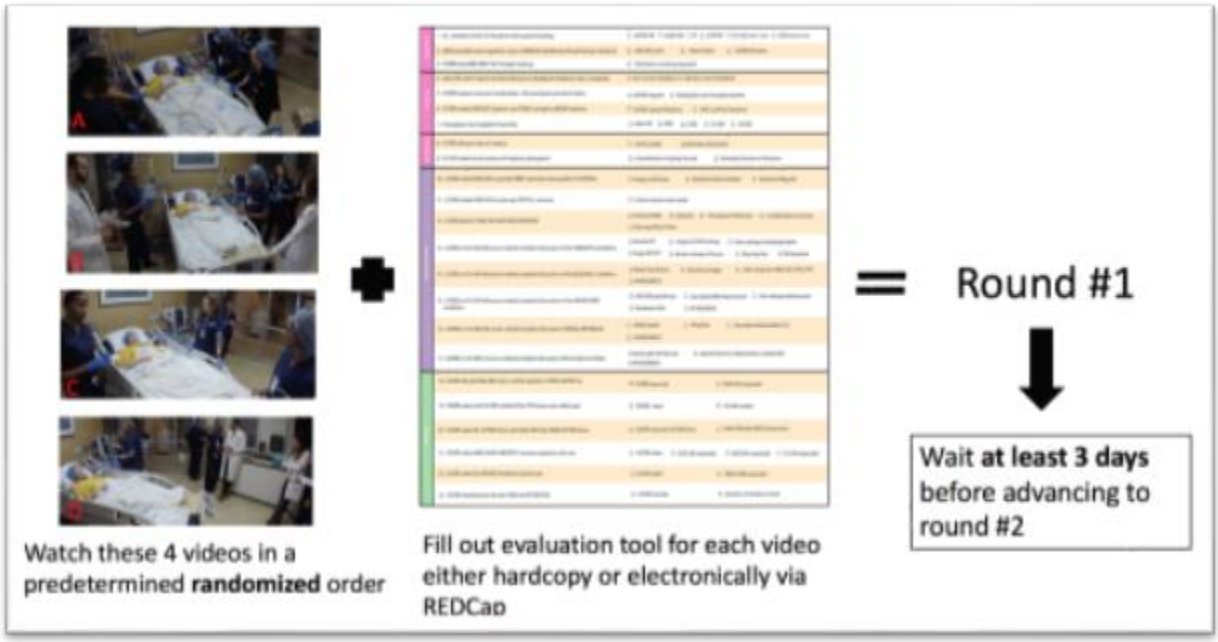

Figure 5- A schematic of a round in the observer training program. Trainees watch the 4 training videos A-D in a randomized order and use the tool above to evaluate the handovers in each video.

Figure 6- Video C and D reflect non ideal handovers where providers do not adhere to handover best practice requirements. In Video C, the cardiothoracic surgeon is absent for the entire handover forcing the anesthesiologist to also assume the role of surgeon in the handover. In Video D, the anesthesiologist and intensivist conduct their own handoff, excluding remaining team members.

ICU Arrival	1. ALL members of the ICU handover team present/waiting.	☐ COORD RN ☐ ADMIT RN ☐ RT ☐ SUPPORT ☐ ICU MD w/in 5 min ☐ SURG w/in 5 min
	2. ANES provided name & patients name; COORD RN identify him/herself during "wheels in".	☐ ANES MD name ☐ Patient Name ☐ COORD RN name
	3. COORD asks ANES MD if "ok" to begin hook-up.	☐ Permission to hook up requested
Hook-up	4. Admit RN and RT attach Ventilator/Monitors & Readback Verbalized when completed.	☐ Vent connect Readback ☐ Monitor connect Readback
	5. COORD request everyone to take place. ALL participants present/in place	☐ COORD requests ☐ Participants move to proper position
	6. COORD asked ANES MD if patient was STABLE enough to BEGIN handover.	☐ COORD request Readiness ☐ ANES confirms Readiness
	7. Participants have Cognitive Visual Aid.	☐ Admit RN ☐ ANES ☐ SURG ☐ ICU MD ☐ COORD
Introduction	8. COORD did give rules of conduct.	☐ Sterile Cockpit ☐ Minimizes Distractions
	9. ICU MD stated social contract of handover participants.	☐ Committment of staying Focused ☐ Estimated Duration of Handover
Handover Report	10. COORD asked ANES MD to provide BRIEF statement about patient SITUATION.	☐ Surgery performed ☐ Stable/Unstable condition ☐ Treatment Required
	11. COORD asked SURG MD to state any CRITICAL concerns.	☐ Critical concerns were stated
	12. COORD asks/or SURG MD states BACKGROUND?	☐ Pertinent PMH ☐ Indication ☐ Procedure(s) Performed ☐ Complications/Concerns ☐ Dressing/Drains/Tubes
	13. COORD or ICU MD did ensure orderly/complete discussion of the HEMODYN conditions.	☐ Baseline BP ☐ Pre/post ECHO findings ☐ Pacer settings/underlying rhythm ☐ Target BP/CVP ☐ Review inotropes/Pressors ☐ Weaning Plan ☐ RN Readback
	14. COORD or ICU MD did ensure orderly/complete discussion of the BLEEDING Conditions	☐ Blood Transfusions ☐ Transfusion trigger ☐ Next transfusion (RBC,PLT, CRYO, FFP) ☐ RN READBACK
	15. COORD or ICU MD did ensure orderly/complete discussion of the AIRWAY/RESP conditions	☐ A/W Difficulty/Devices ☐ Last Opioid/NM relax/reversal ☐ Vent settings/sedation plan ☐ Extubation Plan ☐ RT READBACK
	16. COORD or ICU MD did ensure orderly/complete discussion of RENAL/METABOLIC	☐ RENAL dysfxn ☐ IV/ admin ☐ Electrolyte abnormalities (K+) ☐ RN READBACK
	17. COORD or ICU MD ensure an orderly/complete discussion of the Endocrine/Other.	☐ Insulin gtt/LAST Glucose ☐ Special Devices (ie Spinal Drain), if applicable ☐ RN READBACK
Wrap-up	18. COORD did ask SURG MD who to call for questions NOW & AFTER hrs.	☐ COORD requested ☐ SURG MD responded
	19. COORD asked and ICU MD verified all the CTQ issues were addressed.	☐ COORD asked ☐ ICU MD verified
	20. COORD asked for ACTION items and Admit RN/other READ ACTION items.	☐ COORD requested ACTION items ☐ Admit RN/other READ action items
	21. COORD asked ANES/SURG GREATEST concern in patients safe care.	☐ COORD asked ☐ SURG MD responded ☐ ANES MD responded ☐ ICU MD responded
	22. COORD asked ICU RN/MD if ready to assume care.	☐ COORD asked ☐ RN/ICU MD responded
	23. COORD thanked team for their TIME and ATTENTION.	☐ COORD thanked ☐ Duration of Handover Scored

Figure 7- The OR to CV-ICU handover evaluation tool, check-list. The tool has 5 sections – ICU arrival, hook-up, introductions, handover report, and wrap-up—where observers can mark whether or not providers adhere to best practice requirements relevant to that section.

Communication and Teamwork Skills (adapted from CATS)		Observed & Good	Variation in Quality	Expected, NOT Observed
Leadership	Coordinator is present and manages handover sequence in efficient and effective manner.			
	Leader (ICU MD/other) is present and manages team expectations; medical sense making, and minimizes interruptions.			
Communication	Closed-loop communication (with READBACK) is used with names used.			
	Information exchange is clearly audible, at appropriate pace; in professional tone.			
	Team members think aloud, take turns; individual member input requested.			
Cooperation	Team member requests are responded to timely manner.			
	All team members engaged (not distracted by pager, phone, environment).			
	Team members exhibit respect for one another.			
Coordination	All members present.			
	Verbalize expected timeframes for patient care needs.			

Subjective Feedback (Please leave your comments about the handoff):

What was Effective/Ineffective about the Handoff?	What aspect(s) of the handoff could be improved?
-Behaviors (preparedness) -Technical/equipment	-Surrounding conditions -Member Training

Figure 8- The OR to CV-ICU handover evaluation tool, open-ended questions. This component of tool was designed to allow observers to provide subjective feedback about the handover.

1. Were the steps of the observer training process clear to you (ie: powerpoint, sample video, introductory didactics session with faculty expert, round I, debriefing session, round II-IV)?
2. Did you review the powerpoint? (ask about clarity/points of improvement)
3. Did you attend the instruction session with faculty expert?
4. Did you attend the debriefing session (after round I)?
5. Were you aware that you need to watch the videos in a randomized order? (ie: obtained a the list from Mandy McBroom)
6. Were you aware that you need to wait at least 3 days before moving from one round to another?
7. Was it clear to you whether or not you could pause the videos and rewatch portions that were unclear?
8. Was it clear to you whether or not you can give credit for an item that was discussed by a different team member? (ie: surgeon discusses hemodynamics instead of the anesthesiologist)
9. Did the entire observer training process take less than 6 hours? (ask how long it took)
10. If you had any questions about the observer training process, did you know who to ask/reach out to?
11. After the observer training program do you feel confident evaluating non-staged handovers?

Figure 9- Focus group feedback questions (comprehension of observer training steps and rules)

1. Were you aware that the evaluation tool was available electronically (via Redcap) and hardcopy?
2. Did you record how long it took you to watch the video+ complete the evaluation tool per round?
3. Did you record each round # on the evaluation tool prior to starting?
4. Before starting round I did you feel confident using the evaluation tool or were elements of the tool still ambiguous?
5. Were the 5 sections of the tool- ICU arrival, hook up, introduction, handover report, and wrap-up- clear to you?
6. Did you feel like the 3 questions in the ICU arrival section of the tool were clear? (if not, which one(s) were confusing)
7. Did you feel like the 4 questions in the hook up section of the tool were clear? (if not, which one(s) were confusing)
8. Did you feel like the 8 question in the handover report section of the tool were clear? (if not, which one(s) were confusing)
9. Did you feel like the 6 questions in the wrap-up section of the tool were clear? (if not, which one(s) were confusing)
10. Overall, would you say the tool is user friendly/easy to use?
11. If you had any questions about the evaluation tool, did you know who to ask/reach out to?

Figure 10- Focus group feedback questions (evaluation tool)

1. Were the videos easily accessible? (ie: thumbdrive vs onedrive)
2. Was the audio component of the videos clear?
3. Was the video component of the videos clear?
4. Did all 4 videos appear of similar cinematographic quality to you? (ie: or was one video you felt was poorly recorded)
5. Did the videos make it clear who each member of the handover team was?
6. Were you able to clearly delineate the cognitive aid in the videos?
7. Were you able to appreciate when the anesthesia tech and RT were attaching the monitors and vent?
8. Did you watch all 4 videos per round consecutively? (ie did not take long breaks)
9. Did you find yourself needing to pause videos and re-watching portions?
10. Did you remember or “memorize” the content of the videos after the first couple of rounds?
11. If you had any questions about the videos, did you know who to ask/reach out to? (ie readily accessible)

Figure 11- Focus group feedback questions (training videos)

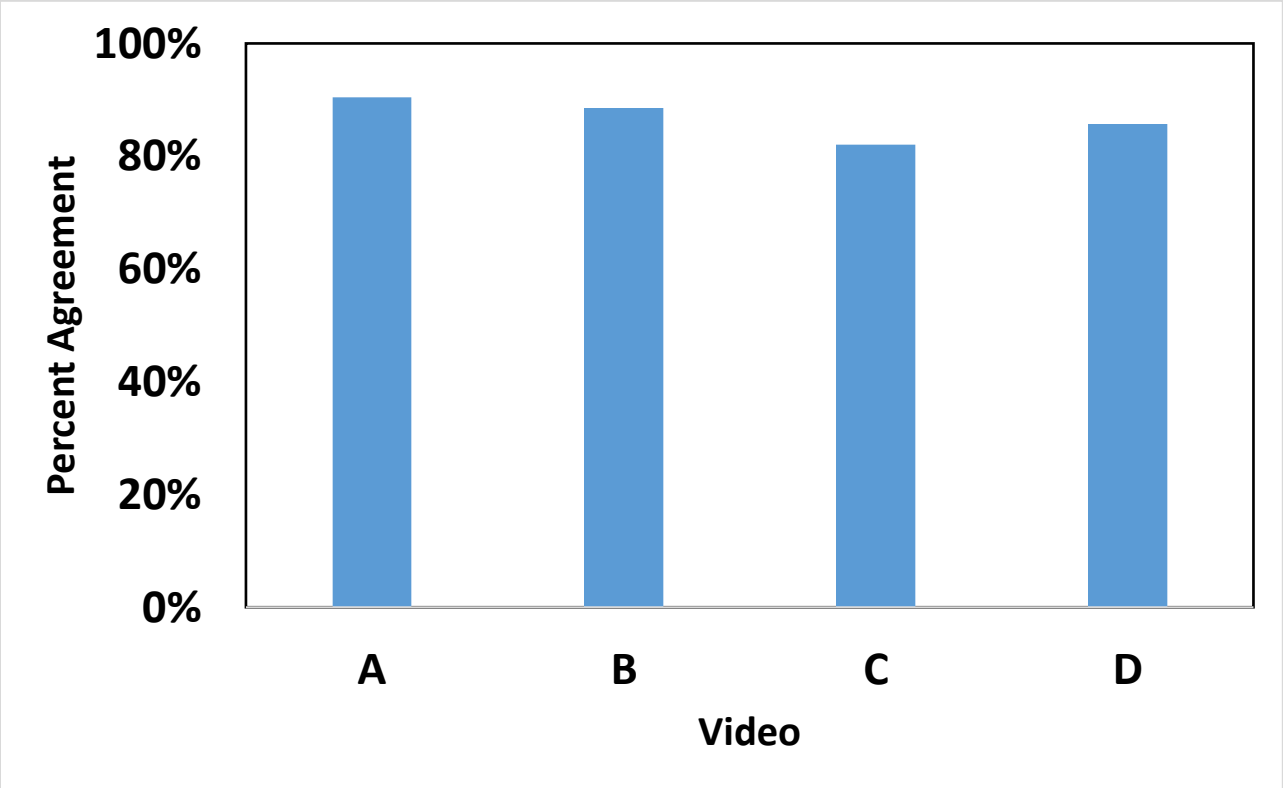

Figure 12- An average of all 6 observers' percent agreement compared to master key across four rounds of observer training. Video A and B had the highest percent agreement at 90% and 89%, respectively. Video C and D had the lowest percent agreement at 82% and 86%, respectively.

	Observer					
	1	2	3	4	5	6
Video A	84%	89%	92%	95%	93%	89%
Video B	88%	89%	87%	88%	90%	88%
Video C	84%	82%	82%	77%	84%	83%
Video D	86%	87%	90%	87%	83%	83%
Average	**85%**	**87%**	**88%**	**87%**	**88%**	**86%**

Figure 13- Each individual observer's average percent agreement across four rounds of observer training for Video A-D.

Round	Agreement	Kappa
1	0.84	0.6
2	0.85	0.6
3	0.85	0.7
4	0.84	0.6

Figure 14- Average percent agreement and inter-rater reliability (Fleiss Kappa) for observers 1-6 evaluating videos A-D for each round of observer training.

Section of Evaluation Tool	Number of questions missed
ICU arrival	1
Hook up	2
Introductions	0
Handover report	5
Wrap up	4

Figure 15- Questions missed reflects questions where observers received less than 80% agreement with the master key across four rounds of observer training for Videos A-D.

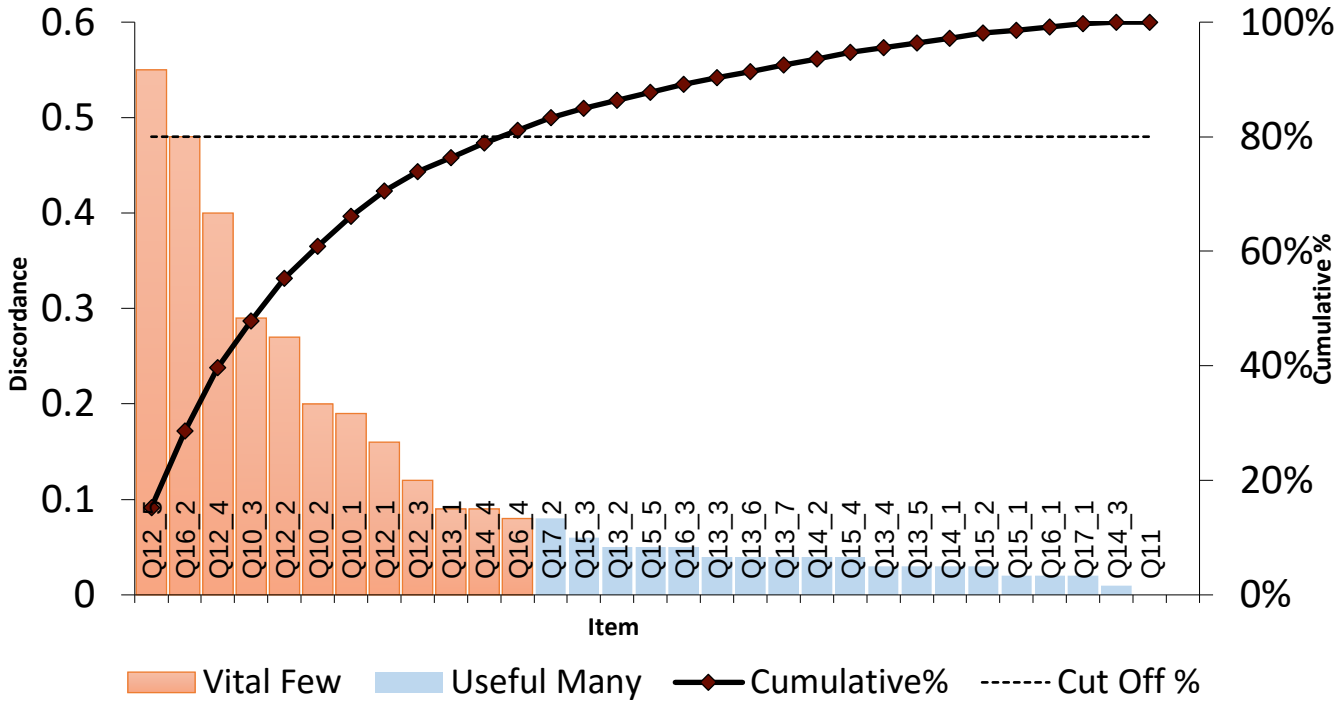

Figure 16- Pareto analysis of questions from handover report section of evaluation tool. The 12 questions highlighted in red contribute to 80% of cumulative defect.

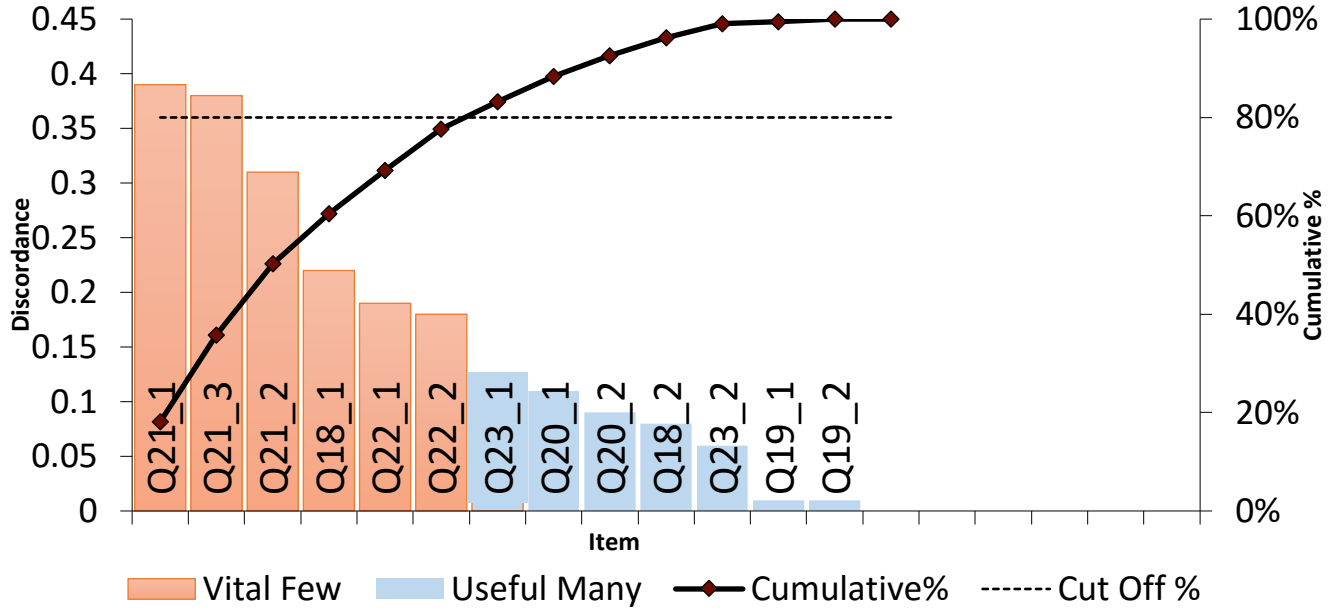

Figure 17- Pareto analysis of questions from wrap up section of evaluation tool. The six questions highlighted in red contribute to 80% of the cumulative defect.

Section of tool	Question number	Question content
Handover report	10_1	Anesthesiologist discusses surgery performed
	10_2	Anesthesiologist discusses patient condition
	10_3	Anesthesiologist states if any interventions required
	12_1	Anesthesiologist discussed past medical history
	12_2	Anesthesiologist discusses indication for surgery
	12_3	Anesthesiologist states the procedures performed
	12_4	Anesthesiologist discusses any complications due to surgery
	12_5	Anesthesiologists discusses placement of lines/drains
	13_1	Intensivist mentions patient's baseline blood pressure
	14_4	RN receiving patient "reads-back" hemodynamic parameters discussed by team
	16_2	Team discusses patient's IV fluids
	16_4	RN receiving patient "reads-back" renal review of systems
Wrap up	18_1	Coordinating RN asks for on-call provider information
	21_1	Coordinating RN asks providers about greatest concern in patient safety
	21_2	Surgeon addresses the greatest concern in patient safety
	21_3	Anesthesiologist addresses the greatest concern in patient safety
	22_1	Coordinating RN asks if ICU team ready to assume care
	22_2	ICU team confirms or denies readiness to assume care

Figure 18- Questions from handover report and wrap up sections of evaluation tool contributing to 80% of cumulative defect with Pareto analysis.

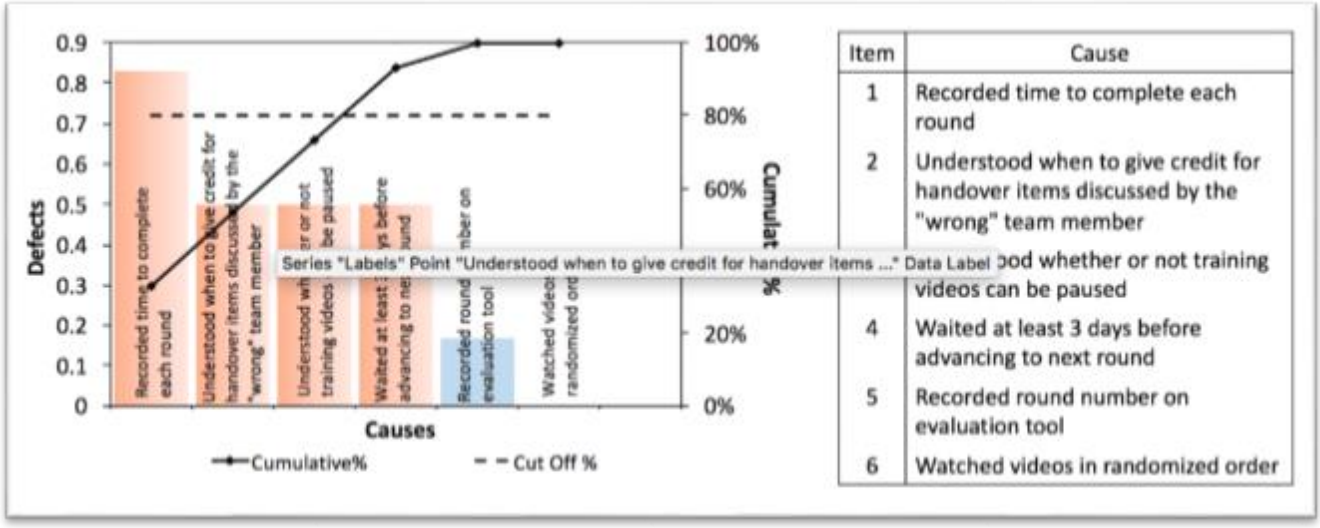

Figure 19- Pareto analysis of survey questions assessing observers' comprehension of training program instruction.

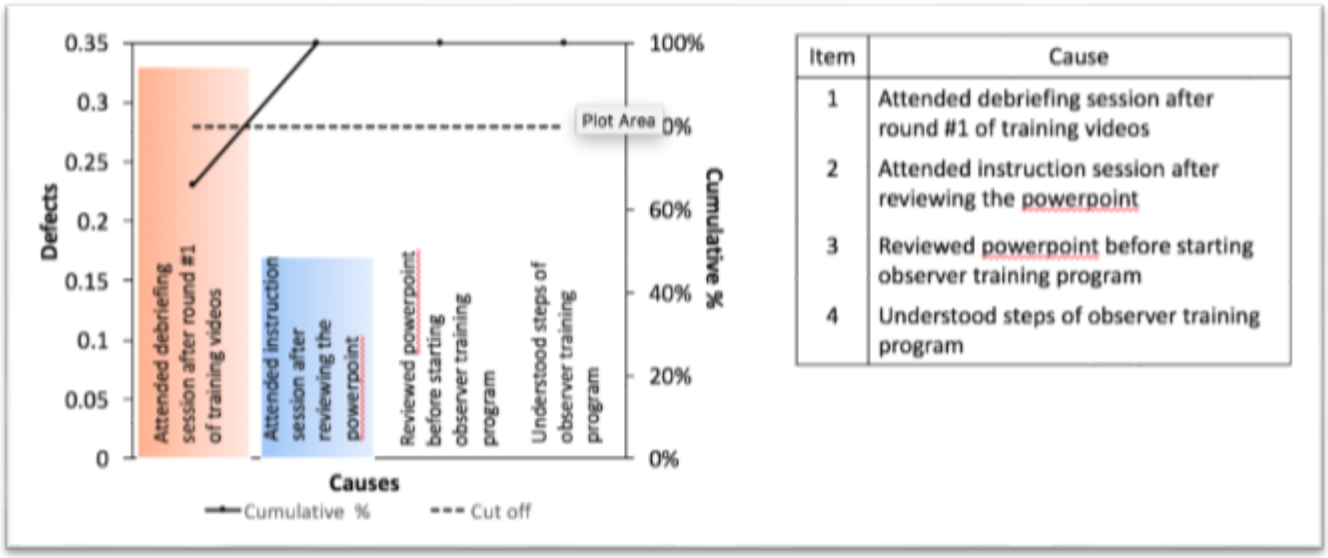

Figure 20- Pareto analysis of survey questions assessing observers' compliance with mandated steps of observer training program.

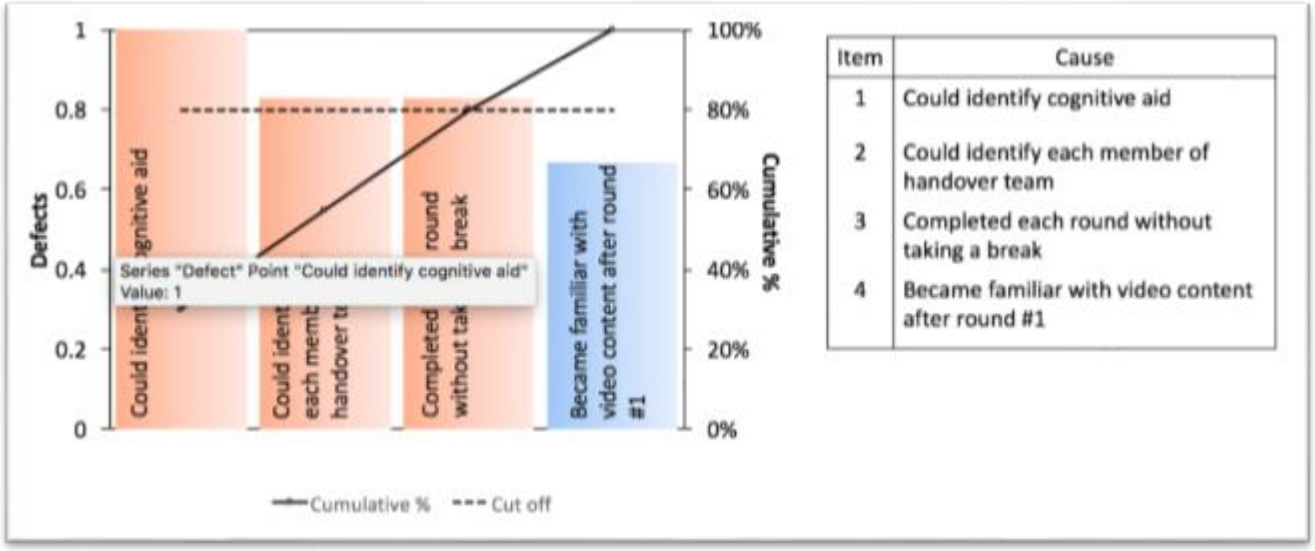

Figure 21- Pareto analysis of survey questions assessing observers' experience with the training videos.

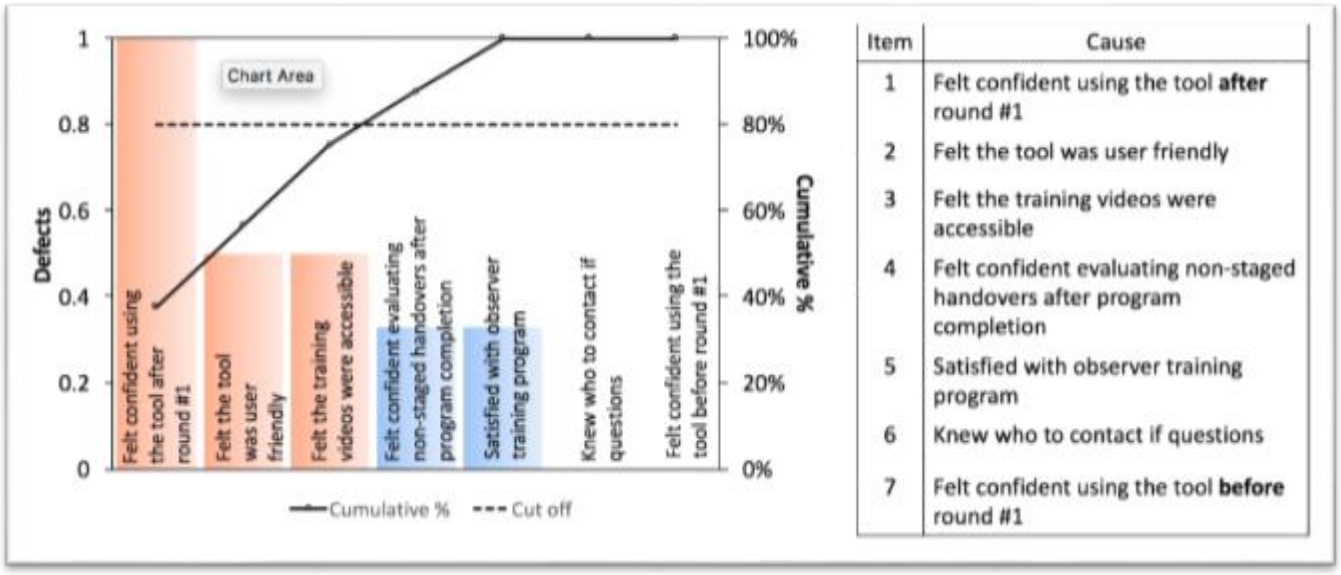

Figure 22- Pareto analysis of survey questions assessing observers' overall experience with the training program.

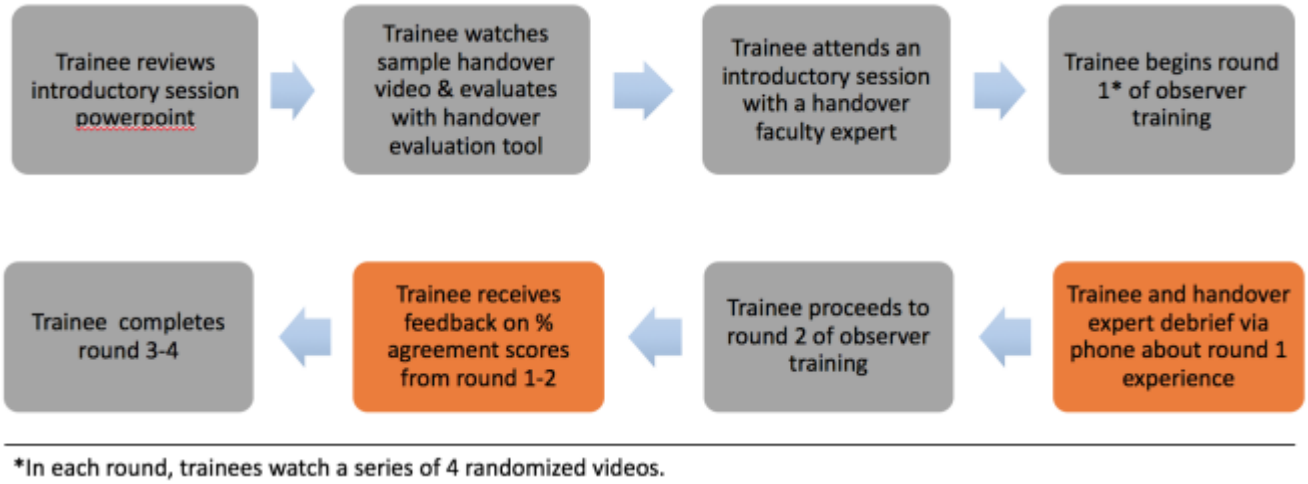

Figure 23- Process flow diagram of the new 2017 observer training program. Salient changes from the previous version of observer training program have been highlighted in orange.

ICU Entry	1. ALL members of the ICU handover team present/waiting when report begins.	☐ COORD RN ☐ ADMIT RN ☐ RT ☐ ICU MD ☐ SURG
	2. ANES provided name & patients name.	☐ ANES MD name ☐ Patient Name
	3. All other participants introduced themselves (name/roles).	☐ COORD RN ☐ ADMIT RN ☐ RT ☐ SURG ☐ ICU MD
Hook-up	4. COORD asks ANES MD if "ok" to begin hook up.	☐ Permission to hook up requested
	5. Ventilator monitor connection verbalized.	☐ Vent connect Readback ☐ Monitor connect Readback
	6. COORD request everyone to take place. ALL particpants at bedside.	☐ COORD requests ☐ Participants at bedside
Sterile Cockpit	7 COORD asked ANES MD if patient was STABLE enough to BEGIN handover.	☐ COORD request Readiness ☐ ANES confirms Readiness
	8. Participants have Cognitive Visual Aid.	☐ Admit RN ☐ ANES ☐ SURG ☐ ICU MD ☐ COORD
	9. COORD did give rules of conduct.	☐ Sterile Cockpit/ Minimizes Distractions
	10. ICU MD stated social contract of handover participants.	☐ Committment of staying Focused ☐ Estimated Duration of Handover
Handover Report	11. COORD asked ANES MD to provide BRIEF statement about patient SITUATION.	☐ Surgery performed ☐ Stable/Unstable condition ☐ Need for Treatment
	12. COORD asks/or SURG MD states BACKGROUND?	☐ Pertinent PMH ☐ Indication ☐ Procedure(s) Performed ☐ Complications/Concerns ☐ Location of tubes/drains
	13. COORD or ICU MD did ensure orderly/complete discussion of the HEMODYN conditions.	☐ Baseline BP ☐ Pre/post ECHO findings ☐ Pacer settings/underlying rhythm ☐ Target BP/CVP ☐ Review inotropes/Pressors ☐ Weaning Plan ☐ RN Readback
	14. COORD or ICU MD did ensure orderly/complete discussion of the BLEEDING Conditions	☐ Blood Transfusions ☐ Transfusion trigger ☐ Next transfusion (RBC,PLT, CRYO, FFP) ☐ RN READBACK
	15. COORD or ICU MD did ensure orderly/complete discussion of the AIRWAY/RESP conditions	☐ A/W Difficulty/Devices ☐ Last Opioid/NM relax/reversal ☐ Vent settings/sedation plan ☐ Extubation Plan ☐ RT READBACK
	16. COORD or ICU MD did ensure orderly/complete discussion of CO-MORBIDITIES.	☐ Pertinent COMORBIDITIES ☐ Stated there were no other conditions
Wrap-up	17. Information about surgical resident on call provided.	☐ Information provided
	18. ICU MD verifed all the CTQ issues were addressed.	☐ ICU MD verified
	19. Readback of care goals.	☐ SURG /ANES MD responded ☐ ICU MD/RN responded
	20. COORD asked ANES/SURG GREATEST concern in patients safe care.	☐ COORD asked ☐ SURG MD responded ☐ ANES MD responded ☐ ICU MD responded
	21. Admit RN/ICU MD stated readiness to assume care.	☐ Stated
	22. COORD thanked team for their TIME and ATTENTION.	☐ COORD thanked ☐ Duration of Handover Stated

Figure 24- The revised evaluation tool for 2017 observer training program.

Evaluation tool: ICU arrival

ICU Arrival	1. ALL members of the ICU handover team present/waiting when report begins.	☐ COORD RN ☐ ADMIT RN ☐ RT ☐ ICU MD ☐ SURG
	2. ANES provided name & patients name.	☐ ANES MD name ☐ Patient Name
	3. All other participants introduced themselves (name/roles).	☐ COORD RN ☐ ADMIT RN ☐ RT ☐ SURG ☐ ICU MD

Handover Pearls-

Pre-arrival preparation

- ICU room clean/ equipped for patient transfer
- ICU team ready to receive patient

Adequate personnel and equipment

- Coordinator RN should be ready in the room BEFORE patient arrives
- Anesthesiologist should be physically with patient during arrival
- Admit RN and RT should be ready BEFORE or BY THE TIME patient arrives
- ICU MD and surgeon should be IN THE ROOM by the time the handover report starts
- Absence of a team member **is unacceptable** (ie: anesthesiologist cannot substitute for surgeon)

Figure 25- Slide from the introductory powerpoint explaining how to use the ICU arrival section of the evaluation tool.

Evaluation tool: hook up

Hook-up	4. COORD asks ANES MD if "ok" to begin hook-up.	☐ Permission to hook up requested
	5. Ventilator monitor connection verbalized.	☐ Vent connect Readback ☐ Monitor connect Readback
	6. COORD request everyone to take place. ALL particpants at bedside.	☐ COORD requests ☐ Participants at bedside

Handover Pearls-

Notification/coordination of event

- Monitor and ventilator "hook-up"
  - Even if team members can visually appreciate the ventilator and the monitors being transferred and attached, it is extremely important for this information to be verbalized **since not all team members may have visualized the event.**
- Coordinator requesting all members to take place
  - Coordinator must explicitly assess "readiness" to start the handover and ask participants to tak their place
  - Credit cannot be given for this item if the participants are in place "by chance" and so the coordinator skips asking this

Figure 26- Slide from the introductory powerpoint explaining how to use the hook up section of the evaluation tool.

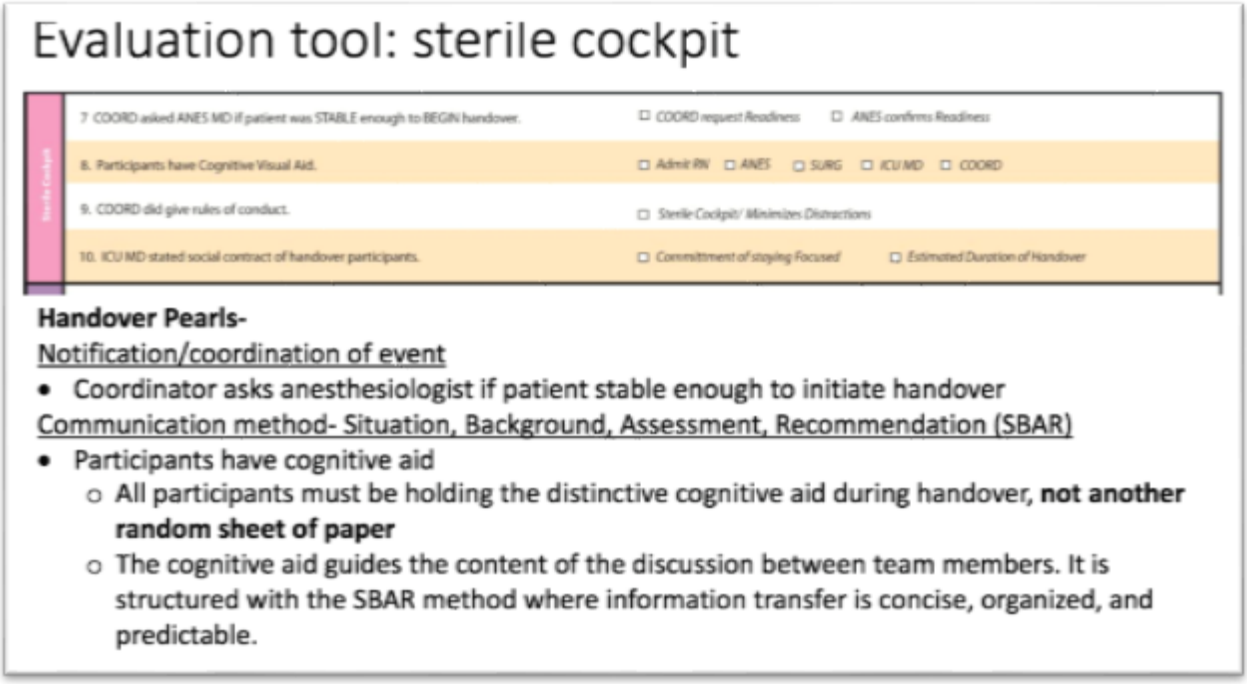

Figure 27- Slide from the introductory powerpoint explaining how to use the sterile cockpit section of the evaluation tool.

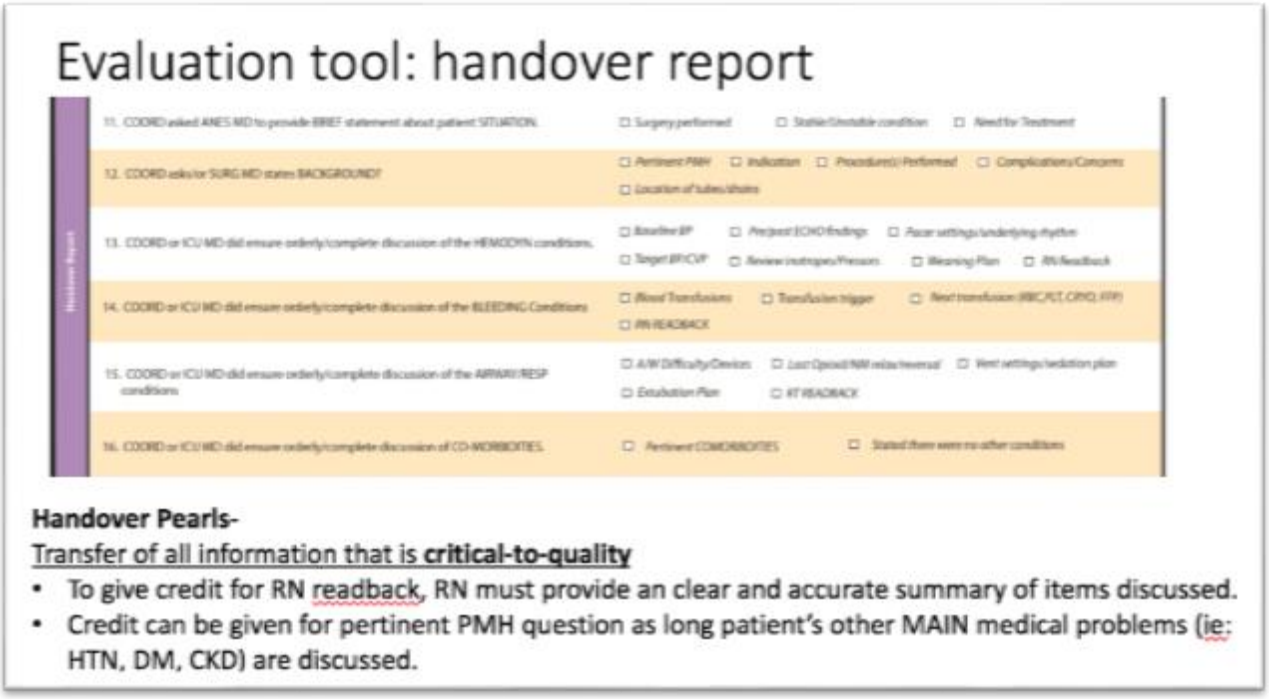

Figure 28- Slide from the introductory powerpoint explaining how to use the handover report section of the evaluation tool.

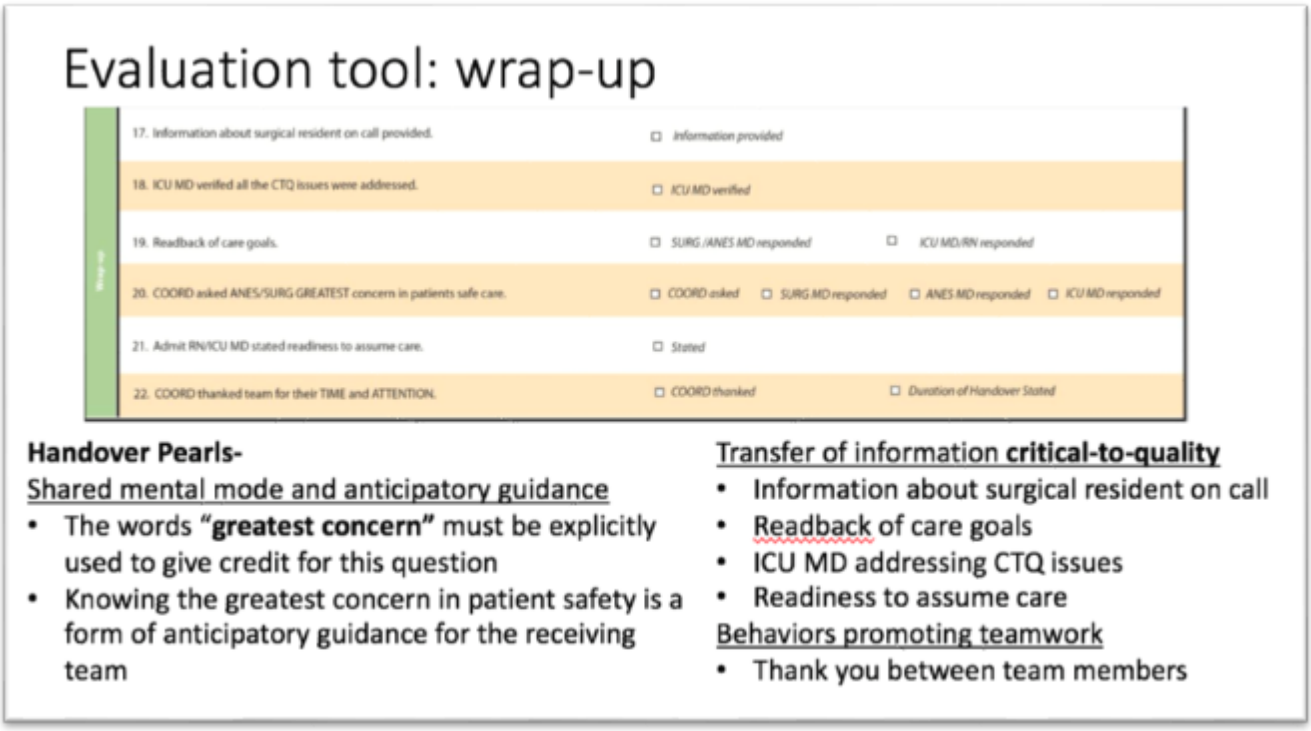

Figure 29- Slide from the introductory powerpoint explaining how to use the wrap-up section of the evaluation tool.

CTQ element identified	Action item
Need breaks within a round	2 hour break permitted for each round
Need clarification of people in videos and cognitive aid	Watch the sample video with faculty expert in introductory session
Clarification of handover best practice requirements	Breakdown of tool by section and explanation of handover best practices in introductory powerpoint slideset
User friendly evaluation tool	More intuitive grouping of questions into sections of tool
Improve access to training videos	Thumbdrive for every observer
Need for easy reference FAQ sheet	FAQ slide added at end of introductory powerpoint
Midpoint feedback during rounds of observer training	Provide observers with % agreement scores after round #2

Figure 30- CTQ elements identified from observer satisfaction survey and focus group analysis with their respective action items.

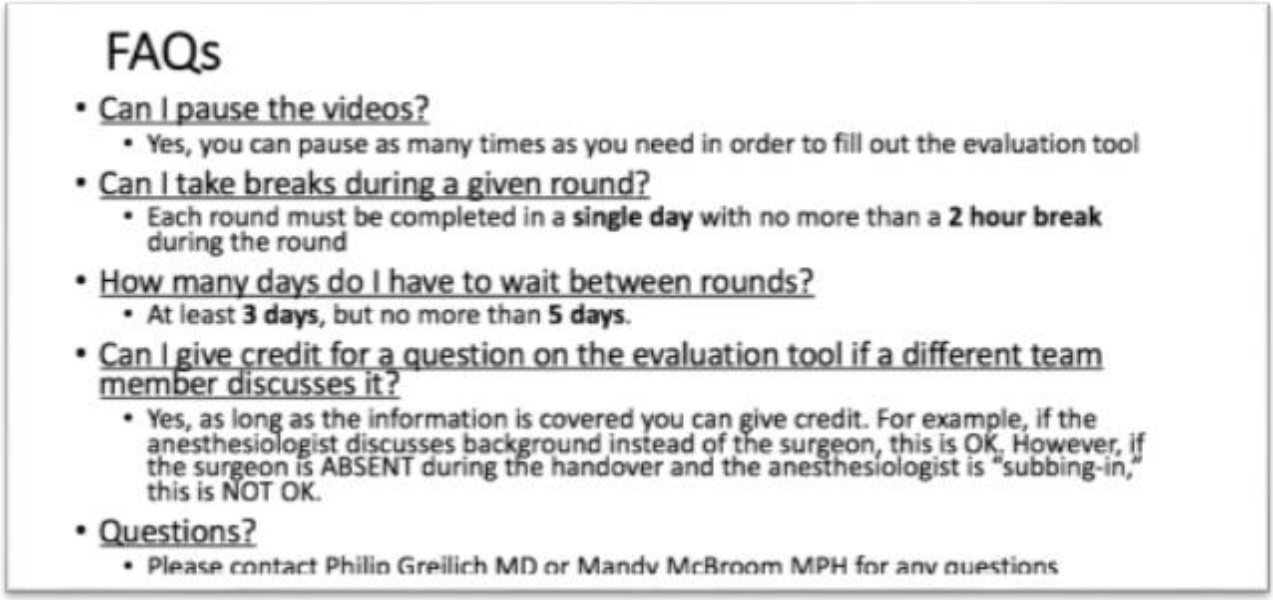

Figure 31- Frequently asked question (FAQ) resource slide from the introductory powerpoint.

REFERENCES

AJ Starmer, T. S. (2013). Rates of Medical Errors and Preventable Adverse Events Among Hospitalized Children Following Implementation of a Resident Handoff Bundle. *JAMA*, 2262-2270.

Apker J, M. L. (2007). Communicating in the 'gray zone': perceptions about emergency physician hospitalist handoffs and patient safety. *Acad Emerg Med, 14*, 884-94.

Bomba DT, P. R. (2005). A description of handover processes in an Australian public hospital. *Aus Health Rev, 29*, 68-79.

Canberra. (2006). Safe handover: safe patients. Guidance on clinical handover for clinicians and managers. . *Australian Medical Association* .

Johnson JK, A. V. (2009). Improving clinical handovers: creating local solutions for a global problem. . *Qual Saftey Health Care, 18*, 244-5.

KR Klein, D. B. (2005). The Use of Trained Observers as an Evaluation Tool for a Multi-Hospital Bioterrorism Exercise. *Prehospital and Disaster Medicine*, 159-63.

Li P, S. H. (2011). A prospective observational study of physican handoff for intensie-care unit to ward patient transfers. *American Journal of Medicine* , 860-7.

R Habicht, L. B. (2016). Assessing intern handover process. *Clinical Teaching*, 187-91.

V Arora, J. J. (2005). Communication failures in patient sign-out and suggestions for improvement: a critical incident analysis. *Qual Saf Health Care*, 401-407.

Ye K, M. T. (2007). Handover in the emergency department: deficiencies and adverse effect. *Emerg Med Australias*, 433-41.