Summer 8-20-2017

A Standardized Electronic Handover Report for Anesthesia Providers

Amber Kristine Lindsay
DePaul University, amk.schmidt@gmail.com

Elisa Rue
DePaul University, asarue@gmail.com

A Standardized Electronic Handover Report for Anesthesia Providers

Amber Lindsay, RN, BSN and Elisa Rue, RN, BSN

DePaul University, School of Nursing, Doctor of Nursing Practice Program

NorthShore University HealthSystem, School of Nurse Anesthesia

May 15, 2017

Table of Contents

Abstract……3
Introduction
Background and Significance of the problem…….....……...…….5
The Problem Statement……7
Purpose of Study…….…….8
Clinical Questions……8
Literature Review
Handovers: Standardization……..…….……..8
Handovers: Electronic Tools……...11
Conceptual Framework……..13
Study Design……..……14
Ethical Consideration…….14
Risks and Benefits……...16
Phase 1 Evaluation of Preliminary AHR
Methods……...16
Results……...….18
Discussion……..20
Phase 2 Evaluation of Finalized AHR
Methods……..21
Results……....23
Discussion……..……27
Phase 3 Uptake of AHR
Methods……...31
Results……31
Discussion……..32
Anesthetic Implications…….……35
Direction for Future Research……36
Conclusion…….37
References……..38
Table 1. Evidence-based Table on Studies Relating to Handover.....…….…..…….42
Table 2. Demographic Variables of Study Participants…….47
Table 3. Descriptive Anesthesia Handover Survey Results……..…….48
Table 4. Fisher's Exact Test Results……..49
Table 5. Mann-Whitney U-Test Results……50
Table 6. Item-total Statistics……..51
Figure 1. Graph of Descriptive Anesthesia Handover Survey Results……..52
Figure 2. Weekly Anesthesia Handoff Event Report …….....53
Appendix A. Recruitment Email – Expert Sampling Group ……..54
Appendix B. Expert Sampling Group Questionnaire……..……55
Appendix C. Recruitment Email – All Anesthesia Providers……..…….....56
Appendix D. Information Sheet……...…….…….....57
Appendix E. Anesthesia Handover Survey……..……59
Appendix F. CITI Certificates……... …...……..……...……...……...61
Appendix G. IRB Approval Letters (NorthShore and DePaul Universities)….....69
Appendix H. AHR Cheat Sheet…….……...71

Abstract

Background: Numerous studies and agencies have recommended the standardization of handovers to improve the quality and safety of patient care. Intraoperative anesthesia handovers remain unstandardized at many institutions.

Objectives: The purposes of this study were to 1) develop a preliminary Anesthesia Handover Report (AHR) and evaluate its accessibility, layout, and content using feedback from an Expert Sampling Group; 2) create a finalized AHR and evaluate the impact it had on the perceived quality of handover among anesthesia providers; and 3) to assess the uptake of the finalized AHR.

Methods: This study was implemented at NorthShore University Health System (NSUHS), Evanston, Highland Park and Glenbrook locations. The study utilized a post-test design. In Phase 1, an Expert Sampling Group evaluated a preliminary AHR for its accessibility, layout and content. Study investigators used the feedback gained during Phase 1 to develop the finalized AHR. In Phase 2, all anesthesia providers at the three study locations were invited to utilize and evaluate the finalized AHR when giving intraoperative anesthesia handovers. In Phase 3, use of the finalized AHR was queried twice a week for the duration of Phase 2 to assess uptake.

Results: Five anesthesia providers completed the Expert Sampling Group Questionnaire in Phase 1. Changes made to the preliminary AHR in response to feedback from the Expert Sampling Group included the removal of redundant information, more appropriate layout of information in the sidebar, the addition of total drug dose given in the medications panel, an additional hyperlink to anesthesia nerve block reports, and corrections to wrong information being pulled into the AHR. 21 anesthesia providers used the AHR and completed the Anesthesia Handover Survey in Phase 2, which evaluated the perceived handover conduct, teamwork, and

quality. The overall mean Likert score for handover conduct was 3.72 with a SD of .475 (minimum 2, maximum 4), this indicated that overall the majority of the respondents perceived that the AHR improved the conduct component of handover. The overall mean Likert score for teamwork was 3.76, with a SD of .432 (minimum 3, maximum 4), indicating that respondents felt the AHR improved teamwork during handover. Lastly, the mean Likert score for the handover quality was 3.64 with a SD of .611 (minimum 1, maximum 4), indicating respondents felt the AHR improved overall handover quality. Results of Phase 3 indicated the uptake did not increase as expected over the six-week monitoring window but rather peaked during week four and quickly dropped off thereafter. The mean number of times the "Anesthesia Handoff" button was clicked each week was 3.17.

Conclusions: The use of the AHR improved the perceived conduct, teamwork, and quality of anesthesia handovers. The use of the AHR did not improve over time. Overall, use of the AHR improved the perceived quality of anesthesia handovers. Future studies should be done to determine if use of the AHR would result in the standardization of anesthesia handovers.

Introduction

Background and Significance of the Problem

The American Association of Nurse Anesthetists (AANA) recommends all nurse anesthetists follow the standards of practice published by AANA (2013). According to Standard VII, the nurse anesthetist is required to provide a handover that accurately reports the "patient's condition, including all essential information, and transfer the responsibility of care to another qualified healthcare provider in a manner that assures continuity of care and patient safety" (AANA, 2013, p. 2). The Joint Commission Center for Transforming Healthcare (2014) defines handover as:

> A transfer and acceptance of patient care responsibility achieved through effective communication. It's a real-time process of passing patient-specific information from one caregiver to another or from one team of caregivers to another for the purpose of ensuring the continuity and safety of the patient's care (para 1).

Despite the AANA standard of practice, ineffective communication between health care professionals has been recognized as one of the leading causes of errors and handovers, and are no longer seen as "care-neutral events" (Hyder et al., 2016, p.141). Handover of patient care is a time when critical details may be lost resulting in delays, inefficiencies, adverse events, increased length of stay, increased costs or even patient harm (Joint Commission Center for Transforming Healthcare, 2014).

In its groundbreaking report, Crossing the Quality Chasm, the Institute of Medicine (2001) stated that one of the first breakdowns in patient safety occurs during handovers. In 2006, as part of its National Patient Safety Goals, the Joint Commission (2007) published recommendations for patient safety that included the standardized handover of care. Despite this

recommendation, in 2012 the Joint Commission (2015) continued to cite breakdown in communication to be responsible for up to 80% of hospital sentinel events and 91% of anesthesia-related sentinel events.

The preoperative, intraoperative, and postoperative periods are complex environments that involve multiple providers who interact with the patient. Typically, one surgical team provides care to the patient during all aspects of the operative period. However, the anesthesia profession utilizes a care team model that allows for several anesthesia providers to participate in a single patient's surgery. The care team often consists of different types of anesthesia providers, namely anesthesiologists, certified registered nurse anesthetists (CRNAs), resident anesthesiologists, and student registered nurse anesthetists (SRNAs). Owing to breaks, meals and the end of shifts, multiple anesthesia providers may provide care to a single patient in this period; consequently, multiple anesthesia handovers may occur during a single operative case. A recent study by Hyder et al. (2016) has shown a positive correlation between the number of anesthesia providers and postoperative complications. Hart and Owen (2005) found that the breakdown in communication during patient handover is due to the lack of standardization of the handover. Additionally, Wright (2013) states that when "information and processes are standardized, variation, and all of its unknown consequences, is minimized" (p. 231).

Currently, no universally accepted standardized handover exists among anesthesia providers. To address this issue, The Joint Commission Center for Transforming Healthcare (2014) identified root causes for breakdown in communication during handover, which included ineffective communication methods and inaccurate or incomplete information provided. The Targeted Solutions Tool for Hand-off Communication was developed and identified solutions to target these root causes, which included development of a standardized tool, method, or form to

be used every time a handover occurs and to identify new and existing technologies to assist in making handover efficient and complete. Despite this recommendation, many anesthesia providers have yet to adopt a standardized handover.

The Problem Statement

Gibney, Lee, Feczko, and Florez (2016) conducted a needs assessment among anesthesia providers at NorthShore University HealthSystem (NSUHS), Evanston Hospital for the development of an anesthesia handover tool. The results of this survey indicated that 64.6% of respondents did not currently have a standardized process for anesthesia handover and that 73.2% of the time they felt that sometimes, most of the time, or always were given inadequate information (Gibney et al., 2016). The study investigators concluded that most respondents perceived anesthesia handovers as inadequate.

Despite hospitals investing in electronic health records (EHRs) with the goal of improving safety, quality, efficiency, and cost-savings, handovers have remained a major source of breakdown in communication, leading to adverse outcomes (Patterson, 2012). Wright (2013) stated that:

> The use of an effective communication tool or checklist by anesthesia providers actively engaged in the transfer of care could enable the incoming anesthetist to adapt more readily to the new environment through a purposeful orientation directed at the salient components of the anesthetic and patient condition (p. 225).

To improve the quality of anesthesia care, the primary goal in the development of a Anesthesia Handover Report (AHR) was to determine if the use of the standardized report would improve the perceived quality of anesthesia handovers.

Purpose of the Study

The purposes of this study were to 1) develop a preliminary AHR based on data collected by Gibney and colleagues in 2016, and evaluate its accessibility, layout, and content using feedback from an Expert Sampling Group, 2) create a finalized AHR and evaluate the impact it had on the perceived quality of handover among anesthesia providers and 3) to assess the uptake of the finalized AHR. Findings of this project identified if the use of the AHR improved the perceived quality of anesthesia handover and if use of the AHR increased over time.

Clinical Questions

The following clinical questions were addressed through this research:

- What is the usability and acceptability rate of the AHR during transfer of care in the intraoperative period among anesthesia providers?
- Does a standardized AHR in the EHR improve anesthesia provider perceptions of conduct, teamwork, and quality of handover communication?
- What is the rate of uptake for the AHR post implementation?

Literature Review

Prior to designing this study, a comprehensive review of existing literature was performed. The academic search engines used were CINAHL and PubMed. Key words used were: *anesthesia*, *handoff(s)*, *hand off(s)*, *handover(s)*, *hand over(s)*, *sign out(s)*, *transition(s)*, *electronic medical record(s)*, *electronic health record(s), patient safety*, and *quality*. Only recently published studies (2011 to present) from peer-reviewed journals were included in the literature review. Effects of the standardization of handovers and the use of the electronic handovers were reviewed.

Handovers: Standardization

Until recently, the safety of anesthesia handovers had not been well documented. Several recent reports have identified a positive relationship between the number of anesthesia providers during a case and postoperative complications (Hudson et al., 2015; Hyder et al., 2016; Saager et al., 2014). Each anesthesia care transition may result in up to an 8% increased risk of major in-hospital morbidity and mortality (Saager et al., 2014, p. 695). Hudson et al. (2015) reported that anesthesia handovers during cardiac surgery were associated with a 43% increased risk of mortality and a 27% increased risk of major complications (p. 15). These findings have challenged the long-held assumption that anesthesia handovers are care neutral events (Hyder et al., 2016).

Loss of information during non-standardized intraoperative anesthesia handover is one potential cause for the direct association between number of anesthesia providers and postoperative complications. Non-standardized handovers result in critical information being lost, which result in an increased risk for "delays, inefficiencies, suboptimal care, or patient harm" (Saager et al., 2014, p. 695). Intraoperative anesthesia handovers are strongly associated with worse patient outcomes, suggesting that standardizing or reducing the number of handovers would clearly result in improved patient outcomes (Saager et al., 2014).

Jayaswal et al. (2011) reported that the communication skills of the provider are one of the major limiting factors in the quality of non-standardized anesthesia handovers. However, human errors and poor communication skills may be eliminated during anesthesia handovers by the implementation of standardized checklist tools (Wright, 2013). In their survey evaluating non-standardized handovers among anesthesia providers, Jayaswal et al. (2011) found 84% provided and 57% received an incomplete handover within the past year and 25% reported an adverse patient outcome due to an inadequate handover. Similarly, Gibney et al. (2016) reported

64.6% of anesthesia providers did not use a standardized handover process; consequently, most providers felt they were given an inadequate handover.

To attenuate the problems associated with non-standardized anesthesia handovers, Abraham, Kannampallil, Patel, Almoosa, and Patel (2012) performed a study that compared two handover tools. This study was based on the hypothesis that adequate handovers would result in effective and safe transitions in patient care. The control was the existing handover tool, which utilized the problem-based SOAP note. This tool was compared to the proposed HAND-IT tool, which was a body-systems based checklist developed by the authors. The authors found that the HAND-IT checklist tool prevented information and decision making mistakes, ensured the continuity of care, and was more resilient to the effects of breakdowns in communication (Abraham et al., 2012).

Several recent studies support the standardization of handovers to improve quality of care (Boat & Spaeth, 2013; Starmer et al., 2013). In 2013, Starmer et al. conducted a study that investigated whether the introduction of a handover bundle would decrease medical errors and preventable adverse events among hospitalized children. The authors concluded there was a direct relationship between the standardization of handover and patient morbidity and mortality (Starmer et al., 2013).

With the recent mandates to transition from paper records to an EHR, the EHR has created seemingly limitless access to patient information not only within a hospital but also between hospitals. However, despite this increased access to patient information, finding all the relevant information has remained difficult during paper-based anesthesia handovers. Manual compilation of the relevant patient information from the EHR has remained one of the major downfalls to paper-based handovers (Abraham et al., 2012). Electronic handover tools that

automatically query information from the patients record would attenuate this problem and have the potential to dramatically improve anesthesia handovers.

Handovers: Electronic Tools

Many dollars have been invested by health systems to transition to EHR with the goal of improving efficiency, accuracy, and safety. Despite this advancement, handovers are still identified as a major source of breakdown in communication. EHRs have a wealth of information about a patient. They optimize documentation and record keeping, but fare less helpful when it comes to collecting the pertinent data to "tell the story" or "paint a picture" on the patient. In addition, users of current EHR systems are unable to share subjective data, such as opinions or warnings. These limitations by EHRs for the use of handovers have led to the development of electronic handover tools (Flemming & Hübner, 2013).

During handovers, technology should not be used to replace verbal handover. Rather, technology should be used to support the outgoing provider to allow them to concisely communicate all the pertinent information and help the incoming provider to quickly capture the clinical case (Flemming, Paul, & Hübner, 2014). In their multi-case study, Randell, Wilson, and Woodward (2011) concluded that the failures of verbal handover could be compensated using an electronic handover tool. Some of the benefits included automatic importation of pertinent patient information (i.e., name, sex, age, weight, diagnosis, allergies, medications, numerical data, problem list), reduced of reliance of human memory, aided in work management, and improved the efficiency and structure of the verbal exchange (Patterson, 2016).

In a study conducted by Raval et al. (2015), an EHR-based handover and rounding tool resutled in improved workflow, communication, quality and continuity of care. Agarwala, Firth, Albrecht, Warren, and Musch (2015) found that the use of an electronic checklist during

permanent intraoperative handovers by anesthesia providers resulted in improved communication and retention of information. Specifically, the percentage of handovers in which the details of medication administration was discussed increased from 44% to 85% for vasopressors, from 15% to 46% for anti-emetics, and from 63% to 97% for antibiotics (Agarwala et al., 2015). Use of an electronic checklist also resulted in a larger percentage of anesthesiologists who could recall critical information after the handover occurred, as well as the type of antibiotics given and the amount of muscle relaxant and fluids administered. The authors also found the use of this voluntary electronic checklist increased over time, which suggested the perception of the tool improved. In addition, communication between the anesthesia team and operative team improved. Most notably, respondents reported an increased satisfaction with communication quality and were more able to identify perioperative concerns (Agarwala et al., 2015).

Flemming and Hübner's (2013) literature review concluded the use of an electronic handover tool improved retention of information by providers, demonstrated less missing data, and provided more accurate and up-to-date information. Subjective findings included increased perceived quality and safety of handover, decreased perception of inadequate or incorrect information being given, and overall resulted in greater satisfaction with the handover process and the quality of information received. Lastly, improvement of physician communication and continuity of care was noted.

Despite awareness of communication breakdowns during handovers and the implementation of the EHR, there has remained limited data on the practical use of EHR for patient handover. Flemming and Hübner (2013) conducted a systematic literature review aiming to answer how electronic handover tools can overcome errors and their consequences. They

concluded that an electronic handover tool should be implemented with the intent to achieve:

- access to up-to-date and complete data, i.e., patient details;
- visualization of the pertinent data, i.e., the full clinical case;
- presentation of the information to give support to cognitive processes, e.g., perception, memory, clinical decision making; and
- stimulation of social interaction, including communication, to achieve a common understanding and thereby establish continuity of care (Flemming & Hübner, 2013, p. 588).

In summary, current literature supports improved handover communication and patient care using an electronic, standardized handover process among anesthesia providers (Table 1). Although advances in EHRs have been made to improve patient safety, this resource has not been fully utilized to improve anesthesia handovers. As concluded by Flemming and Hübner (2013) EHRs play an important role in documenting and structuring patient details but continue to fail in capturing the "full story" to better aid in provider handovers. More studies are needed to better analyze how handover tools through the EHR can be utilized to achieve these outcomes.

Conceptual Framework

A conceptual framework was utilized to facilitate the identification and categorization of the various steps of this study. Using the Donabedian Quality Framework, the studies' structure, process and outcome were identified as shown below. This framework guided the development of this study by ensuring the study investigators remained focused on the desired outcome.

The Structure	***The Process***	***The Outcome***
NSUHS in Evanston, Glenview, and Highland Park, Illinois	Implement standardized AHR to be used during intraoperative anesthesia handovers	Improved perception of quality of intraoperative anesthesia handovers

Study Design

This study was implemented at NSUHS at the Evanston, Highland Park and Glenbrook locations. It utilized a post-test only study design where the quality of handover was evaluated following the implementation of the AHR within the EHR. This study was conducted in three phases. In Phase 1, the Expert Sampling Group evaluated the layout, content, and accessibility of the preliminary AHR using a brief questionnaire (Appendix B, Expert Sampling Group Questionnaire). The feedback gained from this questionnaire was used to create a finalized AHR. Phase 2 utilized a prospective, descriptive survey to evaluate the impact the finalized AHR had on the perceived quality of handover among anesthesia providers at the study locations (Appendix E, Anesthesia Handover Survey). In Phase 3, the study investigators tracked the use of the AHR using the Anesthesia Handoff Event Report that had been built into the EHR. The primary goal of this study was to determine if use of the novel AHR built into the EHR would improve the perceived quality of anesthesia handovers. Copies of IRB approval forms from the NSUHS and DePaul University can be found in Appendix G. The preliminary AHR was designed by the study investigators with the technical assistance of Alvin Medina, RN, MSN of the Health Information Technology (HIT) department at NSUHS. Upon IRB approval, A. Medina implemented this report into the live environment of the EHR.

Ethical Consideration

The IRB at NSUHS and DePaul University reviewed and approved this study prior to its implementation (Appendix G). The investigators obtained a Waiver of Documentation of Informed Consent from the IRB's at NSUHS and DePaul University. Written consent was not required for this study because the procedures investigated in this study, namely the handover of patient care using information gathered from the EHR, was something already performed daily

by anesthesia providers at the NSUHS. Current anesthesia handovers do not require written consent by the participants. This study investigated whether the use of the AHR contained within the EHR improved the quality of anesthesia handovers.

Participation in this study was voluntary. Numerous steps were taken in the design of this study to ensure participant anonymity. The investigators never had access to any to participant contact information. To help ensure this, the Faculty Advisor sent all electronic communications to the prospective participants of this study for Phases 1 and 2. The Faculty Advisor did not directly recruit but rather distributed the emails for Phases 1 and 2. The Faculty Advisor removed all identifying information from correspondence before compiling and sending data to the investigators for Phase 1 of study. The Anesthesia Handover Survey did not contain any identifying information. Participants could both obtain and return the Anesthesia Handover Surveys anonymously in the designated envelopes located in the anesthesia workrooms. Participants could complete the Anesthesia Handover Survey at any point during Phase 2 of the study. Only the investigators had access to the data obtained from the survey. Collected Anesthesia Handover Surveys were destroyed once data analysis completed. In Phase 3, no identifying information about the patients, anesthesia provider, or surgeon were included in the Anesthesia Handoff Event Report.

The Faculty Advisor, study investigators, and HIT specialist were trained on human subject protections by the Collaborative Institutional Training Initiative (CITI) and completed the Financial Conflict of Interest (FCOI) module on DevelopU at NSUHS. CITI training for investigator E. Rue was completed on May 15, 2016, and FCOI was completed on August 25, 2016. CITI training for investigator A. Lindsay was completed on May 10, 2016 and FCOI was completed on October 7, 2016. CITI training for faculty advisor, Julia Feczko, was completed

on September 28, 2016 and FCOI was completed on August 21, 2014. CITI training for HIT specialist, A. Medina, was completed on October 31, 2016 and FCOI was completed on October 14, 2016. See Appendix F for copies of the CITI certificates for E. Rue, A. Lindsay and A. Medina.

Risks and Benefits

This study presented no more than minimal risk to the participants. The probability of harm or discomfort in this research was not greater than encountered in daily life as an anesthesia provider. There were no physical or psychological risks associated with this study and the participants were not asked to perform anything that could cause physical or psychological harm. The investigators did not have access to any participant identifying or contact information during this study. Participants were anonymous to the investigators. Participation in this study was voluntary. Potential benefits of this study included the development of a standardized AHR and improved perceived quality of anesthesia handovers.

Phase 1 Evaluation of Preliminary AHR

Methods

Handover Report Development. Pucher, Johnston, Aggarwal, Arora and Darzi (2015) concluded that the identification of the essential elements of handovers is imperative to ensure continuity of care. Following this directive, one of the first steps taken in this study was to identify the essential components of an anesthesia handover. In 2016, Gibney et al., performed a needs assessment which included anesthesia providers at NSUHS. The providers ranked importance of the twelve components of the PATIENT protocol developed by Wright (2013). Based on this ranking, Gibney et al., (2016) identified nine essential features of anesthesia handovers, which were: airway type, airway difficulty, allergies, analgesia, anesthetic,

intravenous access, medical history, procedure, and vital signs. Guided by the conclusions from Gibney et al. (2016), the AHR for this study was designed by the study investigators. The AHR was implemented into the EHR by HIT specialist A. Medina. Any financial burden associated with the development of this report was carried by the anesthesia department at NSUHS.

Project Implementation. The objective of Phase 1 was to evaluate the accessibility, layout and content of the preliminary AHR using the Expert Sampling Group Questionnaire (Appendix B). The study investigators developed the questionnaire and the Faculty Advisor distributed the it to an Expert Sampling Group of anesthesia providers who work at the NSUHS Evanston, Highland Park, and Glenbrook locations. The Expert Sampling Group Questionnaire used was adapted from Wright's (2013) questionnaire. Wright (2013) validated this questionnaire using the input of an expert panel of one administrator, two academicians, and two anesthesia providers.

The study investigators and committee members hand-selected the participants of the Expert Sampling Group. This group consisted of a purposive sample of five anesthesiologists and five CRNAs practicing at NSUHS, and covered the three study locations. Purposive sampling is a sampling technique in which the researchers selectively choose members of a population that are of interest and will best enable the researchers to answer the research question. Some advantages of purposive sampling are it allows researchers to generalize from the sample being studied and it is time-effective (Laerd Dissertation, 2012). There are different types of purposive sampling techniques that can be used, for this study, expert sampling was chosen. Expert sampling was used because the study investigators needed to gather knowledge from individuals with a particular expertise, in this case anesthesia handovers (Laerd Dissertation, 2012). It was felt that an expert sampling of five anesthesiologists and five CRNAs

who practiced at NSUHS was a representative sample that would provide sufficient feedback to create the finalized AHR.

Upon IRB approval from NSUHS and DePaul University, the preliminary AHR was built into the live environment of the EHR. The Faculty Advisor sent the recruitment email (Appendix A) and the Expert Sampling Group Questionnaire (Appendix B) to the Expert Sampling Group. During Phase 1, the Expert Sampling Group reviewed the preliminary AHR and provided feedback via the Expert Sampling Group Questionnaire. Instructions to access the AHR were included on the Expert Sampling Group Questionnaire. The Expert Sampling Group participants emailed their completed questionnaire to the Faculty Advisor, who compiled the data, deleted any identifying information, and then forwarded it to the study investigators. The study investigators did not have access to any participant contact information. Phase 1 began January 3, 2017 and ended January 12, 2017.

Data Analysis. No statistical data analysis was required for Phase 1 of the study. The compiled questionnaires were reviewed by the study investigators and changes were made to the preliminary AHR to create the finalized AHR.

Results

The Expert Sampling Group Questionnaire consisted of four open-ended questions that looked at the accessibility, layout, and content of the report, as well as an additional question for suggestions. Ten anesthesia providers were invited to participate in the Expert Sampling Group; however, only five providers completed the questionnaire.

The first question asked if the report was easily accessible. Overall, the responses indicated that the report was easy to find. One responded that the sidebar was hard to find at first but very easy thereafter. Another responded they had to use the mouse to hit the sidebar, versus

finger on the touch screen, because the sidebar button was so small. Due to the limitations in the EHR, the sidebar could not be made larger or a different color to help it stand out more.

The second question asked about the layout of the report. Responses included moving some of the hyperlinks to the bottom of the report and having the lab values panel and blood transfusion panel next to each other. The hyperlinks were moved to the bottom of the report, lab values and blood transfusion panels were rearranged so they were next to each other.

In addition, three of the five responses indicated panel 1 information was redundant, which included procedure, diagnosis, surgeon, and anesthesia provider. Panel 1 was removed from the report.

The third question asked if the content of the report enabled adequate handover. One response indicated the report was too busy, while another said there wasn't enough information. Requests for additional information included a post-operative surgical report, last time a dose was given, total dose of medications given, and nerve block reports. Lastly, one response indicated the antibiotic information that was pulling through the report was incorrect. Due to the limitations in the EHR, HIT was unable to insert post-operative surgical reports. After experimenting with different options, it was decided not to include the last time a dose was given because it changed the format of the panels and made them look too busy and difficult to read. HIT added a column for total dose of medications given, a hyperlink to nerve block reports, and resolved the issue of incorrect antibiotic information pulling through the report.

The fourth question was open ended and asked for additional comments/suggestions. There was one suggestion to add an "Anesthesia Handoff" event button at the end of the report to allow users to click and therefore mark on the intra-operative record that an anesthesia handover had taken place. This was a feature that had been unsuccessfully attempted during the design of

the preliminary AHR. Due to limitations in the EHR, the "Anesthesia Handoff" event button was unable to be added in the report.

Discussion

The five anesthesiologists and five CRNAs who were hand selected to participate in the Expert Sampling Group were providers who held leadership roles, provided anesthesia daily, and were interested in research. The goal was to receive feedback from all ten providers, but only five completed Expert Sampling Group Questionnaires were returned. The information disseminated to them was through one email and they were given ten days to respond. To increase participation, a second recruitment email could have been sent or the timeline could have been extended; however, due to time constraints for this study, extending the timeline was not a possibility.

The study investigators and HIT specialist worked closely to make the requested changes in the AHR, but the complexities of the EHR made some changes impossible. Requests for changes made by the Expert Sampling Group that were not able to be changed included: a larger sidebar button to make it easier to open/close the report, changing the color of the sidebar button to help make it stand out, insertion of a hyperlink to the post-operative surgical report, adding a column for last time dose was given in the medications panel, and adding an "Anesthesia Handoff" event button at the end of the report. Major changes made to the AHR in response to feedback from the Expert Sampling Group included the removal of redundant information, more appropriate layout of information in the sidebar, the addition of total drug dose given in the medications panel, an additional hyperlink to anesthesia nerve block reports, and corrections to wrong information being pulled into the AHR. These revisions to the AHR and re-uploading it live into the EHR took two weeks.

Phase 2 Evaluation of Finalized AHR

Methods

Project Implementation. The finalized AHR was implemented into the live intraoperative EHR on February 1, 2017. Once the AHR was live, all anesthesia providers within the NSUHS, Evanston, Highland Park, and Glenbrook locations had access. The Faculty Advisor sent a recruitment email (Appendix C) and Information Sheet (Appendix D) to anesthesia providers at NSUHS who worked at the study locations. The Information Sheet included instructions to access the AHR.

All 140 anesthesia providers at the three study locations were invited to participate in the study. Inclusion criteria for participation in Phase 2 included anesthesia providers who were: English-speaking, legally licensed to provide anesthesia in the state of Illinois, currently practicing anesthesia at NSUHS, Evanston, Highland Park or Glenbrook locations, and had utilized the AHR. Exclusion criteria included anesthesia providers who were: non-English speaking, not licensed to practice anesthesia in the state of Illinois, not currently practicing anesthesia at NSUHS, Evanston, Highland Park or Glenbrook locations, or had not utilized the AHR.

Paper Anesthesia Handover Surveys (Appendix E) were in the anesthesia workroom of each respective NSUHS location in a manila envelope labeled "Anesthesia Handover Surveys – Blank". To ensure anonymity, the Anesthesia Handover Survey did not contain any identifying information. Participants completed the Anesthesia Handover Survey at any point during Phase 2 of the study, approximately six weeks. Participants were instructed to submit completed Anesthesia Handover Surveys to the designated manila envelopes labeled "Anesthesia Handover Survey – Completed" located in the anesthesia workrooms of each location. The investigators

collected the completed surveys biweekly. Only the investigators had access to the data obtained from the survey. Collected Anesthesia Handover Surveys were destroyed once data analysis was complete.

Anesthesia Handover Survey. The Anesthesia Handover Survey (Appendix E) used in Phase 2 to evaluate the AHR had two sections. The first section contained multiple-choice questions regarding demographics of participants. Information collected in this section included: anesthesia role, length of time providing anesthesia, hours spent per week providing anesthesia, gender, and ethnic origin.

The second section of the Anesthesia Handover Survey was modified from the Handover Quality Rating Form (HQRF) developed at the University of Aberdeen in the United Kingdom (Manser, Foster, Gisin, Jaeckel, & Ummenhofer, 2010). The HQRF was developed to measure the quality of handover as a self-assessment by healthcare providers. The HQRF was used during 126 patient handovers, in three different clinical handover settings: 1) paramedics to emergency room staff, 2) anesthesia care provider to post-anesthesia care unit staff, and 3) post-anesthesia care unit staff to floor nurse staff. Each handover was assessed immediately by three raters: 1) outgoing provider, 2) incoming provider, and 3) a human factors observer. For the purposes of this study, the HQRF was modified to answer statements regarding the following handover characteristics: conduct, teamwork and handover quality.

During its development, Manser et al. (2010) performed correlation and multiple regression analysis to ensure all three factors of the HQRF survey (i.e., information transfer, working atmosphere, and shared understanding) had good predictive validity. However, Manser et al. (2010) had not confirmed the reliability of the HQRF. Reliability was confirmed by the study investigators, using the results of Phase 2.

Data analysis. The investigators input raw data from the paper Anesthesia Handover Surveys into the Statistical Packages for the Social Sciences (SPSS) software version 22 (International Business Machines, 2017). Descriptive statistics were used to describe and summarize data. Frequencies, means and standard deviation (SD) were reported for the outcome variables.

Results

Completed Anesthesia Handover Surveys (N = 21) were collected and analyzed. The first five questions of the survey collected demographic information on the participants. The second half of the survey consisted of participant responses to 14 statements regarding the handover conduct, teamwork and overall quality of the anesthesia handover. To ensure the Anesthesia Handover Survey used in this study was reliable, a Cronbach Alpha coefficient was calculated based on the results. Because statements 3, 12, and 13 were written in reverse language, they were reverse coded when calculating the Cronbach Alpha. The Cronbach Alpha coefficient for the 14 item Anesthesia Handover Survey was calculated at .742, indicating excellent reliability of the tool (Table 6).

The demographic information of the 21 study participants has been summarized in Table 2. Most participants were either SRNAs or CRNAs (76.2%, 16 out of 21) versus residents or anesthesiologists (23.8%, 5 out of 21). More than half of the participants were female (71.4%, 15 out of 21) and identified themselves as White (90.5%, 19 out of 21). The majority had greater than one year of experience providing anesthesia (61.9%, 13 out of 21) and on average spent more than 12 hours a week providing anesthesia (90.5%, 19 out of 21).

The fourteen statements that comprised the second half of the Anesthesia Handover Survey assessed participant's perception of conduct, teamwork and the quality of the handover

after using the AHR. Responses to statements were rated on a Likert scale: 1 (disagree), 2 (partially disagree), 3 (partially agree), and 4 (agree). Results have been summarized in Table 3.

To assess the conduct of the handover, participants were asked to respond to the following eight statements:

1. Handover followed a logical structure
2. The AHR sidebar was used to structure the handover when either giving or receiving report on the patient
3. Not enough time was allowed
4. In case of interruptions during handover, attempts were made to minimize them
5. All relevant information was selected and communicated
6. Priorities for further treatment were addressed
7. The person providing the handover clearly communication her/his assessment of the patient
8. Possible risks and complications were discussed

In response to whether the AHR followed a logical structure, the majority (N = 18, 81%) of participants "agreed" and one participant (4.8%) "partially agreed," while one participant (4.8%) "partially disagreed" (mean Likert score 3.67, minimum 2, maximum 4, SD .730). In response to whether the AHR sidebar was used, the majority (N = 18, 85.7%) of participants "agreed" while 14.3% (N = 3) "partially agreed" (mean Likert score 3.86, minimum 3, maximum 4, SD .359). In response to whether enough time was allowed, 57.1% (N = 12) "agreed" while 42.9% (N = 9) "partially agreed" (mean Likert score 3.57, minimum 3, maximum 4, SD .507). In the case of interruptions during handover, 61.9% (N = 13) "agreed" and 38.1% (N = 8) "partially agreed" that attempts were made to minimize them (mean 3.62, minimum 3, maximum 4, SD

.498). 71.4% (N = 15) of participants "agreed" that all relevant information was selected and communicated, while 28.6% (N = 6) "partially agreed" with this statement (mean Likert score 3.71, minimum 3, maximum 4, SD .463). 66.7% (N = 14) of participants "agreed" that the AHR allowed priorities for further treatment to be addressed, while 33.3% (N = 7) "partially agreed" (mean Likert score 3.67, minimum 3, maximum 4, SD .483). The majority of participants (95.2%, N = 20) "agreed" that the person providing the handover clearly communicated their assessment of the patient, while one participant (4.8%) "partially agreed" (mean Likert score 3.95, minimum 3, maximum 4, SD .218). 81% (N = 17) of participants "agreed" that possible risks and complications were discussed during handover, while three participants (14.3%) "partially agreed" and one participant (4.8%) "partially disagreed" (mean Likert score 3.76, minimum 2, maximum 4, SD .539). The overall mean Likert score for handover conduct was 3.72 with a SD of .475 (minimum 2, maximum 4).

To assess teamwork during anesthesia handover, participants were asked to respond to the following two statements:

9. Questions and ambiguities were resolved
10. Team jointly ensured that the handover was complete

In response to whether questions and ambiguities were resolved, the majority (71.4%, N = 15) "agreed" and 28.6% (N = 6) "partially agreed" (mean Likert score 3.71, minimum 3, maximum 4, SD .463). Similar results were found with the second statement, where 81% (N = 17) "agreed" the team jointly ensured handover was complete and 19% (N = 4) "partially agreed" with this statement (mean Likert score 3.81, minimum 3, maximum 4, SD .402). The overall mean Likert score for teamwork was 3.76, with a SD of .432 (minimum 3, maximum 4).

To assess the quality of handover, participants were asked to respond to the following four statements:

11. Documentation was complete
12. There was too much information in the electronic AHR sidebar
13. Too much information was asked for
14. Overall, the quality of handover was very high when using the electronic AHR

The mean Likert score for the handover conduct section was 3.64 with a SD of .611 (minimum 1, maximum 4). 85.7% (N = 18) of participants "agreed" documentation was complete while the remaining three participants (14.3%) "partially agreed" with this statement (mean Likert score 3.86, minimum 3, maximum 4, SD .359). Fourteen participants (66.7%) "agreed" the AHR contained the right amount of information, three participants (14.3%) "partially agreed," three participants (14.3%) "partially disagreed," and one participant (4.8%) "disagreed" (mean Likert score 3.43, minimum 1, maximum 4, SD .926). Thirteen participants (61.9%) "agreed" that handover using he AHR gave enough information, while six participants (28.6%) "partially agreed," and two participants (9.5%) "partially disagreed" (mean Likert score 3.43, minimum 2, maximum 4, SD .680). Lastly, 19 participants (90.5%) "agreed" that use of the AHR resulted in high quality of handover, while one participant (4.8%) "partially agreed" and one participant (4.8%) "partially disagreed" (mean Likert score 3.86, minimum 2, maximum 4, SD .478).

The chi-squared test was not performed because the data did not meet all the three assumptions of this test, specifically some of the frequencies were less than five. As an alternative to the chi-squared test, the Fisher's exact test was used for data analysis because was an ideal test for small sample sizes and small frequencies. The five demographic characteristics were analyzed against each statement on the Anesthesia Handover Survey to determine if any

results were statistically significant ($p < 0.05$). Since none of the p values generated by the Fisher's exact test were less than 0.05, it can be concluded that there is no association between demographics and answers provided on the Anesthesia Handover Survey (Table 4). The Fisher's exact test could not be calculated for five statements on the Anesthesia Handover Survey because responses had greater than two groups (disagree, partially disagree, partially agree or agree).

An independent *t* test was not performed because the data did not meet all three required assumptions; specifically, test variables were not normally distributed. As an alternative to the independent t test, the Mann-Whitney u-test was used to determine whether a relationship existed between the demographic characteristics and the test variables. Data analysis indicated that there was no demographic characteristic associated with any statement on the Anesthesia Handover Report (Table 5). Additionally, two of the demographic characteristics, years in anesthesia and hours worked per week, were unable to be analyzed, as these characteristics were not ordinal.

Discussion

The objective of Phase 2 was to evaluate the impact the AHR had on the perceived quality of handover among anesthesia providers. Overall, analysis of the Anesthesia Handover Survey results indicated that the AHR improved the perceived conduct, teamwork and quality of anesthesia handovers.

The conduct section of the Anesthesia Handover Survey consisted of eight statements that looked at the structure, use, amount of time, interruptions, information, priorities, clarity and anesthetic risks. For the handover conduct section, the mean Likert score was 3.72 and mean SD was .475, this indicated that overall the majority of the respondents perceived that the AHR improved the conduct component of handover. However, as seen on Figure 1, two statements

had markedly greater variability: statement 1 “handover followed a logical structure” and statement 8 “possible risks and complications were discussed.”

The mean Likert score for statement 1 was 3.67 with a mean SD of .730, this indicated the majority of respondents felt the AHR followed a logical structure. Although 85.8% (N = 18) either “agreed” or “partially agreed” that the handover followed a logical structure, three participants (14.3%) “partially disagreed” which resulted in greater variability (.730). The AHR was structured to aid the outgoing provider in relaying information in chronological order (i.e., pre-operative information, intra-operative information, post-operative information). The layout of the AHR was specifically addressed in the Phase 1 Expert Sampling Group Questionnaire and revisions were made to the layout of the AHR based on the feedback gained from this questionnaire. The study investigators realized the layout of the AHR would be in a different order than what some providers are accustomed to following. However, as the literature review indicated, the benefit in creating a standardized anesthesia handover outweighed the potential discomfort some providers might feel when changing their routine anesthesia handover.

The mean Likert score for statement 8 was 3.76 with a mean SD of .539, this indicated the majority of respondents felt strongly that the AHR allowed for possible risks and complications to be discussed during handover, however there was a good deal of variability. While the majority of participants (95.3%, N = 20) either “agreed” or “partially agreed” that possible risk and complications were discussed, one participant (4.8%) “partially disagreed” to this statement, this resulted in a SD of .539. Perhaps a reason for the variability in this answer comes from the fact that the AHR does not have a specific section dedicated to risks and complications. So although the AHR might have prompted discussion of risks and complications (resulting in a high mean score), it was not explicitly included (resulting in high variability). The

addition of a free text box titled “risks and complications” could have been added to the AHR to specifically spur this discussion between anesthesia providers.

The handover conduct statements that received mean Likert scores above average (3.72) included the following:

- the AHR sidebar was used to structure the handover when either giving or receiving report on the patient (mean 3.86),
- the person providing the handover clearly communicated her/his assessment of the patient (mean 3.95), and
- possible risks and complications were discussed (mean 3.76).

The overall goal of Phase 2 of this study was to determine if the AHR would positively impact the perceived quality of handover. Statement 7 (“The person providing the handover clearly communicated her/his assessment of the patient”) received the highest mean score (3.95) of the conduct section. This is highly encouraging because this statement mostly closely matched the Phase 2 goal and was also rated most highly.

The teamwork section of the survey consisted of two statements. The first statement referred to whether the report helped resolve questions and ambiguities, thus leading to improved communication and teamwork. The second statement sought to identify if the report helped ensure completeness of the handover. All participants either “agreed” or “partially agreed” to both statements regarding teamwork. These findings indicate the AHR included the necessary information and aided in prompting any questions or clarifications needed by the outgoing or incoming provider. In addition, use of the AHR helped the outgoing provider convey a handover that resulted in completeness of information as well as the incoming provider receiving a full

sense of the clinical picture. The overall high rating (3.76) and small SD (.432) indicated the respondents felt the AHR improved teamwork during handover.

The last section of the survey consisted of four statements that measured handover quality. Statements 12 and 13 provided a bit of a challenge for statistical analysis because they were written in reverse. These questions were aiming for a "disagree" response as opposed to an "agree" response. For example, statement 12 stated "there was too much information in the AHR sidebar" and statement 13 stated "too much information was asked for." If the quality of the handover report was high, respondents would disagree or strongly disagree with these statements, resulting in a lower mean Likert score. Although these 2 statement did indeed have the lowest mean Likert scores, they also had very high variability. This could be explained by the reverse language present in these 2 statements compared to the rest of the survey. For example, if a participant was responding "agree" or "strongly agree" to the first 11 statements, they might get to statement 12 and 13 and accidentally answer in a similar manner. The high variability (SD .926 for statement 12 and SD .680 for statement 13) in these statements might be explained by participant error; either that they read the statement wrong or they simply circled the incorrect response out of habit. To avoid this, it would have been clearer to have used the phrasing "the AHR contained the right amount of information" and "handover using the AHR gave enough information."

Despite the possible confusion over statements 12 and 13, the other two statements in this section of the survey had high mean scores and low variability. Statement 11 had a mean score of 3.86 indicating that the majority of respondents agreed that the AHR allowed for complete documentation. Statement 14 stated, "overall, the AHR resulted in high quality handover" and had a mean score of 3.86, indicating that most respondents agreed with this statement.

Phase 3 Uptake of AHR

Methods

Project Implementation. The final step of instructions for using the AHR directed the participant to click the "Anesthesia Handoff" button in the event tabs on the intraoperative EHR. The study's HIT provider set up an Anesthesia Handoff Event Report that automatically recorded information every time a provider clicked the "Anesthesia Handoff" button. Information in the Anesthesia Handoff Event Repot included the date of anesthetic, type of provider, and the number of times the "Anesthesia Handoff" event button was clicked. All anesthetic cases during Phase 2 where an anesthesia provider had the clicked "Anesthesia Handoff" event button were queried when the Anesthesia Handoff Event Report was run. No identifying information about the patients, anesthesia provider, or surgeon were included in the report.

Data analysis. The Anesthesia Handoff Event Report tallied how many times the "Anesthesia Handoff" button was clicked in the EHR. These numbers were graphed to better visualize trends and determine whether use of the report increased over time (Figure 2).

Results

Results of the report are illustrated in Figure 2. This graph indicated the uptake did not increase as expected over the six-week monitoring window but rather peaked during week four and quickly dropped off thereafter. The "Anesthesia Handoff" report button was clicked the least during weeks three and six, with one event. The mean number of times the "Anesthesia Handoff" button was clicked each week was 3.17.

Discussion

Phase 3 tracked the use of the AHR over the duration of Phase 2 (approximately six weeks). By doing this, the study investigators aimed to answer the third clinical question: What was the rate of uptake of the AHR post implementation? Specifically, the goal was for the use of the AHR to increase over time, illustrating buy-in from the anesthesia providers. The weekly audits depicted in Figure 2 demonstrated that the use of the AHR did not increase over time, but rather peaked during the fourth week of the study with eight "Anesthesia Handoff" events. This indicated minimal use of the "Handoff Event" button with wide variance from week to week. In the context of this study, the low mean indicated that the AHR was not well integrated into the standard of practice. One possible contributor to the low uptake of the AHR may have been the lack of an educational component to this study. Had the anesthesia providers at NSUHS been educated about the importance of a standardized anesthesia handover, the goals of implementation of a standardized AHR within the EHR, and tracking the use of the AHR was done via clicking the "Anesthesia Handoff" even button, results for phase 3 of this study might have improved. Due to limitations within the functionality of EPIC, it was impossible to track use of the AHR without providers actually clicking on the "Anesthesia Handoff" event button. In essence, providers could have been using the AHR quite frequently, but there was no proof of its use because the "Anesthesia Handoff" event button was never clicked. With more than 160 anesthetics being performed on average per day at NSUHS, it is hard to believe that the handoff report was only used approximately three times per week. An option for future study would be to provide education to the anesthesia providers as described above, then re-audit the Anesthesia Handoff Event Report.

Limitations

Due to the inherent complexity of the computerized charting system at the study locations, multiple limitations existed in the design of the AHR during Phase 1 of the study. Improvements suggested by the expert panel that weren't able to be implemented due to these functional limitations included an inability to make the sidebar button larger or a different color, inability to insert a post-operative surgical report, inability to include the last time a dose was given due to formatting changes, and the inability to add the "Anesthesia Handoff" event button at the end of the report.

The study's biggest limitation was lack of participation in completion of the Phase 2 survey. Twenty-one participants (15%) out of a sample size of 140 anesthesia providers completed the surveys. The goal was to have 50 completed surveys (36% participation). The small size prevented further statistical analysis, including Chi-square statistics for association of demographic factors and ordinal dependent outcomes of handover quality. In response to poor participation, the Faculty Advisor resent the Recruitment Email (Appendix D) to all anesthesia providers on March 1, 2017. In addition, an AHR Cheat Sheet (Appendix H) was created and conveniently placed in all the operating rooms next to the computers. This Cheat Sheet was only available during the last two weeks of the study period and therefore did not have the intended positive impact on use of the AHR. Had it been implemented prior to the start of data collection, the cheat sheet would have served as a prompt that increased education for the anesthesia providers, provided buy-in, and ultimately improved participation.

Considering the small participation size, three contributing factors were identified in the study design. The surveys were in paper format, which required participants to actively go to the designated location to obtain and return the Anesthesia Handover Surveys. A larger number of

blank surveys were missing than were completed, suggesting that participants may have obtained and even completed surveys but did not return them. This may have been prevented if the surveys were designed in an electronic rather than paper format, eliminating the need for participants to actively return completed surveys. Another issue identified was that the three locations selected for this study were also the primary clinical sites for a Doctor of Nursing Anesthesia program. Consequently, anesthesia providers at these sites had received numerous requests for study participation for other doctoral projects that involved surveys. Survey burnout may explain, in part, the low participation in this study. Lastly, the study design did not include an educational component. This limited the dissemination of information to the recruitment emails, Information Sheet, and AHR cheat sheet that had been included in the initial study design. In retrospect, an educational component could have been implemented during the monthly anesthesia provider meeting which would have helped create buy-in and increased participation.

In addition to issues concerning study design, two limitations were identified concerning the information gathered from the participants. First, because most participants were women, white, and either a SRNA or CRNA, the sample did not represent the characteristics of the locations studied nor anesthesia practice as a whole. This limits the generalizability of these study results. Second, the nature of using surveys in this study design lent itself to a self-reporting bias (Althubaiti, 2016). The two aspects of self-reporting bias that may have been encountered during this study include social desirability bias and recall bias. Social desirability bias is a participant's desire to partake in high quality handover and recall bias is a result of not completing the survey immediately after the handover occurred. In this study, these biases could

have influenced the results by participants answering the statement with the most desirable response or an inaccurate response.

The goal of Phase 3 was to track the use of the AHR during Phase 2. To track this, the Anesthesia Handoff Event Report was queried biweekly for the six-week study period of Phase 2. This report tallied the number of times the "Anesthesia Handoff" event button was clicked each day. Study participants were instructed to click the "Anesthesia Handoff" event button each time the AHR was used to provide or receive an anesthesia handover. This would indicate the AHR had been used during handover. Although these instructions were clearly conveyed to the study participants in the Information Sheet, the study investigators realized the AHR may have been used for handovers without this event button being clicked. It was not possible to track the use of the AHR without this event button being clicked. This suggested the rate of uptake of the AHR may have been higher than the Anesthesia Handoff Event Report indicated.

Anesthesia Implications

The design of the AHR evaluated in this study was guided by the essential features for anesthesia handovers identified by Gibney et al. (2016) in their needs assessment of anesthesia providers for the development on an anesthesia handover tool. In this study, performed at NSUHS in 2016, 73.2% of anesthesia providers indicated they felt that sometimes, most of the time, or always were given inadequate information during handovers (Gibney et al., 2016). After using the AHR developed for this study, 95% of anesthesia providers at the three NSUHS study locations either agreed or partially agreed that the AHR improved handover conduct, teamwork, and resulted in a high quality of handover. Despite the small sample size, the overall rating of the AHR pointed to the effectiveness of the report. The electronic AHR designed and

implemented in this study shows promise to improve the perceived quality of anesthesia handovers.

The Joint Commission Center for Transforming Healthcare (2014) cites ineffective communication method and inaccurate or incomplete information provided as the root causes for breakdown in communication during handover. The AHR presented in this study had means scores of 3.72 and 3.86 in the areas of conduct and quality, indicating that it could directly address the root causes identified by the Joint Commission. The AHR did not intent to replace verbal handover, but rather supported the outgoing provider to concisely communicate all the pertinent information and helped the incoming provider to quickly capture the clinical picture. The benefits of the AHR included easy access, automatic importation of pertinent information (i.e., airway difficulty, analgesia, intravenous access, medical history, surgical history, etc.) from the EHR, reduced reliance on human memory, and improved efficiency of anesthesia handover. Anesthesia departments should consider adopting this AHR as a standard of practice to promote safe, quality anesthesia care. In addition, Epic, the electronic heath record software this report was built in, should consider disseminating the AHR to anesthesia departments interested in standardizing anesthesia handover.

Direction for Future Research

The literature review completed for this study supported both the need for standardized anesthesia handovers and the use of EHRs to facilitate this standardization. The electronic AHR presented in this study should be implemented and evaluated in the future at a different study location with a larger participation size and less survey burnout among participants to allow for further statistical analysis and greater generalizability. Additionally, studies should be conducted to determine if this AHR resulted in a standardized anesthesia handover.

Conclusion

This study addressed the following clinical questions: did a standardized AHR in the EHR result in improved anesthesia provider perceptions of conduct, teamwork, and quality of handover and did the rate of uptake for the AHR improve over time? Phase 2 concluded the AHR did result in improved provider perception of conduct, teamwork, and quality of handover communication. Phase 3 concluded the rate of uptake for the AHR did not improve; however, rate of uptake may have been higher than indicated due to the event button having to be clicked in order to track it use. Lastly, the usability and acceptability rate of the AHR was not addressed directly. However, we can conclude the AHR was usable based on improved perception of handover while the acceptability rate was poor based on low uptake.

Despite recommendations made by various agencies and current evidence, no universally accepted standard for anesthesia handover exists. Consequently, anesthesia handovers remain a constant, lingering threat to anesthesia quality and patient safety. The AHR was designed and implemented in response to the study by Gibney et al. (2016) that concluded anesthesia providers at NSUHS perceived both their peers and themselves as currently providing inadequate handoff. The findings in this study indicated the perceived of quality handover at NSUHS improved as a result of using the AHR. Future studies should be done to determine if use of the AHR results in standardization of anesthesia handovers and helps facilitate safe, quality anesthesia care.

References

Abraham, J., Kannampallil, T., Patel, B., Almoosa, K., & Patel, V. (2012). Ensuring patient safety in care transitions: An empirical evaluation of a handoff intervention tool. *American Medical Informatics Association Annual Symposium Proceedings, 2012*(2012), 17-26.

Agarwala, A., Firth, P., Albrecht, M., Warren, L., & Musch, G. (2015). An electronic checklist improves transfer and retention of critical information at intraoperative handoff of care. *Anesthesia & Analgesia, 120*(1), 96-104. doi:10.1213/ANE.0000000000000506

Althubaiti, A. (2016). Information bias in health research: definition, pitfalls, and adjustment methods. *Journal of Multidisciplinary Healthcare, 9*, 211- 217. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4862344/

American Association of Nurse Anesthetists. (2013). *Scope and Standards for Nurse Anesthesia Practice*. Retrieved on April 25, 2016, from http://www.aana.com/resources2/professionalpractice/Documents/PPM%20Standards%20for%20Nurse%20Anesthesia%20Practice.pdf

Boat, A.C., & Spaeth, J.P. (2013). Handoff checklists improve the reliability of patient handoffs in the operating room and postanesthesia care unit. *Pediatric Anesthesia, 23*(7), 647-654. doi:10.1111/pan.12199

Flemming, D. & Hübner, U. (2013). How to improve change of shift handovers and collaborative grounding what role does the electronic patient record system play? Results of a systematic literature review. *International Journal of Medical Informatics, 82(*7), 580-592. doi:10.1016/j.ijmedinf.2013.03.004

Flemming, D., Paul, M., & Hübner, U. (2014). Building a common ground on the clinical case: Design, implementation and evaluation of an information model for a handover EHR. *Studies in Health Technology and Informatics, 201*(1), 167-174. doi:10.3233/978-1-61499-415-2-167

Gibney, C., Lee, Y., Feczko, J., Florez. (2016). A needs assessment for the development of an anesthesia handoff tool. *DePaul University College of Science and Health Theses and Dissertations.*

Hart, E. & Owen, H. (2005). Errors and omissions in anesthesia: A pilot study using a pilot's checklist. *Anesthesia & Analgesia, 101*(1), 246-250.

Hudson, C., McDonald, B., Hudson, J., Tran, D., & Boodhwani, M. (2015). Impact of anesthetic handover on mortality and morbidity in cardiac surgery: A cohort study. *Journal of Cardiothoracic and Vascular Anesthesia, 29*(1), 11-16. doi:10.1053/j.jvca.2017.05.018

Hyder, J., Bohman, K., Kor, D., Subramanian, A., Bittner, E., Narr, B., …Montori, V. (2016). Anesthesia care transitions and risk of postoperative complications. *Anesthesia & Analgesia, 122*(1), 134-144. doi:10.1002/jhm.2023

Institute of Medicine. (2001). *Crossing the Quality Chasm: A New Health System for the 21st Century.* Washington D.C.: National Academies.

International Business Machines. (2017). *IBM SPSS statistics.* Retrieved from http://www.ibm.com/analytics/us/en/technology/spss/

Jayaswal, S., Berry, L., Leopold, R., Hart, S., Scuderi-Porter, H., DiGiovanni, N., & Phillips, N. (2011). Evaluating safety of handoffs between anesthesia care providers. *The Ochsner Journal, 11*(2), 99-101.

Laerd Dissertation. (2012). Purposive Sampling. *Lund Research Ltd.* Retrieved from http://dissertation.laerd.com/purposive-sampling.php

Manser, T., Foster, S., Gisin, S., Jaeckel, D., Ummenhofer, W. (2010). Assessing the quality of patient handoffs at care transitions. *British Medical Journal of Quality and Safety, 19*(6), 1-5. doi: 10.1136/qshc.2009.038430

Patterson, E. (2012). Technology support of the handover: promoting observability, flexibility, and efficiency [Supplement 1]. *British Medical Journal of Quality and Safety, 21*(Suppl 1), 19- 21. doi:10.1136/bmjqs-2012-001307

Pucher, P., Johnston, M., Aggarwal, R., Arora, S., & Darzi, A. (2015). Effectiveness of interventions to improve patient handover in surgery: A systematic review. *Surgery, 158*(1), 85- 95. doi:10.1016/j.surg.2015.02.017

Randell, R., Wilson, S., & Woodward, P. (2011). The importance of the verbal shift handover report: A multi-site case study. *International Journal of Medical Informatics, 80*(11), 803- 812. doi:10.1016/j.ijmedinf.2011.08.006

Raval, M.V., Rust, L., Thakkar, R., Kurtovic, K., Nwomeh, B., Besner, G., & Kenney, B. (2015). Development and implementation of an electronic health record generated surgical handoff and rounding tool. *Journal of Medical Systems, 39*(2), 8. doi:10.1007/s10916-015-0202-x

Saager, L., Hesler, B., You, J., Turan, A., Mascha, E., Sessler, D., & Kurz, A. (2014). Intraoperative transitions of anesthesia care and postoperative adverse outcomes. *Anesthesiology, 121*(4), 695-706. doi:10.1097/ALN.0000000000000401

Starmer, A., Sectish, T., Simon, D., Keohane, C., McSweeney, M., Chunk, E., Yoon, C., …Landrigan, C. (2013). Rates of medical errors and preventable adverse events among

hospitalized children following implementation of a resident handoff bundle. *Journal of the American Medical Association, 310*(21), 2262-2270. doi:10.1001/jama.2013.281961

The Joint Commission. (2007). *Improving America's hospitals: The Joint Commission's annual report on quality and safety*. Retrieved on April 25, 2016, from http://www.jointcommission.org/assets/1/6/2007_annual_report.pdf

The Joint Commission. (2015). *Sentinel event data- root causes by event type (2004-2015).* Retrieved on April 25, 2016, from http://www.jointcommission.org/assets/1/18/Root_Causes_by_Event_Type_2004-2015.pdf

The Joint Commission Center for Transforming Healthcare. (2014). *Improving transitions of care: Hand-off communications.* Retrieved on April 25, 2016, from http://www.centerfortransforminghealthcare.org/assets/4/6/handoff_comm_storyboard.pdf

Wright, S. M. (2013). Examining transfer of care processes in nurse anesthesia practice: Introducing the PATIENT protocol. *American Association of Nurse Anesthetist Journal, 81*(3), 225-232.

Table 1. Evidence-based Table on Studies Relating to Handover

Author (Year)	Study Design, Setting, Sample	Tools and Statistics Used	Findings	Conclusion
Abraham, Kannampallil, Patel, Almoosa, and Patel (2012)	Pre and post prospective study. Two handoff tools were evaluated, the HAND-IT (Handoff Intervention Tool) and the SOAP note. The SOAP note was problem based and the HAND-IT tool was based on a checklist body system format with a problem-case narrative approach. Team handoffs were done each morning. Immediately after the handoff, Multi-Professional Rounds (MPRs) were done to evaluate the quality and thoroughness of the handoff. The MPRs were attended by the MICU director, on-call physician, on-call resident and intern, patients' nurse, a pharmacist, a respiratory therapist and the first author. During the MPR, the handoff note (either HAND-IT or SOAP) was read aloud and omissions were discussed. Informal interviews with the participants were conducted following the MPR. For the first month, participants used the SOAP note for four days, followed by a five-day experimental stage using the SOAP note, the next three days MPRs were conducted after the morning team handoffs were completed. Following this, participants were trained on the HAND-IT tool. The HAND-IT tool was used for four days, followed by a five-day experimental period and then the next three days MPRs were conducted immediately after team handoffs. This same procedure was repeated the second month with a new MICU team, except the order was reversed so the HAND-IT tool was tested first followed by the SOAP note. Study setting was a large academic hospital in the Gulf Coast. Participants were physicians, clinical fellow, internal medicine residents, interns, respiratory therapists, a pharmacist and nurses in a 16-bed Medical Intensive Care Unit that was managed by intensivists. Study was conducted over 2 months in 2011.	Three measures were used to assess the efficiency of handoff documentation for each tool: number of information breakdowns, decision-making breakdowns, and expertise of the clinicians involved.	Significantly more information was missed using the SOAP note than when using the HAND-IT note: $M_{SOAP} = 12.5$, $M_{HAND-IT} = 2.8$, $t(18) = 5.98$, $p < 0.0001$. More incorrect information was conveyed when using the SOAP note than when using the HAND-IT note: $M_{SOAP} = 1.8$, $M_{HAND-IT} = 0.0$, $t(18) = 2.1$, $p < 0.05$. Significantly more anesthesiologist changes to plan of care were made when the SOAP note was used than when the HAND-IT note was used: Msoap = 4.0, Mhand-it = 0.8, $t(18) = 3.7$, $p < 0.001$. Significantly more problems list items were missed when the SOAP note was used as well: Msoap = 2.1, Mhand-it = 0.8, $t(18) = 1.93$, $p = 0.051$. Using a Poisson regression, the HAND-IT tool was more resilient because it required significantly more breakdowns before it resulting in missing information from the problem list. Effects of Experience: Using the regression model it was found that the HAND-IT tool improved the performance of interns, or providers with less experience.	Use of the HAND-IT tool for provider handoff had many benefits, namely it helped prevent information and decision making mistakes and supported education and learning. The authors also stated that by its design it helped to ensure care continuity.
Agarwala, Firth, Albrecht, Warren, and Musch (2015)	Prospective observational assessment. The authors developed an observational assessment tool. Sixteen days prior to implementation of the checklist the authors started to assess communication during handoffs.	Observational assessment tool designed to measure effectiveness of handoff. Tool was used for intervention and control group. Post handoff assessment tool was designed to measure satisfaction level of the handoff recipients. Departmental survey sent prior to	The use of the electronic checklist resulted in improved relay and retention of specific information and improved interpersonal communication. Authors found that satisfaction trended upward, but results were not statistically significant. Use of the	Use of an electronic checklist during permanent intraoperative handoff improved communication and relay and retention of information.

	An electronic checklist was then introduced. Use was voluntary. Authors continued to assess communication during handoffs approximately three months, both using and not using the new electronic checklist. Study was conducted at Massachusetts General Hospital in Boston, MA. All anesthesia staff involved in intraoperative handoffs were involved: residents, fellows, CRNAs and anesthesiologists.	and ten month after implementation of the electronic handoff.	checklist was associated with a statistically significant reduction in perception that handoff was rushed. Post-checklist surveys indicated that all providers had higher satisfaction with the quality of communication when the checklist was used.	
Boat and Spaeth (2013)	Two quality improvement projects to develop intraoperative and postoperative handoff checklists, with goal of standardization of handoff info. Study existing handoff processes, identify key components of handoff, development of standardized handoff checklist, implementation of handoff in OR's, checklist on 3x5 laminated card, ask if ready before initiating handoff For 3 weeks, CRNA's and fellows scored intraoperative handoffs based on whether the handoff occurred in the OR and key components of effective handoff.	Feedback from anesthesia & nursing staff were obtained prior to initiation of project and through the 6- month project period. "Reliability was defined as use of a standardized handoff tool and a handoff where both anesthesiologists were present in the operating room" (p. 648). Over a 5-months period, 8 plan-do-study-act (PDSA) cycles were utilized to refine the PACU handoff checklist.	Reliability of intraoperative anesthesia handoffs improved from 20% to 100% w/use of checklist. Reliability of PACU anesthesia handoff improved from 59% to 90%. Success of both projects was related to leadership w/in the anesthesia dept., providing the group frequent data regarding success of the project, and using small tests of change w/limited number of providers.	Acceptance of and adherence to the standardized handoff protocols dramatically increased the quality and reliability of the handoff process.
Flemming and Hübner (2013)	Systematic Review Research papers included empirical designs, observational studies, single group pre-, post-test, experimental trials and randomized and non-randomized controlled trials. Study was included if sample size was mentioned, and if there was a clear description of sample terms of who/what the units were and where they come from.	Searched MEDLINE, CINAHL, and COCHRANE. Searched keywords such as 'handover' 'shift report' and 'handoff' 'electronic medical record'. 519 articles from global search, 60 articles were included in the review.	Question 1: studies identified multiple sources for errors (i.e. barriers to access up-to-date and resident-specific information, lack of standardized procedures during handover, duplication of information, no clear path of gathering information, and insufficient preparation pre-handover. Consequences- delayed diagnoses, treatment, med errors, repeat tests, delays, & major harm. Question 2: verbal only or written w/o face-to-face was desirable. Structured handover results in more correct data, decrease preventable adverse events, communication support, shortened time to organize and prioritize work, significant increase in crucial medical info, improved structure, consistence, and overall quality of report. Question 3: electronic handover tool- decrease length of stay, less missing data, increase perceived quality, safety, & completeness, > user satisfaction, improved continuity of care. "computerized & discussed" ranked 1st, in-person second, "technology only" last. Question 4: only 2 studies, demonstrated existing EHR were not sufficiently supportive in handovers, due to the structure.	Recent significant increase of interest in nursing and physician handovers. Electronic handover, versus paper handover, provide more and better information to the teams involved. Quality of handover depends on structure, quantity & quality, as well as type of information (which is usually not all contained in EHR). Series of studied recommend handover tools being integrated into the EHR.

Flemming, Paul and Hübner (2014)	Comprehensive systematic literature review on handovers was done in order to develop a handover information model. Findings highlighted need for retrospective and prospective information and that documentation style of presenting information was insufficient. 120 clinical cases of a 650-bed hospital. 120 cases were split into 2 groups of equal size. Group 1: 60 cases from records, nursing and medical information extracted. Group 2: 90 patient handovers were observed, with medical and nursing information recorded. Duplicate cases were removed, leaving 60 cases.	Group 1: verified retrospective information available through paper-based patient records. Group 2: handovers observed to identify typical handover information, such as anticipatory guidance.	The concept of the handover EHR is an electronic tool that doesn't substitute direct personal communication. Architecture of handover EHR struction in 4 layers: persistent, semi-persistent, functional, and visualization layer. Persistent layer- data repository, objective clinical information. Semi persistent layer- subjective information, opinions warning and recommendations. Functional layer- all functions that handle or make use of information. Visualization layer- ensure appropriate method of presenting the information.	Handover EHR proved to be a helpful extension of existing EHR's.
Gibney. Lee, Feczko, and Florez (2016)	Descriptive survey. Convenience sample of 100 anesthesia providers practicing in the greater Chicago area. Inclusion criteria consisted of: English-speaking, legally permitted to provide anesthesia in Illinois, at least six months of anesthesia experience, and currently practicing anesthesia.	Survey used was the PATIENT protocol survey (Wright, 2013).	64.6% of respondents did not have a standardized method for handovers. 73.2% sometimes or always were given ineffective handovers. 51.2% sometimes or always gave inadequate handovers. 58.6% sometimes or always discovered something that was missing from the handover.	Most anesthesia providers perceive their current handovers as ineffective. The results of the study indicate that the critical components of an adequate handover include: airway difficulty, invasive lines, medical history, procedure specific concerns, allergies, medications given, and plan for the patient.
Hudson, McDonald, Hudson, Tran and Boodhwani (2015)	Single-center, prospective observational study All patients that had undergone cardiac procedures between April 1, 1999 and October 31, 2009 at the University of Ottawa Heart Institute.	Primary end-point was in-hospital mortality. Secondary end-point was major postoperative morbidity including: MI, CVA, prolonged mechanical ventilation >48hrs, AKI requiring CRRT.	14,421 patients met inclusion criteria. 966 cases involved anesthesia handovers. After propensity score matching, only 7,137 patients were included in the analysis. Mortality was 5.4% for the handover group and 4% for the non-handover group. Major morbidity was 18.5% in the handover group and only 15.6% in the non-handover group. The increased risks associated with anesthesia handovers was greatest in high-risk patients undergoing non-emergent surgery.	Anesthesia handovers were associated with a 43% increase in all-cause in-hospital mortality when compared to non-handover cases. Anesthesia handovers were associated with a 27% increase in major complications.
Hyder et al. (2016)	Prospective observational design. Study done in a single academic tertiary care center, the Mayo Clinic in Rochester, MN. Anesthesia practice is provided by anesthesiologists and CRNAs who have attended the same training institutions. Work environment such that there is minimal cross over between specialties. During time of study no standardized handoff protocol was in place. High-provider number was defined as 3 or more in-room providers and 2 or more anesthesiologists. Patient information was queried from the Mayo Clinic NSQIP data registry between 4/26/06 and 1/28/10 that had undergone an elective colorectal procedure with ASA < V, undergoing GA.	The primary end-point was any major complication and/or death within 30 days postoperatively. Major complications included death, acute renal failure, bleeding that required 4 or more transfusions less than 72 hours postoperatively, cardiac arrest resulting in CPR, coma of 24 hours or longer, MI, unplanned intubation, ventilator use for 48 hours or more, pneumonia, stroke, wound disruption, deep organ-space surgical site infection, superficial surgical site infection, sepsis, septic shock, systemic inflammatory response syndrome. DVT and PE were excluded.	All measurements of anesthesia provider numbers were associated with statistically significant increases in postoperative complications.	Positive relationship was found between the number of anesthesia providers involved in the care of a patient and postoperative complications, this challenges the long-held assumption that anesthesia handovers are care neutral.
Jayaswal et al. (2011)	Single-center, pre and post prospective study. Survey sent to all anesthesia providers asking about: handover effectiveness, best location for handovers, best method for handovers, and	Results from survey were compiled.	The pre-intervention survey indicated that 20% of anesthesia providers found the existing, non-standardized handover process ineffective. 89% felt that standardization would improve handovers. 62% stated handovers should be part of the	Authors stated the results of this study will aid them in current handover practices in effort to decrease patient complications as a result of poor handovers.

	whether they thought inclusion of the EMR would be beneficial. Surveys were sent to all anesthesia providers prior to implementation of an electronic handover. After implementation, anesthesia residents that had used the electronic handover were surveyed.		medical record.	
Patterson (2012)	Literature Review NA	Not addressed by author	3 recommendations were made "1) make common ground observable for both intended and unintended recipients, 2) allow a fleible narrative structure for human-human communications via the HIT and 3) to avoid reliance on real-time data entry during busy bottleneck time periods" (p. 21)	Implementation of the three recommendations will increase the observability, flexibility, and efficiency of patient handovers supported by health information technolocy
Pucher, Johnston, Aggarwal, Arora, and Darzi (2015)	Systematic Review Total of 19 studies included in the final data synthesis.	2 independent researchers conducted search. Searched Medline, EMBASE, and PsycInfo databases from inception to 2013. Studies included were those that reported effects of intervention designed to improve handoff, comparing outcomes between pre- and post intervention, or control and intervention, groups. The intervention described in each study was compared with SHARE domains of JCAHO guidelines.	Primary outcome of 15 studies was accuracy of information transfer. All studies reported significant improvements post-intervention. Interventions were groups into 2 categories: 1) standardized handover (information checklists or written or computer based), 2) formalization of standardized handover.	"The use of checklists to improve surgical handover appears promising but must be backed by robust study designs, relevant outcomes, and clinical implementation strategies to identify the most effective means to improve information transfer and optimize patient outcomes" (p.94). It is imperative to identify what elements of handovers are most crucial to ensure continuity of care.
Randell, Wilson, and Woodward (2011)	Multi-site case study- observations of 15 medical shift handovers and 33 nursing shift handovers across 3 sites. Qualitative data on handovers was collected via Involved observation and audio recording of shift handover (when consent was obtained from pts), and interviews. Site 1: 20- bed general medical ward Site 2: 28- bed in short stay ward Site 3: 11- bed pediatric surgical ward. Across 3 sites, 368 h of observations between May- Sept 2007.	Audio recording enabled detail of verbal handover to be gathered, and allowed researcher to focus on non-verbal interactions. Following each period of observation, field notes were written and audio recordings transcribed. Informal interviews were conducted to obtain explanations of activities.	Content of handovers was practically focused (i.e. tasks to be done). Feature of handover consistent of all 3 sites was ability of reporter to select the information that was relevant for the oncoming provider (i.e. meds, PMH). Handovers were problem focused (i.e. deviations from the norm, relevant concerns such as fluid management). handover is two-way communication. Handover is a time to chat, share experiences, discuss workload. Provides opportunity for teaching/identifying errors	Handover is an opportunity to learn from the previous shift and discuss with patients and their families. Technology should support verbal report.
Raval et al. (2015)	MAD list required manual input & is used to capture basic info, such as: room #, name, MRN, age, sex, anesthesiologist, date of admission, diagnoses, operations, medications, pertinent lab, antibiotics, diet, future plans. Rounding & handoff tool developed in EHR that pulled relevant demographic and clinical data for handoff. EHR captured same points as MAD list. 5 MAD lists were randomly sampled & abstracted for errors that were quantified and qualified. Focus was to identify errors of commission and omission of related items available in the EHR. Similar sampling of EHR- based lists was also performed. Survey sent to members primarily responsible for maintaining the list- interns, residents, fellows, and NP's.	Survey asked users to quantify time spent per week maintaining the list, to rate the list compared to other lists, rate efficiency, accuracy, and safety of the list, and to provide additional feedback. Likers-scale responses were tabulated and compared.	MAD list users spent 155.7 min/week managing the list, while EHR- based list users spent 112.6 min/week. MAD list 38% viewed good/very good, while EHR list 90% good/very good. MAD list 29% efficient, EHR 90% efficient. Similar trends regarding accuracy. Less than ½ users described MAD lists as quite safe or extremely safe, 86% of EHR users said it was safe/extremely safe.	EHR-based list can assist daily patient care, handoffs, and rounding- demonstrating improved accuracy and efficiency w/o compromising patient safety.
Saager et al.	Patient information was obtained	Handovers among/between	Higher incidence of experiencing	Intraoperative anesthesia care

(2014)	from Cleveland Clinic Perioperative Health Documentation System. Retrospective analyses- causality cannot be assumed. Assessed 138, 932 records between total number of anesthesia providers during a case and an adjusted collapsed composite of in-hospital mortality and major morbidities. A total of 135,810 patients were included in the analyses.	anesthesiologists, CRNA, residents and fellows were counted. Breaks less than 40 min were not counted as handover. Adjusted for severity of procedure as a continuous co-variable by using U.S. Agency for Healthcare Research & Quality single-level clinical classifications software for international classification of diseases.	major in-hospital mortality/morbidity (8.8, 11.6, 14.2, 17.0, 21.2% for pts with 0,1,2,3 and >4 transitions. More anesthesia handovers was associated with higher odds of experiencing cardiac, GI, bleeding, and infectious morbidities. Association between handovers and length of stay was not significant.	transitions are strongly associated with worse outcomes, with a similar effect size for anesthesiologists, residents, and CRNAs. Formal protocols for handovers or reducing number of care transitions would clearly improve patient outcomes.
Starmer et al. (2013)	Prospective intervention study- resident handoff bundle w/standardized communication and handoff training, mnemonic, and new team handoff structure. Handoff tool linked to the EHR. 1255 patient admissions, 84 resident physicians from July-September 2009 and November 2009- January 2010 on 2 inpatient units at Boston Children's Hospital.	Daily objective, comprehensive surveillance method to measure rates of medical errors and preventable adverse events. 2 researcher RNs reviewed all medical records and orders on the study units, collected daily error reports from clinicians, and reviewed formal incident reports. Each suspected incident was reviewed by physician investigators who were blinded to the study. Incident classified as adverse event (non-intercepted or intercepted), error w/little potential for harm, or exclusion. Preventability of adverse events was rated using 4-point Likert scale. Research assistant followed intern or resident and recorded start and stop times for activities using a time-motion database. Additional situational data was collecting during handoffs, including duration, interruptions, privacy, and ambient noise.	Medical errors decreased from 33.8 per 100 admissions to 18.3, preventable adverse events decreased from 3.3 per 100 admissions to 1.5, non-intercepted potential adverse events decreased from 7.3 per 100 admissions to 3.3. Intercepted adverse events decreased from 15.0 per 100 admissions to 8.3. Errors decreased from 8.3 to 5.2 per 100 admissions. Fewer omissions of key handoff elements, duration of verbal handoffs unchanged, handoffs more often occur in quiet area and in private, no change in time or interruptions. % time spent in contact with pts increased, time spent at computer decreased, and time creating/editing handoff tool decreased.	A handoff bundle was associated with a reduction in medical errors and preventable adverse events among hospitalized children. Improvements in verbal and written handoff processes occurred. Resident workflow didn't change adversely. Handoff quality improvement projects have potential for benefit.
Wright (2013)	Nonexperimental exploratory study. Phase 1: Expert panel and authors developed questionnaire regarding to be sent to practicing CRNAs regarding their current transfer of care practices. This survey helped authors understand current transfer of care processes, identify essential components, and assess the need for a standardized tool to help facilitate transfer of care. Phase 2: Authors and expert panel developed a transfer of care checklist based on survey results from phase 1 of study. Checklist was tested on pilot group of CRNAs. Following implementation and use of the tool the participants were asked to evaluate its effectiveness. Phase 1: Employed conservative assumptions of variance. Survey sent to convenience sample (active members of the Virginia Association of Nurse Anesthetists in Richmond as well as CRNAs who have attended regional continuing education conferences in past 5 years offered by the Nurse Anesthesiology Faculty Associates) of 1000 CRNAs practicing through the United States. 302 CRNAs responded (30.2%)	Outcomes were measured via descriptive statistics of multiple choice questions and qualitative measurements for open-ended questions.	Phase 1 Results: 302 CRNAs responded to survey, 30.2% response rate. Over half of respondents stated the following were important factors to communicate during transfer of care: patient medical/surgical history (95.7%), allergies (89.1%), information on airway difficulty (83.4%), fluids/urine output/blood loss (80.1%), narcotic administration (77.8%), procedure (75.2%), and IV access/lines (54.0%). Additionally, over half of respondents said the following factors would lead them to change their handoff practices: improvement in patient safety (77.4%), faster orientation to case (73.5%), utility (72.2%), organization (70.9%), and purposeful (57.6%). Phase 2: Authors had a 40.5% response rate of these, 87% liked the idea of adopting a standardized transfer of care. Additionally, the authors cite that all respondents felt that the PATIENT checklist tool provided an effective way to give handoff.	Checklist tools may aide providers in providing vital information to prevent human error, thus improving handovers of care.

	Phase 2: Pilot group consisted of convenience group of 74 CRNA providers at 2 large community hospitals and 1 large teaching hospital in central Virginia 30 of 74 CRNAs responded (40.5%) Both Phases: Did not include other anesthesia providers (anesthesiologists or residents) Power analysis was not cited as being used. Attrition was not addressed.			

Table 2. Demographic Variables of Study Participants

Variables	Frequency	Number (N)	Percent (%)
Role	Resident/Anesthesiologist	5	23.8
	CRNA/SRNA	16	76.2
	Total	21	100
Years providing anesthesia	Less than 1 year	8	38.1
	Greater than 1 year	13	61.9
	Total	21	100
Hours/week providing anesthesia	Less than 12 hours	2	9.5
	Greater than 12 hours	19	90.5
	Total	21	100
Gender	Male	6	28.6
	Female	15	71.4
	Total	21	100
Ethnicity	White	19	90.5
	Asian, Pacific Islander, native Hawaiian	2	9.5
	Total	21	100

Table 3. Descriptive Anesthesia Handover Survey Results

Handover Characteristics	Minimum Likert Score	Maximum Likert Score	Mean Likert Score	Standard Deviation	Frequency (N = 21, 100%)
Handover Conduct *(Mean 3.72, SD .475)*					
1.Handover followed a logical structure	2	4	3.67	.730	Partially Disagree (N = 3, 14.3%) Partially Agree (N = 1, 4.8%) Agree (N = 17, 81%)
2. The AHR sidebar was used to structure the handover when either giving or receiving report on the patient	3	4	3.86	.359	Partially Agree (N = 3, 14.3%) Agree (N = 18, 85.7%)
3. Not enough time was allowed	3	4	3.57	.507	Agree (N = 12, 57.1%) Partially Agree (N = 9, 42.9%)
4. In case of interruptions during handover, attempts were made to minimize them	3	4	3.62	.498	Partially Agree (N = 8, 38.1%) Agree (N = 13, 61.9%)
5. All relevant information was selected and communicated	3	4	3.71	.463	Partially Agree (N 6, 28.6%) Agree (N = 15, 71.4%)
6. Priorities for further treatment were addressed	3	4	3.67	.483	Partially Agree (N = 7, 33.3%) Agree (N = 14, 66.7%)
7. The person providing the handover clearly communicated her/his assessment of the patient	3	4	3.95	.218	Partially Agree (N = 1, 4.8%) Agree (N = 20, 95.2%)
8. Possible risks and complications were discussed	2	4	3.76	.539	Partially Disagree (N = 1, 4.8%) Partially Agree (N = 3, 14.3%) Agree (N = 17, 81%)
Teamwork *(Mean 3.76, SD .432)*					
9. Questions and ambiguities were resolved (active enquiry by the person taking on)	3	4	3.71	.463	Partially Agree (N = 6, 28.6%) Agree (N = 15, 71.4%)
10. Team jointly ensured that the handover was complete	3	4	3.81	.402	Partially Agree (N = 4, 19%) Agree (N = 17, 81%)
Handover Quality *(Mean 3.64, .611)*					
11. Documentation was complete	3	4	3.86	.359	Partially Agree (N = 3, 14.3%) Agree (N = 18, 85.7%)
12. There was too much information in the electronic AHR sidebar	1	4	3.43	.926	Agree (N = 14, 66.7%) Partially Agree (N = 3, 14.3%) Partially disagree (N = 3, 14.3%) Disagree (N = 1, 4.8%)
13. Too much information was asked for	2	4	3.43	.680	Agree (N = 13, 61.9%) Partially Agree (N = 6, 28.6%) Partially Disagree (N = 2, 9.5%)
14. Overall, the AHR resulted in high quality of handover	2	4	3.86	.478	Partially Disagree (N = 1, 4.8%) Partially Agree (N = 1, 4.8%) Agree (N = 19, 90.5%)

Table 4. Fisher's Exact Test Results

Test Variable	Role in Anesthesia	Years in Anesthesia	Hours/week providing anesthesia	Gender	Ethnicity
Handover Conduct					
1.Handover followed a logical structure	n/a	n/a	n/a	n/a	n/a
2.The AHR sidebar was used to structure the handover when either giving or receiving report on the patient	1.000	.257	1.000	.526	1.000
3.Not enough time was allowed	1.000	1.000	.486	1.000	.486
4. In case of interruptions during handover, attempts were made to minimize them	1.000	.646	1.000	1.000	.505
5. All relevant information was selected and communicated	.262	1.000	.071	.623	1.000
6. Priorities for further treatment addressed	.624	.656	.100	1.000	.533
7. The person providing the handover clearly communicated her/his assessment of the patient	1.000	1.000	1.00	1.000	1.000
8. Possible risks and complications were discussed	n/a	n/a	n/a	n/a	n/a
Teamwork					
9. Questions and ambiguities were resolved (active enquiry by the person taking on responsibility for the patient)	.262	.336	.500	1.000	.071
10. Team jointly ensured handover was complete	.532	1.000	.352	.544	.352
Handover Quality					
11. Documentation was complete	.549	.531	1.000	1.000	.271
12. There was too much information in the electronic AHR sidebar	n/a	n/a	n/a	n/a	n/a
13. Too much information was asked for	n/a	n/a	n/a	n/a	n/a
14. Overall, the quality of handover was very high when using the electronic AHR	n/a	n/a	n/a	n/a	n/a

H_0 = Demographic characteristics will not be significantly related to the test variables
H_A = Demographic characteristics will be significantly related to the test variables
α-level = .05
*n/a indicates requirements for Fisher's exact test not met (e.g., more than 2 categories)

Table 5. Mann-Whitney U-Test Results

Test Variable	Role in anesthesia	Gender	Ethnicity
Handover Conduct			
1.Handover followed a logical structure	.445	.569	.686
2.The AHR sidebar was used to structure the handover when either giving or receiving report on the patient	.842	.519	.771
3.Enough time was allowed	.905	.733	.343
4.In case of interruptions during handover, attempts were made to minimize them	1.000	.850	.400
5.All relevant information was selected and communicated	.240	.569	.533
6.Priorities for further treatment were addressed	.603	1.000	.467
7.The person providing the handover clearly communicated her/his assessment of the patient	.842	.850	1.000
8.Possible risks and complications were discussed	.445	.910	.533
Teamwork			
9.Questions and ambiguities were resolved (active enquiry by the person taking on responsibility for the patient)	.240	.850	.086
10.Team jointly ensured that the handover was complete	.445	.519	.467
Handover Quality			
11.Documentation was complete	.548	.910	.400
12.There was too much information in the electronic AHR sidebar	.153	.470	.467
13.Too much information was asked for	.109	.267	.400
14.Overall, the quality of handover was very high when using the electronic AHR	.719	.733	.857

H_0 = There will be no statistically significant difference in scores between the two groups
H_A = There will be a statistically significant difference in scores between the two groups
α-level = .05

Table 6. Item-Total Statistics

Test Variable	Mean	SD	N	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item – Total Correlation	Cronbach's Alpha if Item Deleted
Handover Conduct							
1.Handover followed a logical structure	3.67	.730	21	47.57	14.757	.690	.722
2. The AHR sidebar was used to structure the handover when either giving or receiving report on the patient	3.86	.359	21	47.81	12.662	.546	.702
3. Not enough time was allowed for the handover	3.57	.507	21	48.43	13.557	.171	.773
4. In case of interruptions during handover, attempts were made to minimize them	3.62	.498	21	47.95	15.048	.120	.751
5. All relevant information was selected and communicated	3.71	.463	21	47.81	14.762	.277	.734
6. Priorities for further treatment were addressed	3.67	.483	21	47.95	13.648	.443	.717
7. The person providing the handover clearly communicated her/his assessment of the patient	3.95	.218	21	47.57	15.557	.207	.740
8. Possible risks and complications were discussed	3.76	.539	21	47.76	13.590	.524	.710
Teamwork							
9. Questions and ambiguities were resolved (active enquiry by the person taking on responsibility for the patient)	3.71	.463	21	47.81	15.262	.134	.746
10. The team jointly ensured that the handover was complete	3.81	.402	21	47.71	14.814	.318	.732
Handover Quality							
11. Documentation was complete	3.86	.359	21	47.67	15.833	.000	.752
12. There was too much information in the electronic AHR sidebar	3.43	.926	21	48.10	11.090	.651	.681
13. Too much information was asked for	3.43	.680	21	48.00	12.600	.601	.696
14. Overall, the quality of handover was very high when using the electronic AHR	3.86	.478	21	47.67	13.333	.687	.698

Figure 1. Graph of Descriptive Anesthesia Handover Survey Results

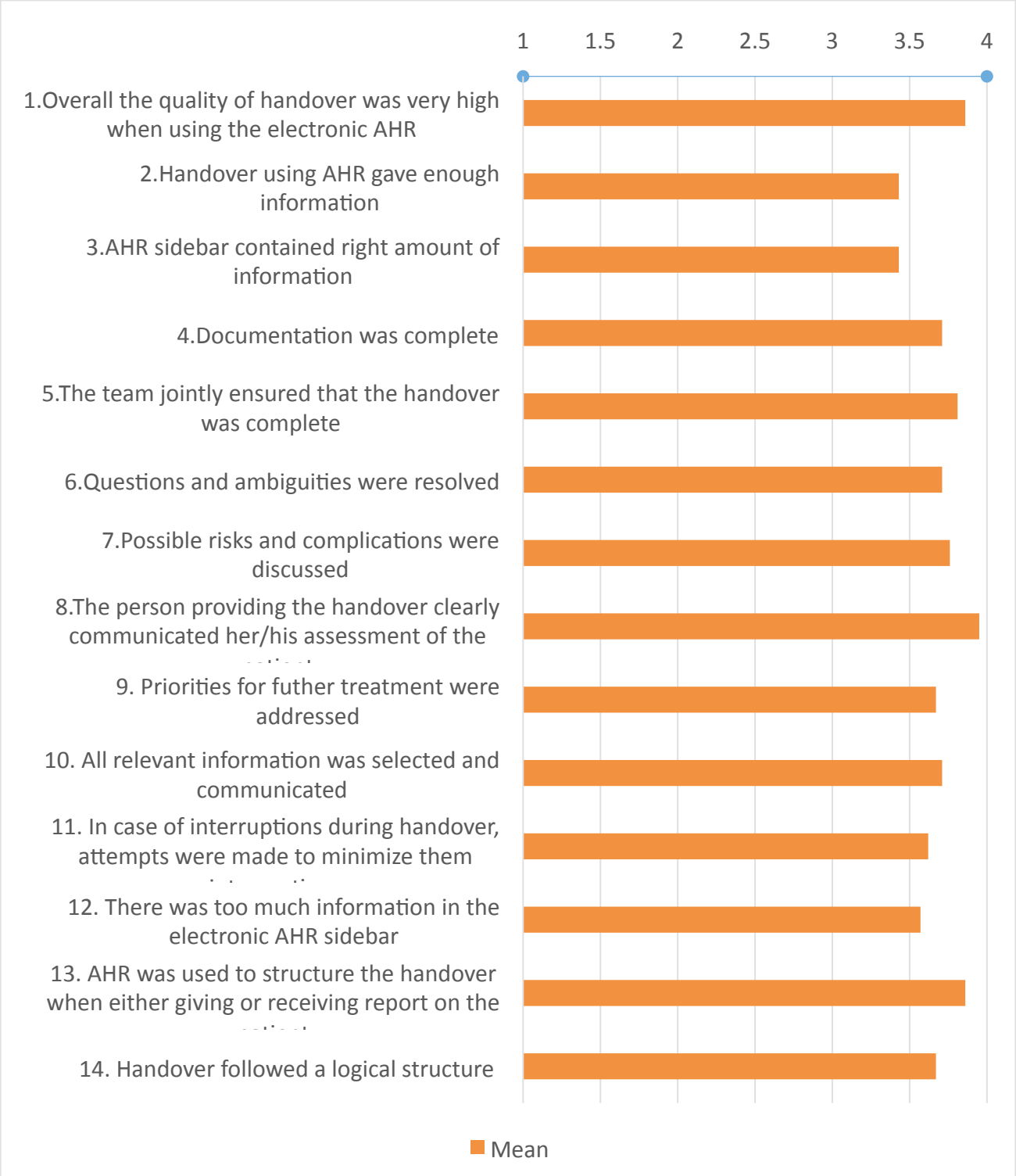
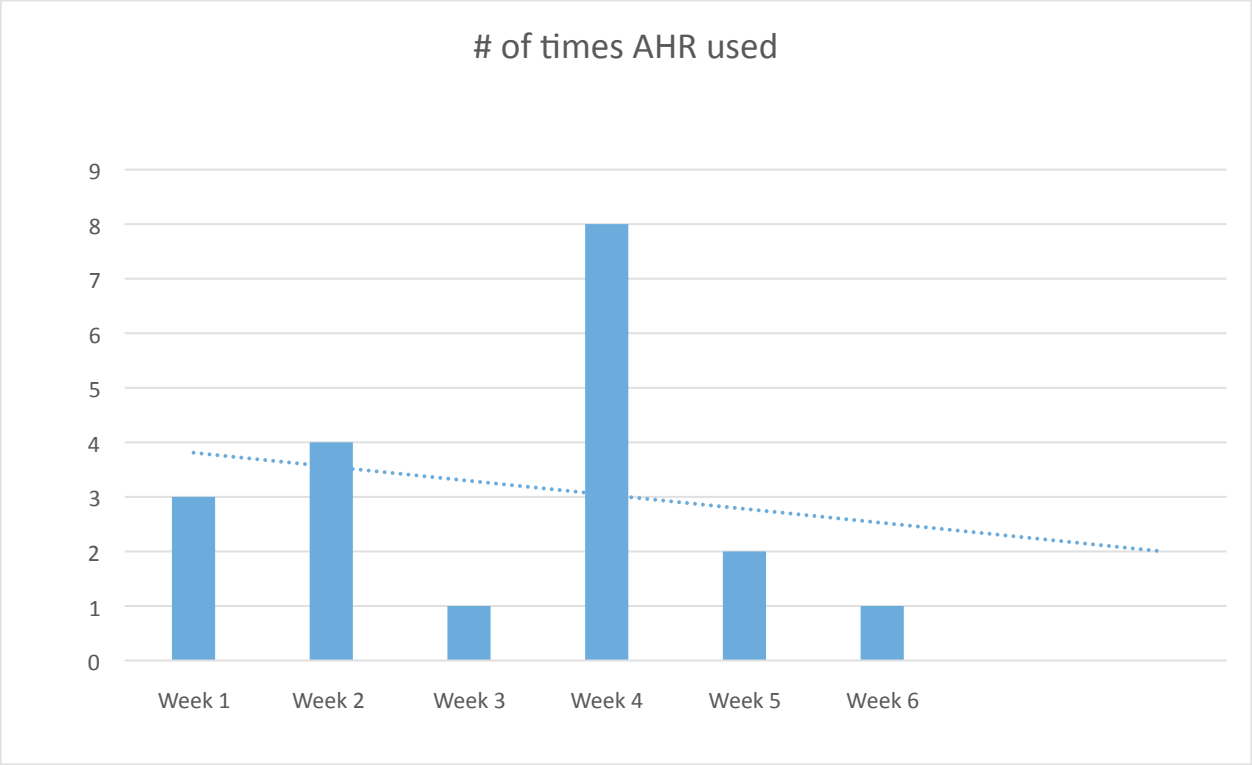


Figure 2. Weekly Anesthesia Handoff Event Report



Appendix A

Recruitment Email- Expert Sampling Group

Dear Anesthesia Provider,

Our names are Amber Lindsay, RN, BSN and Elisa Rue, RN, BSN. We are seniors at the School of Nurse Anesthesia, NorthShore University HealthSystem. We are conducting a research study for our Doctorate of Nursing Practice through DePaul University. With the support of Julia Feczko, DNP, CRNA, Mark Deshur, MD, the Health Information Technology department at NorthShore University HealthSystem, and a literature review, we have designed a preliminary AHR in the intraoperative electronic health record. As experts in the field of anesthesia, we are writing to invite you to participate in the first phase of our study, which utilizes an Expert Sampling Group to evaluate our preliminary AHR.

The purposes of this study are to 1) develop a preliminary AHR, to be based on data collected by Gibney and colleagues in 2016, and evaluate its accessibility, layout, and content using the expert sampling research method, 2) create the finalized AHR, based on feedback from the expert sampling group, and evaluate the impact the finalized AHR has on the perceived quality of handover communication among anesthesia providers and 3) to assess the uptake of the AHR. Findings of this project will identify if the use of the AHR enables standardization of handover among anesthesia providers, improves the perception of effective communication during handover, and if use of the report increases over time.

Participation in the expert sampling group is voluntary. You have the right to withdrawal at any time. You have the right to not answer any question(s) in the Expert Sampling Group Questionnaire. Submission of the questionnaire will constitute your understanding of voluntary agreement to participate. Your responses will be confidential and anonymous to both investigators. Questionnaire results will only be used by these investigators for the purposes of this study.

If you would like to participate, please review the attached document. Then email questionnaire answers to Julia Feczko, DNP, CRNA at JFeczko@northshore.org.

Thank you for your time and consideration.

Sincerely,

Amber Lindsay, RN, BSN
amk.schmidt@gmail.com

Elisa Rue, RN, BSN
elisamrue@gmail.com

Appendix B

Expert Sampling Group Questionnaire

Thank you for participating in evaluating the preliminary AHR in the intraoperative electronic health record. As experts in the field of anesthesia, we are seeking your feedback on this report. Based on your comments/concerns/suggestions, we will create the finalized AHR. This finalized report will "go live"" at NorthShore University HealthSystem, Evanston, Highland Park, and Glenbrook locations.

The preliminary AHR will be open for evaluation from 1/04/2017 to 1/13/2017. Please email the completed questionnaire to our Faculty Advisor, Julia Feczko, DNP, CRNA at JFeczko@northshore.org by 1/13/2017. Your responses will be anonymous to the primary researchers, Amber Lindsay, RN, BSN and Elisa Rue, RN, BSN, who will not have access to personal contact or identifying information.

Instructions to access and when to use the preliminary AHR:

- This report should be utilized during all intraoperative anesthesia handovers
- Login to EPIC, the electronic health record
- Highlight your patient, click the intraoperative navigator
- To open the sidebar: On the right side of the screen is a small arrow. Click on this small arrow to open the sidebar that contains the AHR. The sidebar will automatically open to this report.
    - If you do not close the sidebar prior to exiting a patients' chart, the sidebar will remain open when you open your next patients chart. If the sidebar is continuously open, you will need to refresh the report (upper right corner of report) prior to providing your next anesthesia handover.
- To close the sidebar: Click on the small arrow that's left of the sidebar.

Expert Sampling Group Questionnaire:

1. Was the AHR easily accessible? Please provide comments.

2. Was the layout of the AHR conducive for handover? Please provide comments.

3. Did the AHR contain the necessary content to provide adequate handover between anesthesia providers? Please provide comments.

4. Additional comments/suggestions:

Thank you for your time.

Appendix C

Recruitment Email- All Anesthesia Providers

Dear Anesthesia Provider,

Our names are Amber Lindsay, RN, BSN and Elisa Rue, RN, BSN. We are senior nurse anesthesia students at the School of Nurse Anesthesia, NorthShore University HealthSystem. We are conducting a study for our Doctorate of Nursing Practice through DePaul University. With the support of Julia Feczko, DNP, CRNA, Mark Deshur, MD, the Health Information Technology department at NorthShore University HealthSystem, and a literature review, we have designed an AHR in the intraoperative electronic health record. We are writing to invite you to participate in the second phase of our study, which aims to improve perceived satisfaction of information transfer during intraoperative anesthesia handovers.

The purposes of this study are to 1) develop a preliminary AHR, to be based on data collected by Gibney and colleagues in 2016, and evaluate its accessibility, layout, and content using the expert sampling research method, 2) create the finalized AHR, based on feedback from the expert sampling group, and evaluate the impact the finalized AHR has on the perceived quality of handover communication among anesthesia providers and 3) to assess the uptake of the AHR. Findings of this project will identify if the use of the AHR enables standardization of handover among anesthesia providers, improves the perception of effective communication during handover, and if use of the report increases over time.

If you agree to participate in this study you will be asked to use the AHR and then complete the Anesthesia Handover Survey to evaluate the perceived satisfaction of information transfer during intraoperative anesthesia handovers. This survey will be available in the anesthesia offices at Evanston, Highland Park, and Glenbrook locations in the manila envelope labeled “Anesthesia Handover Survey – Blank”. Anesthesia Handover Surveys will be available between 2/1/2017 to 3/15/2017.

Use of the AHR is voluntary. Participation in this study is voluntary, confidential and anonymous. Participation in this study will not affect your employment at NorthShore University HealthSystem. You have the right to withdrawal at any time. You have the right to not answer any question(s) in the survey. Submission of the survey will constitute your understanding of informed consent and voluntary agreement to participate in the study. Survey results will only be used by these investigators for the purposes of this study. Data will be secured in a locked cabinet at the School of Nurse Anesthesia, NorthShore University HealthSystem and destroyed upon completion of the doctoral project.

Please see the attached Information Sheet for more information. Thank you for your time and consideration.

Sincerely,

Amber Lindsay
amk.schmidt@gmail.com

Elisa Rue
elisamrue@gmail.com

Appendix D

Information Sheet for Participation in Research Study

A STANDARDIZED ELECTRONIC HANDOVER REPORT FOR ANESTHESIA PROVIDERS

Researchers: Amber Lindsay, RN, DNP Candidate, Nurse Anesthesia Trainee and Elisa Rue, RN, DNP Candidate, Nurse Anesthesia Trainee

Institution: NorthShore University HealthSystem, Evanston, IL and DePaul University, Chicago, IL

Faculty Advisor: Julia Feczko, DNP, CRNA, School of Nurse Anesthesia, Department of Anesthesia, NorthShore University HealthSystem, Evanston, IL

Collaborators: Mark Deshur, MD, Anesthesiologist, Department of Anesthesia, NorthShore University HealthSystem, Evanston, IL

Our names are Amber Lindsay and Elisa Rue. We are senior nurse anesthesia students at NorthShore University HealthSystem School of Nurse Anesthesia. We are conducting a study for our Doctorate of Nursing Practice through DePaul University. With the support of Julia Feczko, DNP, CRNA, Mark Deshur, MD, the Health Information Technology department at NorthShore University HealthSystem, and a literature review, we have designed an AHR in the intraoperative electronic health record.

In 2016, Courtney Gibney, DNP (Alumni, NorthShore University HealthSystem School of Nurse Anesthesia) conducted a Needs Assessment at NorthShore University HealthSystem, Evanston Hospital in 2016. Her study concluded the perception of quality among anesthesia providers is poor. In response, we are developing an AHR in hopes to improve the perceived quality of handovers at NorthShore University HealthSystem. Intended use of the AHR is to support the outgoing provider to allow him/her to concisely communicate all the pertinent information and help the incoming provider capture the clinical case.

We are seeking participants for this study who are English-speaking, legally licensed to provide anesthesia in the state of Illinois, are currently practicing anesthesia at NorthShore University HealthSystem in Evanston, Glenview, or Highland Park, and *have utilized the AHR in the intraoperative electronic health record.*

Instructions to access and when to use the preliminary AHR:

- This report should be utilized during all intraoperative anesthesia handovers
- Login to EPIC, the electronic health record
- Highlight your patient, click the intraoperative navigator
- To open the sidebar: On the right side of the screen is a small arrow. Click on this small arrow to open the sidebar that contains the AHR. The sidebar will automatically open to this report.
    - If you do not close the sidebar prior to exiting a patients' chart, the sidebar will remain open when you open your next patients chart. If the sidebar is continuously open, you will need to refresh the report (upper right corner of report) prior to providing your next anesthesia handover.
- To close the sidebar: Click on the small arrow, that is now to the left of the sidebar.
- To mark your use of the AHR, click "Anesthesia Handoff" in the events tab.

Upon implementation of the AHR we will be using the Anesthesia Handover Survey to evaluate the perceived satisfaction of information transfer during intraoperative anesthesia handovers. This survey will be available in the anesthesia offices at Evanston, Highland Park, and Glenbrook locations in the manila envelope labeled "Anesthesia Handover Survey – Blank". Anesthesia Handover Surveys will be available between 2/1/2017 to 3/15/2017.

Participation in the study is voluntary, confidential and anonymous. To ensure anonymity, the survey does not contain any identifying information. Consent to participate is implied once the survey is submitted. Participation will not affect your employment at NorthShore University HealthSystem. You have the right to withdrawal from the study at any time without penalty. You have the option to not answer any question(s). Submission of the survey will constitute your understanding of informed consent and voluntary agreement to participate in the study. Surveys that are not submitted will not be included in the data collection. The survey should take approximately 5 minutes to complete.

The Anesthesia Handover Survey includes questions regarding demographic information, such as your role in anesthesia, years of experience, amount of time spent providing anesthesia, and gender and ethnic origin. The survey also asks questions regarding the quality, conduct, and teamwork of handover between anesthesia providers during transfer of care of a patient. Upon completion, please return the survey to the respective anesthesia office in the manila envelope labeled "Anesthesia Handover Survey – Completed".

Questions, concerns, feedback, complaints or for more information, please contact the investigators, Amber Lindsay (amk.schmidt@gmail.com) or Elisa Rue (elisamrue@gmail.com) or the faculty advisor Dr. Julia Feczko (JFeczko@northshore.org). Please contact Susan Loess-Perez, the Director of Research Compliance in the Office of Research Services at DePaul University at (sloesspe@depaul.edu) or at 312-362-7593, if you have questions regarding your rights as a study participant. You may also contact DePaul's Office of Research Services if:

- Your questions, concerns, or complaints are not being answered by the research team.
- You cannot reach the research team.
- You want to talk to someone besides the research team.

Please keep this information for your records if you decide to participate in this study.

Thank you very much for your time and consideration.

Appendix E

Anesthesia Handover Survey

A STANDARDIZED ELECTRONIC HANDOVER REPORT FOR ANESTHESIA PROVIDERS

If you have used the AHR, please complete the following survey. Participation in this study is voluntary, confidential, and anonymous. Completion of this survey implies that you consent to participate. Completing this survey should take less than 5 minutes.

Once completed, please return the survey to the respective anesthesia office in the manila envelope labeled "Anesthesia Handover Survey- Completed". This survey can be submitted at any point during this study, but please submit no later than 3/15/2017.

Demographic Information:

1) What best describes your role?

1. Anesthesiologist
2. 1st year Anesthesia Resident
3. 2nd year Anesthesia Resident
4. 3rd year Anesthesia Resident
5. 4th year Anesthesia Resident
6. Anesthesia Fellow
7. Certified Registered Nurse Anesthetist
8. Student Registered Nurse Anesthetist
9. Anesthesia Assistant

2) How long have you been providing Anesthesia?

1. Less than 6 months
2. 6 months- 1 year
3. 2- 5 years
4. 6- 10 years
5. 11- 15 years
6. 16- 20 years
7. 21- 25 years
8. 26- 30 years
9. 31- 35 years
10. over 35 years

3) On average, how many hours per week do you spend providing anesthesia?

1. Less than 12 hours
2. Between 12 and 36 hours
3. More than 36 hours

4) What is your gender?

1. Male
2. Female

5) What is your ethnic origin?

1. White
2. Black, African, African American
3. Asian, Pacific Islander, Native Hawaiian
4. Hispanic, Latino, Spanish Origin
5. American Indian or Alaskan Native

Handover Quality Rating Form:

Handover Characteristics	Agree	Partially agree	Partially disagree	Disagree
Conduct of Handover				
Handover followed a logical structure	1	2	3	4
The AHR sidebar was used to structure the handover when either giving or receiving report on the patient	1	2	3	4
Not enough time was allowed for the handover	1	2	3	4
In case of interruptions during handover, attempts were made to minimize them	1	2	3	4
All relevant information was selected and communicated	1	2	3	4
Priorities for further treatment were addressed	1	2	3	4
The person providing the handover clearly communicated her/his assessment of the patient	1	2	3	4
Possible risks and complications were discussed	1	2	3	4
Teamwork				
Questions and ambiguities were resolved (active enquiry by the person taking on responsibility for the patient)	1	2	3	4
The team jointly ensured that the handover was complete	1	2	3	4
Handover quality				
Documentation was complete	1	2	3	4
There was too much information in the AHR sidebar	1	2	3	4
Too much information was asked for	1	2	3	4
Overall, the quality of handover was very high when using the electronic AHR	1	2	3	4

Appendix F

CITI Certificates

CITI Program Completion Certificates for E. Rue

COLLABORATIVE INSTITUTIONAL TRAINING INITIATIVE (CITI PROGRAM)

COURSEWORK REQUIREMENTS REPORT*

* NOTE: Scores on this Requirements Report reflect quiz completions at the time all requirements for the course were met. See list below for details. See separate Transcript Report for more recent quiz scores, including those on optional (supplemental) course elements.

- **Name:** Elisa Rue (ID: 5555855)
- **Email:** Elisamrue@gmail.com
- **Institution Affiliation:** NorthShore University HealthSystem Research Institute - Evanston, IL (ID: 1050)
- **Phone:** 260-415-1879

- **Curriculum Group:** Basic/Refresher Course - Human Subjects Research
- **Course Learner Group:** Biomedical Research
- **Stage:** Stage 1 - Basic Course

- **Report ID:**19541592
- **Completion Date:** 05/15/2016
- **Expiration Date:** 05/15/2018
- **Minimum Passing:** 80
- **Reported Score*:** 97

REQUIRED AND ELECTIVE MODULES ONLY	DATE COMPLETED
Belmont Report and CITI Course Introduction (ID: 1127)	05/15/16
History and Ethics of Human Subjects Research (ID: 498)	05/15/16
Basic Institutional Review Board (IRB) Regulations and Review Process (ID: 2)	05/15/16
Informed Consent (ID: 3)	05/15/16
Social and Behavioral Research (SBR) for Biomedical Researchers (ID: 4)	05/15/16
Records-Based Research (ID: 5)	05/15/16
Genetic Research in Human Populations (ID: 6)	05/15/16
Populations in Research Requiring Additional Considerations and/or Protections (ID: 16680)	05/15/16
FDA-Regulated Research (ID: 12)	05/15/16
Research and HIPAA Privacy Protections (ID: 14)	05/15/16
Conflicts of Interest in Research Involving Human Subjects (ID: 488)	05/15/16
Avoiding Group Harms - U.S. Research Perspectives (ID: 14080)	05/15/16
Recognizing and Reporting Unanticipated Problems Involving Risks to Subjects or Others in Biomedical Research (ID: 14777)	05/15/16
NorthShore University HealthSystem (ID: 12615)	05/15/16
NorthShore University HealthSystem Research Institute: Roles and Responsibilities of the Research Team (ID: 12713)	05/15/16
NorthShore University HealthSystem Research Institute: Forms and Processes (ID: 12714)	05/15/16

For this Report to be valid, the learner identified above must have had a valid affiliation with the CITI Program subscribing institution identified above or have been a paid Independent Learner.

CITI Program

Email: citisupport@miami.edu Phone: 305-243-7970

Web: https://www.citiprogram.org

COLLABORATIVE INSTITUTIONAL TRAINING INITIATIVE (CITI PROGRAM)

COURSEWORK TRANSCRIPT REPORT**

** NOTE: Scores on this Transcript Report reflect the most current quiz completions, including quizzes on optional (supplemental) elements of the course. See list below for details. See separate Requirements Report for the reported scores at the time all requirements for the course were met.

- **Name:** Elisa Rue (ID: 5555855)
- **Email:** Elisamrue@gmail.com
- **Institution Affiliation:** NorthShore University HealthSystem Research Institute - Evanston, IL (ID: 1050)
- **Phone:** 260-415-1879

- **Curriculum Group:** Basic/Refresher Course - Human Subjects Research
- **Course Learner Group:** Biomedical Research

• **Stage:** Stage 1 - Basic Course
• **Report ID:**19541592
• **Report Date:** 05/15/2016
• **Current Score**:** 97

REQUIRED, ELECTIVE, AND SUPPLEMENTAL MODULES	MOST RECENT
History and Ethics of Human Subjects Research (ID: 498)	05/15/16
Informed Consent (ID: 3)	05/15/16
Social and Behavioral Research (SBR) for Biomedical Researchers (ID: 4)	05/15/16
Belmont Report and CITI Course Introduction (ID: 1127)	05/15/16
Records-Based Research (ID: 5)	05/15/16
Genetic Research in Human Populations (ID: 6)	05/15/16
FDA-Regulated Research (ID: 12)	05/15/16
Research and HIPAA Privacy Protections (ID: 14)	05/15/16
Conflicts of Interest in Research Involving Human Subjects (ID: 488)	05/15/16
NorthShore University HealthSystem (ID: 12615)	05/15/16
NorthShore University HealthSystem Research Institute: Roles and Responsibilities of the Research Team (ID: 12713)	05/15/16
NorthShore University HealthSystem Research Institute: Forms and Processes (ID: 12714)	05/15/16
Avoiding Group Harms - U.S. Research Perspectives (ID: 14080)	05/15/16
Basic Institutional Review Board (IRB) Regulations and Review Process (ID: 2)	05/15/16
Recognizing and Reporting Unanticipated Problems Involving Risks to Subjects or Others in Biomedical Research (ID: 14777)	05/15/16
Populations in Research Requiring Additional Considerations and/or Protections (ID: 16680)	05/15/16

For this Report to be valid, the learner identified above must have had a valid affiliation with the CITI Program subscribing institution identified above or have been a paid Independent Learner.
CITI Program
Email: citisupport@miami.edu Phone: 305-243-7970
Web: https://www.citiprogram.org

COLLABORATIVE INSTITUTIONAL TRAINING INITIATIVE (CITI PROGRAM)

COURSEWORK REQUIREMENTS REPORT*

* NOTE: Scores on this Requirements Report reflect quiz completions at the time all requirements for the course were met. See list below for details. See separate Transcript Report for more recent quiz scores, including those on optional (supplemental) course elements.

• **Name:** Elisa Rue (ID: 5555855)
• **Email:** Elisamrue@gmail.com
• **Institution Affiliation:** DePaul University (ID: 1435)
• **Phone:** 260-415-1879

• **Curriculum Group:** Students
• **Course Learner Group:** Students - Class projects
• **Stage:** Stage 1 - Basic Course

• **Report ID:**19541573
• **Completion Date:** 05/19/2016
• **Expiration Date:**05/19/2019
• **Minimum Passing:** 80
• **Reported Score*:** 100

REQUIRED AND ELECTIVE MODULES ONLY	DATE COMPLETED	SCORE
History and Ethical Principles - SBE (ID: 490)	05/19/16	5/5 (100%)
Defining Research with Human Subjects - SBE (ID: 491)	05/19/16	5/5 (100%)
The Federal Regulations - SBE (ID: 502)	05/19/16	5/5 (100%)
Assessing Risk - SBE (ID: 503)	05/19/16	5/5 (100%)
Informed Consent - SBE (ID: 504)	05/19/16	5/5 (100%)
Privacy and Confidentiality - SBE (ID: 505)	05/19/16	5/5 (100%)
Students in Research (ID: 1321)	05/19/16	5/5 (100%)
Conflicts of Interest in Research Involving Human Subjects (ID: 488) DePaul University (ID: 12952)	05/19/16	No Quiz

For this Report to be valid, the learner identified above must have had a valid affiliation with the CITI Program subscribing institution identified above or have been a paid Independent Learner.
CITI Program
Email: citisupport@miami.edu Phone: 305-243-7970
Web: https://www.citiprogram.org

COLLABORATIVE INSTITUTIONAL TRAINING INITIATIVE (CITI PROGRAM)

COURSEWORK TRANSCRIPT REPORT**

** NOTE: Scores on this Transcript Report reflect the most current quiz completions, including quizzes on optional (supplemental) elements of the course. See list below for details. See separate Requirements Report for the reported scores at the time all requirements for the course were met.

- **Name:** Elisa Rue (ID: 5555855)
- **Email:** Elisamrue@gmail.com
- **Institution Affiliation:** DePaul University (ID: 1435)
- **Phone:** 260-415-1879

- **Curriculum Group:** Students
- **Course Learner Group:** Students - Class projects
- **Stage:** Stage 1 - Basic Course

- **Report ID:** 19541573
- **Report Date:** 05/19/2016
- **Current Score**:** 100

REQUIRED, ELECTIVE, AND SUPPLEMENTAL MODULES	MOST RECENT	SCORE
History and Ethics of Human Subjects Research (ID: 498)	05/15/16	7/7 (100%)
Students in Research (ID: 1321)	05/19/16	5/5 (100%)
Informed Consent (ID: 3)	05/15/16	5/5 (100%)
History and Ethical Principles - SBE (ID: 490)	05/19/16	5/5 (100%)
Social and Behavioral Research (SBR) for Biomedical Researchers (ID: 4)	05/15/16	4/4 (100%)
Defining Research with Human Subjects - SBE (ID: 491)	05/19/16	5/5 (100%)
Belmont Report and CITI Course Introduction (ID: 1127)	05/15/16	3/3 (100%)
Records-Based Research (ID: 5)	05/15/16	3/3 (100%)
The Federal Regulations - SBE (ID: 502)	05/19/16	5/5 (100%)
Genetic Research in Human Populations (ID: 6)	05/15/16	5/5 (100%)
Assessing Risk - SBE (ID: 503)	05/19/16	5/5 (100%)
Informed Consent - SBE (ID: 504)	05/19/16	5/5 (100%)
Privacy and Confidentiality - SBE (ID: 505)	05/19/16	5/5 (100%)
FDA-Regulated Research (ID: 12)	05/15/16	5/5 (100%)
Research and HIPAA Privacy Protections (ID: 14)	05/15/16	5/5 (100%)
Conflicts of Interest in Research Involving Human Subjects (ID: 488)	05/15/16	5/5 (100%)
Basic Institutional Review Board (IRB) Regulations and Review Process (ID: 2)	05/15/16	5/5 (100%)
Populations in Research Requiring Additional Considerations and/or Protections (ID: 16680)	05/15/16	5/5 (100%)
DePaul University (ID: 12952)	05/19/16	No Quiz

For this Report to be valid, the learner identified above must have had a valid affiliation with the CITI Program subscribing institution identified above or have been a paid Independent Learner.

CITI Program

Email: citisupport@miami.edu Phone: 305-243-7970

Web: https://www.citiprogram.org

CITI Program Completion Certificate for A. Lindsay

COLLABORATIVE INSTITUTIONAL TRAINING INITIATIVE (CITI PROGRAM)

COURSEWORK REQUIREMENTS REPORT*

* NOTE: Scores on this Requirements Report reflect quiz completions at the time all requirements for the course were met. See list below for details. See separate Transcript Report for more recent quiz scores, including those on optional (supplemental) course elements.

• **Name:** Amber Lindsay (ID: 5264044)
• **Email:** amk.schmidt@gmail.com
• **Institution Affiliation:** NorthShore University HealthSystem Research Institute - Evanston, IL (ID: 1050)
• **Phone:** 9202095585

• **Curriculum Group:** Basic/Refresher Course - Human Subjects Research
• **Course Learner Group:** Research with data or laboratory specimens- ONLY
• **Stage:** Stage 1 - Basic Course

• **Report ID:** 19612566
• **Completion Date:** 05/23/2016
• **Expiration Date:** 05/23/2018
• **Minimum Passing:** 80
• **Reported Score*:** 96

REQUIRED AND ELECTIVE MODULES ONLY	DATE COMPLETED
Belmont Report and CITI Course Introduction (ID: 1127)	05/22/16
History and Ethics of Human Subjects Research (ID: 498)	05/22/16
Basic Institutional Review Board (IRB) Regulations and Review Process (ID: 2)	05/23/16
Informed Consent (ID: 3)	05/23/16
Records-Based Research (ID: 5)	05/23/16
Genetic Research in Human Populations (ID: 6)	05/23/16
Populations in Research Requiring Additional Considerations and/or Protections (ID: 16680)	05/23/16
Research and HIPAA Privacy Protections (ID: 14)	05/23/16
Conflicts of Interest in Research Involving Human Subjects (ID: 488)	05/10/16
NorthShore University HealthSystem (ID: 12615)	05/23/16
NorthShore University HealthSystem Research Institute: Roles and Responsibilities of the Research Team (ID: 12713)	05/23/16
NorthShore University HealthSystem Research Institute: Forms and Processes (ID: 12714)	05/23/16

For this Report to be valid, the learner identified above must have had a valid affiliation with the CITI Program subscribing institution identified above or have been a paid Independent Learner.
CITI Program
Email: citisupport@miami.edu Phone: 305-243-7970
Web: https://www.citiprogram.org

COLLABORATIVE INSTITUTIONAL TRAINING INITIATIVE (CITI PROGRAM)

COURSEWORK TRANSCRIPT REPORT**

** NOTE: Scores on this Transcript Report reflect the most current quiz completions, including quizzes on optional (supplemental) elements of the course. See list below for details. See separate Requirements Report for the reported scores at the time all requirements for the course were met.

• **Name:** Amber Lindsay (ID: 5264044)
• **Email:** amk.schmidt@gmail.com
• **Institution Affiliation:** NorthShore University HealthSystem Research Institute - Evanston, IL (ID: 1050)
• **Phone:** 9202095585

• **Curriculum Group:** Basic/Refresher Course - Human Subjects Research
• **Course Learner Group:** Research with data or laboratory specimens- ONLY
• **Stage:** Stage 1 - Basic Course

• **Report ID:**19612566
• **Report Date:** 05/23/2016
• **Current Score**:** 96

REQUIRED, ELECTIVE, AND SUPPLEMENTAL MODULES	MOST RECENT

History and Ethics of Human Subjects Research (ID: 498) Informed Consent (ID: 3)	05/22/16
Belmont Report and CITI Course Introduction (ID: 1127) Records-Based Research (ID: 5)	05/23/16
Genetic Research in Human Populations (ID: 6)	05/22/16
Research and HIPAA Privacy Protections (ID: 14)	05/23/16
Conflicts of Interest in Research Involving Human Subjects (ID: 488)	05/10/16
NorthShore University HealthSystem (ID: 12615)	05/23/16
NorthShore University HealthSystem Research Institute: Roles and Responsibilities of the Research Team (ID: 12713)	05/23/16
NorthShore University HealthSystem Research Institute: Forms and Processes (ID: 12714)	05/23/16
Basic Institutional Review Board (IRB) Regulations and Review Process (ID: 2)	05/23/16
Populations in Research Requiring Additional Considerations and/or Protections (ID: 16680)	05/23/16

For this Report to be valid, the learner identified above must have had a valid affiliation with the CITI Program subscribing institution identified above or have been a paid Independent Learner.
CITI Program
Email: citisupport@miami.edu Phone: 305-243-7970
Web: https://www.citiprogram.org

COLLABORATIVE INSTITUTIONAL TRAINING INITIATIVE (CITI PROGRAM)

COURSEWORK REQUIREMENTS REPORT*

* NOTE: Scores on this Requirements Report reflect quiz completions at the time all requirements for the course were met. See list below for details. See separate Transcript Report for more recent quiz scores, including those on optional (supplemental) course elements.

- **Name:** Amber Lindsay (ID: 5264044)
- **Email:** amk.schmidt@gmail.com
- **Institution Affiliation:** NorthShore University HealthSystem Research Institute - Evanston, IL (ID: 1050)
- **Phone:** 9202095585

- **Curriculum Group:** CITI Good Clinical Practice
- **Course Learner Group:** CITI Good Clinical Practice Course
- **Stage:** Stage 1 - Basic Course
- **Description: This ICH E6 GCP Investigator Site Training meets the Minimum Criteria for ICH GCP Investigator Site Personnel Training identified by TransCelerate BioPharma as necessary to enable mutual recognition of GCP training among trial sponsors.**

- **Report ID:**19612567
- **Completion Date:** 05/23/2016
- **Expiration Date:**05/22/2020
- **Minimum Passing:** 80
- **Reported Score*:** 100

REQUIRED AND ELECTIVE MODULES ONLY	DATE COMPLETED
The CITI Good Clinical Practice Course for Clinical Trials Involving Drugs and Devices (ID: 1350)	05/23/16
Overview of New Drug Development (ID: 1351)	05/23/16
Overview of ICH GCP (ID: 1352)	05/23/16
ICH - Comparison Between ICH GCP E6 and U.S. FDA Regulations (ID: 1354)	05/23/16
Conducting Investigator-Initiated Studies According to FDA Regulations and GCP (ID: 1355)	05/23/16
Investigator Obligations in FDA-Regulated Research (ID: 1356)	05/23/16
Managing Investigational Agents According to GCP Requirements (ID: 1357)	05/23/16
Overview of U.S. FDA Regulations for Medical Devices (ID: 1358)	05/23/16
Informed Consent in Clinical Trials of Drugs, Biologics, and Devices (ID: 1359)	05/23/16
Detecting and Evaluating Adverse Events (ID: 1360)	05/23/16
Reporting Serious Adverse Events (ID: 1361)	05/23/16
Audits and Inspections of Clinical Trials (ID: 1363)	05/23/16
Monitoring of Clinical Trials by Industry Sponsors (ID: 1362)	05/23/16
Completing the CITI GCP Course (ID: 1364)	05/23/16

For this Report to be valid, the learner identified above must have had a valid affiliation with the CITI Program subscribing institution identified above or have been a paid Independent Learner.
CITI Program
Email: citisupport@miami.edu Phone: 305-243-7970
Web: https://www.citiprogram.org

COLLABORATIVE INSTITUTIONAL TRAINING INITIATIVE (CITI PROGRAM)

COURSEWORK TRANSCRIPT REPORT**

** NOTE: Scores on this Transcript Report reflect the most current quiz completions, including quizzes on optional (supplemental) elements of the course. See list below for details. See separate Requirements Report for the reported scores at the time all requirements for the course were met.

• **Name:** Amber Lindsay (ID: 5264044)
• **Email:** amk.schmidt@gmail.com
• **Institution Affiliation:** NorthShore University HealthSystem Research Institute - Evanston, IL (ID: 1050)
• **Phone:** 9202095585

• **Curriculum Group:** CITI Good Clinical Practice
• **Course Learner Group:** CITI Good Clinical Practice Course
• **Stage:**Stage 1 - Basic Course
• **Description: This ICH E6 GCP Investigator Site Training meets the Minimum Criteria for ICH GCP Investigator Site Personnel Training identified by TransCelerate BioPharma as necessary to enable mutual recognition of GCP training among trial sponsors.**

• **Report ID:**19612567
• **Report Date:** 05/23/2016
• **Current Score**:** 100

REQUIRED, ELECTIVE, AND SUPPLEMENTAL MODULES	MOST RECENT
The CITI Good Clinical Practice Course for Clinical Trials Involving Drugs and Devices (ID: 1350)	05/23/16
Overview of New Drug Development (ID: 1351)	05/23/16
Overview of ICH GCP (ID: 1352)	05/23/16
ICH - Comparison Between ICH GCP E6 and U.S. FDA Regulations (ID: 1354)	05/23/16
Conducting Investigator-Initiated Studies According to FDA Regulations and GCP (ID: 1355)	05/23/16
Investigator Obligations in FDA-Regulated Research (ID: 1356)	05/23/16
Managing Investigational Agents According to GCP Requirements (ID: 1357)	05/23/16
Overview of U.S. FDA Regulations for Medical Devices (ID: 1358)	05/23/16
Informed Consent in Clinical Trials of Drugs, Biologics, and Devices (ID: 1359)	05/23/16
Detecting and Evaluating Adverse Events (ID: 1360)	05/23/16
Reporting Serious Adverse Events (ID: 1361)	05/23/16
Audits and Inspections of Clinical Trials (ID: 1363)	05/23/16
Monitoring of Clinical Trials by Industry Sponsors (ID: 1362)	05/23/16
Completing the CITI GCP Course (ID: 1364)	05/23/16

For this Report to be valid, the learner identified above must have had a valid affiliation with the CITI Program subscribing institution identified above or have been a paid Independent Learner.
CITI Program
Email: citisupport@miami.edu Phone: 305-243-7970
Web: https://www.citiprogram.org

COLLABORATIVE INSTITUTIONAL TRAINING INITIATIVE (CITI PROGRAM)

COURSEWORK REQUIREMENTS REPORT*
NOTE: Scores on this Requirements Report reflect quiz completions at the time all requirements for the course were met. See list below for details. See separate Transcript Report for more recent quiz scores, including those on optional (supplemental) course elements.

• **Name**: Amber Lindsay (ID: 5264044)
• **Email**: amk.schmidt@gmail.com
• **Institution Affiliation**: DePaul University (ID: 1435)
• **Phone**: 847-570-1959

• **Curriculum Group**: Students
• **Course Learner Group**: Students - Class projects
• **Stage**: Stage 1 - Basic Course

• **Report ID**: 18195808
• **Completion Date**: 05/10/2016
• **Expiration Date**: 05/10/2019
• **Minimum Passing**: 80
• **Reported Score***: 100

REQUIRED AND ELECTIVE MODULES ONLY	DATE COMPLETED	SCORE
Students in Research (ID: 1321)	05/10/16	5/5 (100%)
History and Ethical Principles - SBE (ID: 490)	05/10/16	5/5 (100%)
Defining Research with Human Subjects - SBE (ID: 491)	05/10/16	5/5 (100%)
The Federal Regulations - SBE (ID: 502)	05/10/16	5/5 (100%)
Assessing Risk - SBE (ID: 503)	05/10/16	5/5 (100%)
Informed Consent - SBE (ID: 504)	05/10/16	5/5 (100%)
Privacy and Confidentiality - SBE (ID: 505)	05/10/16	5/5 (100%)
Conflicts of Interest in Research Involving Human Subjects (ID: 488)	05/10/16	5/5 (100%)
DePaul University (ID: 12952)	05/10/16	No Quiz

For this Report to be valid, the learner identified above must have had a valid affiliation with the CITI Program subscribing institution identified above or have been a paid Independent Learner.
CITI Program
Email: citisupport@miami.edu Phone: 305-243-7970
Web: https://www.citiprogram.org

COLLABORATIVE INSTITUTIONAL TRAINING INITIATIVE (CITI PROGRAM)

COURSEWORK TRANSCRIPT REPORT**

** NOTE: Scores on this Transcript Report reflect the most current quiz completions, including quizzes on optional (supplemental) elements of the course. See list below for details. See separate Requirements Report for the reported scores at the time all requirements for the course were met.

- **Name**:Amber Lindsay (ID: 5264044)
- **Email**:amk.schmidt@gmail.com
- **Institution Affiliation**: DePaul University (ID: 1435)
- **Phone**: 847-570-1959

- **Curriculum Group**: Students
- **Course Learner Group**: Students - Class projects
- **Stage**: Stage 1 - Basic Course
- **Report ID**: 18195808
- **Report Date**: 05/17/2016
- **Current Score****: 100

REQUIRED, ELECTIVE, AND SUPPLEMENTAL MODULES	MOST RECENT	SCORE
Students in Research (ID: 1321)	05/10/16	5/5 (100%)
History and Ethical Principles - SBE (ID: 490)	05/10/16	5/5 (100%)
Defining Research with Human Subjects - SBE (ID: 491)	05/10/16	5/5 (100%)
The Federal Regulations - SBE (ID: 502)	05/10/16	5/5 (100%)
Assessing Risk - SBE (ID: 503)	05/10/16	5/5 (100%)
Informed Consent - SBE (ID: 504)	05/10/16	5/5 (100%)
Privacy and Confidentiality - SBE (ID: 505)	05/10/16	5/5 (100%)
Conflicts of Interest in Research Involving Human Subjects (ID: 488)	05/10/16	5/5 (100%)
DePaul University (ID: 12952)	05/10/16	5/5 (100%)

For this Report to be valid, the learner identified above must have had a valid affiliation with the CITI Program subscribing institution identified above or have been a paid Independent Learner.
CITI Program
Email: citisupport@miami.edu Phone: 305-243-7970
Web: https://www.citiprogram.org

CITI Program Completion Certificate for A. Medina

COLLABORATIVE INSTITUTIONAL TRAINING INITIATIVE (CITI PROGRAM)
COMPLETION REPORT - PART 1 OF 2
COURSEWORK REQUIREMENTS*

* NOTE: Scores on this Requirements Report reflect quiz completions at the time all requirements for the course were met. See list below for details. See separate Transcript Report for more recent quiz scores, including those on optional (supplemental) course elements.

- **Name:** Alvin Medina (ID: 2793795)
- **Email:** amedina@northshore.org
- **Institution Affiliation:** NorthShore University HealthSystem Research Institute - Evanston, IL (ID: 1050)
- **Institution Unit:** Anesthesia/HIT
- **Phone:** 8479825210

- **Curriculum Group:** Basic/Refresher Course - Human Subjects Research
- **Course Learner Group:** Biomedical Research
- **Stage:** Stage 1 - Basic Course

- **Report ID:** 20994686
- **Completion Date:** 03-Oct-2016
- **Expiration Date:** 03-Oct-2018
- **Minimum Passing:** 80
- **Reported Score*:** 96

Appendix G

Approval Letters from the International Review Boards

IRB Approval Letter from NorthShore University HealthSystem

DocuSign Envelope ID: 918F8998-73B4-4B24-8603-A274625E93A4

NorthShore
University HealthSystem

Research Institute

1001 University Place
Evanston, Illinois 60201
www.northshore.org

Phone (224) 364-7100
Fax (847) 570-8011

December 5, 2016

Amber Lindsay, R.N., B.S.N.
Department of Nursing
2650 Ridge Avenue
Evanston, IL 60201

Re: EH17-034: Lindsay, Amber R.N., B.S.N.: A Standardized Electronic Handover Report for Anesthesia Providers. *Protocol Dated 10/26/16 (RI-2.2 application date).*

Dear Ms. Lindsay:

The above-referenced project was reviewed in the Research Institute and by a member of the Third Friday Institutional Review Board (IRB) of NorthShore University HealthSystem. This project was approved on the date of this letter and has IRB approval through **12/4/2018**.

The project was reviewed in accordance with the Code of Federal Regulations (45 CFR 46 - as revised). The NorthShore University HealthSystem Institutional Review Board has an approved assurance of compliance with OHRP which covers this activity (Federal Wide Assurance: FWA00003000). This project conforms to the requirements for exemption from the Code of Regulations and does not require a Consent form because the proposed research will involve educational tests (cognitive, diagnostic, aptitude, achievement) and survey procedures [45 CFR 46.101(2)].

According to institutional policy, your project must be reviewed **every two years**. A Progress Report Form (RI-5.0) will be **due** in the Research Institute **no later than 45 days prior** to the above expiration date. **Changes in the experimental protocol must not occur without prior approval of the IRB.** Unanticipated problems must be reported to the IRB. If this project is terminated before its next Review, please submit a Termination Report Form (RI-5.1) to the Research Institute.

Sincerely yours,

DocuSigned by:
Sara Levin
E3560AAEBE834E6...

Sara Levin, MSN, RN-BC
Chairperson, Institutional Review Board

/lk

cc: Mary Keegan, R.N.
Robert Stanton, J.D.

IRB Approval Letter from DePaul University

DEPAUL
UNIVERSITY

Office of Research Services
Institutional Review Board
1 East Jackson Boulevard
Chicago, Illinois 60604-2201
312-362-7593
Fax: 312-362-7574

Research Involving Human Subjects

NOTICE OF INSTITUTIONAL REVIEW BOARD ACTION

To: Elisa Rue, BSN, RN, Graduate Student, School of Nursing

Date: December 16, 2016

Re: Research Protocol # ER111116NUR
"A Standardized Electronic Handover Report for Anesthesia Providers"

Please review the following important information about the review of your proposed research activity.

Review Details
This submission is an initial submission.

Your research project meets the criteria for Exempt review under 45 CFR 46.101 under the following category:

> *(2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, unless:*
> *(i) information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects; and (ii) any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, or reputation.*

Approval Details
Your research was originally reviewed on November 22, 2016 and revisions were requested. The revisions you submitted on December 8, 2016 were reviewed and approved on December 16, 2016.

Number of approved participants: 140 Total
You should not exceed this total number of subjects without prospectively submitting an amendment to the IRB requesting an increase in subject number.

Funding Source: 1) None.

Approved Performance sites: 1) DePaul University; 2) Northshore University HealthSystem (lead site).

Reminders
- Under DePaul's current institutional policy governing human research, research projects that meet the criteria for an exemption determination may receive administrative review by the Office of Research

Appendix H

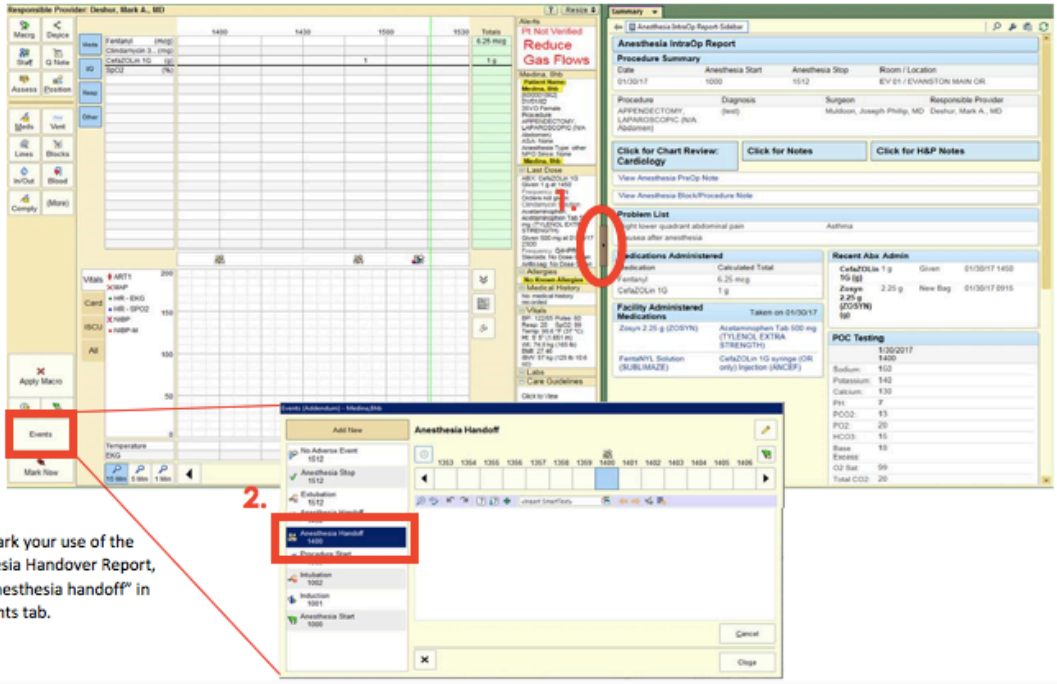
AHR Cheat Sheet

Anesthesia Handover Report

This report should be utilized during all intraoperative anesthesia handovers.

Login to EPIC, the electronic health record. Highlight your patient, click the intraoperative navigator.

1. To open the sidebar: on the right side of the screen is a small arrow. Click on this small arrow to open the sidebar that contains the Anesthesia Handover Report. To close the sidebar: click on the small arrow, that is now to the left of the sidebar. The sidebar report is titled "Anesthesia IntraOp Report."



2. To mark your use of the Anesthesia Handover Report, click "anesthesia handoff" in the events tab.