

**IMPLEMENTATION AND EVALUATION OF AN EVIDENCE BASED HANDOFF
TOOL FOR USE BY ANESTHESIA DURING TRANSFER OF CARE OF POST-CABG
PATIENTS TO THE INTENSIVE CARE UNIT**

by

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A DNP final project report submitted in partial fulfillment of the
requirements for the degree of
DOCTOR OF NURSING PRACTICE

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ACKNOWLEDGEMENTS

We would like to thank our DNP project chair Dr. Anne Hranchook for her guidance and continual support throughout our project. This project would not have been possible without your knowledge and encouragement. To our families who have supported us through this journey, we are forever grateful.

Abstract

Poor communication is a contributing factor to medical errors and increased costs within healthcare. The handoff period between teams is a prime opportunity for communication failure. According to The Joint Commission, inadequate handoffs are estimated to contribute to 80% of all adverse events. To address the issue, they added a new National Patient Safety Goal in 2006 calling for standardization of the handoff process. The aim of this project was to improve the communication and interdepartmental transition of care between heart team CRNAs (HTCRNAs) and heart team ICU nurses (HTICU-RNs) using a standardized handoff tool at UP-Health System Marquette (UPHSM).

This evidence-based quality improvement project incorporated a pre-test/post-test design to explore provider satisfaction and assess the functionality of an evidence-based standardized handoff tool developed collaboratively with an interprofessional team. Eleven providers completed the pre-intervention survey and eight completed the post-intervention survey. There was a statistically significant improvement in satisfaction with the transfer of care process following the implementation of the standardized handoff tool ($Z = -2.23, p = 0.026$). Participants also found the new handoff tool to be more comprehensive ($Z = -2.33, p = 0.02$); less likely to lead to mistakes ($Z = -2.45, p = 0.014$); and a better mechanism to communicate important patient information during transfer of care ($Z = -2.04, p = 0.041$).

An opportunity was identified to improve and standardize the hand-off process between HTCRNA's and HTICU-RN's at UPHSM. Findings from this project demonstrate an improvement in the process as well as provider satisfaction during transfer of care between the ICU and anesthesia department using a standardized handoff tool.

Keywords: handoff, transfer of care, operating room, intensive care

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Background & Significance

Standardized handoff processes between heart team Certified Registered Nurse Anesthetists (HCRNA's) and heart trained Intensive Care Unit Registered Nurses (HTICU-RN's) at UP Health System Marquette (UPHSM), a Duke LifePoint Hospital, are not formally in place for patients being transferred directly to the ICU from the operating room. With no standardization to the process, what is communicated during a handoff is primarily driven by the CRNA facilitating the transfer and, as such, is typically extremely variable. This has resulted in ineffective communication and frustration between providers. More importantly, an ineffective handoff process can and has led to information that is omitted, incomplete or misinterpreted which results in medical errors and the potential for patient harm (Shah et al, 2019). The utilization of a standardized handoff tool has long been a topic of discussion amongst ICU personnel who have expressed support for the development of a tool.

Inadequate handoffs have contributed to approximately 80% of adverse events with significant cost to healthcare organizations (The Joint Commission, 2018). Ineffective communication in healthcare may lead to a plethora of unwanted and detrimental effects, most of which affect the patients that we are sworn to protect (The Joint Commission, 2017). Things such as increased incidence of cardiopulmonary resuscitation, cardiac arrest, prolonged hypotension, line infection and medication errors all can be a result of poor communication during handoff (Chatterjee et al, 2018). This has become such a significant patient safety issue that in 2006 the Joint Commission established the National Patient Safety Goal which was aimed to address the lack of standardization for handoff in healthcare institutions (The Joint Commission, 2017). Then in 2010, this goal became a requirement through the Provision of Care Standard PC.02.02.01 requiring that a healthcare organization's process for handoff "provides

for the opportunity for discussion between the giver and receiver of patient information.” While many healthcare organizations implemented a standardized process and tool to facilitate the transfer of patient care and information, UPHSM has not yet done so (The Joint Commission, 2017).

In order for the successful implementation of such a protocol or tool there has to be a desire from both parties to ensure compliance and proper adoption and to experience the full benefit. The HTCRNs and HTICU-RNs at UPHSM have expressed their frustration with poor communication during the transfer of patient care. In having discussions with both sides, there has been interest in the development and use of a standardized tool to improve upon the existing process and help facilitate better transfer of patient information and improve patient care.

Purpose

There is currently not a structured hand-off process or tool available at UPHSM to facilitate a complete and thorough handoff between anesthesia providers and ICU-RNs when care is transitioned from the operating room to the intensive care unit. The purpose of this quality improvement project was to develop a functional standardized handoff ‘tool’ that will be utilized by the HTCRNAs and HTICU-RNs when transferring patients directly from the operating room to the intensive care unit.

PICOT

In the transfer of care of post-CABG patients, does the use of a standardized handoff tool compared to no standardized handoff tool, improve the perceptions of the quality of the handoff process and lead to higher satisfaction of both parties?

Literature Review

Literature Search

Articles related to postoperative handoff tools between anesthesia and intensive care unit staff were obtained using the CINAHL complete, Google Scholar and PubMed Medline databases. Combinations of the following keywords were used for the database searches: handoff, hand-off, handover, checklist(s), anesthesia handoff, ICU, intensive care unit and critical care. Articles were excluded that were greater than 10 years old (prior to 2011), did not have full-text availability, were not written in English, and had participants < 19 years old. A total of 58 articles were identified. Two duplicates were eliminated and the remaining articles were reviewed for applicability and appropriateness. A total of 12 articles from these sources were chosen to be included in this project. Additionally, The Joint Commission website was used as a source for hand-off related information.

Communication

According to the Joint Commission, a breakdown in communication accounts for as many as 30% of malpractice claims with a cost of \$1.7 billion dollars over 5 years. Additionally, inadequate handoffs can be linked to 80% of adverse events (The Joint Commission, 2018). A handoff is defined as “a transfer and acceptance of patient responsibility achieved through effective communication.” It involves both a sender and a receiver. The sender is an individual who transmits patient data and releases the care of that patient to a receiver. The receiver is a person or team who will receive this patient data and accept care of that patient (The Joint Commission, 2017).

The transfer of accurate complete information is crucial in order to prevent a breakdown in communication. In Wright's 2013 study, she notes, when discussing transfer of care between providers, that "An effective transfer involves the communication of critical information to preserve the quality and continuity of care." Her study was non-experimental and included a questionnaire mailed to a group of anesthesiologists. The data from the questionnaire was used in the development of a checklist that was subsequently used during patient handoff between anesthesia providers intra-operatively. After 2 weeks, an overwhelming majority of respondents indicated that they liked the idea of adopting a standardized transfer of care process. In a study conducted by Manser et al (2013) it was found that during a typical handoff many crucial details such as allergies, comorbidities, intraoperative problems and postoperative plan were not communicated. Similarly, Shah et al (2019) concluded that there was a significant decrease ($p < 0.05$) in the communication of critical events such as the anesthetic type, hemodynamics, medication use and fluids when a handoff tool was not utilized in the transfer of care from the operating room and intensive care unit. In addition to many of these objective data points that must be conveyed for a complete handoff, patient assessment during handoff has also been found to be of importance, with Manser et al (2013) finding an association between patient assessment during handoff and receiver handover quality ratings. In their prospective cross-sectional observation study, self-ratings by the clinicians were the measured outcome after a structured observation of the handover. Four communication behaviors were identified as being dominant (information giving, assessment, acknowledgment, and planning and decision making). Assessment was found to be significantly ($P < .05$) related to 3 of 4 dimensions of handover quality for receiver ratings.

Adverse Events

In a systematic review conducted by Chatterjee et al (2019) published by the Society of Thoracic Surgeons multiple studies were identified illustrating an increase in adverse events when a handoff tool/checklist was not utilized. In a group of 1,078 cardiothoracic patients it was found that a standardized handoff was associated with decrease incidence of cardiopulmonary resuscitation (5.4% vs 2.6%), mediastinal reexploration (9.0% vs 5.5%), and metabolic acidosis (6.7% vs 2.6%) ($p < 0.05$ for each). Additionally, there was found to be an increase in early extubation (<24hours) (43.2% vs 50.0%) ($p < 0.04$). Another landmark study of 1,127 patients in an adult cardiovascular ICU showed preventable serious complications (cardiac arrest, prolonged hypotension, line complications, anaphylaxis, drug dosage errors and pneumothorax) decreased significantly (preventable complications (5.3% vs 1.9%) $p < 0.002$) with implementation of a structured handoff process. A study of 142 ICU patients in a medical non-cardiac surgical ICU showed an improvement in the number of hemodynamic and respiratory interventions and patient pain scores within 6 hours of arrival with the implementation of a handoff checklist (Chatterjee et al, 2019). Similarly, a study done by Hall et al, (2017) demonstrated a decrease in 29 predetermined preventable complications (0.35, 98.3% CI, 0.15-0.84; $p < 0.004$) with the introduction of a structured handover tool.

Checklist Benefits

The use of checklists, although relatively new to healthcare, has been utilized in multiple other high-risk fields with success for years. One such field that has demonstrated improved safety with the use of a checklist is aviation dating back to the 1930s. With Boeing's development of their new model 299 for the US Army came a significantly more complex

aircraft. During one of the first test flights, an engine stalled and the plane crashed killing all on board. Exploring ways to improve safety a checklist was developed to help pilots during takeoff and landing. Following its implementation, the model 299 flew 1.8 million miles with no further incidents (Elmezzi & Deering, 2019). Shortly after the value of checklists were realized, the use of them in aviation was mandated by the Federal Aviation Administration and the European Aviation Safety Agency (Chaparro et al, 2019).

Similar to their use in the aviation industry, checklists have been widely utilized in the medical field outside of the operating room. With the use of a standardized checklist in all Michigan ICU's, catheter related bloodstream infections decreased from 2.7 infections per 1000 catheter days to 0 ($p < 0.002$) with results being sustained during an 18 month follow up period (Elmezzi & Deering, 2019).

Theoretical Framework

Donabedian Quality of Care Framework

The Donabedian quality of care framework was utilized for this project. This framework looks at three categories in order to assess the quality of care delivered. These three categories are structure, process and outcomes. Structure relates to the area where healthcare occurs. For this quality improvement project, the structure included the anesthesia department and the ICU of a small rural hospital in Marquette, Michigan. Process refers to the transfer of care between the HTCNRAs and HTICU-RNs when patients are brought to the ICU from the operating room. The outcomes that were evaluated included the satisfaction of those using the newly implemented standardized handoff tool as well as their perceptions of the functionality of the new tool.

Project Methodology

Project Design and Approvals

This evidence-based quality improvement project incorporated a pre intervention and post intervention survey design to gather input from a convenience sample of HTCRNAs and HTICU-RNs at UPHSM. The data was used to develop a post-operative hand-off tool to improve hand-offs between HTCRNA's and HTICU-RNs

Project Setting

This project was conducted at UPHSM, a Duke LifePoint Hospital. UPHSM is a 222-bed specialty care hospital with 65 specialties/subspecialties and a level II trauma center designation that hosts a 24-bed Medical/Surgical (general) ICU with 14 operating rooms including 2 OB suites.

Participants/Population

The primary target population for the development and testing of this handoff tool was the HTCRNA's and HTICU-RNs involved in the care of cardiovascular surgery patients in the ICU and operating rooms respectively.

Key Personnel/Stakeholders

The key stakeholders for this project included the chief CRNA, HTCRNA's of UPHS-M, medical director of the ICU (who is also an anesthesiologist), a physician's assistant for the cardiothoracic surgery group and the HTICU-RN's. They were presented with evidence including the pre-intervention survey results along with the current literature on the topic and the

tool to be utilized during handoff. Collaboration with all group members occurred throughout the process to ensure that the objectives of the project were met and the tool was developed to meet the needs of the stakeholders at UPHSM.

Recruitment

A convenience sample was recruited via snowball sampling from HTC RNAs and HTICU-RNs working at UPHSM. The recruitment strategy for this quality improvement project took place during the regularly scheduled monthly staff meetings for the anesthesia department where HTC RNAs were provided with the background for the project and the objectives and asked if they would be willing to participate. Recruitment of the HTICU-RNs was accomplished through meetings with the ICU educator, emails, and conversation with key RN leaders in the ICU. To ensure that all individuals who were willing to participate were captured, we presented the QI project at multiple meetings and huddles in order to recruit the maximum number of participants.

Evidence-based Practice Model

Implementation of this quality improvement project was through the use of the Plan-Do-Study-Act (PDSA) model. This is an effective and straight-forward approach to documenting a test of change involving a 4-step cycle. According to the IHI (2022), the cycle begins with planning a way to test the change that is being implemented (Plan), carrying out said test (Do), evaluation and study of the outcomes/responses (Study), and deciding what modifications if any should be made to the intervention (Act). Each time through the process is considered a cycle. Multiple cycles can be conducted as the change/intervention is modified.

Survey Instrument

The pre-intervention and post-intervention surveys employed a mixed method and were an adaption of a pilot instrument published by Wright (2013) on Examining Transfer of Care Processes in Nurse Anesthesia Practice. The pre-intervention survey consisted of 4 categorical items, 5 Likert scale items, 3 multiple choice items, and 4 open ended questions (see Appendix B). The post-intervention survey consisted of 2 categorical items, 7 Likert scale items and 5 open ended questions (see Appendix C).

Intervention

The intervention followed the PDSA framework. This quality improvement method consists of working in a team to identify a plan for improvement, testing change, collecting and analyzing data to understand the problem and identify if change or progress occurred. This DNP Project underwent 2 PDSA cycles which included a pre-intervention stage and a post-intervention stage.

The pre-intervention stage consisted of identifying an inter-professional team of stakeholders to assist in developing, implementing and evaluating a standardized hand-off tool. The post-intervention stage included launching a survey to evaluate participant satisfaction and perceptions of the tool's functionality and effectiveness in assisting with providing a consistent, thorough transfer of care communication. The data from the post intervention survey will guide future revisions to the hand-off tool. The entire PDSA cycle is presented as follows:

PDSA Cycle I

The "Plan" phase includes identifying an interprofessional team, determining a goal/s for improvement and a plan for how to measure if progress or change has occurred. The planning phase began in the spring of 2022 and ran through the fall of 2022. During that time, we

identified an inter-professional team of HTC RNAs, HTICU-RNs, and the medical director of the ICU. We determined that the primary objectives were as follows:

1. Improve the transfer of care process between HTC RNAs and HTICU-RNs during handoff from the operating room to the ICU.
2. Develop a standardized handoff tool incorporating best evidence along with stakeholder input.
3. Evaluate HTC RNA's and HTICU-RN's satisfaction with the revised handover process, and
4. Make any final revisions if needed using post intervention survey data as a guide.

From September 2022 to December 2022, we collaborated with members of the team to develop a pre and post intervention survey to assess the practice concern and evaluate progress after implementation of a new handoff tool. As part of this process, we submitted an application to UPHSM's IRB for review. The IRB submission was deemed "not research" and the proposal was approved (Appendix A).

The "Do" phase occurred between December 2022 and January of 2023 and involved carrying out the plan. The pre-intervention survey was launched via internal email distribution and collected via Qualtrics®, a web – based software platform. The survey queried HTC RNAs and HTICU-RNs working at UPHSM on their current practices and suggestions for development of the new hand-off tool.

The "Study" phase occurred in early February of 2023. This phase consisted of analyzing the data obtained from the pre-interventional survey using IBM SPSS® statistical software. Descriptive statistics were used to analyze quantitative data and a qualitative approach was used to identify themes from the open-ended responses.

The “Act” phase started mid-February of 2023. The data from the pre-interventional survey was used in combination with the expertise of the inter-professional team to develop a new hand-off tool (Appendix D) for use by UPHSM for transfer of care communication between the anesthesia department and the cardiovascular ICU. The new tool was modeled after the mnemonic “I PUT PATIENTS FIRST”. This mnemonic was developed by Moon et al. (2015) to improve the handoff from the HTC RNA’s to the HTICU-RN’s. The components of the mnemonic are as follows:

I: Identify yourself and role and obtain the nurse’s name

P: Past medical history

U: Underlying diagnosis/procedure

T: Technique (anesthetic type)

P: Peripheral IV’s and other lines

A: Allergies

T: Therapeutic Interventions

I: Intubation (degree of difficulty)

E: Extubation likelihood

N: Need for Drips

T: Treatment plan postoperatively (BP goals, vent settings, etc)

S: Signs (vital signs during case)

F: Fluids (I/O)

I: Intraoperative events

R: Recent Labs

S: Suggestions for immediate post-op care (Positioning, pumps, pain management)

T: Timing (when to expect arrival)

This mnemonic is comprehensive in nature, but there were slight modifications made based on the data obtained from stakeholders on the pre-intervention survey as well as the omission of non-related information. Following development, the participants were asked to use the tool during patient hand-off from the operating room to the ICU for a 5-week period which began at the end of February and went through to the end of March.

PDSA Cycle II

PDSA Cycle II began with the launch of the post-interventional survey on March 28th, 2023. The post-intervention survey evaluated the HTCRNAs and HTICU-RNs perceptions of the functionality of the hand off tool and their satisfaction with the process. The procedure to launch the post-interventional surveys was identical to the process outlined earlier for the pre-interventional surveys. Results were shared with the department of anesthesia and the inter-professional team on XX, 2023 at a department meeting. Data from this survey and feedback from the inter-professional team will be used to make any further changes to the hand-off tool. The providers who participated in the study are able to either adopt, adjust or reject the tool.

Data Analysis

The data that was collected from both the pre-intervention and post-intervention surveys were analyzed using IBM® SPSS® data software. A combination of descriptive and inferential

statistics was used to analyze the pre and post intervention data. In addition, thematic analysis of free-text responses was conducted to identify themes that emerged from relevant patterns and trends.

Budget and Resources

Resources for this project primarily consisted of time invested by the interprofessional team and paper. We spent approximately 2 hours in total with the HTCRNA's and HTICU-RN leaders and the RN Educator educating them on the tool as well as our goals and allowed time for input.

Provider	Hourly Rate of Pay	Time Commitment	Cost
CRNA	\$99.00	120 min/60 = 2 hours	\$99 X 2 hours = 198 X 10 CRNAs=\$1980
RNs	\$36.00	120 min/60 = 2 hours	\$36 X 2 = 72 X 10 = \$720
ICU Medical Director	\$200	35 min/60 = 0.58 hours	\$200 X 0.58 hours = \$116
Total Cost of Inservice			\$2816

Evaluation

This evidence-based quality improvement project was evaluated using the PDSA model using data collected via pre- and post-implementation surveys and through feedback provided

during the dissemination of the project at UPHSM in the summer of 2023. Evaluation data is presented in the results section of this paper.

Results

Pre-Intervention Survey

A total of 11 participants responded to the pre-interventional survey. This included: 5 HTC RNAs and 6 HTICU-RNs. Respondents were asked to identify their years of experience in their roles. Of those surveyed, the majority (45.5%; $n = 5$) reported they had 5 or less years of experience and 63.6% ($n = 7$) worked more than 36 hours per week.

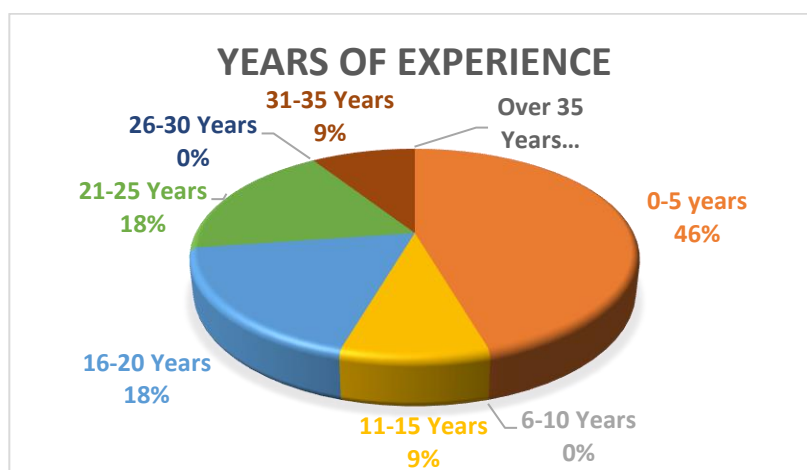


Figure 1. Demographic for Pre-intervention survey

When asked if they were currently using a formal tool or systematic process for the handoff, 90.9% ($n = 10$) indicated that they were not. Participants were then asked to answer a series of questions about the effectiveness of the current handoff process and their satisfaction with it using the following Likert scale (1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree). None of the respondents indicated they were satisfied with the current handoff process ($M = 2.5$, $SD = 0.69$). Respondents either agreed or strongly agreed that the current process lends itself to mistakes ($M = 3.82$, $SD = 0.60$); was not comprehensive ($M =$

2.36, $SD = 0.67$) and not an adequate means to communicate information during transfer of care ($M = 2.64$, $SD 0.93$). When asked if the current process was time consuming, the responses were mixed ($M = 3.09$, $SD = 1.0$).

Participants were presented with 12 possible items to communicate during handoff and asked to select 7 that they felt were the most important to include in the handoff tool. Table I provides a list of the top 7 selected.

Table I. *Items for Inclusion*

Item Selected for Inclusion	Frequency	Percent
Fluid Administration/UOP/Blood loss	11	100%
Procedure Details	10	91%
Info about ventilatory status/settings	9	82%
Level of difficulty intubating/ventilating	9	82%
Patient med/surg history	9	82%
Info on administered narcotics	7	64%
Info on IV access and lines	7	64%

Respondents were then asked to select the characteristics that would most likely lead them to adopt a standardized handoff tool. The top five results are presented in Table 2.

Table 2. *Characteristics for Adoption*

Characteristics	Frequency	Percent
Utility (ease to use)	10	91%
Organized	9	82%
Improves patient safety	8	73%
Provides quick orientation to the ongoing case and patient condition	8	73%
Purposeful	7	64%

Two open-ended questions were also asked. The first asked participants to suggest any additional items not listed that they would like included on the transfer of care tool. Responses included information about hemodynamic trends (CO, CI), blood products administered, vasoactive drips running, and lab results. The second question asked participants to list any additional characteristics that would lead them to adopt the tool. Participant responses included that the tool needed to be simple to use and that both anesthesia and nursing needed to review it before adoption.

The last question asked participants if there were any barriers that would prevent them from adopting the tool. The majority (87.5%, $n = 7$) selected the answer “none of the above; I would be willing to adopt a systematic approach to transferring care if it improved my practice and promoted patient safety”. One participant (12.5%) selected “it would take my attention away from the patient”.

Post-Intervention Survey

Of the eleven participants completing the preintervention survey, only eight completed the postintervention survey : Five HTICU-RNs (62%) and three HTCRNAs (38%).Of the eight who completed the post-intervention survey, 62.5% ($n = 5$) used the tool between 1-5 times during the implementation period, 12.5% ($n = 1$) used it 6-10 times, 12.5% ($n = 1$) used it 11-15 times and one respondent had not used it.

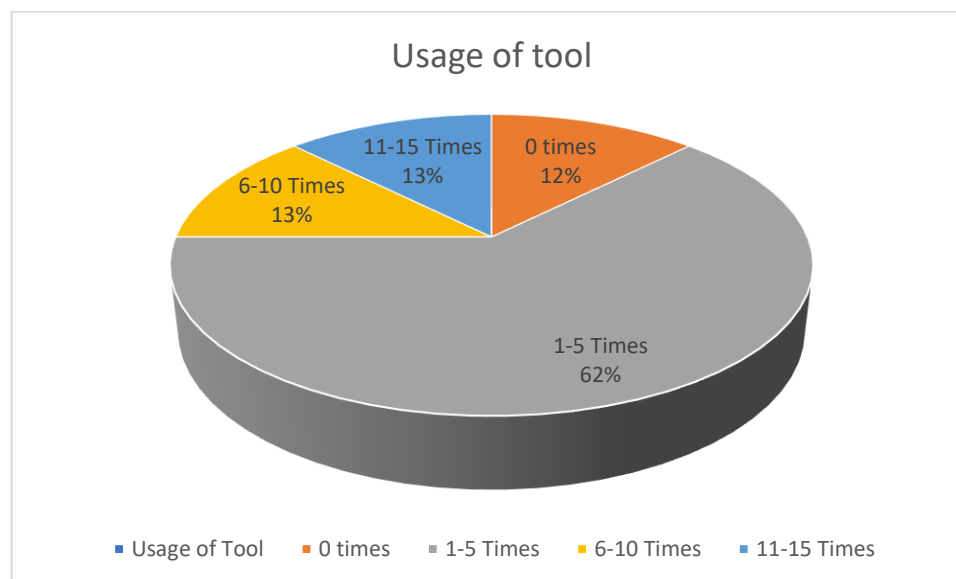


Figure 2. Tool usage by participants

The post intervention survey asked participants to answer the same questions as the pre intervention survey with the exception that the focus was on the new handoff tool and process. Participants were asked to evaluate the effectiveness and functionality of the new handoff tool and their satisfaction with the new process using the following Likert scale (1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree). The results are presented in Table 3.

Table 3. *New Handoff Tool Functionality and Satisfaction*

Handoff Tool Functionality & Satisfaction	Mean	Std Deviation
I am satisfied with the new handoff tool	3.63	0.52
The new handoff tool lends itself to mistakes	2.13	0.35
The handoff process is comprehensive	3.75	0.46
The new handoff process provides an adequate way to communicate important information about the patient	3.88	0.84
The new handoff process is efficient and not time consuming	3.5	1.07
The length of the new handoff tool is appropriate	3.75	0.46
The new handoff tool lends itself to memory	3.75	0.46

Comparison of pre-intervention and post-intervention surveys

A Wilcoxon Signed-Ranks Test was used to examine pre- and post-intervention variables. There was a statistically significant improvement in satisfaction with the transfer of care process following the implementation of the standardized handoff tool ($Z = -2.23, p = 0.026$). There were also statistically significant differences in responses demonstrating that participants found the new handoff tool to be more comprehensive ($Z = -2.33, p = 0.02$); less likely to lead to mistakes ($Z = -2.45, p = 0.014$); and a better mechanism to communicate important patient information during transfer of care ($Z = -2.04, p = 0.041$). There was no statistically significant difference regarding the providers' time with or without the tool during transfer of care ($Z = -0.81, p = .414$).

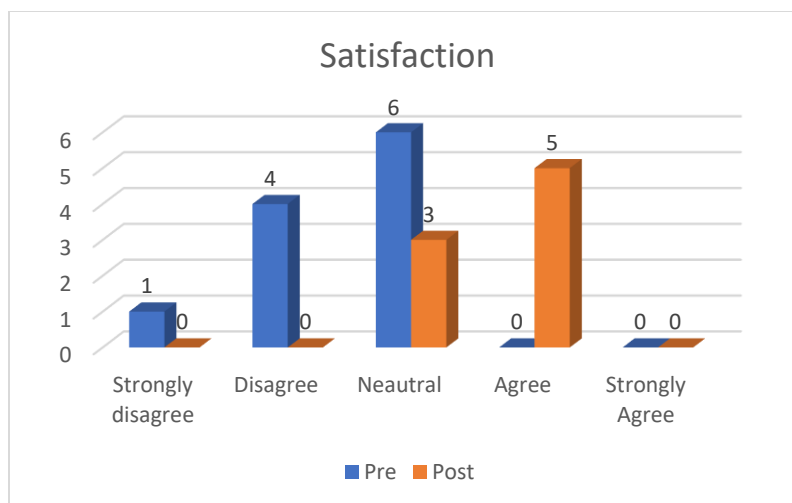


Figure 3. I am satisfied with the handoff process

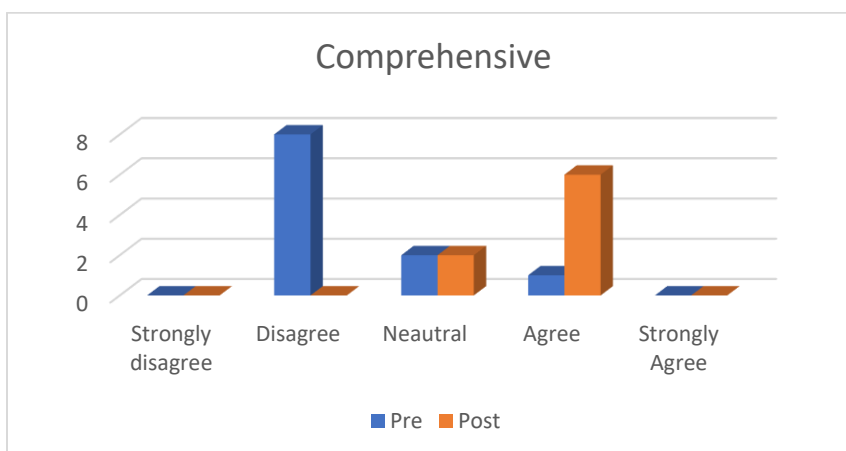


Figure 4. The handoff process is comprehensive

Participants felt the new tool lent itself to memory ($M = 3.75$, $SD = 0.46$) and was appropriate in length ($M = 3.75$, $SD = 0.46$). When asked to describe any positive aspects to the new tool, responses included increases level of care, very comprehensive, beneficial tool, ensures information is not missed. When asked to describe any barriers to implementation, one respondent wrote that it could not be filled out until the end of the surgery which would take their focus off the patient.

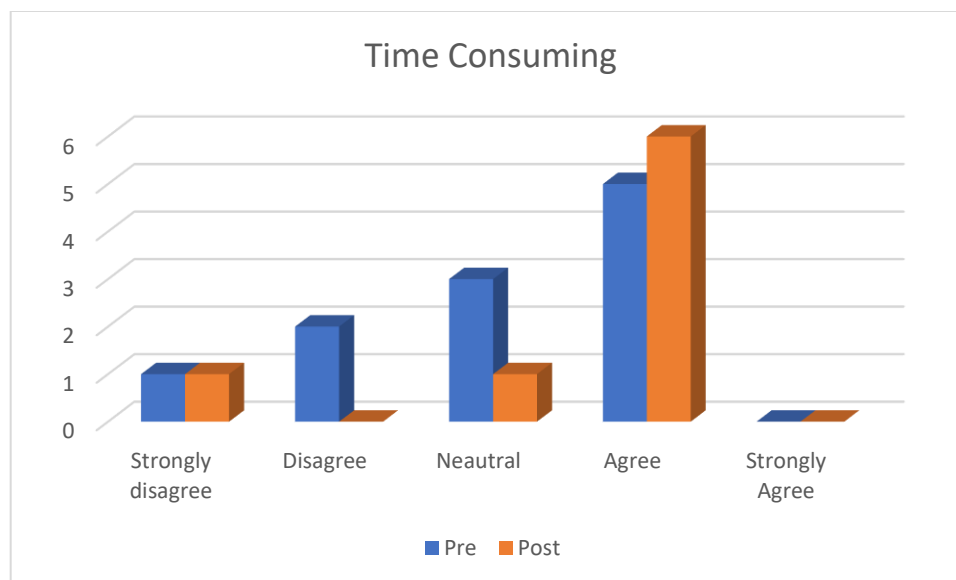


Figure 5. The handoff process is efficient and not time consuming

Discussion

A quality improvement project was undertaken at UPHSM to address the lack of a standardized handoff tool and process during the transition of care between HTCRNA's and HTICU-RN's. A handoff tool was developed with the input of stakeholders gleaned from a pre-intervention survey and feedback was sought following implementation of the new tool through a post-intervention survey. Data analysis was conducted following completion of the tool implementation and collection of feedback. Survey questions assessed pre- vs post-intervention satisfaction, efficiency, and some determinants of patient safety using a combination of Likert scale and open-ended questions.

Analysis of a Wilcoxon Signed-Ranks Test to compare pre and post intervention survey data indicated a statistically significant improvement in participant's overall satisfaction with the use of a standardized handoff tool compared to the handoff process without a tool employed prior to implementation. In addition to improved satisfaction, there were also statistically significant differences in responses demonstrating that participants found the new handoff tool to

be more comprehensive, less likely to lead to mistakes, and a better mechanism to communicate important patient information during transfer of care. The findings from this quality improvement project are similar to those reported in the literature which demonstrate improvement in scores evaluating satisfaction, propensity for errors, comprehensiveness and completeness of the handoff process following the implementation of a handoff tool intervention (Benton et al, 2020; Manser et al, 2013; Wright, 2018).

The only area not showing improvement was the perception regarding the amount of time needed to transfer care with the new tool compared to the process without it. Respondents may feel there is no time saved using the new process. The tool was not used many times during the 5-week period due to some down time on the part of the surgical team. Perhaps with more experience using the tool, providers find it is less time consuming to complete and use. In addition, the authors are still working with the HTICU-RNs and HTCRNs to make any final revisions based on recommendations.

An analysis of responses to open-ended questions asking participants to provide any positive aspects of the new handoff tool revealed that the tool was very well received and seen as a mechanism to improve care and communication. When asked about barriers, only one participant responded with concerns over the tool distracting from care at the end of the case.

Limitations/Barriers/Recommendations

This project had several limitations. This project was conducted in a single institution that has only one heart surgeon and a small team of HTCRNs and HTICU-RNs. As a result of a relatively small volume of weekly post-CABG patients, many participants were unable to use the tool more than 5 times and some likely did not get to use the new tool at all. A longer implementation phase would be recommended for future projects allowing more time for greater

familiarity with the tool. In addition, repeating this project in multiple institutions and in larger facilities with more providers is also recommended.

The implementation phase was conducted at a time when the heart surgeon was unexpectedly unavailable for part of the time. This impacted the number of times participants could use the tool as well. Finally, there may have been some survey fatigue on the part of the respondents. The quantity of post-intervention responses to the follow-up survey lagged behind pre-intervention response numbers. Despite multiple verbal and email reminders, the number of respondents did not significantly increase. If a similar project is conducted at this facility in the future, a link to the survey sent via text message as well as some type of incentive may increase participation.

Conclusion

The use of a standardized handoff tool allows for a consistent and complete handoff of necessary patient information from one provider to another. The goal of this project was to improve knowledge transfer during the handoff period between HTCRNAs and HTICU-RNs as well as satisfaction with the transfer of care process. This evidence-based quality improvement project was successful in implementing a standardized handoff tool that has the potential to reduce medical errors and improve patient safety for post-CABG patients at UPHSM. Further education will be necessary to reinforce, improve and maintain this success.

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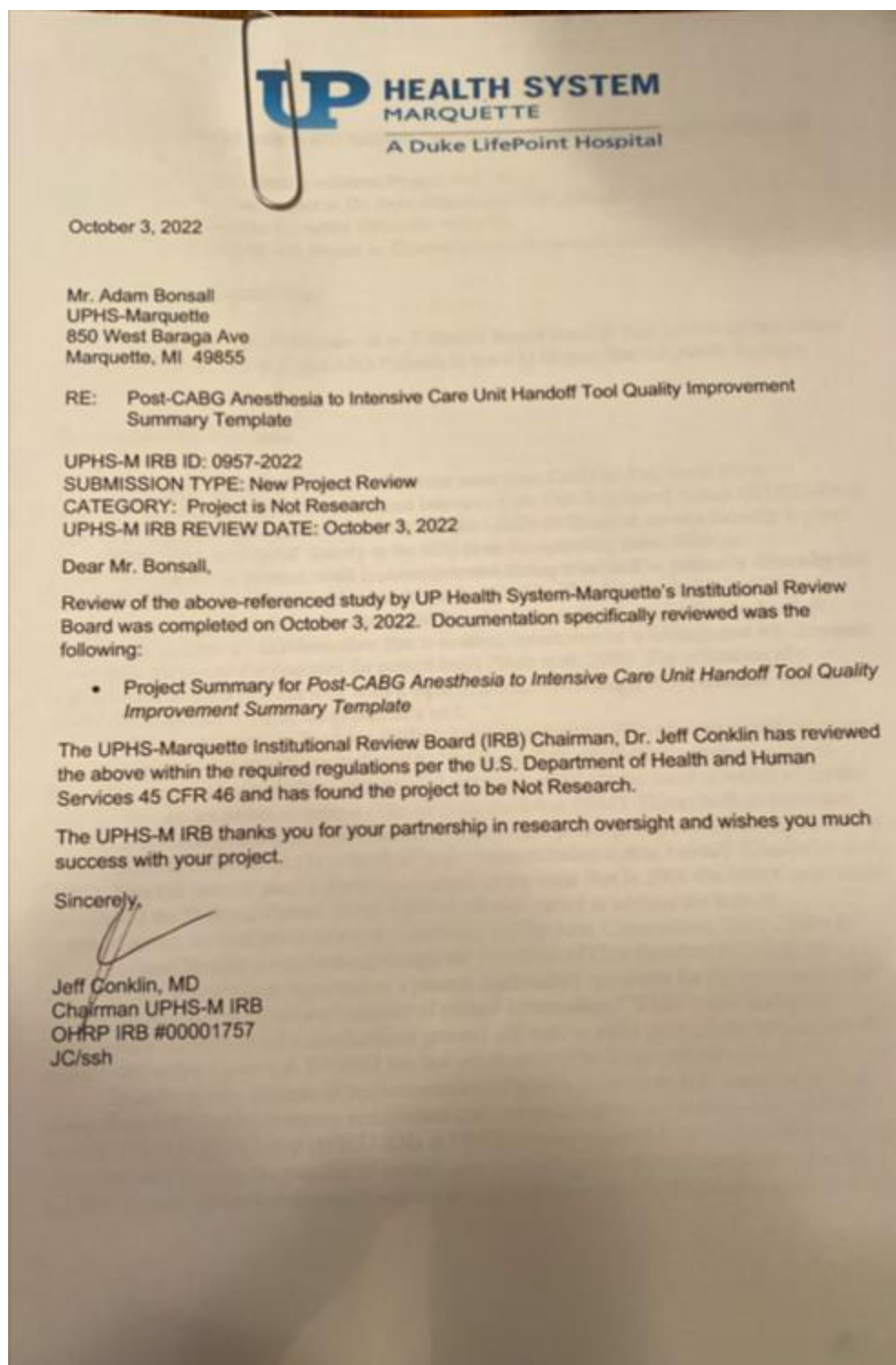
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APPENDIX A: IRB LETTER



APPENDIX B: PRE-INTERVENTION SURVEY

1. What is your specialty?
 Anesthesiologist CRNA ICU RN

2. How long have you been working at UPHS Marquette Hospital?
 0-5 years 6-10 years 11-15 years 16-20 years 21-25 years 26-30 years
 31-35 years Over 35 years

3. On average how many hours per week do you provide care at UPHS Marquette
 36 hours Less than 36 hours More than 36 hours

4. Are you currently using a systematic process for communicating vital information during transfer of care between the anesthesia department and ICU for Post-CABG patients (e.g. do you have an existing process for report)
 Yes No
 If so please describe

5. I am satisfied with the current handoff when giving/receiving information on the patient.
 1-Strongly Disagree 2-Disagree 3-Neutral 4-Agree 5-Strongly Agree

6. The current handoff process lends itself to mistakes.
 1-Strongly Disagree 2-Disagree 3-Neutral 4-Agree 5-Strongly Agree

7. The current handoff process is comprehensive.
 1-Strongly Disagree 2-Disagree 3-Neutral 4-Agree 5-Strongly Agree

8. The current handoff process provides an adequate way to communicate important information about the patient
 1-Strongly Disagree 2-Disagree 3-Neutral 4-Agree 5-Strongly Agree

9. The current handoff process is efficient and not time consuming

1-Strongly Disagree 2-Disagree 3-Neutral 4-Agree 5-Strongly Agree

10. Please choose what you feel to be the 7 most important factors to communicate when transferring care of an anesthetized patient from one provider to another post-CABG.

patient medical/surgical history

Procedure details

Allergies

Status of paralysis (e.g. train of four)

Information about narcotics that have been administered/narcotics left to be accounted for

Information about ventilatory status (PIP, ETCO₂, LMA vs ETT, ventilation mode etc.)

IV access and other invasive lines

Fluid administration output/blood loss

Information about temperature; warming or cooling the patient

Information on level of difficulty of ventilation/intubation

Information on antibiotic administration

Time on bypass

11. Please suggest any other information you feel would be important when transferring care

from one provider to another

12. Which characteristics of the transfer of care process would MOST likely lead you to

adopt the use of a standardized hand off tool in practice? (choose all that apply)

Brevity

Purposeful

Utility (easy to use)

Organized (organizes salient elements of the case for easy retrieval)

Comprehensive

Conductive to memory

Has a written component

Improves patient safety

Encourages proper reconciliation of controlled substances

Provides quick orientation to the ongoing case and patient condition

13. Please suggest any other characteristic of a transfer of care process that might lead you to adopt a standardized hand off tool.

14. What barriers would MOST likely prevent you from adopting a standardized hand off tool for the transfer of care process (select all that apply)

There is nothing wrong with the way I am doing it now

I don't see the point

It would take to long

It would take my attention away from the patient

It would be difficult to police

None of the above; I would be willing to adopt a systematic approach to transferring care if it improved my practice and promoted patient safety.

15. Please suggest any other barriers you feel would prevent you from adopting a standardized hand off tool for the transfer of care from anesthesia department to the ICU for post-CABG patients

APPENDIX C: POST-INTERVENTION SURVEY

1. What is your specialty

Anesthesiologist CRNA ICU RN

2. Over the past 5 weeks, how many times did you use, to some extent, the new handoff tool as part of your transfer of care process when either giving or receiving report of a post CABG patient.

0 1-5 6-10 11-15 15+

3. I am satisfied with the new handoff process when giving/receiving information on a patient.

1-Strongly Disagree 2-Disagree 3-Neutral 4-Agree 5-Strongly Agree

4. The new handoff process lends itself to mistakes.

1-Strongly Disagree 2-Disagree 3-Neutral 4-Agree 5-Strongly Agree

5. The new handoff process is comprehensive.

1-Strongly Disagree 2-Disagree 3-Neutral 4-Agree 5-Strongly Agree

6. The new hand off process provides an adequate way to communicate important information about the patient.

1-Strongly Disagree 2-Disagree 3-Neutral 4-Agree 5-Strongly Agree

7. The new hand off process is efficient and not time consuming.

1-Strongly Disagree 2-Disagree 3-Neutral 4-Agree 5-Strongly Agree

8. The new handoff tool lends itself to memory

1-Strongly Disagree 2-Disagree 3-Neutral 4-Agree 5-Strongly Agree

9. If you have used the new handoff tool for the transfer of care process in the past week/month, please briefly describe any positive aspects of the process.
10. If you have used the new handoff tool for the transfer of care process in the past week/month please provide suggestions for improvement/barriers to its use.
11. Was there anything else that should be added? Deleted?
12. If you have chosen not to use the new hand off tool for the transfer of care process, please explain.
13. Additional comments.

APPENDIX D: HANDOFF TOOL

CRNA Name _____

RN Name _____

Date _____

<u>Relevant medical history</u> Allergies _____	<u>Procedural Details</u> Number of Bypass 1 2 3 4 Valve Replacement N/A AV MV _____ Time on pump _____ Defibrillation Yes No Other-	<u>Access</u> Peripheral 1 2 3 4 Location/Gauge CVC/PA - Yes No Swan Depth _____cm Aline R L Other _____
<u>Intubation</u> Easy Moderate Difficult Glide/DL Tube Depth _____cm Teeth/lip	<u>Vitals/hemodynamics</u> Rhythm _____ Pacer Dependent Yes No PA pressure Pre _____ Post _____ CO/CI Pre _____ Post _____ Temperature _____ C F	<u>Infusions</u> Dobutamine _____ mcg/kg/min Insulin _____ units/hr Norepi _____ mcg/min Amio _____ mg/min Epi _____ mcg/min Milrinone _____ mcg/kg/min Other:
<u>Analgesia</u> Narcotic Total _____ <u>Current Train of four</u> — _____/4	<u>Recent Labs</u> ABG- PH _____ PH _____ PcO2 _____ PcO2 _____ P02 _____ P02 _____ Becf _____ Becf _____ HC03 _____ HCO3 _____ Sa02 _____ Sa02 _____ Blood Glucose _____ HGB/HCT _____ / _____ Fibrinogen _____ Other _____	<u>Fluids/I&O</u> Crystalloid (L) 1 2 3 4 _____ Colloid (ml) 250 500 750 _____ Cell Saver (ml) _____ PRBC (units) 1 2 3 4 _____ Plt's 1 2 3 4 _____ FFP 1 2 3 4 _____ Other _____ Urine output _____ ml EBL _____ ml
<u>BP parameters</u> <u>Standard</u> POD 0 – Systolic 100-120mmhg POD 1 – Systolic 100-140mmhg <u>Other-</u>	<u>Report called</u> Yes No Time out of OR _____	<u>Vent Settings</u> FI02 % 50 60 70 80 90 100 RR _____ Tidal volume _____ PEEP _____ MODE _____ Concerns _____