

STANDARDIZING THE INTRA-OPERATIVE HANDOVER BETWEEN FACULTY
ANESTHESIOLOGISTS USING AN EMR-BASED TOOL

by

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DISSERTATION

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

DOCTOR OF MEDICINE WITH DISTINCTION IN QUALITY IMPROVEMENT

The University of Texas Southwestern Medical Center
Dallas, TX

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ACKNOWLEDGMENTS

Thank you to my faculty mentors Trenton Bryson, MD and Philip Greilich MD for their guidance in completing this project. I would also like to thank Eleanor Phelps, RN and Patty Brown, RN for their continued assistance and mentorship.

Special thanks to:

The UT Southwestern Office of Quality, Safety, and Outcomes Education
UT Southwestern Department of Anesthesiology & Pain Management

ABSTRACT

STANDARDIZING THE INTRA-OPERATIVE HANDOVER BETWEEN FACULTY ANESTHESIOLOGISTS USING AN EMR-BASED TOOL

Short Description: The primary aim of this project is to improve faculty satisfaction with a newly implemented intra-operative handoff tool. The secondary aim is to increase the effectiveness of the intra-operative handoffs by creating a user-friendly electronic medical record (EMR)-based cognitive aid designed to improve the reliability of this process.

Background: Communication failures during intra-operative handoffs can lead to adverse events and poor patient outcomes [1]. Faculty anesthesiologists frequently perform intra-operative handoffs as a part of their patient care responsibilities. While handoffs have garnered international attention calling for standardization [2,3], there are currently few specific recommendations on how intra-operative handoff should be completed. Checklists in the electronic medical record (EMR) have been shown to be effective in improving relay and retention of critical patient information during intra-operative transfers of care [3]. However, the essential elements and qualities in an intra-operative handoff tool have not been explored. This project identified the attributes in an EMR-based intra-operative handoff tool that are critical to faculty anesthesiologists at UT Southwestern Medical Center (UTSW).

Methods: Faculty anesthesiologists were interviewed for thoughts and comments about the current intra-operative handoff tool implemented at UTSW. Qualitative interview responses were separated into unique comments and analyzed for common themes. Quantitative results on opinions about current process handoff process and tool were determined. Critical-to-quality elements for effective intra-operative handoff tool were extracted from interview responses.

Evaluation and Outcomes: Faculty had mixed opinions about current intra-operative handoff process, and most were unsatisfied about current handoff tool. From one-on-one interviews to explore faculty opinion, a total of 80 unique comments were generated regarding the tool, and 4 main themes were identified: patient information, tool functionality, data organization, and implementation. A total of 17 subtopics were identified based on comments. 15 critical-to-quality in an intra-operative tool was identified.

Impact and Lessons Learned: Detailed faculty opinion and feedback regarding current intra-operative handoff process and tool at our institution were collected. Key critical-to-quality elements for an effective intra-operative handoff tool were identified and a proposed tool was created based on feedback. Further work will focus on working with electronic medical record system to develop updated and "ideal" tool based on results of this study.

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INTRODUCTION

Problem Description

"Handover", also known as "handoff", is the transfer of care and responsibility between healthcare providers. In the operating room, anesthesiologists frequently participate in intra-operative handovers. Currently, the UT Southwestern (UTSW) University Hospital system does not have a standardized process for intra-operative handovers, and an intra-operative handoff tool has not been optimized to support high-quality handoffs. This lack of a structured handover process and an effective handoff tool can lead to inefficiencies and poor clinical outcomes, if vital information is not adequately reported.

Available Knowledge

Clinical Impact of Standardized Patient Handover

Handoffs commonly take place between healthcare providers in the hospital. During handoffs, clear communication and transfer of critical patient data is pivotal for safe patient care. However, "communication failure" was determined as the root cause of 65 percent of all sentinel events in 2006 ¹. In response to growing concerns for patient safety due to poor handoffs, The Joint Commission identified handover communication as a National Patient Safety Goal in 2007 ¹ and as a sentinel event in 2017 ². The World Health Organization (WHO) has also identified "Communication during patient care handover" as one of its "High Five" Patient Safety Initiatives ³. Standardized patient handovers are associated with reduced medical errors, less preventable adverse events, and improve communication and team work ^{4,5}. Thus, both quality studies on handovers and external pressures from overhead organizations have promoted

institutions around the country to standardize the way patient care is transferred between providers.

Intra-operative Patient Handovers

Handoffs for patients undergoing operations in the operating room frequently occur between anesthesia providers, but currently, there are no universally accepted guidelines for performing intra-operative handovers. Intra-operative handoffs can be "high-risk, error-prone" patient care responsibilities, with many potential barriers to safe transfer of care: lack of consistency and organization, information overload, and inaccurate information transfer ⁶. While prospective studies focused on intra-operative handoffs are scarce, retrospective studies have shown that intra-operative anesthesia care transitions are strongly associated with worse patient outcomes ^{7,8,9}. The more times a patient is handed off to another care provider during the operation, the more likely the patient will have poor outcomes post-operatively. This trend associated with intra-operative handoffs is present in both general and specialty surgeries ⁸. Therefore, intra-operative handoffs are critical events that if not performed adequately, can lead to major adverse events. However, while several checklist tools and mnemonics have been studied to improve handover communication around the hospital, such as the I-PASS tool ^{10, 11}, few have been created specifically for the intra-operative setting.

EMR Based Intra-operative Handover Checklist

The electronic medical record (EMR) system is quickly replacing traditional methods of paper anesthesia charting in the operating room. The EMR offers a variety of features that a paper chart cannot, such as efficiently extracting information from the patient's complex medical records, providing notifications to highlight important aspects of the chart, and organizing the information into a concise but thorough display. Due to growing concerns for patient safety

during intra-operative handovers, many hospitals have adopted electronic checklists as a way to optimize handoffs and reduce communication errors. In a study conducted at Massachusetts General Hospital, Agarwala showed that an electronic checklist significantly improves transfer and retention of critical information during intra-operative handovers ⁵. With an electronic checklist, providers were able to respond correctly about how much fluid was administered, amount of certain medications were given, and when the next dose of antibiotics would be due more times than if no checklist was used. Additionally, a department survey following checklist implementation saw significant improvements in the perception of quality of communication and identification of concerns.

Rationale

An EMR-based checklist was decided as the most effective format for the intra-operative handover tool at UTSW. The current intra-operative handoff tool used at UTSW University Hospitals was developed by Dr. Trenton Bryson (Deputy, CMIO for Perioperative Services) and implemented into the EPIC EMR as a first step to standardized the intra-operative handoff in 2014. The tool has undergone two complete PDSA cycles since its inception. The first PDSA cycle of this project laid the groundwork for an EMR-based checklist pop-up screen. Through literature review and faculty interviews, a list of potential items to include in the intra-operative tool was compiled. Faculty anesthesiologists were then surveyed via multi-voting to determine the essential elements of handoff (ie. Patient allergies, estimated blood loss of the patient) that should be included in the tool. Dr. Bryson designed the tool following an SBAR (Situation - Background - Assessment - Recommendation) format. A screenshot of the first version of the intra-operative tool can be found in Appendix 1.

Faculty reaction to the first iteration of the tool was mixed. The main issues many faculty had included data overload, poor organization and display, distracting color scheme, and poor workflow. The second PDSA cycle of the project aimed to improve the initial effort. Based on feedback, Dr. Bryson surveyed faculty on top elements to keep and discard on the tool, and the tool was modified to included less data. The new tool still retained the SBAR format, but the background section was simplified to have only a focused problem list, estimated blood loss, and amount of blood given. Critical actions and questions to review were moved to be its separate section on the side of the screen. Additionally, a hard-stop step was implemented to link the handoff tool with the attestation step. Faculty now can only access the attestation step after using the handoff tool, and they must complete the attestation within 10 minutes of filing a handoff event in the EMR. This was added as a quality measure aimed to improve compliance of handoff tool usage. Lastly, the tool was changed to have an overall grey color scheme that was less distracting. The second version of the intra-operative handoff tool that is currently implemented at UTSW can be seen in Figure 1, and the steps to complete a handoff using the tool are detailed in Figure 2.

Situation		• ARE THERE ANY MEDICATIONS COMING DUE? • ARE YOU ANTICIPATING ANY CHANGES? • ARE ANY LABS PENDING? • DOES ANYTHING NEED TO HAPPEN RIGHT NOW?
@NAME@ is a @AGE@ year old @GENDER@ having @ORPCALL@ for @ORDXCPRE@. @ALLERGIES@		
@ASASTATUS@ @DIFFICULTAIRWAY@		
Background		
Focused Problem list		
Cardiac	Neuro	
Pulmonary	Renal	
		@EBL@ @BLOODGIVEN@
Plan		
@ADMISSIONCLASS/ASSIGNEDBED@		IS THE PLAN TO EXTUBATE OR STAY INTUBATED? DO YOU HAVE ANY PACU CONCERNS?

Figure 1. Current intra-operative handoff tool at UTSW University Hospitals. This is version 2 of the handoff tool. This tool is displayed on against a grey background. "@" symbols represent SmartPhrases where data can be automatically pulled from the patient's hospital chart.

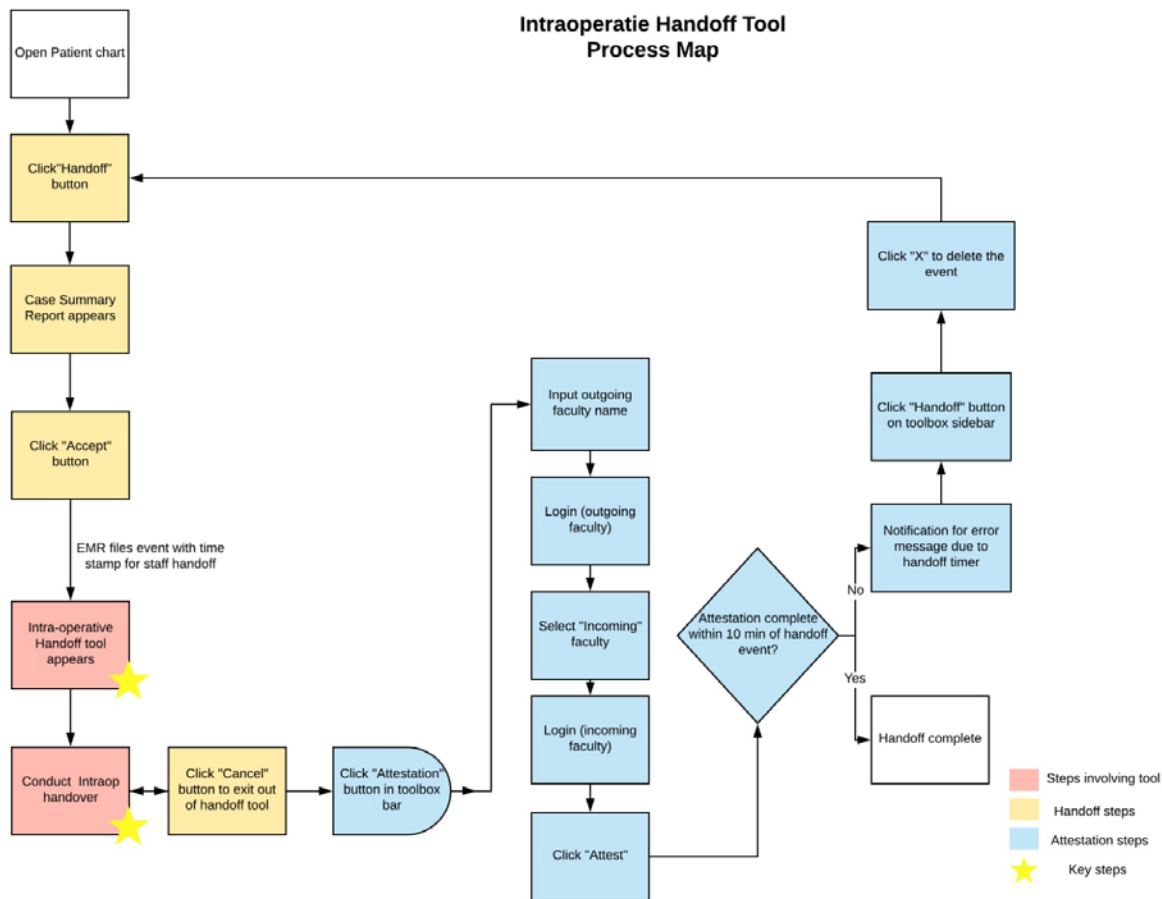


Figure 2. Current intra-operative handoff tool process map. Organized based on steps that involve using the tool to conduct the handoff (red and starred), steps that use the intra-operative handoff tool (tan), and steps that involve completing the attestation (blue)

Current State of Handovers and Areas of Improvement

Intra-operative handoffs at UTSW University Hospitals vary between institutions, between departments, and between faculty. Currently, there are no specific institution- or department-wide guidelines on the structure of intra-operative handoffs. Faculty handoffs are usually dependent where the faculty received his/her residency training. While significant variability exists, most faculty anesthesiologists follow a similar organizational format: pre-operative patient information, to intra-operative course, to post-operative plans. Incoming faculty

anesthesiologists usually have the opportunity to ask questions about the patient and the case to clarify any additional information prior to the end of the presentation.

After the intra-operative handoff tool was introduced, handoffs at UTSW did not change significantly. Most faculty continued to perform handoffs as they had been, and simply clicked through the tool as a series of required buttons in the EMR. There are several reasons for why the tool has been less successful. Foremost, most faculty are likely not familiar with having a standardized handoff protocol, and thus have established a culture of being comfortable with the status quo. Peter Drucker, famous economics intellectual and author, once wrote, "culture eats strategy for breakfast". Without first changing the culture and getting all players on board, planned projects often fail. Secondly, the project did not adequately account for the varied cases and patients across departments. Cases at the outpatient surgery center are usually quick procedures done on healthier patients, which differ significantly from the patients undergoing cardiothoracic surgery with multiple co-morbidities on the cardiac floor. The tool was designed for a thorough patient review, and may be seen as excessive for a straightforward case. Thirdly, the tool functionalities have not been optimized. Following the first iteration of the tool, the tool was simplified to include even less data. Many faculty had mentioned that the tool was "not useful" and "add no value", which are likely due to its lacking functionalities and information density.

Specific Aim

The primary end goal of this project is to establish a more structured intra-operative handover process within the UTSW university hospital system and implement an effective intra-

operative handover tool within the EMR. A version of a proposed intra-operative handover tool has already been implemented as a previous iteration of the PDSA cycle for this project.

The primary aim of this current study and PDSA cycle is to increase the user satisfaction of the handoff tool by 50% from current baseline by 2019. The secondary aim of the project is to identify main causes of ineffective usage at the various UTSW university hospital sites. The third aim of this study cycle is to understand the opinions of faculty anesthesiologists at three UTSW university hospital sites regarding intra-operative handover process. Finally, the fourth aim is to implement the feedback from the primary and secondary aims to improve the intra-operative handover tool and process.

METHODS

Study Setting

The UT Southwestern University Hospital includes William P. Clements University Hospital (CUH), Zale Lipshy University Hospital (ZLUH), and the Outpatient Surgery Center (OSC). Clements and Zale-Lipshy University Hospitals are large hospitals with over 30 combined operating rooms that perform procedures on over 3,500 patients per year. From October 2016 to September 2017, 2996 intra-operative faculty handoffs were documented between CUH, ZLUH, and the OSC.

The first intra-operative handover tool was developed and implemented at UTSW University Hospitals in 2014. It was programmed through the EMR system used at the hospital, Epic Systems (EPIC), and made available for access to all faculty anesthesiologists at the study sites. Two PDSA cycles have been completed to initiate the project and improve on the first version of the tool.

Intervention Development

The intra-operative handover tool was created by Dr Trenton Bryson to be implemented within the EPIC EMR system. The tool was intended to be a visual aide that can guide faculty anesthesiologists to perform standardized handovers that are efficient and thorough, and prompt discussion. Elements to be included in the tool was gathered through multi-voting, with a strong emphasis on keeping it short and concise. The organization of the handover tool followed a SBAR (Situation, Background, Assessment, Response) format, which was recommended by literature review as an effective communication mnemonic.

The tool was built into the intra-operative records and allowed faculty anesthesiologists to access the handover button with a single click. Following the single button click, the handover tool is presented as a pop-up report to guide the handover process with pertinent handoff information and visual cues. The tool includes data that can be extracted automatically from the patient's hospital charts using SmartPhrases, such as the patient's most updated allergy list and airway status, as well as visual cues to prompt discussion about critical topics. Concurrently, clicking on the handover button triggers a time stamp with provider name and event time, which will document the handover as an event in the intra-operative records.

Modified Delphi Survey/Multi-voting

We used a modified Delphi method to identify items to be included in the intra-operative handover tool. A detailed list of possible items was compiled from literature review and faculty input, then faculty were surveyed on the items that they felt were "essential for the handover". Items on the list that received greater than 90% consensus as "essential" were included in the final tool. Items that received greater than 75% consensus but less than 90% consensus were sent out on a second survey for voting, and items that receive greater than 90% consensus on the second survey were also included in the final tool. An example of the survey can be found in Appendix 2.

Measures and Data Collection

To understand faculty perception of the intra-operative handover process and tool, and obtain constructive feedback from users to improve the current tool, we conducted one-on-one interviews with faculty anesthesiologists at all UTSW University Hospital sites currently utilizing the intra-operative handover tool. Responses from interviews were both qualitative and

quantitative. To assess overall satisfaction of the handover tool and process, questions included "what are your thoughts about the current state of the intra-operative handover and the most recent iteration of the intra-operative handover tool?" and "if resources were not an issue, what does your ideal handover and handover tool look like"? To quantify this data, several questions were administered on a ten-point Likert scale, which evaluated faculty satisfaction of handovers and tool, and faculty perception of the handover tool. Qualitative responses regarding faculty's opinions about the intra-operative handover process and tool were transcribed and de-identified. Common themes were extracted from the responses and analyzed for frequency using qualitative analysis. A full list of interview questions can be found in Appendix 3.

Qualitative Analysis

One-on-one interview responses were transcribed, and each interview response was separated into unique comments. All comments were analyzed and identified for relevance for topic. Relevant comments were separated based on common themes, and number of comments within each theme was counted. Within each theme, comments were further sub-grouped based on recurring topics. A summary statement or topic was created based on comments within each subgroup.

Statistical Analysis

Data was merged and inputted into Microsoft Excel spreadsheet for analysis. Likert scale responses were summed and analyzed for average. Free text responses were analyzed for positive and negative feedback, and sorted for frequency of specific comments on topics.

Ethical Considerations

The project was designed for internal program evaluation and quality improvement only.

No major conflict of interest was identified in this study.

RESULTS

Faculty Interview Results

A total of 15 faculty interviews were conducted with varying degree of detail in responses. From their transcribed responses, 80 unique comments were generated regarding the intra-operative handover tool, and 40 were generated regarding the intra-operative handover process. Regarding the intra-operative tool, four main themes were identified based on faculty comments: patient information (n= 22), data organization (n = 15), tool functionality (n = 24), and implementation (n = 4). Regarding the intra-operative process, faculty comments were grouped into three main themes: general thoughts (n=10), quality of intra-operative handoffs (n= 19), and visual guide usage (n = 7). Detailed breakdown and subgrouping of comments can be found in Table A and B.

Table A. Faculty Response to Current Intra-operative Handoff Tool

Theme	Frequency	Topic	Example
Patient Information (n=22)	7/22 (32%)	Incomplete patient information (not enough fields)	"However, the tool is often incomplete, with a lot of missing information about the patient in the problem list, comorbidities etc" "[Handovers] need extra information about the patient that's not in the handover tool right now, such as echo findings, labs"
	2/22 (9%)	Poorly auto-generated patient data	"Many fields are missing because people do not fill them out"
	5/22 (23%)	No access to critical data/results	"The main thing is that there should be easy access to the important information for each case."
	3/22 (14%)	Irrelevant information in tool	"OSC patients are usually healthy and cases are short; so faculty don't really use the handover tool to handover cases to other faculty members"
	5/22 (23%)	Nonessential information for supervisor	"The handoff tool may be better for residents/CRNAs since there are a lot of "boxes to check off" and they can actually look at the information."

Data Organization (n=15)	7/15 (47%)	Poor/unfamiliar formatting	• "Screen looks different from guides that faculty are familiar with (ie preop notes), people are not used to it" • "SBAR doesn't really apply, so it's strange for users to have to be in a different frame of mind when giving handoffs."
	2/15 (13%)	Pop up fatigue	• "Just another pop-up"
	3/15 (20%)	Bland color palettes/display	• "The grey font does not look very appealing to the eye." • "Colors are bland... looks like another pop up window"
	3/15 (20%)	Tool not applicable for all settings	• "OSC patients are usually healthy and cases are short; so faculty don't really use the handover tool to handover cases to other faculty members"
Tool Functionality (n=24)	6/24 (25%)	Poor extraction of information (Lots of noise)	• "For example, while the problem list auto populates information, it will be better if the info was pulled from the pre-op note instead of the hospital chart."
	6/24 (25%)	Too many clicks	• "Feels like extra screen to click through" • "Improve workflow so you don't have to click multiple buttons to reach the handover screen"
	2/24 (8%)	No interactability	• "Don't want to use cues. Want actual data if possible/in a summary sheet way"
	6/24 (25%)	Tool disrupts workflow (handoff > attestation is not ideal)	• "Attestation should be linked to handover tool, so you don't have to do multiple clicks" • "The current workflow is also disorganized"
	4/24 (17%)	Inconvenient with time lock	• "Forced to sign in and sign out within a certain time, which can be good and bad, requiring some additional clicks/multiple "handovers" if you miss the window to sign in."
	1/24 (4%)	Process separate from billing	• "Make sure process works for billing so no back tracking."
	2/24 (8%)	No way to contact resident/CRNAs	• "If can minimize clicks and notify the resident/CRNA in the room, it would be great. "
Implementation (n=4)	4/4 (100%)	Faculty culture	• "It's more likely that it's a culture thing why people don't use it" • "The culture is that most people are ok with the way things are right now."

Table B. Faculty Response to Current Intra-operative Handoff Process

Themes	Summary Statement	Examples
General thoughts (n=10)	Faculty are accepting of current handoff process (6/10)	• "The culture is that most people are ok with the way things are right now." • "Current faculty to faculty handovers on the CV floor are good"
	Faculty want to pursue standardization of intra-operative handoffs (4/10)	• "It would be nice to standardize the handover like the ICU presentations." • "Ideally best if standardized, but people will need to get educated about the new process."
Quality of handoffs (n = 19)	Quality of handoffs vary depending on patient and case complexity, as well as who is performing handoff (7/19)	• "Handoffs are done in person between faculty, and can have variation depending on who's giving handoff" • "[Current quality of handoffs] varies, depends on person/case, probably good to standardize"
	Organization of patient information varies greatly (4/19)	• "Handovers are pretty variable and the order people talk about things in the handoff is somewhat random." • "Right now it is disorganized and can benefit from standardization." • "People say things in the order they want, and most of the time will be ok."
	Completeness handoff varies, but generally most patient information is passed down well (4/19)	• "Everyone has a diff style of handovers, but information usually gets passed." • "... Most faculty do a good job passing on the "unique" information about the case"
	Location of handoff varies (3/19)	• "Most people do handovers outside, not in the OR." • "If the case is bigger/patient is more complex, the handovers get more time. If it's something very serious, then faculty will also go into the Ors to do the handoff."
Visual guide usage (n=7)	Most faculty usually go off the pre-op note for intra-operative handoff, not the intra-operative handoff tool. Having a guide for handoff would be helpful. (6/7)	• "Most people just go through pre-op note if they need information about the patient" • "Faculty go off the pre-op." • "Ideally, handoffs would be good to be standardized and have something to help guide."

Faculty Response to Intra-operative Handoff Process and Tool

Faculty response to current handoff tool was generally poor. On a ten-point Likert scale, faculty satisfaction of the current intra-operative tool received a mean score of 4 out of 10 (1: not

satisfied, 10: very satisfied). Faculty rated usefulness of the current intra-operative tool as a mean of 3.9 on a 10 point Likert scale (1: not very useful, 10: very useful). (Figure 3)

Out of 24 comments made regarding patient information, comments were grouped into 5 main subtopics: incomplete patient information (7/24), poorly auto-generated patient data (2/24), lack of access to critical data and results (5/24), irrelevant information presented in tool (3/24), and presentation of nonessential information for the supervising anesthesiologist (5/24). 15 statements were made directly commenting on the data organization and display of the current tool, with four main subtopics: poor and unfamiliar formatting of the tool (7/15), pop-up fatigue (2/15), bland color palettes (3/15), and tool not organized for all settings (3/15). 24 comments were extracted directed at the tool functionality, with 7 subtopics: poor extraction of information with excessive noise (6/24), requiring too many clicks (6/24), lack of interactability with the tool (2/24), feeling that the tool disrupts workflow (6/24), the tool is inconvenient with the current timer between handoff and attestation (4/24), the handoff process is separate from billing (1/24), and no way to contact the primary anesthesia provider/anesthesia trainee in the room after handoff (2/24).

Faculty responses to the current intra-operative handover process was mixed, with a mean of 6.25 out of 10 when asked about satisfaction of the current process. The most common responses when surveyed about the current intra-operative handover process were "okay" and "generally satisfactory". Out of 10 general opinion comments, 6 comments state that faculty are accepting of current handoff process, while 4 other comments state that faculty want to pursue more structure in intra-operative handoffs. Out of 19 comments generated regarding faculty perception of quality of handoffs, 4 sub-statements were generated: faculty believe that quality of handoffs vary depend on patient and case complexity (7/19), organization of patient information

delivery vary greatly between handoffs (4/19), completeness of handoffs vary but generally patient information is passed down well (4/19), and that location of handoffs often vary (3/19). 7 comments were generated regarding usefulness of a visual aid during intra-operative handoffs, with 5 of 7 making specific comments stating that faculty usually use the pre-op note instead of the intra-operative tool as guide.

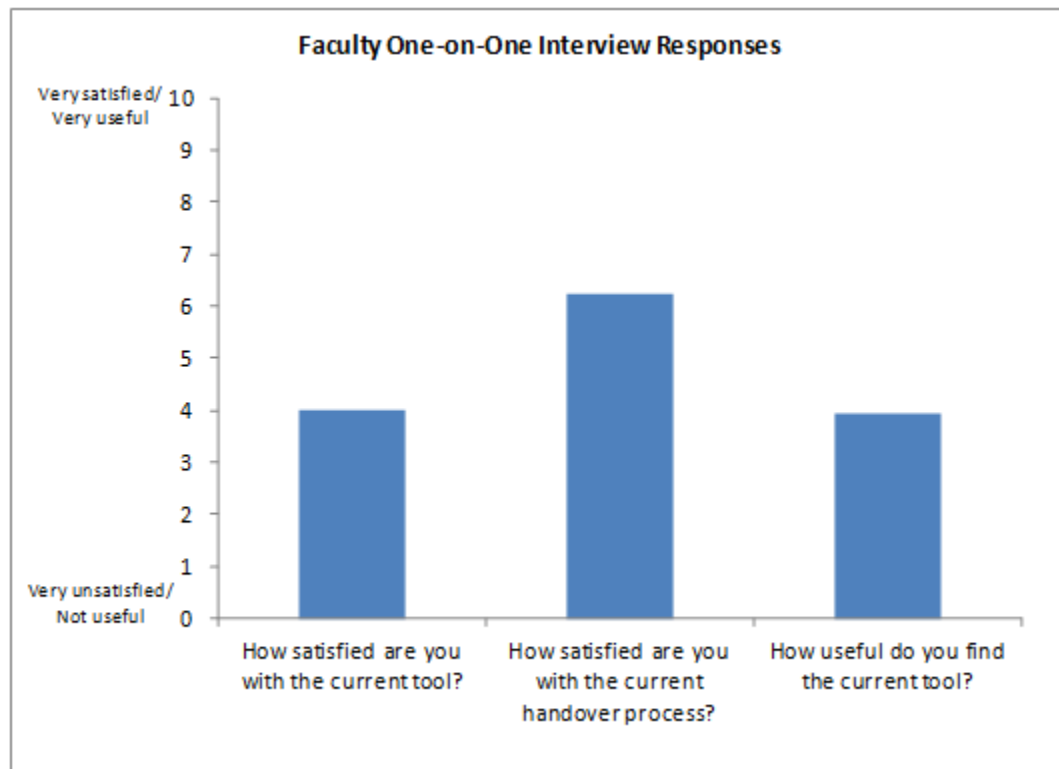


Figure 2. Faculty one-one-one interview responses to 1) how satisfied they are with the current intra-operative handoff tool, 2) how satisfied they are with the current intra-operative handoff process, and 3) how useful they find the intra-operative handoff tool. Responses were reported in a 10 point likert scale. 1 - very unsatisfied/not useful, 10 - very satisfied/very useful. (n=14)

Ideal Intra-operative Handoff Tool and Process

When asked about the "ideal" intra-operative handoff process, most faculty expressed that it should be "fast" and "efficient", with a format that complements the handoff tool, and is organized in a pre-operative patient information to intra-operative course to post-operative plan

flow. The ideal workflow should directly integrate the handoff tool to the attestation screen, and minimize the number of clicks in the EMR required for faculty to complete a handoff.

When asked what the "ideal" tool would be, most faculty anesthesiologists expressed that the tool should also be "fast" and "efficient", requiring minimal number of clicks on the tool. Critical patient information should be displayed cleanly and clearly on a single page, and results such as echocardiogram and EKG should be easily accessible if not already displayed. Faculty also strongly preferred a tool that followed a format they are familiar with.

DISCUSSION

Summary

This project is the third PDSA cycle in the implementation of a structured intra-operative handoff process and creation of an intra-operative handoff tool at UTSW University Hospitals. The first PDSA cycle of the project initiated the project, and involved the planning, designing, and implementation of the first intra-operative handoff tool. The second PDSA changed the tool drastically, and significantly increased intra-operative handoff tool usage. The current PDSA cycle aims to modify the tool further based on faculty needs, understand faculty opinion on handoff process, and implement feedback to improve effective usage of the intra-operative handoff tool.

Faculty surveys and one-on-one interviews revealed generally negative opinions about the current intra-operative handoff tool, with most reporting the tool as an extra step that does not add value to patient care. Specifically, faculty most often commented on the poor organization and formatting of the tool, the incompleteness of patient information, lack of access of critical labs, and inconvenient workflow. The amount of patient data in the tool was a change implemented during the previous PDSA cycle, as most faculty had felt the first tool contained too much information. This change to decrease patient information likely negatively impacted the utility of the current tool.

The SBAR format of the tool was also frequently mentioned as a negative. Faculty are most accustomed to using the pre-operative note when retrieving patient information. When presenting patients, most noted that they discuss patients with a pre-operative to intra-operative to post-operative course in mind. The tool is designed with the SBAR format as it has been

proven to improve handoff safety across departments and fields ^{12,13}, but intra-operatively, many faculty anesthesiologists expressed that this format was less appropriate.

The major other concern faculty expressed regarding the tool was the excessive number of clicks and poor workflow. In order to complete a handoff, faculty must click the "handoff" button to access the handoff tool, and then submit an "attestation" of handoff separately. The current version of the handoff tool was designed as a hard-stop before the attestation for three main reasons. One, by creating two separate screens, the handoff tool can be accessed at any time. This allows faculty to review a summary of the patient freely without filing a new attestation. Secondly, attestation of handoff is required for billing and legal purposes. By locking the attestation behind a handoff tool, we hoped to incite more active usage of the handoff tool and discussion. Thirdly, the design and programming of the tool was limited by the EMR.

Overall, opinion about the current intra-operative handoff processes were mixed, with many feeling that the quality of handoffs depended heavily on the culture, workflow, and value-add of using an EMR-based tool. Faculty attitudes could overcome some of these limitations. For example, the cardiothoracic anesthesiologists are used to providing very detailed handoffs due to case and surgical complexity. General anesthesia faculty from the inpatient and outpatient surgical centers reported handoffs can be brief, and it usually is a matter of "trust" and "culture" between the faculty that determine quality of the handoffs. Faculty members with extensive experience working with each other often relayed a sense of trust, and therefore asking less questions to clarify the patient or case because they understand each other's clinical judgment. Faculty receiving handoff from people who they have not worked often provide more detailed handoffs and ask more questions, largely due the more senior faculty does not yet know the thought process of the new faculty, and the new faculty must "earn" the trust of the senior.

Because most faculty at UTSW did not train with an intra-operative handoff tool and most have completed handoffs without using one, the culture of the UTSW anesthesiology is reluctant to undergo major changes.

Proposed Intra-operative Handoff Tool and Process

A proposed intra-operative handoff tool was designed based on feedback from faculty responses. The updated tool emphasizes improvements in workflow, data presentation and organization, and access to critical patient data. Qualities of an ideal intra-operative handoff tool based on faculty interview responses and literature review are summarized in Table C.

Table C. Qualities of an Ideal Intra-operative Tool

Theme	
Patient information	Essential information displayed only
	Easy access to critical data (ie. Critical labs, echo findings, ekg)
	Provide adequate background patient data (ie focused problem list, allergies, type and screen)
	Provide adequate intra-operative information (ie. Fluids, I/o)
	Provide post-op plans (ie. Disposition, post op orders)
Data organization	Format align with pre-op, intra-op, post-op
	Keep tool short, ideally 1 page or less
	Improve color scheme, not too bland or too distracting
	Avoid clutter in design, with clear display that's easy to read
	Color code critical information, possibly flag data
Functionality	Minimize number of clicks to use tool
	Eliminate timer between "handoff" and "attestation"
	Link attestation directly to handoff
	Fast and efficient
	Improve auto-generated texts to be more consistent (ensure fields are completed and display properly) to incite discussion but also provide data

To improve workflow, an attestation button was created on the tool to link the attestation step directly to the handoff. By linking handoff directly into attestation, three steps that were causing delay in the current intra-operative tool process are eliminated. Additionally, the time lock on the tool, where faculty must complete the attestation within 10 minutes after conducting a handoff in the EMR will be removed. The steps to complete an intra-operative handoff using the new tool are detailed in Figure 4.

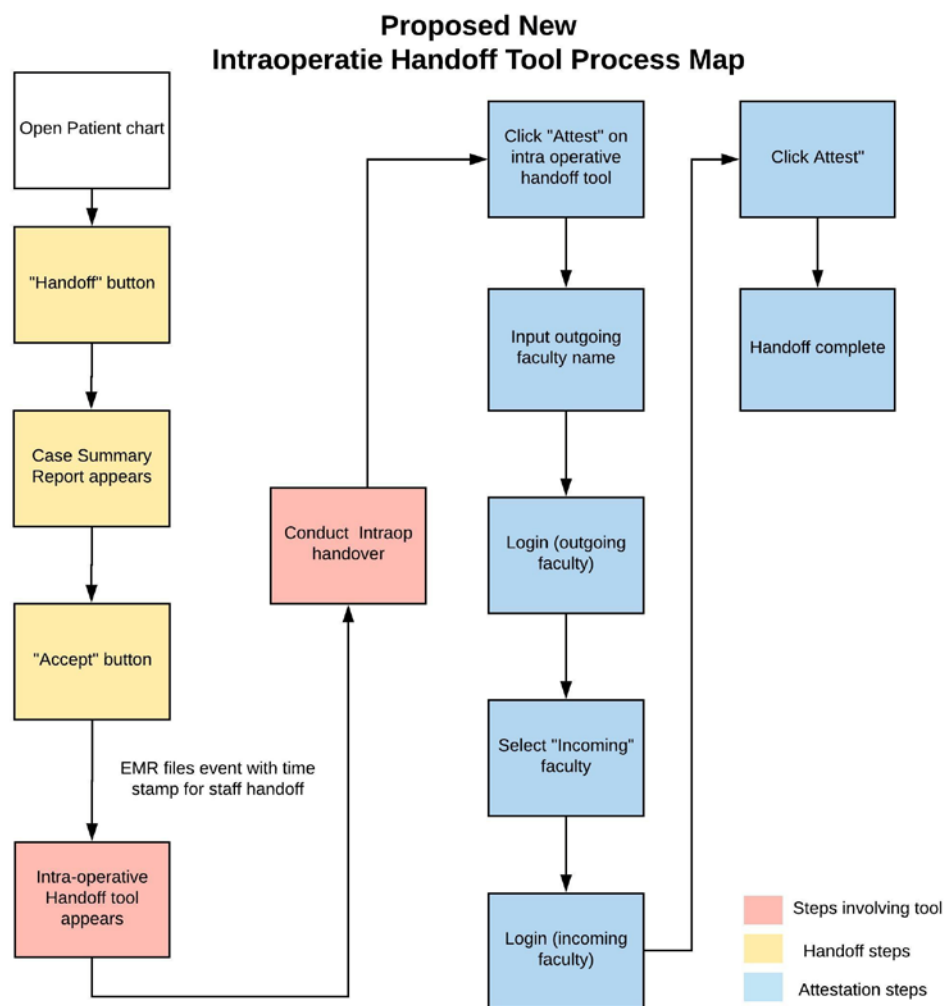


Figure 4. Proposed intra-operative handoff tool process map. Steps that involve the handoff tool (red), steps to access the tool (tan), and steps to complete attestation (blue) are color coded. 6 total delay steps were eliminated from original process map.

Intra-operative data formatting was updated to simulate a patient hospital course, starting with the top section highlighting notable patient demographic information, which allows the anesthesia provider to immediately identify the patient. The next section highlights key pre-operative patient background information, with emphasis on past medical history, system based problem list, and a procedure list. The next section highlights critical intra-operative data, including patient airway status, estimated blood loss and urine output, and some intra-operative medications. The detailed content of this section will be determined from the original Delphi/multi-voting results. The final section targets post-operative plans, post-op disposition, and incites discussion about final comments and questions. The new intra-operative handoff tool will also have color coding and a flag system to notify critical values, which many faculty commented was missing in the current tool.

One of the main issues faculty anesthesiologists had with the current tool is the lack of access to critical patient labs and imaging results. The new tool will have hyperlinks on the right side that grant users quick access to data when needed. Links will include echo results, EKG results, labs, type and screen, and previous patient notes. This data will not be displayed directly over the tool to avoid clutter. A version of the proposed tool is detailed in Figure 5.

Staff Handoff tool v3

Demographic

@NAME@ is a @AGE@ year old
@GENDER@ having @ORPCALL@ for
@ORDXCPRE@.
Allergies: @ALLERGIES@

ASA: @ASASTATUS@
AIRWAY: @DIFFICULTAIRWAY@

Patient History

Past medical history

Cardiac XXX	Neuro XXX
Pulmonary XXX	Renal XXX

Previous procedures

Complete

Intra-Op

Airway

Airway typeMask Quality

Access

IV LocationIV Size

Fluids

Crystalloids	Urine
Colloid	EBL
Blood	

Intra-op Medications:

Abx

Abx Name	Last Start Time	Last Dose
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Complete

Post-Op

Dispo:@ADMISSIONCLASS/ASSIGNE

Extubation plan

DBED@

Concerns?

Post-op pain:

Post-op orders in?

Complete

QUICK LINKS

ECHO results
EKG results
Labs
Type/Screen

Pre-Op note
H&P note
Previous procedures?
Others?

Attest

Cancel

Figure 5. Proposed version 3 intra-operative handoff tool based on faculty feedback and literature review. Created in Microsoft Powerpoint. Final display and functionality of the tool may vary depending on programming limitations.

The intra-operative handoff process will be modified in response to the updated intra-operative tool. With the elimination of several delayed steps in the tool, the process will be more streamlined. Faculty will still be able to tweak their handoffs on a case-to-case basis, but the tool will supplement the handoff process more smoothly. In the new tool, patient information will be

organized in a pre-op to intra-op to post-op format, which many faculty commented to be the "ideal" process. With the tool more accessible and provide more useful data, handoffs will also improve in their reliability and consistency.

Limitations

As the current intra-operative handover project is implemented at UTSW University Hospitals using the EPIC EMR system, the findings regarding satisfaction and usefulness of the tool and process may not be generalized to all other facilities. Facilities and departments encounter different types of cases, patient populations, faculty needs, and sometimes different EMR systems. Additionally, the current project focuses on faculty anesthesiologists only, not residents or Certified Registered Nurse Anesthetists (CRNAs). Faculty anesthesiologists often manage multiple rooms simultaneously, and with greater clinical experience, they may have different needs when compared to a resident or CRNA. Therefore, the results of this study may not be generalized to other types of anesthesia providers as of yet.

Conclusion and Next Steps

The work completed in this project highlights key areas of concern for faculty anesthesiologists when designing an intra-operative handoff tool and rolling out a standardized intra-operative handoff process. By analyzing faculty opinion on the project, we determined factors that make a tool successful and more convenient. These comments will help us address issues in future updates of the tool. We are also concurrently collaborating with Epic Systems and other large academic institutions to design an intra-operative tool for the next official update of the EPIC EMR. An official tool from EPIC will have a significantly greater impact across the

country. Data from our study will be considered strongly in the creation of this tool to accommodate for the needs of all potential users.

Another key aspect of the study to be completed involves extending the project to incorporate residents and CRNAs, in addition to faculty anesthesiologists. Residents and CRNAs are frequently the direct anesthesia provider in the operating room, thus ensuring a standardized handoff protocol for them would be the logical next step.

Funding Disclosure

This project was not funded by any grant programs and was completed using existing resources within the UTSW University Hospital System.

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VITAE

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