

**Implementation of an Intraoperative Standard Handoff Tool Among Anesthesia Providers  
in a Rural Hospital**

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**Author Note**

The candidate completing this quality initiative project has no current or potential conflicts of interest.

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**Abstract**

**Problem:** A system assessment at an operating room in a small community hospital disclosed that a standardized handoff process among anesthesia providers does not exist intraoperatively. Bronchospasms, bleeding from nasal trumpet insertions, and double-dosing of antibiotics are adverse events that have occurred during relief periods. This quality improvement(QI) project is anticipated to impact ten anesthesia providers and over 5,000 patients annually. **Purpose:** The purpose of this QI initiative is to implement a standardized handoff checklist for anesthesia providers. The evidence-based intervention was the use of the PATIENT mnemonic checklist tool. The tool was developed to standardize transfer of care periods among nurse anesthetists. **Methods:** The project lead mobilized a team of stakeholders to assist in the planning, facilitating, and implementation of the initiative. Stakeholder buy-in was achieved by disseminating peer-reviewed literature. A weekly audit of the handoff tool was completed by a change champion. A provider questionnaire was emailed weekly to assess how often anesthesia providers employed the handoff checklist. Anesthesia providers reported all pertinent patient information daily using an anesthesia handoff validation tool. **Results:** Providers report on the patient's status, airway, allergies, antibiotics, intravenous access, and narcotics 90% or more of the time. Temperature, ventilation, and twitches are mentioned less than 90% of the time. Providers have reported using the checklist between six to ten times 25% of the time and between one to five times 45% of the time. The checklist has not been used 30% of the time. **Conclusion:** Findings suggest that in the intraoperative setting, anesthesia providers are utilizing the handoff checklist tool to give report to oncoming providers. Although some providers have reported zero use of the checklist, others use it one to ten times per week.

*Keywords:* anesthesia, intraoperative handoff, nurse anesthesia, checklist

### **Implementation of an Intraoperative Standard Handoff Tool Among Anesthesia Providers in a Rural Hospital**

The American Association of Nurse Anesthesiologists (AANA) has established eleven core standards for nurse anesthetists to incorporate into their clinical practice. The core standards state that vital patient information should be communicated during transfer of care periods (American Association of Nurse Anesthetists, 2019). The transfer of responsibility from one anesthesia provider to another increases the risk of adverse outcomes (Jones et al., 2018). Therefore, pertinent information about the patient's condition should be relayed during the transfer of care. During the intraoperative phase, there are approximately 4.8 handoffs per case (Wheeler, 2015). Each time care of an anesthetized patient is transitioned to another anesthesia provider, important information can be lost. The transition of care period is high-risk, so the report of essential information between providers must be accurate, explained clearly, and understood. Handoff accounts for over 50% of all communication breakdowns (Jullia et al., 2017). Unsuccessful handover is common and poses a threat to patient safety.

A standardized handoff process among anesthesia providers did not exist intraoperatively at a small community hospital in Southern Maryland. Before the implementation phase, anesthesia providers were offered a break, minimal information was relayed, then the oncoming provider assumed care of the patient. During this time, handoff was unstandardized, informal, and varied among anesthesia providers. Critical information such as the patient's position, narcotics, twitches, administered medications, and ventilation were not always addressed. According to the anesthesia team at the aforementioned hospital, bronchospasms, bleeding from nasal trumpet insertions, and double-dosing of antibiotics were adverse events that occurred during relief periods. The root cause most responsible for an unstandardized handoff process was

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the lack of a standardized handoff policy and checklist. Major factors leading to inadequate handoff among anesthesia providers are presented in the fishbone diagram in Figure 1. The purpose of this Quality Improvement (QI) initiative was to implement a standardized handoff checklist for anesthesia providers. The evidence-based intervention was the use of the PATIENT mnemonic checklist tool.

### **Available Knowledge**

A combined evidence review and synthesis was conducted to explore the use of intraoperative standardized handoff tools and checklists between anesthesia providers. Narrowing the search with specific inclusion criteria yielded seven articles that supported using a standardized handoff tool. Utilizing the Johns Hopkins Nursing Evidence-Based Practice (JHNEBP) Model (Dang et al., 2022), the overall recommendation was to proceed with a practice change based on the level of evidence and quality rating. A detailed evidence review and synthesis are presented in Appendices A and B, respectively.

Multiple findings emerged from the review and synthesis of the evidence. The first finding was that the use of an intraoperative standardized handoff tool among anesthesia providers improved provider communication. Agarwala et al. (2015), Gibney et al. (2017), Jullia et al. (2017), and Lambert & Adams (2018) had statistically significant results. The use of a standardized handoff tool improved worker satisfaction, patient safety perceptions, and the quality of the transfer of essential information among anesthesia providers (Canale, 2018). Multiple studies supported a standardized intraoperative handoff with a checklist (Abraham et al., 2021; Gibney et al., 2017; Lambert & Adams, 2018; Riesenber et al., 2022).

Another emerging theme from Agarwala et al. (2015) was that using an intraoperative handoff checklist improved the transfer and retention of vital patient information. Abraham et al.

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(2021) found that using a standardized handoff tool significantly improved clinical and process outcomes. This DNP project aims to implement a standardized handoff checklist for anesthesia providers to utilize during all transition of care periods in the intraoperative setting.

### **Rationale**

The framework used to guide this QI project was the Promoting Action on Research Implementation on Health Services (PARiHS) model. This three-dimensional framework facilitates implementing evidence-based research into practice (Kitson et al., 2008). The PARiHS framework addresses barriers and challenges to successfully implementing a QI project. The three key elements that guided the growth of this QI project include evidence, context, and facilitation. A visualization of how the core concepts were interrelated is presented in Figure 2.

The element of evidence addressed the available data on current practices that supported the practice change. Evidence should be derived from multiple sources, such as professional knowledge, local information, and published sources (Bergström et al., 2020; Kitson et al., 2008). The evidence gathered during the evidence review came from highly-rated peer-reviewed literature. The context element describes the setting where the intervention was introduced (Kitson et al., 2008). The organization's culture was casually assessed using the organizational culture assessment questionnaire to determine readiness for change. Lastly, the third element describes the facilitation methods to enhance the likelihood of success. Facilitators were identified as early adopters and change champions to advance the implementation of the project.

### **Methods**

To achieve the project's aims, the project lead mobilized a team of two clinical site representatives (CSRs), two site sponsors, and two change champions to assist in the planning, facilitating, and implementation of the QI initiative. Before implementing the QI initiative,

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educational sessions and training were initiated. Four physician anesthesiologists, six certified registered nurse anesthetists (CRNAs), and two anesthesia technicians were educated and trained on the intervention. Attendance was recorded using an education session form. First, a PowerPoint presentation was reviewed with the stakeholder group. Thereafter, all anesthesia providers received a methodical overview of the project, synthesis of the evidence, instruction on data collection, measurement plans, and the project's goals. A recorded version of the presentation was made available to anyone who missed the session. The anesthesia technician received training on the use and significance of the handoff checklist.

### **Context**

The QI project was implemented within the perioperative department in a small, rural community hospital. As previously mentioned, this organization had a small anesthesia department composed of four physician anesthesiologists, six CRNAs, and two anesthesia technicians. Eight operating rooms existed, but only five could functionally operate at a time. The facility had numerous surgeons, nurses, and surgical technicians. Perioperative services were provided to adult and pediatric patients. Many surgical cases were elective same-day procedures, so patients were typically discharged home. There were a considerable number of daily cases with a rapid turnover. This facility sometimes operates similarly to an outpatient surgery center. Consequently, production pressure and staff burnout occurred. Due to the organization's location and small anesthesia team, resources are limited.

An assessment of the site's culture included assessing the existing structures and processes, which revealed that a pre-existing handoff protocol or policy did not exist. Therefore, proving that the handoff process needed more consistency and structure. There was no formal education process on handoff procedures for anesthesia providers. Furthermore, procedures were

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performed in a fast-paced environment with a short-staffed anesthesia team. An assessment of the site's processes revealed minimal exchange of critical and pertinent patient information, which was sometimes omitted entirely during handoffs. Generally, the physician anesthesiologist completed the patient's preoperative assessment, while the CRNA maintained the patient's care intraoperatively. The department's pre-implementation process map is presented in Figure 3.

### **Intervention**

The evidence-based intervention that was implemented in this project is the PATIENT checklist tool. It is a standardized mnemonic tool meant to be utilized among CRNAS during the intraoperative transition of care periods (Wright, 2013). Each letter represents a core topic that is supposed to be discussed during the transfer of care process. This tool was used and supported within the literature. Each anesthesia machine at the clinical site was equipped with a laminated 8.5-inch by 11-inch PATIENT checklist tool. A copy of the tool is presented in Figure 4.

Anesthesia providers were educated on the literature review findings and the tool's value and use before the implementation period. The anesthesia technician was educated on the importance of the intervention tool and the audit process. Every anesthesia provider was invited to participate in the initial educational session for the project. Subsequently, a recorded version of the session was thoughtfully disseminated to each anesthesia provider to ensure access and continuity of information.

The desired workflow included an anesthesia provider relieving a colleague for a break or assuming patient care. Next, either provider was to notify the OR staff that handoff was being completed to prevent distractions and facilitate a quiet environment. The PATIENT checklist tool would be utilized. The outgoing provider would answer any questions that the oncoming provider might have had. Then, the oncoming provider would utilize the provided QR code to

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document that report was given using the PATIENT checklist tool. Either provider would notify the surgeon that a change in caregivers had occurred. The desired process map for intraoperative handoff periods is presented in Figure 5.

### **Strategies and Tactics**

Multiple strategies were employed to achieve the aims of the project. The project leader obtained formal commitments from project team members to help foster the goals of the project. Early adopters and change champions were recruited to promote and facilitate the project. Change champions helped providers overcome barriers and resistance to change. Buy-in was acquired by disseminating peer-reviewed literature as study findings support the idea that a standardized handoff improves clinical outcomes and patient safety. Peer-reviewed literature also motivates providers to change. To monitor the progression of the project, ongoing data collection occurred. Ongoing education was provided to facilitate the project's success.

### **Measurement**

The structure measures included the following: (a) equipping each anesthesia machine with a laminated PATIENT checklist tool, (b) educating anesthesia providers on the use of the tool, and (c) educating anesthesia technicians on the use of the PATIENT checklist tool. On a weekly basis, the anesthesia technician was responsible for conducting inspections in all operating rooms and the minor procedure room to confirm the presence of the anesthesia handoff checklist on each anesthesia gas machine. To facilitate this process, the technician used the provided audit tool to record whether the checklist was affixed to the machine. The process measure was that anesthesia providers would utilize the PATIENT checklist tool for handoff report during intraoperative transition periods. A validated questionnaire was emailed to anesthesia providers to assess their weekly usage of the anesthesia handoff checklist. The

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outcome measure was that anesthesia providers would report all pertinent patient information on the checklist. The incidence of anesthesia providers that use all parameters of the PATIENT mnemonic was tracked using an anesthesia handoff validation form. Upon completing the handoff, a QR code was available for providers to scan, enabling them to document the specific elements of the checklist used during the handoff. This documentation was to occur each time a provider took a break. A detailed measurement plan is presented in Table 1. See Appendices C through G for all measurement and data collection tools and instruments adapted through REDCap.

### **Ethical Considerations**

The anonymity of each provider involved in data collection was maintained. Methods that were employed for collecting data did not reveal the identity of any individual provider. Importantly, this project did not require or involve collecting patient-specific information. Data collection was facilitated through secure means such as QR codes and survey links, maintaining the utmost confidentiality. Any reports generated for analysis did not contain any identifiers. No one was coerced or incentivized to participate in this project. All participant's identities were kept anonymous; no names or identifying data were collected. Non-human Subject's Research determination from the Human Research Protections Office (HRPO) of the University of Maryland School of Medicine's Institutional Review Board (IRB) was obtained before project implementation. The site reviewed the project proposal and deemed that no further review was required by their IRB and approved this QI project as non-human research.

### **Results**

Findings suggest that in the intraoperative setting, anesthesia providers were utilizing the handoff checklist tool to report to oncoming providers. Providers reported on the patient's status,

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airway, allergies, antibiotics, intravenous access, and narcotics 90% or more of the time.

Temperature, ventilation, and twitches were mentioned less than 90% of the time. Providers reported using the checklist between six to ten times per week 25% of the time and between one to five times per week 45% of the time. The checklist was not used 30% of the time.

Interestingly, despite providers acknowledging multiple instances of checklist usage throughout the week, there is a disconnect in that they are not consistently completing the anesthesia handoff validation survey. The anesthesia handoff validation and the provider questionnaire run charts have fluctuations, but not enough points above or below the median to determine runs and shifts.

Several notable barriers that encompassed a range of challenges were identified that impeded the project's data collection process. One major barrier was the loss of anesthesia providers during the implementation phase. Remarkably, there was a total loss of three nurse anesthetists. Turnover within the anesthesia provider team disrupted the continuity of data collection efforts. The absence of the anesthesia technician, who played a pivotal role in ensuring the presence of the anesthesia handoff checklist on anesthesia gas machines, hindered data collection. This caused delays in confirming the checklist's availability. A major facilitator was the motivation to change.

### **Discussion**

Notably, no handoff checklist tool audits were recorded during the project's initial phase. However, as weeks two and three progressed, more audit tools were completed. After week three, increased engagement and participation in the data collection process were noted. There was a 100% compliance rate with the handoff checklist tool audit. Although most of the anesthesia team was educated on the intervention, four surveys were returned indicating if an anesthesia provider attended an educational session. Week one was primarily focused on the

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educational aspect of the project, but two surveys regarding the anesthesia handoff validation were completed during that time. During week two, there was a marked improvement in data collection efforts, with a total of three anesthesia handoff validation surveys successfully completed. Participation fluctuated during the implementation phase, reflecting diverse levels of engagement. Whenever participation waned, measures were taken to increase involvement through additional educational initiatives. Subsequently, these efforts yielded an uptick in survey completion rates, indicating a responsive approach.

Moreover, zero provider questionnaire surveys were completed during week two, the first week of implementation. Week three witnessed heightened engagement, with seven provider questionnaire surveys being diligently filled out, suggesting potential fluctuations in participation. These fluctuations persisted throughout the implementation phase. A run chart of the anesthesia handoff validation and provider questionnaire are presented in Figures 6 and 7, respectively. A percentage bar graph that visualizes measures of the anesthesia handoff validation and a frequency pie chart that visualizes measures of the provider questionnaire are presented in Figures 8 and 9, respectively.

This QI initiative is a streamlined process with minimal impact on providers or systems, consuming a mere one to two minutes to complete. A visual aid integrated onto the anesthesia machine allowed for easy access with clear directives for providers to follow. Despite these advantages, significant challenges persist. High turnover among providers exacerbates staffing shortages. Consequently, locum providers are being employed at increased rates. These providers do not receive proper education on the use and value of the handoff tool. Frequent re-education efforts are essential to adjust to project limitations and ensure its efficacy.

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A prior literature review demonstrated the positive effects of a standardized handoff tool. While specific metrics such as provider satisfaction, information retention, and communication enhancement were not formally assessed, anecdotal evidence from staff members attests to the tool's positive influence. Additionally, negative outcomes during break reliefs were not reported during the implementation phase. Suggesting that patient safety was maintained. The literature shows that the use and display of intraoperative checklists improve intraoperative checklist usage scores, similarly, as this QI project discovered.

This initiative is cost-effective with minimal financial investment as existing resources can be leveraged during implementation. Following the completion of this QI project, all of the anesthesia machines are equipped with a laminated copy of the PATIENT checklist tool. Education among the anesthesia team is complete. Lastly, anesthesia providers are utilizing a standardized handoff tool during the intraoperative phase.

### **Conclusion**

In conclusion, anesthesia providers transitioned from improvised handoff periods in the operating room to adopting the standardized PATIENT handoff tool. Thus, creating a streamlined process for handoff. This standardized approach not only fosters improved communication among providers but also facilitates the seamless transfer and retention of critical patient data. The report of vital patient information is a requirement that must be completed before transferring care of the patient from one provider to the next. The intraoperative handoff tool effectively supports this, proving its feasibility and simplicity in integration into practice. Its affordability and straightforward implementation make it an attractive intervention, particularly as it can be easily communicated to incoming staff. However, to ensure its widespread adoption and long-term sustainability, ongoing education initiatives are essential. Moreover, addressing

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staffing challenges is crucial for the successful implementation and maintenance of this valuable tool across anesthesia practices.

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**Table 1**

*Measurement Plan*

<b>Measurement Plan</b>		
<b>Project Goals</b>	<b>Data Collection Procedures (who, how, when)</b>	<b>Name of Data Collection Tool</b>
By August 28, 2023, 100% of the anesthesia machines will be equipped with a laminated PATIENT checklist tool.	Prior to implementation, the project lead and anesthesia tech (change champion) will work together to ensure each anesthesia machine has the implementation tool in a visible location. Thereafter, the anesthesia tech will perform weekly audits to ensure each machine has the tool.	Handoff Checklist Tool Audit: Appendix A
By August 28, 2023, 100% of anesthesia providers will be educated on using the checklist to improve intraoperative handoff.	Prior to the implementation of the project, the project lead will educate the anesthesia providers using a PowerPoint presentation. At the end of the session, anesthesia providers	PATIENT Handoff Tool Training: Appendix B

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	<p>will be provided with a link and a QR code to complete the handoff tool training.</p>	
<p>By August 28, 2023, 100% of anesthesia technicians will be educated on the use of the PATIENT checklist tool.</p>	<p>Prior to the implementation of the project, the project lead will educate the anesthesia tech using the laminated PATIENT mnemonic tool. By August 28, 2023, 100% of anesthesia technicians will be educated on the use of the PATIENT checklist tool.</p>	<p>Educational training: Appendix C</p>
<p>By December 22, 2023, 100% of anesthesia providers will utilize the PATIENT checklist tool to give handoff report during intraoperative transition periods. (Process)</p>	<p>Anesthesia providers will utilize the handoff tool to give report. The checklist will be present on each machine. A weekly questionnaire will be emailed. Anesthesia providers will complete the survey using the link or QR code sent in the email. Data will be collected weekly.</p>	<p>Provider questionnaire: Appendix D</p>

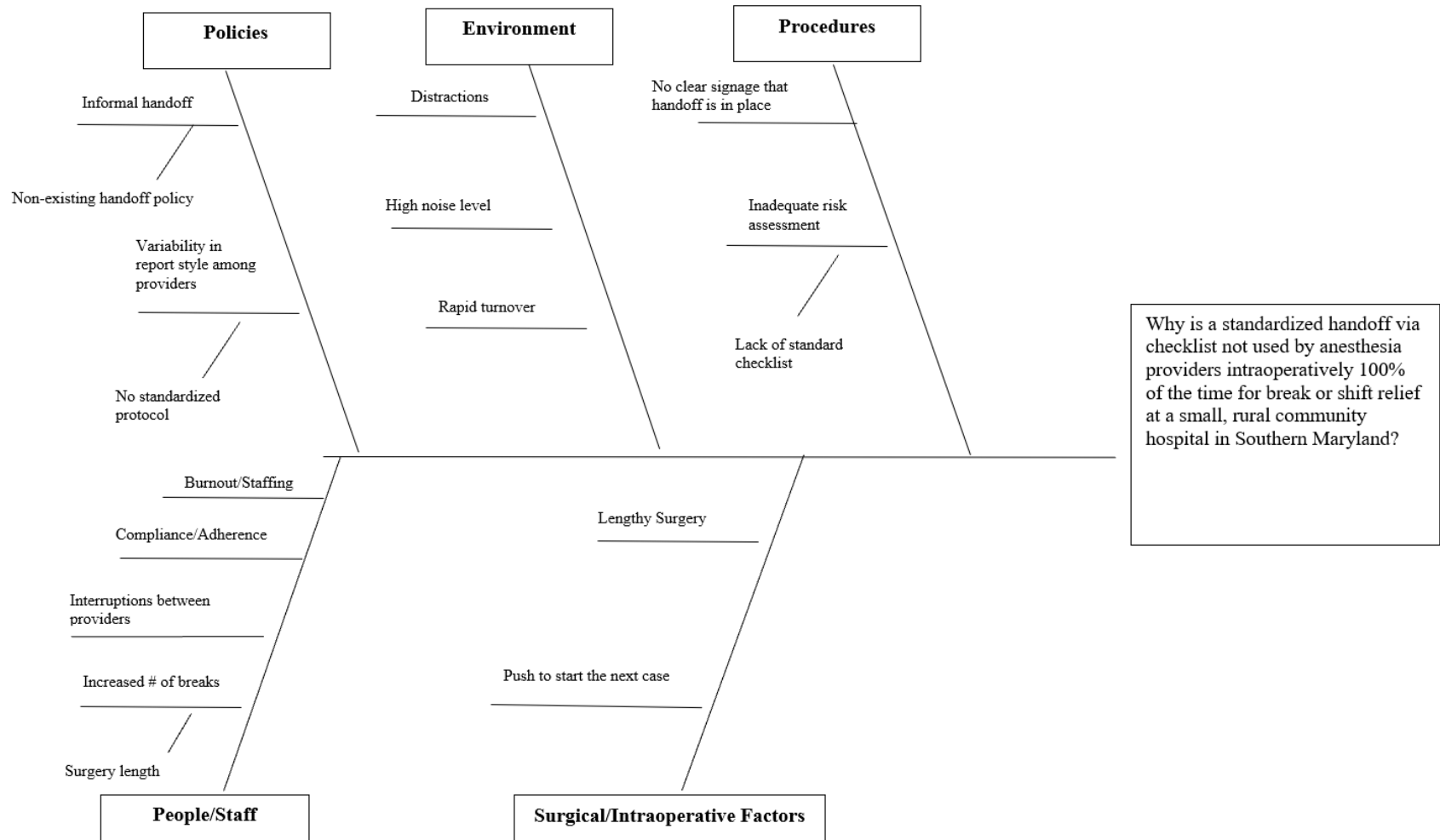
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<p>By December 22, 2023, anesthesia providers will report all pertinent patient information included on the handoff checklist during periods of handoff 100% of the time.  (Outcome)</p>	<p>Anesthesia providers will utilize the handoff tool to give report. Each time the oncoming provider receives report, they will scan the QR code on the anesthesia machine and document the use of the PATIENT mnemonic.  Documentation of any portion of the PATIENT mnemonic indicates that the tool was used to give report.</p>	<p>Anesthesia Handoff Validation: Appendix E</p>
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**Figure 1**

*Fishbone Diagram Portrays Factors Leading to Inadequate Handoff Among Anesthesia Providers*



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**Figure 2**

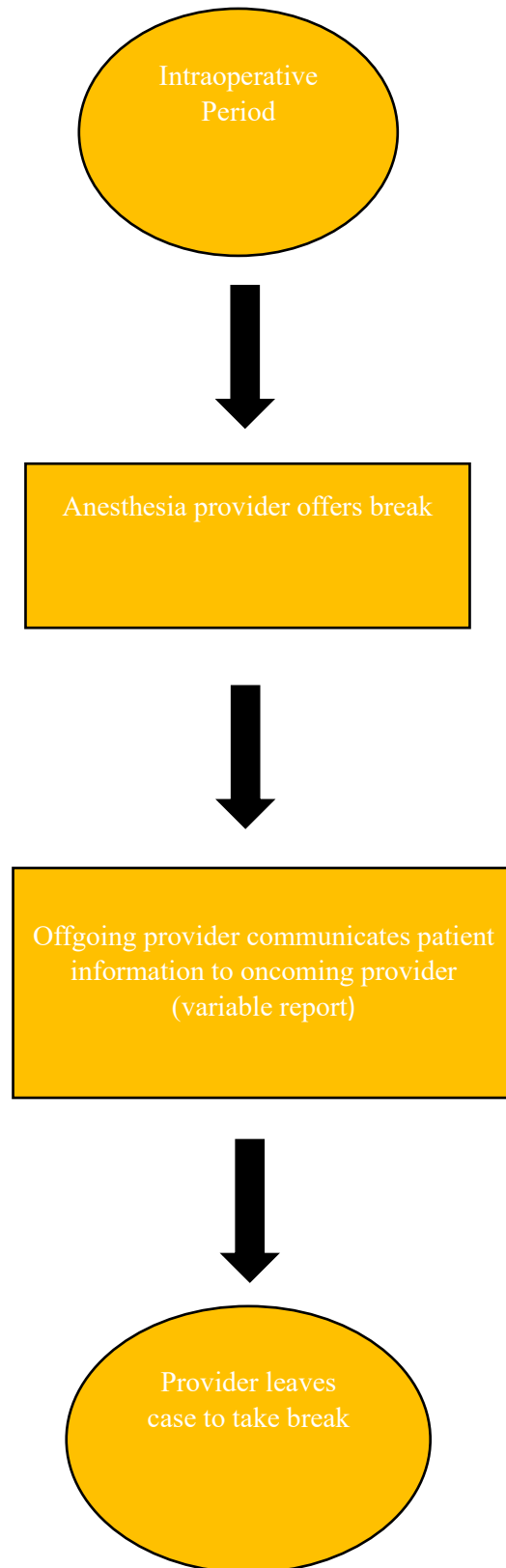
*Theoretical Framework: The PARIHS Model (Kitson et al., 2008)*

**P**romoting **A**ction on **R**esearch **I**mplementation in  
**H**ealth **S**ervices (PARIHS)



**Figure 3**

*Pre-implementation Process Map*



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**Figure 4***PATIENT Checklist Tool*

<b>PATIENT PROTOCOL</b>	
<b>P</b>	<ul style="list-style-type: none"> <li>○ <b>Procedure</b></li> <li>○ <b>Patient (Quick Scan)</b></li> <li>○ <b>Position</b></li> </ul>
<b>A</b>	<ul style="list-style-type: none"> <li>○ <b>Anesthesia</b></li> <li>○ <b>Antibiotic</b></li> <li>○ <b>Airway</b></li> <li>○ <b>Allergies</b></li> </ul>
<b>T</b>	<ul style="list-style-type: none"> <li>○ <b>Temperature</b></li> </ul>
<b>I</b>	<ul style="list-style-type: none"> <li>○ <b>IVs and other Invasive lines</b></li> </ul>
<b>E</b>	<ul style="list-style-type: none"> <li>○ <b>ETCO<sub>2</sub> (ventilation)</b></li> </ul>
<b>N</b>	<ul style="list-style-type: none"> <li>○ <b>Narcotics</b></li> </ul>
<b>T</b>	<ul style="list-style-type: none"> <li>○ <b>Twitches</b></li> </ul>

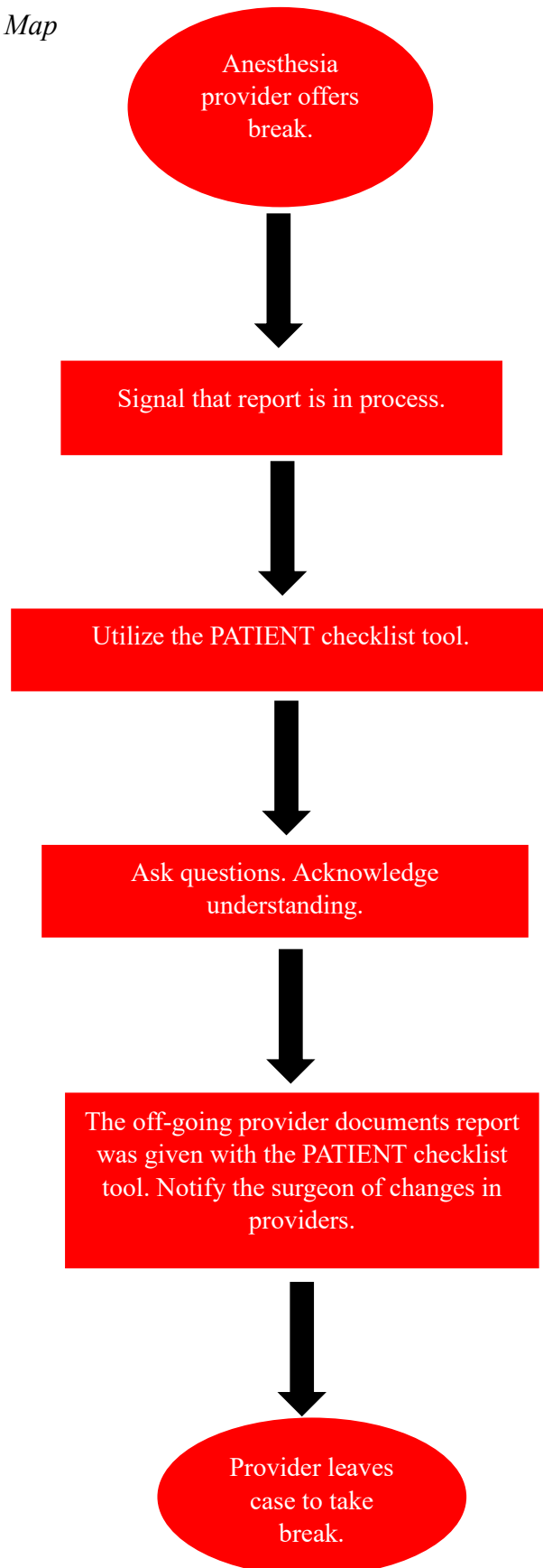
<b>PATIENT Protocol Use Guidelines</b>
<b>1) To be utilized for handoff among anesthesia providers (CRNAs and Physician anesthesiologists)</b>
<b>2) Not for use in PACU or ICU Handoffs</b>
<b>3) Report all pertinent patient information. The oncoming provider will complete the validation link after handoff is completed.</b>
<b>4) Please track weekly usage</b>
<b>5) A weekly survey will be emailed to track protocol usage</b>
DNP student: Shaneisha McMillan, BSN, SRNA Email: <a href="mailto:smcmillan@umaryland.edu">smcmillan@umaryland.edu</a> Permission to utilize PATIENT protocol granted by Suzanne Wright, PhD, CRNA Anesthesia handoff validation: <a href="https://redcap.link/anesthesiahandoffvalidation">https://redcap.link/anesthesiahandoffvalidation</a>

**Scan me to complete anesthesia handoff validation!**

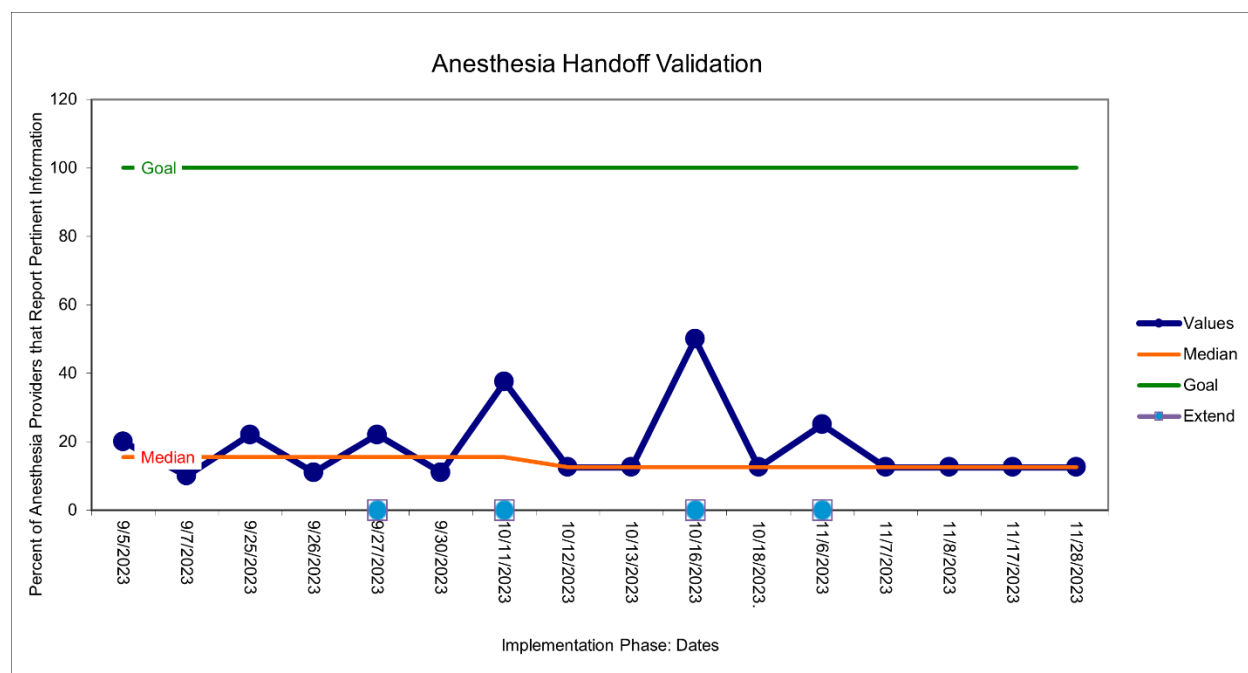


**Figure 5**

*Desired Site Process Map*

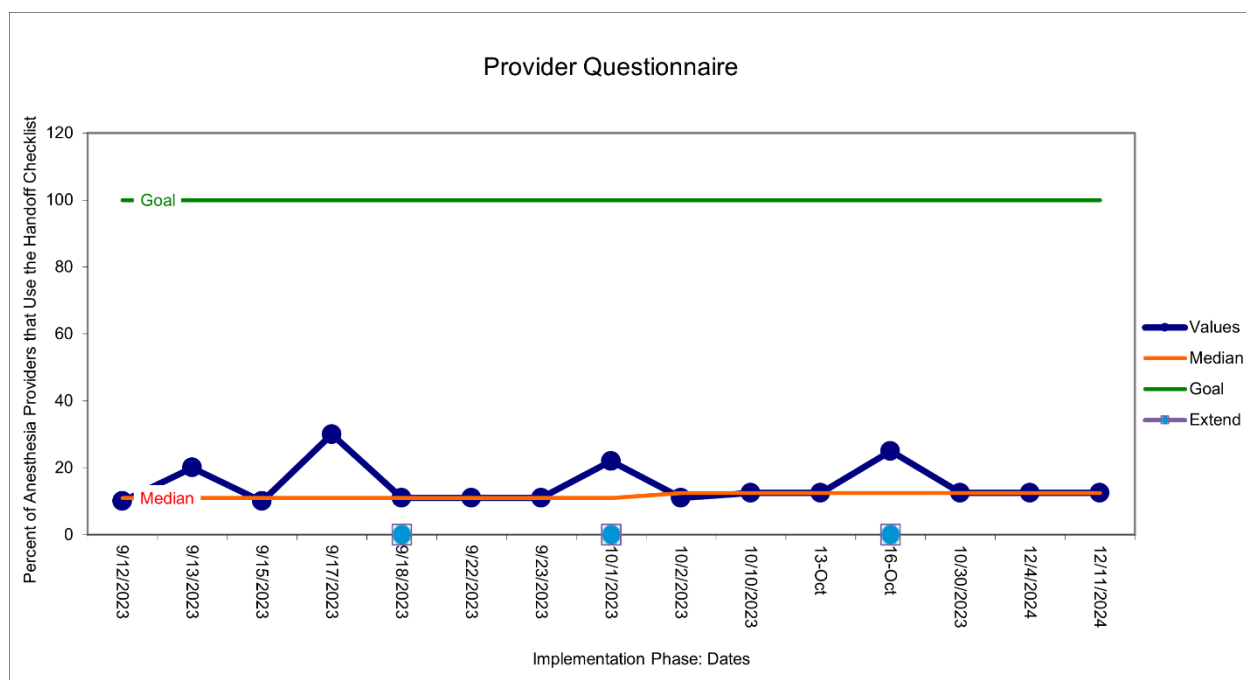


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**Figure 6***Anesthesia Handoff Validation Run Chart*

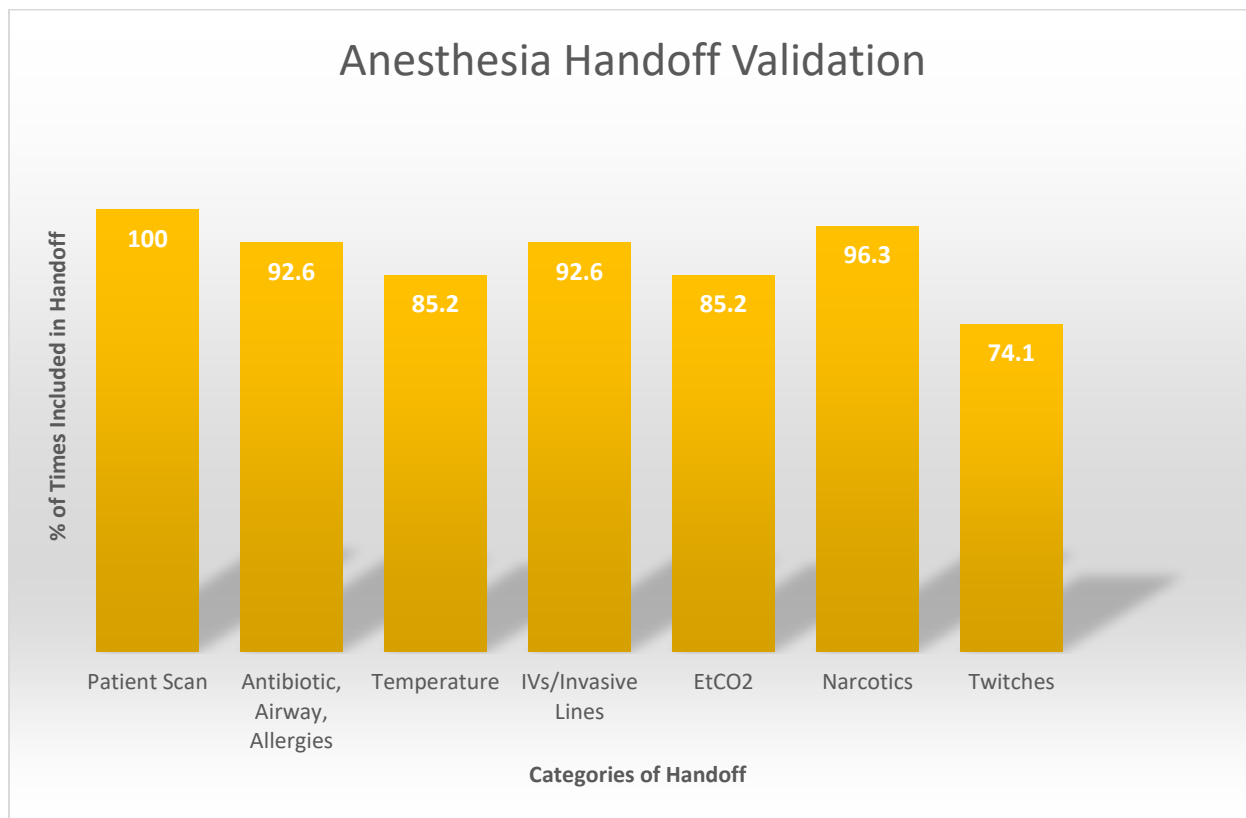
Note: Education occurred during the week of 8/28-9/3/23. Week 1 of implementation began on 9/4/23. The implementation phase began with 10 anesthesia providers and 2 anesthesia technicians. By 9/18, there were 9 anesthesia providers. It was noted that the handoff checklists were not on all of the anesthesia machines by 9/26. By 10/9, there were 8 anesthesia providers with 2 locum nurse anesthetists. Per diem physician anesthesiologists continued picking up shifts to fill in the gaps. Onsite individual education was provided the week of 10/9-10/15. Education was sent via email the week of 9/25-10/1. Education was emailed the week of 10/16-10/22. Loss of another nurse anesthetist on 11/13. Towards the end of the implementation phase, there were a total of 7 anesthesia providers and 2 anesthesia technicians.

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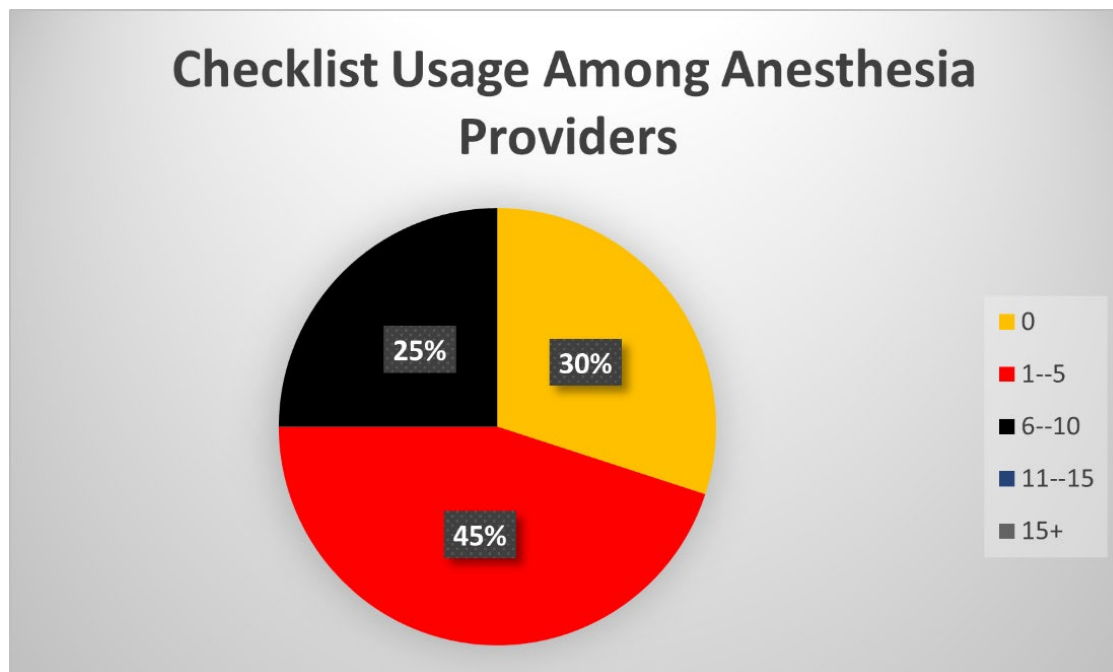
**Figure 7***Provider Questionnaire Run Chart*

Note: The implementation phase began with 10 anesthesia providers and 2 anesthesia technicians. By 9/18 there were 9 anesthesia providers. By 10/9 there were 8 anesthesia providers with 2 locum nurse anesthetists. Loss of another nurse anesthetist on 11/13. Towards the end of the implementation phase, there were a total of 7 anesthesia providers and 2 anesthesia technicians.

## IMPLEMENTATION OF AN INTRAOPERATIVE STANDARD HANDOFF TOOL

**Figure 8***Categories documented in the Anesthesia Handoff Validation*

## IMPLEMENTATION OF AN INTRAOPERATIVE STANDARD HANDOFF TOOL

**Figure 9***Provider Questionnaire Survey Results*

Note: Anesthesia providers were emailed a questionnaire weekly to document their usage of the anesthesia handoff checklist.

IMPLEMENTATION OF AN INTRAOPERATIVE STANDARD HANDOFF TOOL

**Appendix A  
Evidence Review**

**Citation #1** Abraham, J., Pfeifer, E., Doering, M., Avidan, M. S., & Kannampallil, T. (2021). Systematic review of intraoperative anesthesia handoffs and handoff tools. *Anesthesia & Analgesia* 132(6), 1563–75. <https://doi.org/10.1213/ANE.0000000000005367>.

**Level and Quality: 3B**

Purpose or Hypothesis	Type of Evidence and Research Design	Sample (population, size, setting)	Intervention Procedures	Primary Outcome/Measures	Results Conclusions
<p>The purpose of this systematic review was to appraise current evidence on intraoperative handoff. The authors aimed to gather evidence on how intraoperative handoffs and content of intraoperative handoff tools impact clinical outcomes.</p>	<p>Research: Prospective cohort studies (6) Retrospective cohort studies (8)</p>	<p><b>Sampling technique:</b> Convenience <b>Eligible participants:</b> Adult patients undergoing any type of surgery. Any type of anesthesia clinician. <b>Setting:</b> Any study setting and population. Any country, any operating room in any medical center/hospital. <b>Excluded:</b> any handoff studies including people outside of anesthesia providers, any studies completed outside of the intraoperative period <b>Accepted:</b> All studies on intraoperative handoffs and handoff tools published until September 2019. Any comparison group. Any outcome. <b>Control:</b> Group without handoffs <b>Intervention:</b> Intraoperative anesthesia handoffs (retrospective) and use of tools for intraoperative handoffs (prospective). <b>Power analysis/achieved:</b> N/A <b>Group homogeneity:</b> Commonality exists among patients as they are all surgical patients in the OR setting. All clinicians are anesthesia providers.</p>	<p><b>Control protocol:</b> No handoff. <b>Intervention Protocol:</b> Completion of handoff. Completion of handoff with handoff tool. <b>Treatment Fidelity:</b> N/A</p>	<p><b>Dependent variable:</b> clinical outcomes <b>DV Measure:</b> Measurement of the use of the intraoperative handoff tool</p>	<p><b>Statistical Results:</b> <b>Conclusions:</b> Intraoperative handoffs are associated with an increased risk of adverse outcomes (retrospective). All studies proved that the use of a standardized handoff tool significantly improves process outcomes.</p>

## IMPLEMENTATION OF AN INTRAOPERATIVE STANDARD HANDOFF TOOL

<p><b>Citation #2</b> Agarwala, A. V., Firth, P. G., Albrecht, M. A., Warren, L., &amp; Musch, G. (2015). An electronic checklist improves transfer and retention of critical information at intraoperative handoff of care. <i>Anesthesia &amp; Analgesia</i>, 120(1), 96-104. <a href="https://journals.lww.com/anesthesia-analgesia/Fulltext/2015/01000/An_Electronic_Checklist_Improves_Transfer_and.17.aspx">https://journals.lww.com/anesthesia-analgesia/Fulltext/2015/01000/An_Electronic_Checklist_Improves_Transfer_and.17.aspx</a> Level: 2A</p>					
Purpose or Hypothesis	Type of Evidence and Research Design	Sample (population, size, setting)	Intervention Procedures	Primary Outcome/Measures	Results Conclusions
<p>The purpose of this assessment was to evaluate handoff receiver satisfaction and compare the information relayed among the incoming and outgoing anesthesia providers as well as the retention of that information that was relayed. This information was assessed before and after the introduction of an electronic handoff checklist.</p>	<p>Prospective observational assessment</p>	<p><b>Sampling technique:</b> Convenience</p> <p><b>Eligible participants:</b> All anesthesia providers involved in intraoperative transfers of care</p> <p><b>Setting:</b> Massachusetts General Hospital, Boston</p> <p><b>Excluded:</b> Any clinician not an anesthesia provider</p> <p><b>Accepted:</b> 262 faculty anesthesiologists, 120 residents, 86 fellows, and 56 CRNAs in the precheck list group. 266 faculty anesthesiologists, 118 residents, 88 fellows, and 69 CRNAs in the post checklist group.</p> <p>30 preintervention cases were observed. 39 postintervention cases were observed. 300 preintervention responses were received. 266 postintervention responses were received.</p> <p><b>There was not a control group.</b></p> <p><b>Intervention group:</b> Every practicing anesthesia provider (anesthesiologist, resident, fellow, and CRNA)</p> <p><b>Power analysis/achieved:</b></p> <p><b>Group homogeneity:</b> Demographics not included. All participants are anesthesia</p>	<p><b>Control protocol:</b> N/A</p> <p><b>Intervention Protocol:</b> Each clinician had access to a standardized electronic checklist to use during intraoperative transfer of care.</p> <p><b>Treatment Fidelity:</b></p>	<p><b>Dependent variable:</b> The dependent variables are the type and frequency of information relayed during intraoperative handoff and handoff receiver satisfaction.</p> <p><b>DV Measure:</b> The relay of information was measured using an observational assessment tool. Handoff receiver satisfaction and information retention was measured using a post-handoff assessment tool. Three subjective and four objective questions were included in the tool.</p>	<p><b>Statistical Results:</b> There was significant improvement in the number of times information was relayed during handoff with the use of a checklist. The following results proved to be statistically significant related to frequency of information relayed: administration of vasopressors and antiemetics (<math>P = 0.008</math>; <math>P = 0.015</math>, respectively); estimated blood loss and urine output (<math>P = 0.014</math>; <math>P = 0.006</math>, respectively); communication about potential areas of concern (<math>P = 0.001</math>), postoperative planning (<math>P &lt; 0.001</math>), and introduction of the relieving anesthesiologist to the operating team (<math>P &lt; 0.001</math>). Relieving providers more frequently knew the antibiotic (<math>P = 0.020</math>), muscle relaxant (<math>P = 0.003</math>), and amount of fluid administered (<math>P = 0.008</math>) when the checklist of the</p>

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		providers.			time ( $P = 0.003$ ). <b>Conclusions:</b> The use of an electronic checklist improved the transfer and retention of vital patient information. Additionally, provider communication during intraoperative handoff was improved.
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## IMPLEMENTATION OF AN INTRAOPERATIVE STANDARD HANDOFF TOOL

<p><b>Citation #3</b> Canale, M. L. (2018). Implementation of a standardized handoff of anesthetized patients. <i>AANA Journal</i>, 86(2), 137-145. <a href="#">Implementation of a Standardized Handoff of Anesthetized Patients, AANA Journal, April 2018</a></p> <p style="text-align: center;">Level: 2A</p>					
Purpose or Hypothesis	Type of Evidence and Research Design	Sample (population, size, setting)	Intervention Procedures	Primary Outcome/Measures	Results Conclusions
<p>The purpose was to implement a standardized handoff to improve the quality and continuity of the transfer of information, perceptions of patient safety, and healthcare worker satisfaction.</p>	<p>Prospective study, pretest/posttest</p>	<p><b>Sampling technique:</b> purposive, nonprobability, snowball sampling from a convenience sample of CRNAs</p> <p><b>Eligible participants:</b> CRNAs involved in the transfer of care of anesthetized patients</p> <p><b>Setting:</b> Intraoperative; 800-bed regional medical center in West Central Florida</p> <p><b>Excluded:</b> Any clinician not an anesthesia provider.</p> <p><b>Accepted:</b> 20 CRNAs involved in transfer of care of anesthetized patients in the OR</p> <p><b>Control:</b></p> <p><b>Intervention:</b> 20 CRNA providers</p> <p><b>Power analysis/achieved:</b></p> <p><b>Group homogeneity:</b> All participants are anesthesia providers working in the same setting. Demographics not included.</p>	<p><b>Control protocol:</b></p> <p><b>Intervention Protocol:</b></p> <p>PATIENT mnemonic checklist. Education of change team. (The change team was educated. Next a standardized handoff procedure in the perioperative setting using the Team STEPPS model was implemented.)</p> <p><b>Treatment Fidelity:</b> N/A</p>	<p><b>Dependent variables:</b> Quality and continuity of the transfer of information, perceptions of patient safety, and healthcare worker satisfaction</p> <p><b>DV Measure:</b> Pretest and Posttest surveys</p>	<p><b>Statistical Results:</b> Preintervention and postintervention survey data were analyzed using paired t test with a range of P &lt; .0001 to .0003, demonstrating statistically significant improvements in the quality and continuity of the transfer of information, perceptions of patient safety, and healthcare worker satisfaction.</p> <p><b>Conclusions:</b> The adherence to federal guidelines regarding the use of a standardized tool for handoff was achieved. Improvements were made in worker satisfaction, patient safety perceptions, and the quality of the transfer of information among providers.</p>

## IMPLEMENTATION OF AN INTRAOPERATIVE STANDARD HANDOFF TOOL

**Citation #4:** Gibney, C., Lee, Y., Feczko, J., & Aquino, E. (2017). A needs assessment for development of the TIME anesthesia handoff tool. *AANA Journal*, 85(6), 431–437. Retrieved from [A Needs Assessment for Development of the TIME Anesthesia Handoff Tool, AANA Journal, December 2017](#)

Level: 3B

Purpose or Hypothesis	Type of Evidence and Research Design	Sample (population, size, setting)	Intervention Procedures	Primary Outcome/Measures	Results Conclusions
<p>The purpose of this study was to assess the need for a standardized handoff tool and to garner providers' opinions on the most vital points to include in the anesthesia handoff tool.</p>	<p>Descriptive survey, cross sectional design</p>	<p><b>Sampling technique:</b> Convenience</p> <p><b>Eligible participants:</b> Anesthesia providers practicing in the Greater Chicago area, English-speaking, legally permitted to provide anesthesia in the state of Illinois independently or under direct supervision of an anesthesia provider, having a minimum of 6 months of providing anesthesia, and currently practicing anesthesia.</p> <p><b>Setting:</b> Greater Chicago, Illinois, area at 2 large academic institutions</p> <p><b>Excluded:</b> Non-anesthesia providers, providers outside of Greater Chicago area, providers not working at one of the hospitals within the 2 large academic institutions, and non-English speaking.</p> <p><b>Accepted:</b> 82 CRNAs, student registered nurse anesthetists (SRNAs), anesthesia residents, and anesthesiologists working at 4 hospitals within the 2 large academic institutions.</p> <p><b>Control:</b> N/A</p> <p><b>Intervention:</b> Not fully applicable to this study. 82 anesthesia providers completed surveys.</p> <p><b>Power analysis/achieved:</b> Not discussed.</p>	<p><b>Control protocol:</b> N/A</p> <p><b>Intervention Protocol:</b> Completion of descriptive surveys.</p> <p><b>Treatment Fidelity:</b> N/A</p>	<p><b>Dependent variable:</b> The dependent variables were providers' opinions on the essential components of an anesthesia handoff tool and the need for a standard tool.</p> <p><b>DV Measure:</b> The dependent variables were measured using a needs assessment tool.</p>	<p><b>Statistical Results:</b> 53 participants (64.6%) denied currently having a standardized process for anesthesia handoff. The other 29 respondents (35.4%) provided a written description of their handoff process. Nineteen respondents (23.2%) thought they were given inadequate information most of the time or always. Forty-one of the respondents (50%) stated they sometimes were given inadequate information. Thirty-one participants (37.8%) said they sometimes reported inadequate information and 11 (13.4%) believed they reported inadequate information most of the time or always. The most essential components for handoff were identified as airway type, airway difficulty, allergies, anesthetic type, invasive lines, patient medical history, procedure, and vital signs. P values were not</p>

IMPLEMENTATION OF AN INTRAOPERATIVE STANDARD HANDOFF TOOL

		<p><b>Group homogeneity:</b> There are similarities and differences based on the sociodemographics displayed in Table 1= 44 male, 38 female; 58 White, 1 Black, 18 Asian Pacific/Islander/Native Hawaiian, and 2 Hispanic/Latino. No reported p value. The author does note that the demographic distribution of participants is representative of the anesthesia profession.</p>			<p>reported.</p> <p><b>Conclusions:</b></p> <p>There are fewer adverse outcomes if an appropriate standardized tool is used. The need for a standardized handoff tool was established. The most essential topics to include in handoff were identified and the TIME handoff tool was developed. Employers of CRNAs should consider adopting the TIME handoff tool as a standard of practice to promote more effective and efficient communication.</p>
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## IMPLEMENTATION OF AN INTRAOPERATIVE STANDARD HANDOFF TOOL

**Citation #5:** Jullia, M., Tronet, A., Fraumar, F., Minville, V., Fourcade, O., Alacoque, X., LeManach, Y., & Kurrek, M. M. (2017). Training in intraoperative handover and display of a checklist improve communication during transfer of care. *European Journal of Anaesthesiology*, 34(7), 471–476. <https://doi.org/10.1097/EJA.0000000000000636>

Level: 1A

Purpose or Hypothesis	Type of Evidence and Research Design	Sample (population, size, setting)	Intervention Procedures	Primary Outcome/Measures	Results Conclusions
<p>The authors hypothesized that intraoperative handover training and display of a checklist would improve communication during anesthesia care transition in the operating room.</p>	<p>Interventional cohort study (prospective, blind randomized observations)</p>	<p><b>Sampling technique:</b> Convenience</p> <p><b>Eligible participants:</b> CRNAs and anesthesia residents</p> <p><b>Setting:</b> Single-center tertiary care university hospital</p> <p><b>Excluded:</b> Handover between student nurse anesthetists, handover not done in the operating room, and handover not done by CRNAs and residents.</p> <p><b>Accepted:</b> All residents and nurse anesthetists working for the university hospital.</p> <p><b>Control:</b> 118 control cases</p> <p><b>Intervention:</b> 86 intervention cases</p> <p><b>Power analysis/achieved:</b> Not discussed.</p> <p><b>Group homogeneity:</b> Not discussed. Existing similarities are that they are all anesthesia providers. Demographics not included.</p>	<p><b>Control protocol:</b> no training/checklist at site</p> <p><b>Intervention Protocol:</b> Handover training (2 1-hr meetings, mock handover) and 22-item laminated checklist displayed at each anesthesia workstation</p> <p>Both sites were studies simultaneously: first a 2-week ‘baseline’ observation period; then handover training and display of checklists in each operating room (at the intervention site only) followed by an ‘immediate’ second and finally a third (3 months later) observation period</p> <p><b>Treatment Fidelity:</b> Data collection was done by two student nurse anesthetist evaluators using their</p>	<p><b>Dependent variable:</b> The dependent variable is improved communication during the transition of care among anesthesia providers intraoperatively or the checklist score.</p> <p><b>DV Measure:</b> The checklist score was calculated with the mean, SD and 95% confidence interval (CI) for the mean.</p>	<p><b>Statistical Results:</b> Intervention group= the mean (95% confidence interval) score increased by 43%, <math>P &lt; 0.001</math>. No change in control group scores.</p> <p><b>Conclusions:</b> The use and display of an intraoperative handoff checklist and intraoperative handoff training improved checklist scores for intraoperative anesthesia handoff. The use of the handoff tool improved intraoperative communication between anesthesia providers by 43%.</p>

IMPLEMENTATION OF AN INTRAOPERATIVE STANDARD HANDOFF TOOL

			<p>smartphones. Research Electronic Data Capture tools was used to manage and collect data. The two evaluators had completed training using simulated handovers and confirmed 100% inter-rater agreement during a trial live observation at a site different from the study.</p>		
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## IMPLEMENTATION OF AN INTRAOPERATIVE STANDARD HANDOFF TOOL

**Citation #6** Lambert, L. H., & Adams, J. A. (2018). Improved anesthesia handoff after implementation of the written handoff anesthesia tool (WHAT). *AANA Journal*, 86(5), 361-370. Retrieved from [Improved Anesthesia Handoff After Implementation of the Written Handoff Anesthesia Tool \(WHAT\), AANA Journal, October 2018](#)

Level: 2A

Purpose or Hypothesis	Type of Evidence and Research Design	Sample (population, size, setting)	Intervention Procedures	Primary Outcome/Measures	Results Conclusions
<p>The purpose of this study was to improve the quality of anesthesia handoffs in the operating room and postanesthesia care unit (PACU).</p>	<p>Quantitative preintervention-postintervention design</p>	<p><b>Sampling technique:</b> Convenience</p> <p><b>Eligible participants:</b> Anesthesia providers in the OR and PACU nurses who are involved in patient care.</p> <p><b>Setting:</b> 350-bed hospital in the Southeastern United States</p> <p><b>Excluded:</b> CRNAs and PACU RNs who were not employees.</p> <p><b>Accepted:</b> All CRNAs and PACU RNs were included in the implementation of the Written Handoff Anesthesia Tool (WHAT) as well as the pre- and post-data collection using the TST forms.</p> <p><b>Control:</b> N/A</p> <p><b>Intervention:</b> 22 CRNAs and 15 PACU RNs</p> <p><b>Power analysis/achieved:</b> To estimate adequate sample size and the number of handoffs, priori power analyses were used. 13 CRNAs and 13 PACU RNs were needed; 70 handoffs per group were needed (280); statistical power of 0.95 (<math>\alpha = .05</math>, SD = 7). Power analysis met.</p> <p><b>Group homogeneity:</b> The demographic characteristics of the 2 groups were similar.</p>	<p><b>Control protocol:</b> N/A</p> <p><b>Intervention Protocol:</b> Implementation of the WHAT</p> <p><b>Treatment Fidelity:</b> N/A</p>	<p><b>Dependent variable:</b> Improved quality (adequacy, contributing factors, and specific patient data omitted by senders) of anesthesia handoff and CRNA satisfaction.</p> <p><b>DV Measure:</b> The Anesthesia Handoff Communication survey was used to evaluate CRNA satisfaction. The Targeted Solutions Tool was used to determine the quality of anesthesia handoff before and after implementation of the WHAT.</p>	<p><b>Statistical Results:</b> Adequacy of the handoff process significantly improved for CRNA-to-CRNA handoff (<math>P &lt; .0001</math>). CRNA satisfaction with anesthesia handoff significantly improved for (<math>P &lt; .001</math>).</p> <p><b>Conclusions:</b> Implementation of the WHAT provided a standard intraoperative handoff process, improved communication among anesthesia providers during handoff, and evidence-based changes in practice.</p>

## IMPLEMENTATION OF AN INTRAOPERATIVE STANDARD HANDOFF TOOL

**Citation #7** Riesenber, L. A., Davis, R., Heng, A., Rosario, C. V., O'Hagan, E. C., & Lane-Fall, M. (2022). Anesthesiology patient handoff education interventions: A Systematic Review. *Joint Commission Journal on Quality and Patient Safety*. <https://doi.org/10.1016/j.jcjq.2022.12.002>

Level: 2B

Purpose or Hypothesis	Type of Evidence and Research Design	Sample (population, size, setting)	Intervention Procedures	Primary Outcome/Measures	Results Conclusions
<p>The purpose of this systematic review was to review handoff studies with educational intervention components.</p>	<p>Systematic review of peer-reviewed literature. Study designs: Cohort pre-post study design, randomized controlled trial, nonrandomized trials, and cohort posttest only.</p>	<p><b>Sampling technique:</b> N/A <b>Eligible participants:</b> Handoff studies that included anesthesiology providers, with education as part of the intervention. <b>Setting:</b> Handoff locations: OR, PACU, ICU <b>Excluded:</b> Conference proceedings, abstracts, and non-English-language materials. Articles prior to 2010. <b>Accepted:</b> 26 articles <b>Control:</b> N/A <b>Intervention:</b> N/A <b>Power analysis/achieved:</b> N/A <b>Group homogeneity:</b></p>	<p><b>Control protocol:</b> N/A <b>Intervention Protocol:</b> Structured protocol <b>Treatment Fidelity:</b> Each phase during the review process used at least two trained independent viewers. All studies used a literature reviewer.</p>	<p><b>Dependent variable:</b> N/A <b>DV Measure:</b> N/A</p>	<p><b>Statistical Results:</b> 58.3% (14/24) achieved statistically significant handoff content/quality improvements. <b>Conclusions:</b> There is a lack of assessment of curriculum effectiveness and development. Handoff education quality needs to be improved.</p>

## IMPLEMENTATION OF AN INTRAOPERATIVE STANDARD HANDOFF TOOL

**Appendix B**  
**Evidence Synthesis**

<b>Project Title:</b> Implementation of an Intraoperative Standard Handoff Tool Among Anesthesia Providers			
<b>PICOT:</b> In the operating room, does the implementation of a standardized handoff tool between anesthesia providers, compared to current handoff methods, improve provider satisfaction, communication, and accurate transfer of patient information?			
<b>JHNEBP Model Level</b>	<b>Total Number of Sources</b>	<b>Author and Quality Rating of each study</b>	<b>Synthesis of Findings</b>
<b>Level I</b>  Experimental study · Randomized Controlled Trial (RCT) · Systematic review of RCTs with or without meta-analysis	1 prospective blind RCT (Jullia et al)	Jullia et al., 2017/ A	The use and display of an intraoperative handoff checklist and intraoperative handoff training improved checklist scores for intraoperative anesthesia handoff. The use of the handoff tool improved intraoperative communication between anesthesia providers by 43% (Jullia et al., 2017).
<b>Level II</b>  Quasi-experimental studies · Systematic review of a combination of RCTs and quasi-experimental studies, or quasi-experimental studies only, with or without meta-analysis	2 Prospective (Argawala et al; Canale et al)  1 quantitative pre/post (Lambert &	Agarwala et al., 2015/A Canale, 2018/A Lambert & Adams, 2018/A  Riesenberg et al., 2022/ B	The use of an electronic checklist improved the transfer and retention of vital patient information. Additionally, provider communication during intraoperative handoff was improved (Agarwala et al., 2015).  With the use of a handoff tool, improvements were made in worker satisfaction, patient safety perceptions, and the quality of the transfer of information among providers

## IMPLEMENTATION OF AN INTRAOPERATIVE STANDARD HANDOFF TOOL

	Adams) 1 systematic review (Riesenberg et al)		(Canale, 2018). Implementation of the WHAT provided a standard intraoperative handoff process, improved communication among anesthesia providers during handoff (Lambert & Adams, 2018). 58.3% (14/24) of studies achieved statistically significant handoff content/quality improvements (Riesenberg et al., 2022).
<b>Level III</b> Non-experimental study · Systematic review of a combination of RCTs, quasi-experimental, and non-experimental studies, or non-experimental studies only, with or without meta-analysis · Qualitative study or systematic review of qualitative studies with or without meta-synthesis	1 systematic review (Abraham et al)  1 cross-sectional, descriptive (Gibney et al)	Abraham et al., 2021/B Gibney et al., 2017/ B	There is a correlation between intraoperative handoffs and adverse outcomes (Abraham et al., 2021). There are fewer adverse outcomes if an appropriate standardized tool is used. The need for a standardized handoff tool was established (Gibney et al., 2017).
<b>Level IV</b> Opinion of respected authorities and/or reports of nationally recognized expert committees/consensus panels based on scientific evidence			
<b>Level V</b> Evidence obtained from literature reviews, quality improvement, program evaluation, financial evaluation, or case reports · Opinion of nationally recognized expert(s) based on experiential evidence			
<b>Overall Quality Rating w/rational and Recommendation: A; consistent results with strong evidence to support an indication for practice change</b>			
<p>Recommendations Based on Evidence Synthesis</p> <ul style="list-style-type: none"> <li>• Strong, compelling evidence, consistent results: solid indication for a practice change. <ul style="list-style-type: none"> <li>• Good and consistent evidence – practice change</li> </ul> </li> <li>• Good but conflicting evidence: questionable indication for practice change; consider risk/benefit analysis <ul style="list-style-type: none"> <li>• Little or no evidence: no indication for practice change</li> </ul> </li> </ul>			

## IMPLEMENTATION OF AN INTRAOPERATIVE STANDARD HANDOFF TOOL

## Appendix C

## Handoff Checklist Tool Audit

Handoff Checklist Audit Tool  
Page 1

**Handoff Checklist Tool Audit**

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Intraoperative Handoff Tool Audit

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Is the intraoperative handoff tool (PATIENT checklist)  
on the anesthesia machine in OR #1?  Yes  
 No

---

Is the intraoperative handoff tool (PATIENT checklist)  
on the anesthesia machine in OR #2?  Yes  
 No

---

Is the intraoperative handoff tool (PATIENT checklist)  
on the anesthesia machine in OR #3?  Yes  
 No

---

Is the intraoperative handoff tool (PATIENT checklist)  
on the anesthesia machine in OR #4?  Yes  
 No

---

Is the intraoperative handoff tool (PATIENT checklist)  
on the anesthesia machine in OR #5?  Yes  
 No

---

Is the intraoperative handoff tool (PATIENT checklist)  
on the anesthesia machine in OR #6?  Yes  
 No

---

Is the intraoperative handoff tool (PATIENT checklist)  
on the anesthesia machine in the minor procedure room?  Yes  
 No

---

## Appendix D

### PATIENT Handoff Tool Training

Training: Education  
Page 1

#### PATIENT Handoff Tool Training

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Record ID

---

Did you attend a training session for the new handoff tool?

- Yes
- No

## Appendix E

### Educational Training

Training: Education  
Page 1

#### Educational Training

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Record ID

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---

What is today's date?

---

---

Did you attend the educational session?

- Yes  
 No

---

What best describes your role?

- Anesthesiologist  
 CRNA  
 Anesthesia tech

## IMPLEMENTATION OF AN INTRAOPERATIVE STANDARD HANDOFF TOOL

## Appendix F

## Provider Questionnaire

*Implementation of an Intraoperative Standard Handoff Tool Among Anesthesia Providers*  
Page 1

**Provider Questionnaire**

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Record ID \_\_\_\_\_

---

Over the past week, how many times did you use, to some extent, the PATIENT transfer of care process intraoperatively when either giving or receiving report of an anesthetized patient?

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

## Appendix G

### Anesthesia Handoff Validation

*Implementation of an Intraoperative Standard Handoff Tool Among Anesthesia Providers*  
Page 1

#### Anesthesia Handoff Validation

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Record ID \_\_\_\_\_

---

Report given to

- Anesthesiologist  
 Certified Registered Nurse Anesthetist

---

Relief Type

- Break  
 Lunch  
 Assuming care  
 Return from break/lunch

---

Checklist items utilized (PATIENT mnemonic)

- Patient (quick scan), Position  
 Antibiotic, Airway, Allergies  
 Temperature  
 IVs and other Invasive lines  
 EtCO2 (ventilation)  
 Narcotics  
 Twitches