# Implementation of a Hand Hygiene Bundle to Decrease Anesthesia Workspace Contamination

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## Abstract

**Problem:** Anesthesia providers have poor hand hygiene compliance leading to microbial contamination of the anesthesia workspaces in the operating rooms at a large academic medical center in the Northeastern United States. Provider reported hand hygiene compliance at the site was as low as 0% when hand sanitizer was not available. **Purpose:** The purpose of this quality improvement (QI) initiative was to improve hand hygiene compliance among anesthesia providers by providing hand hygiene education, improving access to hand sanitizer, and placing visual reminders to perform hand hygiene in the anesthesia workspaces to decrease anesthesia workspace contamination. **Methods:** Two anesthesia providers and an anesthesia technician served as stakeholders and champions for the project. Interventions included education and placement of a hand hygiene bundle consisting of two full hand sanitizer bottles, an educational sheet, and two visual reminders to hand sanitize in the anesthesia workspaces. Data was collected using an audit tool accessed by scanning a quick response (QR) code in the anesthesia workspace. **Results:** 31/450 (6.9%) surveys were returned. Among the 31 returned surveys, 93.6% performed hand hygiene before and after touching the patient (n = 29), 90.3% performed hand hygiene before and after aseptic procedures (n = 28), 77.4% performed hand hygiene before and after medication administration (n = 24), 80.7% performed hand hygiene before touching clean areas of the anesthesia workspace (n = 25), and 83.9% performed hand hygiene before donning gloves and after doffing gloves (n = 26). **Conclusions:** Although completion of the hand hygiene surveys was poor, compliance with hand hygiene was high among the completed surveys and implementation of a hand hygiene bundle improved anesthesia provider compliance with performing proper hand hygiene.

*Keywords:* hand hygiene, decreasing contamination

**Implementation of a Hand Hygiene Bundle to Decrease Anesthesia Workspace Contamination**

Anesthesia providers have poor compliance with hand hygiene which can lead to contamination of the anesthesia workspace by microorganisms. The contamination of the anesthesia workspace propagates the spread of harmful bacteria and can lead to an increase in hospital acquired infections (HAIs) and surgical site infections (SSIs). These HAIs and SSIs are largely preventable and increase patient mortality and morbidity, worsening patient outcomes. According to the Center for Disease Control (2022), one in every 31 patients contracts an HAI every day costing the healthcare system 28.4 billion dollars per year. Hand hygiene (use of hand sanitizer or washing hands with soap and water) is fundamental to preventing HAIs. In the operating room setting, Megeus et al. (2015) found hand hygiene compliance to be a shocking 5.3% among anesthesia providers and as low as 3.1% during induction of anesthesia.

Staff interviews and direct observations at a large academic medical center in the Northeastern United States supported the fact hand hygiene was an issue among anesthesia providers. Provider reported hand hygiene compliance at the site was as low as 0% when hand sanitizer was not available. Site surveys revealed 66.6% of the operating rooms (ORs) contained contaminated anesthesia supplies, indicating anesthesia providers are not removing gloves and performing hand hygiene prior to reaching into the clean supply drawers. Additional site surveys revealed only 40% of ORs at the site contained two full bottles of hand sanitizer in the anesthesia workspaces. The root causes most responsible for the problem at this institution included inadequate supply of hand sanitizer bottles available in the anesthesia workspace, lack of education or training for staff regarding hand hygiene practices, and absence of visual reminders to perform hand hygiene in the anesthesia workspace. Figure 1 contains an Ishikawa Fishbone Diagram highlighting the causes of this problem in more detail.

**Purpose Statement**

The purpose of this project was to improve hand hygiene compliance among anesthesia providers by providing hand hygiene education, improving access to hand sanitizer, and placing visual reminders to perform hand hygiene in the anesthesia workspaces to decrease anesthesia workspace contamination. The practice change consisted of an educational presentation to the Certified Registered Nurse Anesthetists (CRNAs) during a monthly meeting and the placement of a hand hygiene bundle (laminated educational pamphlet, two full hand sanitizer bottles, and two laminated visual reminders to hand sanitize) in the anesthesia workspaces of a pod, or a group of six ORs, at the site.

## Available Knowledge

The evidence-based solution to this problem was developed after an extensive literature review of multiple databases. Searches of PubMed and MEDLINE (OVID) using Boolean search phrases “anesthesia” AND “hand hygiene” AND “compliance” were conducted and the inclusion criteria of articles published between 2016 and 2023, English language, human studies, and type of study (RCT and clinical trials) were applied. Because of the extensive body of research on increasing hand hygiene compliance on patient care units in general, an additional search of MEDLINE (OVID) using Boolean search phrases “hand hygiene” AND “compliance” and “improving” was also conducted. These searches yielded four randomized controlled trials (RCTs) and four non-randomized, quasi-experimental studies with overall quality ratings of A and B based on the Johns Hopkins Nursing Evidence-Based Rating Scale (Dang et al., 2022).

The results of this search concluded several researchers found increased access to alcohol-based hand sanitizers in the anesthesia workspace increased compliance with hand hygiene compared to traditional wall mounted hand sanitizers located outside of the anesthesia workspace (Koff et al., 2016, Munoz-Price et al., 2014, Paul et al., 2019, Plemmons et al., 2019, Porteous et al., 2018, Scheithauer et al., 2013, and Yousef et al., 2018). A randomized controlled trial conducted in Miami found recurrent, electronic visual reminders increased compliance with hand hygiene among anesthesia providers (Rodriguez-Aldrete et al., 2016). Additional researchers found bundled interventions including visual reminders, hand hygiene education, standardized infection prevention protocols, and hand hygiene champions increased hand hygiene compliance compared to pre-implementation practices among both anesthesia providers and healthcare workers in the inpatient setting (Plemmons et al., 2019, Porteous et al., 2018, and Yousef et al., 2020). The components of the hand hygiene bundle used in this project were based on the findings of these studies. Evidence review tables for these studies can be found in Table 1 along with the evidence synthesis table in Table 2.

## Rationale

The Promoting Action on Research Implementation in Health Services (PARIHS) framework was selected to support the proposed project (see Figure 2). It contains three elements: context, evidence, and facilitation. According to the PARIHS framework, success and sustainability of the interventions depend on the strength of these three elements both individually as well the strength of their relationships to each other. When strong, easily accessible evidence is presented to a supportive environment and the proposed intervention facilitates acceptance and change, it is indicative of a successful and sustainable implementation. This theory was used to execute the intervention by ensuring these relationships between the framework concepts at the site were strong. The context, or implementation environment, had an accepting culture, strong leadership, and ample resources, the evidence supporting the intervention was strong, and the facilitation of the project was both simple and easily accessible to the anesthesia providers.

## Methods

The project was implementated at a large academic medical center in the Northeastern United States over a 15-week period from October to December of 2023. The anesthesia team consisted of over 60 CRNAs and 48 anesthesia residents working in collaboration with multiple attending anesthesiologists to perform anesthesia for a variety of complex surgical procedures.

### Context

Contextual elements considered important at the outset of introducing the interventions included culture, resources, and climate. The culture valued teamwork, improving patient outcomes, and evidence-based patient care and interventions. Due to the acuity of the patient population, the climate was highly stressful, but open to practice improvements with change champions willing to support and promote these practice changes.

The structures relevant to the issue included lack of anesthesia provider education on hand hygiene practices and the importance of hand hygiene, lack of hand sanitizer within the anesthesia workspace, and absence of visual reminders to perform hand hygiene in the anesthesia workspace. The processes relevant to the issue included anesthesia providers performing patient care activities without performing hand hygiene and making contact with clean areas of the anesthesia workspace with their contaminated hands (see Figure 3 for current processes map). The project aimed to change the structures and processes to improve hand hygiene compliance among anesthesia providers.

## Interventions

The project consisted of three planned interventions. The first was the placement of a laminated, educational sheet placed on the anesthesia Pyxis machine. This sheet included hand hygiene recommendations based on a modified World Health Organization's (WHO) five moments of hand hygiene, a picture depicting frequently contaminated areas of the anesthesia workspace, and consequences of improper hand hygiene. The second was the placement of colorful, laminated visual reminders to hand sanitize placed in the anesthesia workspaces. The final intervention was the placement of a full hand sanitizer bottle on both the anesthesia Pyxis machines and the anesthesia breathing machines for every surgical case.

These interventions resulted in the desired structures including the actual placement of one laminated, educational hand hygiene sheet on every anesthesia Pyxis machine in the pod of ORs, two full hand sanitizer bottles in the anesthesia workspaces of the six ORs in the pod, and two colorful, laminated visual reminders in the anesthesia workspaces of the six ORs in the pod. The desired processes included the exposure of the anesthesia providers to the interventions, the anesthesia providers then performing patient care activities, and finally utilizing the knowledge gained from the education, increased access to hand sanitizer, and visual reminders to perform hand hygiene before touching clean areas of the anesthesia workspace (see Figure 3 for desired process map).

The roles and responsibilities of the project team members responsible for the support and implementation of these interventions are listed in Table 3. Strategies to achieve project aims included obtaining formal commitments from all individuals involved in the project, identifying early adopters and champions, assessing for site readiness and identifying barriers and facilitators, and conducting cyclical small tests of change by first implementing the project in a group of six ORs, or pod.

**Measures**

The measurements chosen to study structures and processes of the interventions were developed using the Research Electronic Data Capture (REDCap) software. One survey assessed the structure goals of the intervention (Appendix A). The operational definition of this measure was the number of ORs with two full hand sanitizer bottles in the anesthesia workspace, one laminated educational hand hygiene sheet placed on the anesthesia Pyxis machine, and two laminated visual reminders to hand sanitize placed in the anesthesia workspace (Figure 5). The second survey assessed the processes of the intervention (Appendix A). The operational definition of the measure was the percentage of anesthesia providers who reported 100% compliance with hand hygiene practices (Figure 5). Due to the nature of the data being collected, there was no need for the surveys to meet criteria for reliability and validity.

The measurement plan to assess the structure goals entailed providing the anesthesia technician with the daily implementation report survey link. To ensure data accuracy the same anesthesia technician completed the form every Monday morning during the implementation period before the start of the surgical cases and the data was securely stored in REDCap. In order to assess the process goals, a QR code was placed on the anesthesia Pyxis machines that linked to the Hand Hygiene Compliance Survey in REDCap. The providers were asked to scan the QR code and complete the survey at end of every case they complete.

**Ethical Considerations**

The required ethics review procedures for the site were completed proper to project implementation and are listed in Appendix B. This process ensured this project was conducted with honesty and integrity, posed no threat of physical or physiological harm to participants, and protected participants privacy and confidentiality. There were no actual or potential conflicts of interest with the proposed quality improvement project. Participant confidentiality during data collection was maintained using an anonymous survey without participant identifiers or possibility of participant identification. Project data protection was ensured using REDCap, a HIPAA compliant, two-factor authenticated server, only accessible to QI-PL and project faculty, to collect, record, and store data.

## Results

A total of 31 data points were collected over the 15-week implementation period. During the first week of implementation, a total of 3.3% (n = 1) of the anesthesia providers working in the pod of ORs completed the project survey. After the first week of implementation, it was noted primarily anesthesia residents were working in the pod instead of CRNAs. This was an unforeseen barrier. An adjustment was made to improve resident awareness, education, and participation in this project by providing onsite education to anesthesia residents during the weekly site visits.

During the second week of implementation, a total of 16.6% (n = 5) of the anesthesia providers working in the pod completed the project survey. The survey compliance did improve from the first week to the second week due to the increase in onsite education for the anesthesia residents that took place during week two. During the fourth through ninth weeks of implementation, a total of 3.3% (n = 1) of the anesthesia providers working in the pod completed the project survey each week. In order to increase survey completion compliance, new QR codes were placed in the anesthesia workspaces at week five that were larger and contained neon reminder signs to scan the QR codes. This did not improve survey completion compliance. After week seven, compliance did not improve so at the beginning of the eighth week, educational emails were sent out to all CRNAs and anesthesia residents regarding hand hygiene and participation in the project. This did not improve survey compliance, for week nine, but overall survey compliance did increase from weeks 10 to 15, with the exception of week 12. Upon examining trends over the 15 weeks of implementation, there were no discernible trends in the data. However, a negative shift was noted starting at week four with average compliance being below the median compliance rate. There were no astronomical data points. See Appendix C for a run chart depicting the continuous weekly data from this project. In addition, during all 15 weeks of implementation, 100% of the ORs in pod 3 contained two full bottles of hand sanitizer, two visual reminders to hand sanitize, and an educational sheet.

Frequencies and percentages were calculated for the nominal variables to assess compliance with hand hygiene among the providers who completed the survey. They are represented in Table 4. Of the total number of anesthesia providers who completed the survey, 93.55% performed hand hygiene before and after touching the patient (n = 29), 90.32% performed hand hygiene before and after clean or aseptic procedures (n = 28), 77.42% performed hand hygiene before and after medication administration (n = 24), 80.65% performed hand hygiene before touching clean areas of the anesthesia workspace (n = 25), and 83.87% performed hand hygiene before donning gloves and after doffing gloves (n = 26).

As previously discussed, an unforeseen barrier during the implementation of this project was CRNA staffing in the ORs where the hand hygiene bundle was being implemented was poor. A majority of the cases were done by anesthesia residents, while the project education was primarily focused on the CRNAs (although education materials were distributed to all anesthesia providers via email). In-person education was provided to anesthesia residents during site visits, however, in-person education in a group setting to all anesthesia residents at the site was not a possibility, which negatively impacted overall compliance with survey completion. Of note, survey compliance among CRNAs was 43.9%.

## Discussion

The goal of obtaining 100% provider compliance with hand hygiene during the five important moments of hand hygiene was not met. However, compliance with hand hygiene was high among the surveys completed. Implementation of a hand hygiene bundle improved hand hygiene compliance among anesthesia providers from 0% to 77.4%-93.6% at no additional cost to the site. The implementation of a hand hygiene bundle utilized evidence-based research to improve hand hygiene compliance among anesthesia providers, decrease anesthesia workspace contamination and improve awareness of the importance of hand hygiene among anesthesia providers.

In order to foster sustainability and spread, next steps include involving the infection prevention department to track and improve hand hygiene compliance among anesthesia providers and encouraging future nurse anesthesia students to continue the implementation of this project at the facility. The sustainability and spread of the use of a hand hygiene bundle to all ORs at the facility heavily relies on these steps as well as securing buy-in from the anesthesia staff.

The results of this quality initiative project are similar to the results from other publications used to support this intervention. Other publications found providing education, improving access to hand sanitizer, and utilizing visual reminders to perform hand hygiene all increased increased hand hygiene compliance and these findings were noted in this project as well. The post-implementation compliance rates with performing hand hygiene were substantially higher than the pre-implementation rates. Differences between the observed and anticipated outcomes with survey completion can be attributed to the previously discussed barrier of poor CRNA staffing within the ORs where the project was implemented. Other factors that can be attributed to this difference includes survey fatigue and the inability to provide in-person group education to the anesthesia residents.

A major factor limiting the internal validity of the project was the use of a self-reporting survey as the main data collection method used in this project. Unfortunately, direct observation of hand hygiene compliance as the primary method of data collection, was not a possibility for this project. Ensuring data accuracy was difficult with this method because self-reporting has low validity and reliability. In order to improve accuracy, providers were notified the surveys were to be anonymous and encouraged to answer honestly. In addition, a free text explanatory section was included in the hand hygiene compliance survey. The free text explanatory section of the survey did not add to quantitative data gathered by the surveys. However, it was helpful to identify reasons for the moderate compliance with hand hygiene and may be able to offer ideas for potential modifications to this project to improve hand hygiene compliance.

## Conclusion

The results of this project support the use of a hand hygiene bundle to improve hand hygiene compliance among anesthesia providers. This intervention is important to the anesthesia profession because it offers a simple solution to improve the poor hand hygiene compliance rates among anesthesia providers, thereby decreasing infection rates among surgical patients, improving patient outcomes, and improving the overall quality and safety of patient care. It can be implemented with resources already available at most healthcare facilities and institutions.

The cost effectiveness of this intervention increases the likelihood of its sustainability and spread among all anesthesia departments across the country.

Implementation of a hand hygiene bundle is a simple and inexpensive intervention to improve hand hygiene compliance among anesthesia providers. Utilizing a hand hygiene bundle in the anesthesia workspace can improve anesthesia provider compliance with performing proper hand hygiene and decrease contamination of the anesthesia workspace. Future QI initiatives should focus on incorporating hand hygiene education in the training of CRNAs and anesthesia residents to create good habits early on as it is difficult to change established habits among providers.

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**Table 1**

*Evidence Synthesis Table: Improving Hand Hygiene Among Anesthesia Providers*

| Category (Level Type) | Total Number of Sources | Quality Ratings and Author | Synthesis of Findings |
|---|---|---|---|
| Level 1 · Experimental study · Randomized Controlled Trial (RCT) · Systematic review of RCTs with or without meta-analysis | 4 Experimental, randomized trials/studies (Koff et al.; Munoz-Price et al.; Paul et al.; Rodriguez-Aldrete et al.) | Koff et al. B<br>Munoz-Price et al. B<br>Paul et al. A<br>Rodriguez-Aldrete et al. B | Koff et al. (2016), Munoz-Price et al. (2014), and Paul et al. (2019) found increased access to alcohol-based hand sanitizers in the anesthesia workspace increased compliance with hand hygiene compared to traditional wall mounted hand sanitizers located outside of the anesthesia workspace. Koff et al. (2016) found no reduction in hospital acquired infections with the implementation of their personal hand hygiene intervention. Rodriguez-Aldrete et al (2016) found recurrent, electronic visual reminders and placement of hand sanitizer dispensers in the anesthesia workspace increased compliance with hand hygiene among anesthesia providers. |
| Level II · Quasi-experimental studies · Systematic review of a combination of RCTs and quasi-experimental studies, or quasi-experimental studies only, with or without meta-analysis | 4 Nonrandomized quasi-experimental studies (Plemmons et al.; Porteous et al.; Scheithauer et al.; Yousef et al.) | Plemmons et al. B<br>Porteous et al. B<br>Scheithauer et al. A<br>Yousef et al. B | All four studies found increasing access to hand sanitizer increased hand hygiene rates and compliance compared to lack of available hand sanitizer in the baseline, pre-implementation practices. In addition, Plemmons et al. (2019), Porteous et al. (2018), and Yousef et al (2020) found bundled inventions including visual reminders, hand hygiene education, standardized infection prevention protocols, and hand hygiene champions increased hand hygiene compliance compared to baseline, pre-implementation practices lacking these interventions. |
| Overall Quality Rating and Recommendation Based on Evidence Synthesis:<br>The overall quality rating for the studies in this evidence review is B with good, reasonably consistent results, methods, and conclusions to support a practice change as well as to support the interventions proposed in the PICO(T) question for this project. | | | |

**Table 2**

*Evidence Review Table: Improving Hand Hygiene Among Anesthesia Providers*

<table>
<tr><td colspan="2">Citation: Koff, M. D., Brown, J. R., Marshall, E. J., O’Malley, A. J., Jensen, J. T., Heard, S. O., Longtine, K., O’Neill, M., Longtine, J., Houston, D., Robison, C., Moulton, E., Patel, H. M., & Loftus, R. W. (2016). Frequency of hand decontamination of intraoperative providers and reduction of postoperative healthcare-associated infections: A randomized clinical trial of a novel hand hygiene system. Infection Control and Hospital Epidemiology, 37(8), 888–895. https://doi-org.proxy-hs.researchport.umd.edu/10.1017/ice.2016.10</td><td>Level and Quality:<br>I-B</td></tr>
<tr><td>Purpose or Hypothesis</td><td colspan="2">The purpose of this study was to evaluate whether increasing intraoperative hand decontamination event (HDE) rates using a novel, multimodal hand hygiene system was an effective at reducing 30-day postoperative hospital acquired infections (HAIs).</td></tr>
<tr><td>Type of Evidence Research Design</td><td colspan="2">2 Center, Randomized and Controlled Prospective Clinical Trial</td></tr>
<tr><td>Sample Population, Size, Setting</td><td colspan="2">Sampling Technique: Convenience Eligible Participants: Healthcare providers outside the surgical field (CRNAs, anesthesiologists, circulating nurses, and break providers/observers) Setting: Operating Rooms (ORs) at Dartmouth-Hitchcock Medical Center in New Hampshire and UMass Memorial Medical Center in Massachusetts Excluded: Cases involving pediatric or pregnant patients, lack of intravascular catheter, surgical procedures outside those listed in inclusion criteria, and operating rooms in which the anesthesia provider had a documented allergy to hand sanitizer Accepted: Operating rooms that had at least two consecutive surgical cases for patients undergoing elective, urgent, or emergent orthopedic, plastic, neurosurgical, cardiothoracic, urologic, general abdominal, gynecological, vascular, or ENT procedures. Use of peripheral catheters was required Control: 1,620 surgical cases Intervention: 1,636 surgical cases Power Analysis/Achieved: 1,600 cases required for each group to meet a power of 90% with a type 1 error of 0.5: Power Analysis met Group Homogeneity: The intervention and control groups are homogeneous based on the p values in Table 1 for patient and procedural characteristics</td></tr>
<tr><td>Intervention Procedures</td><td colspan="2">Control Protocol: The presence of standard wall-mounted hand sanitizer devices and anesthesia machine/cart dispensers.<br>Intervention Protocol: The use of a personalized, body-worn dispenser and the presence of 3 refills placed on the anesthesia cart. Treatment Fidelity: The ORs were randomly selected for observation. The control and intervention groups were randomly selected.</td></tr>
<tr><td>Primary Outcome and Measures</td><td colspan="2">Dependent Variable: HAI defined as the presence of elevated white blood cell count, fever, anti-infective order, office visit documenting signs of infection, and/or acquisition of bacterial cultures within 30 days following surgical procedure.<br>DV Measure: The dependent variable was measured by a electronic medical record screening for patients positive for one or more of the previously mentioned criteria. If positive, an extensive chart review was performed to determine whether the patient met criteria for diagnosis of HAI according to the National Healthcare Safety Network definitives.</td></tr>
<tr><td>Results/Conclusion</td><td colspan="2">Statistical Results: A Chi-square test for discrete data and a t-test continuous data revealed increase in hand decontamination events from 0.54 events per hour to 4.3 events per hour post-intervention ($P < 0.001$), but the use of the hand hygiene system was not associated with a significant decrease in HAIs ($P = .626$). 6.7% and 7.1% of patients developed HAIs in the control and treatment groups respectively. Conclusion: The hand hygiene system increased the frequency of hand decontamination events, but did not reduce the 30-day postoperative HAI rates.</td></tr>
</table>

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|---|---|---|
| **Citation:** Munoz-Price, L. S., Patel, Z., Banks, S., Arheart, K., Eber, S., Lubarsky, D. A., & Birnbach, D. J. (2014). Randomized crossover study evaluating the effect of a hand sanitizer dispenser on the frequency of hand hygiene among anesthesiology staff in the operating room. *Infection Control and Hospital Epidemiology, 35*(6), 717–720. https://doi.org/10.1086/676425 | | **Level and Quality:** **I-B** |
| **Purpose or Hypothesis** | The purpose of this study was to evaluate the impact of a hand sanitizer dispenser placed on the anesthesia machine on the frequency of hand hygiene among anesthesiology providers while delivering anesthesia in the OR. | |
| **Type of Evidence Research Design** | Randomized, Crossover, Single-Center Study | |
| **Sample Population, Size, Setting** | **Sampling Technique:** Convenience **Eligible Participants:** The primary anesthesia providers defined as "the person who remained in the OR throughout the case" at the facility the study took place **Setting:** Main ORs (n = 30) of a 1,500 bed public teaching hospital in Florida **Excluded:** Primary anesthesia providers working at different hospitals and anesthesia providers delivering anesthetic outside the hospital's main ORs **Accepted:** 45 primary anesthesia providers delivering anesthesia in the hospital's main ORs **Control:** 40 randomized primary anesthesia providers **Intervention:** 40 randomized primary anesthesia providers **Power Analysis/Achieved:** The researchers did not discuss how they determined the sample size, so it cannot be assumed the power analysis was not met. **Group Homogeneity:** The intervention and control groups are not homogeneous based on the *p* values in Table 1 for characteristics of providers at the time of randomization | |
| **Intervention Procedures** | **Control Protocol:** The presence and use of the wall-mounted hand sanitizer dispensers only. **Intervention Protocol:** The placement and use of a hand sanitizer dispenser on the anesthesia machine in addition to the standard wall-mounted dispensers.<br>**Treatment Fidelity:** The subjects were randomized to either intervention or control. The OR selected for observation was also randomly selected each day. One individual performed all observations. The observer entered with OR with the patient and remained next to the anesthesia provider for up to 120 minutes or until the patient left the OR for every observation. The providers were blinded to the outcome being evaluated. | |
| **Primary Outcome and Measures** | **Dependent Variable:** For the purpose of this study, hand hygiene frequency was defined as "the number of hand hygiene events per hour of observation".<br>**DV Measure:** The dependent variable was measured by direct observation of hand hygiene events (the use of hand sanitizer) and then divided by the number of hours observed. | |
| **Results/Conclusion** | **Statistical Results:** A t-test comparison revealed having a hand sanitizer dispenser on the anesthesia machine resulted in a statistically significant increase in the frequency of hand hygiene from 0.5 to 0.8 per hour ($P = 0.01$).<br>**Conclusion:** The researchers concluded placing a hand sanitizer dispenser on the anesthesia machine resulted in an increase in frequency of hand hygiene events while providing anesthesia care. | |

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|---|---|---|
| **Citation:** Paul, E. T., Kuszajewski, M., Davenport, A., Thompson, J. A., & Morgan, B. (2019). Sleep safe in clean hands: Improving hand hygiene compliance in the operating room through education and increased access to hand hygiene products. *American Journal of Infection Control, 47*(5), 504–508. https://doi-org.proxy-hs.researchport.umd.edu/10.1016/j.ajic.2018.10.021 | | **Level and Quality:** **I-A** |
| **Purpose or Hypothesis** | The purpose of this study was to improve hand hygiene compliance among anesthesia providers in the OR through education and increased access to hand hygiene products. | |

| | |
|---|---|
| **Type of Evidence Research Design** | Randomized pre-test/post-test design |
| **Sample Population, Size, Setting** | **Sampling Technique:** Convenience **Eligible Participants:** Anesthesia providers in the main Ors **Setting:** Operating rooms at a university-affiliated community hospital in the Southeastern United States **Excluded:** Anesthesia providers working at different hospitals and anesthesia providers delivering anesthetic outside the hospital's main ORs **Accepted:** Anesthesia providers delivering anesthesia in the hospital's main ORs for all types of cases and anesthetic techniques **Control:** 436 opportunities for hand hygiene in the pre-implementation phase **Intervention:** 432 opportunities for hand hygiene in the post-implementation phase and 433 opportunities for hand hygiene in the 60 days post-implementation phase **Power Analysis/Achieved:** 141 hand hygiene opportunities in each group were required to achieve a 90% Power Analysis, 0.05 Alpha, and moderate effect size (0.30): Power Analysis met **Group Homogeneity:** Not discussed in study |
| **Intervention Procedures** | **Control Protocol:** The observation of the anesthesia providers' hand hygiene compliance (using a World Health Organization observation tool) prior to the implementation of the interventions in which each incidence of hand hygiene indication was recorded as completed or missed. **Intervention Protocol:** The intervention consisted of anesthesia provider education on hand hygiene and placement of hand sanitizer dispenser on anesthesia gas machine. **Treatment Fidelity:** ORs used for observation and therefore the anesthesia provider working in the OR were randomly selected each day. |
| **Primary Outcome and Measures** | **Dependent Variable:** For the purpose of this study, hand hygiene compliance was defined as a hand rub with hand sanitizer. **DV Measure:** The dependent variable was measured through visual observation using a modified version of the "5 moments for hand hygiene" WHO observation tool with indications for hand hygiene before patient contact, before aseptic technique, after body fluid exposure risk, after patient contact, and after contact with patient surroundings. The number of handy hygiene events was then divided by the total hand hygiene opportunities. |
| **Results/Conclusion** | **Statistical Results:** A Chi-square test revealed a statistically significant increase in hand hygiene compliance from the pre-implementation phase to the post-implementation phase (*P* < .001). The overall compliance with hand hygiene was 1.4% pre-implementation (n = 6), 43.1% post-implementation (n = 186), and 37.9% 60 days post-implementation (n = 164). **Conclusion:** The researchers concluded provider education increased compliance with hand hygiene, but did note the use of the hand sanitizer dispenser on the anesthesia machine decreased from the post-implementation observations to the 60 days post-implementation observations. |

| | |
|---|---|
| **Citation:** Plemmons, M. M., Marcenaro, J., Oermann, M. H., Thompson, J., & Vacchiano, C. A. (2019). Improving infection control practices of nurse anesthetists in the anesthesia workspace. *American Journal of Infection Control, 47*(5), 551–557. https://doi-org.proxy-hs.researchport.umd.edu/10.1016/j. ajic.2018.12.009 | **Level and Quality: II-B** |
| **Purpose or Hypothesis** | The purpose of this study was to determine if education and implementation of standardized infection control guidelines addressing evidence-based best practices would improve compliance with infection control procedures in the anesthesia workspace. |
| **Type of Evidence Research Design** | Nonrandomized, pre-test/post-test design |

| | |
|---|---|
| **Sample Population, Size, Setting** | **Sampling Technique:** Convenience **Eligible Participants:** Nurse anesthetists who consistently provide the majority of direct patient care in the main operating suites **Setting:** The main operating suites (n = 51) at a 957 bed medical center in the Southeastern United States. **Excluded:** Anesthesia team members other than nurse anesthetists who provided care at the facility in the study **Accepted:** 35 nurse anesthetists **Control:** Convenience sample of nurse anesthetists (number not specified in study) **Intervention:** 30 nurse anesthetists **Power Analysis/Achieved:** The researchers did not discuss how they determined the sample size, so it cannot be assumed the power analysis was not met. **Group Homogeneity:** Not mentioned in study. |
| **Intervention Procedures** | **Control Protocol:** The observation of the nurse anesthetists' hand hygiene compliance prior to the implementation of the interventions and guidelines.<br>**Intervention Protocol:** The intervention consisted of educational sessions, visual reminders (laminated signs), an educational flyer, and implementation of infection control guidelines.<br>**Treatment Fidelity:** The anesthesia providers we unaware they were being observed. |
| **Primary Outcome and Measures** | **Dependent Variable:** For the purpose of this study, the dependent variable is the improvement in clean workspace behaviors defined as double-gloving and hand hygiene after airway instrumentation, hand hygiene after medication administration, swabbing rubbing stopper prior to drawing up medications, hand hygiene before contact with IV stopcock and swabbing port with alcohol prior to syringe attachment and separation of clean and contaminated items in the workspace.<br>**DV Measure:** The dependent variable was measured using an audit tool that contains the elements listed above. The audit tool determined provider practices to be contaminated if the clean practice tasks were not followed 100% of the time. |
| **Results/Conclusion** | **Statistical Results:** A Chi-square test revealed a significant increase in separation of clean and contaminated items in the workspace ($P < .0001$) and a significant increase in hand hygiene after airway instrumentation ($P < .05$) 3 weeks after implementation of the interventions. It did not reveal a significant increase in hand hygiene after medication administration 3 weeks and 3 months after implementation ($P = 0.99$ and .80, respectively).<br>**Conclusion:** Education, visual reminders, and standardized infection control guidelines were shown to improve compliance with infection control practices in a group of nurse anesthetists. |

| | |
|---|---|
| **Citation:** Porteous, G. H., Bean, H. A., Woodward, C. M., Beecher, R. P., Bernstein, J. R., Wilkerson, S., Porteous, I., & Hsiung, R. L. (2018). A simulation study to evaluate improvements in anesthesia work environment contamination after implementation of an infection prevention bundle. *Anesthesia and Analgesia*, *127*(3), 662–670. https://doi-org.proxy-hs.researchport.umd.edu/10.1213/ANE.0000000000000276 | **Level and Quality:**<br>**II-B** |
| **Purpose or Hypothesis** | The purpose of this study was to determine whether an evidence-based bundled intervention to change anesthesia provider behavior during a simulated case would decrease the extent of anesthesia work environment contamination using ultraviolet fluorescent tracers. |
| **Type of Evidence Research Design** | Nonrandomized simulated crossover design |

| | |
|---|---|
| **Sample Population, Size, Setting** | **Sampling Technique:** Non-probability sampling using voluntary response sampling **Eligible Participants:** Anesthesiology residents, attending anesthesiologists, and CRNAs **Setting:** Simulated OR environment **Excluded:** Non-volunteers who were not members of the Department of Anesthesiology at Virginia Mason Medical Center **Accepted:** Volunteers from the Department of Anesthesiology at Virginia Mason **Control:** 25 subjects (9 residents, 8 attending anesthesiologists, and 8 CRNAs)<br>**Intervention:** 25 subjects (9 residents, 8 attending anesthesiologists, and 8 CRNAs)<br>**Power Analysis/Achieved:** A group size of 22 was required to meet a power of 80%, an alpha of .05, and a moderate effect size of 0.6: Power Analysis met **Group Homogeneity:** Not mentioned in study |
| **Intervention Procedures** | **Control Protocol:** Simulation of clinical care using UV fluorescent gel without implementation of the bundle<br>**Intervention Protocol:** The implementation of an intervention bundle that included double gloving prior to intubation or removing outer gloves after intubation, placing all airway equipment in a tray on the anesthesia machine, performing hand hygiene before touching anything on or in the anesthesia cart, and increasing availability of hand sanitizer dispensers marked with signs.<br>**Treatment Fidelity:** Subjects were not informed infection prevention was the focus of the study. |
| **Primary Outcome and Measures** | **Dependent Variable:** The total number of anesthesia work environment sites contaminated by the subject as evidenced by the presence of UV fluorescent gel (20 possible sites) yielding a contamination score from 0-20.<br>**DV Measure:** The dependent variable was measured using a UV light to identify the areas of contamination of the anesthesia work environment and pictures were taken of areas of contamination. A blinded observer scored the images for the presence or absence of UV tracer gel at the 20 sites pre and post-implementation. |
| **Results/Conclusion** | **Statistical Results:** A mixed effects model showed a decreased subject contamination score of 4 post-intervention ($P < .001$), a 27% reduction in score between baseline and intervention scenarios. In addition, the number of hand hygiene events increased from 0.12 events per provider at baseline to 1.6 events per provider in the post-intervention scenarios.<br>**Conclusion:** The researchers concluded an infection prevention bundle decreased the amount of workspace contamination and increased the number of hand hygiene events (removal of gloves or use of hand sanitizer). |

| | | |
|---|---|---|
| **Citation:** Rodriguez-Aldrete, D., Sivanesan, E., Banks, S., Mavarez, A., Arheart, K., Eber, S., & Munoz-Price, L. S. (2016). Recurrent visual electronic hand hygiene reminders in the anesthesia work area. *Infection Control and Hospital Epidemiology*, *37*(7), 872–874. https://doi.org/10.1017/ice.2016.29 | | **Level and Quality:**<br>**I-B** |
| **Purpose or Hypothesis** | The purpose of this study was to evaluate whether or not a recurrent visual electronic hygiene reminder would increase the frequency of hand hygiene events. | |
| **Type of Evidence Research Design** | Prospective, randomized cohort study. | |

| | |
|---|---|
| **Sample Population, Size, Setting** | **Sampling Technique:** Convenience **Eligible Participants:** Second year anesthesia residents **Setting:** Orthopedic operating rooms in an urban teaching hospital in Miami, Florida **Excluded:** Personnel other than second year anesthesia residents and surgical cases that were not elective upper and lower extremity orthopedic surgeries and cases in which patients' American Society of Anesthesiologists' (ASA) statuses were 4 or 5. **Accepted:** Second year anesthesia residents and elective upper and lower extremity orthopedic surgeries in which the patients had an ASA physical status score of 1-3. **Control:** 10 randomized second year anesthesia residents **Intervention:** 10 randomized second year anesthesia residents **Power Analysis/Achieved:** The researchers did not discuss how they determined the sample size, so it cannot be assumed the power analysis was not met.<br>**Group Homogeneity:** Not mentioned in study. |
| **Intervention Procedures** | **Control Protocol:** No visual reminders to perform hand hygiene.<br>**Intervention Protocol:** The intervention consisted of an electronic visual reminder stating, "Please Sanitize Your Hands," which was shown for 60 seconds every 15 minutes on a monitor immediately adjacent to the vital signs display. Each study participant was exposed to the reminder 4 times over 1 hour per observation.<br>**Treatment Fidelity:** The participants were randomly chosen from the pool of second year anesthesia residents. The groups (control and intervention) were also randomly chosen. The purpose of the study was not disclosed to the participants. |
| **Primary Outcome and Measures** | **Dependent Variable:** For the purpose of this study, hand hygiene was a hand rub using using the hand sanitizer placed on the anesthesia machine.<br>**DV Measure:** The participants were observed over 1 hour during the control and intervention periods. Within 1–5 days after the original observation, these study participants were observed a second time in the opposite group. Observations were performed by authors of the study starting at the time of entry to the operating room. The observer was seated inside the room within view of the anesthesiology resident, counting the number of hand rubs per hour of observation. |
| **Results/Conclusion** | **Statistical Results:** A t-test comparison revealed a significant difference ($P < .05$) between the two groups with 2 hand hygiene events per hour in the control group compared to 22 hand hygiene events per hour in the intervention group.<br>**Conclusion:** The researchers concluded the recurrent visual electronic hygiene reminder did increase the frequency of hand hygiene events among anesthesia providers in the experimental group. |

| | |
|---|---|
| **Citation:** Scheithauer, S., Rosarius, A., Rex, S., Post, P., Heisel, H., Krizanovic, V., Schulze-Röbbecke, R., Rossaint, R., & Lemmen, S. W. (2013). Improving hand hygiene compliance in the anesthesia working room work area: More than just more hand rubs. *American Journal of Infection Control, 41*(11), 1001–1006. https://doi.org/10.1016/j.ajic.2013.02.00 | **Level and Quality:**<br>**II-A** |
| **Purpose or Hypothesis** | The purpose of this study was to identify causative factors of low hand hygiene compliance and to assess whether or not interventions aimed at increasing the number of hand rubs and improving anesthesia workflow (by decreasing unnecessary hand rubs due to recontamination) would increase hand hygiene compliance. |
| **Type of Evidence Research Design** | Prospective, triphase before/after study |

| | |
|---|---|
| **Sample Population, Size, Setting** | **Sampling Technique:** Convenience **Eligible Participants:** The members of anesthesiology team comprised of 88 physicians and 55 nurses **Setting:** The ORs at a University Hospital in Aachen, Germany. **Excluded:** Any healthcare worker not included in the anesthesiology team was excluded from this study. **Accepted:** Members of the anesthesiology team. **Control:** 4,636 observed opportunities for hand hygiene prior to implementation of interventions **Intervention:** 7506 observed opportunities for hand hygiene after implementation of interventions **Power Analysis/Achieved:** 217 observations were required to achieve a 90% Power Analysis and 0.05 Alpha: Power Analysis met **Group Homogeneity:** Not mentioned in study. |
| **Intervention Procedures** | **Control Protocol:** Initial observation of anesthesia activities and procedures up until the surgical procedures started prior to the implementation of the two interventions. **Intervention Protocol:** The interventions consisted of increasing the number of number of hand disinfectant dispensers at appropriate places in the anesthesia working area and by promoting gown pocket dispensers, staff education and audits and attempting to decrease the number of hand disinfections needed for a single process (by decreasing avoidable recontaminations during events such as preparing for invasive procedure, administering IV medications, and intubations/airway management). After these interventions were implemented and observed, a second intervention which included audits and presentation of results as a training tool was implemented and then observed. **Treatment Fidelity:** Three trained observers anonymously performed the direct observation for this study. |
| **Primary Outcome and Measures** | **Dependent Variable:** For the purpose of this study, hand hygiene compliance is defined as "the use of alcohol hand disinfection".<br>**DV Measure:** The dependent variable was measured through visual observation of the WHO's indications for hand hygiene (before patient contact, before aseptic technique, after body fluid exposure risk, after patient contact, and after contact with patient surroundings). The total number of hand events was divided by the total number of hand hygiene opportunities to assess compliance. |
| **Results/Conclusion** | **Statistical Results:** Fisher exact tests and Chi-square tests revealed a significant increase in compliance from the pre-intervention observation to the first post-interventional observation ($P < .0001$) and from the first post-interventional observation to the second post-observational intervention ($P < .001$).<br>**Conclusion:** The researchers concluded simple measures such as increasing the number of hand sanitizer bottles available improved compliance with hand hygiene practices without increasing the workload or negatively impacting anesthesia workflow. |

| | |
|---|---|
| **Citation:** Yousef, R. H. A., Salem, M. R., & Mahmoud, A. T. (2020). Impact of implementation of a modified World Health Organization multimodal hand hygiene strategy in a university teaching hospital. *American Journal of Infection Control, 48*(3), 249–254. https://doi-org.proxy-hs.researchport.umd.edu/10.1016 /j.ajic.2019.07.01 | **Level and Quality:**<br>**II-B** |
| **Purpose or Hypothesis** | The purpose of this study was to evaluate whether hand hygiene knowledge, attitude, and practice improved after the implementation of a modified World Health Organization hand hygiene strategy. |
| **Type of Evidence Research Design** | A pre-test post-test quasi-experimental study |

| | |
|---|---|
| **Sample Population, Size, Setting** | **Sampling Technique:** Convenience **Eligible Participants:** Nurses working in the hospital **Setting:** The internal medicine department of a university-affiliated teaching hospital in Cairo, Egypt **Excluded:** Healthcare workers that were not nurses and nurses did not work in the hospital where the study was conducted **Accepted:** All nurses working in the hospital during the study duration **Control:** 83 nurses **Intervention:** 83 nurses **Power Analysis/Achieved:** The researchers did not discuss how they determined the sample size, so it cannot be assumed that the power analysis was met. **Group Homogeneity:** Not mentioned in this study. |
| **Intervention Procedures** | **Control Protocol:** Baseline assessment of nurses' baseline knowledge on hand hygiene, assessment of hand hygiene resources, and the observation of current hand hygiene compliance by nursing staff.<br>**Intervention Protocol:** Increasing access to hand sanitizer dispensers by making them more readily available (outside each bed and outside each ward), training and education on hand hygiene, visual reminders (hand hygiene posters and reminders), identification of hand hygiene champions.<br>**Treatment Fidelity:** The same there infection control personnel performed all observations using the same WHO criteria for hand hygiene opportunities and hand hygiene actions. |
| **Primary Outcome and Measures** | **Dependent Variable:** For the purpose of this study, hand hygiene compliance was defined as a "positive action of performing waterless hand rub with alcohol or hand wash with soap and running water".<br>**DV Measure:** The dependent variable was measured through visual observation using a modified version of the "5 moments for hand hygiene" WHO observation tool with indications for hand hygiene before patient contact, before aseptic technique, after body fluid exposure risk, after patient contact, and after contact with patient surroundings. The number of actual hand hygiene events were divided by total number of opportunities to determine compliance. |
| **Results/Conclusion** | **Statistical Results:** Comparisons between groups were done using the chi-square test and fisher exact tests for qualitative variables and the Mann-Whitney U test and Kruskal-Wallis H test for quantitative variables and showed a significant increase in hand hygiene compliance from 28% pre-intervention to 50% post-intervention and 58% after the follow-up period ($P < .001$) and the use of alcohol hand rub increased from 9.5% before intervention to 65% post-intervention and 76% after the follow-up period.<br>**Conclusion:** The implementation of a modified version of the WHO's multimodal strategy for improving hand hygiene compliance (increased access to hand sanitizer, visual reminders, education, and hand hygiene champions) doubled hand hygiene rates. |

**Table 3**

*Roles and Responsibilities of Site Team Members (Names removed to prevent site identification)*

| Team Member Name/Credentials/Title | Responsibilities |
|---|---|
| 1. Clair Maher, RN, BSN, SRNA | Project leader responsible for planning project, obtaining buy-in from team members for project implementation, obtaining approval of project, and overseeing the implementation of the project. |
| 2. MHS, CRNA, Director of Nurse Anesthetists | Faculty Sponsor |
| 3. DNP, CRNA | CSR, CRNA hand hygiene champion. |
| 4. Anesthesia Technician | Act as anesthesia technician hand hygiene champion. Ensure full hand sanitizer bottles are placed on anesthesia Pyxis machines and anesthesia breathing machines when setting up rooms during implementation period. Ensure educational materials and visual reminders are still present during implementation period. |
| 5. RN, BSN | Assist with questions or issues regarding information technology (IT) that pertain to the project. |

**Table 4**

*Anesthesia Provider Compliance with Important Moments of Hand Hygiene (n=31)*

| **Variable** | **n** | **%** |
|---|---|---|
| Before and After Touching Patient | | |
| Yes | 29 | 93.55 |
| No | 2 | 6.45 |
| Before and After Clean/Aseptic Procedures | | |
| Yes | 28 | 90.32 |
| No | 3 | 9.68 |
| Before and After Medication Administration | | |
| Yes | 24 | 77.42 |
| No | 7 | 22.58 |
| Before Touching Clean Area of Anesthesia Workspace | | |
| Yes | 25 | 80.65 |
| No | 6 | 19.35 |
| Before Donning Gloves and After Doffing Glove | | |
| Yes | 26 | 83.87 |
| No | 5 | 16.13 |

*Note*. Due to rounding errors, percentages may not equal 100%.

**Table 5**

*Project Measurement Plan*

| **Measures**<br>(Examples serve as suggestion only – each project will have unique measures) | | |
|---|---|---|
| Project Goals | Measure Pre-Implementation | Measure During Implementation |
| 1. 2 full hand sanitizer bottles are placed in the anesthesia workspace (on the anesthesia Pyxis machine and the anesthesia breathing machine) in every OR in pod 3 for every case daily | Daily Implementation Report (*Can be used for pre-implementation measurement, but pre-implementation measurement not needed for this QI project) | **Measurement:** Number of ORs with 2 full hand sanitizer bottles<br>**Tool:** Daily Implementation Report |
| 2. 1 laminated hand hygiene educational sheet will be placed on the anesthesia Pyxis machine in every OR in pod 3 | Daily Implementation Report (*Can be used for pre-implementation measurement, but pre-implementation measurement not needed for this QI project) | **Measurement:** Number of ORs with 1 laminated educational hand hygiene sheet<br>**Tool:** Daily Implementation Report |
| 3. 2 laminated visual reminder signs will be placed on the anesthesia Pyxis machine and anesthesia breathing machine in every OR in pod 3 | Daily Implementation Report (*Can be used for pre-implementation measurement, but pre-implementation measurement not needed for this QI project) | **Measurement:** Number of ORs with 2 laminated visual reminders to hand sanitize<br>**Tool:** Daily Implementation Report |
| Process Goal | | |
| 1. 100% of anesthesia providers in pod 3 who have proper access to hand sanitizer, educational materials, and visual reminders to perform hand hygiene in the anesthesia workspace will report 100 % compliance with hand hygiene during the 5 important moments of hand hygiene (before and after touching the patient, | **Measurement:** Number of CRNAs who reported 100% compliance with hand hygiene in percentages<br>**Numerator:** # of anesthesia providers who were compliant with performing hand hygiene during the 5 moments of hand hygiene<br>**Denominator:** Total # of anesthesia providers who had proper access to hand sanitizer, educational materials, and visual reminders to hand sanitize in pod 3 | **Measurement:** Percentage of CRNAs who reported 100% compliance with hand hygiene in percentages<br>**Numerator:** # of anesthesia providers who were compliant with performing hand hygiene during the 5 moments of hand hygiene<br>**Denominator:** Total # of anesthesia providers who had proper access to hand sanitizer, educational materials, and visual reminders to hand sanitize in pod 3 |

| | | |
|---|---|---|
| before and after administering medication, before donning gloves and after doffing gloves, before and after clean/aseptic technique, before touching clean areas of the workspace) | | |
| Outcome | | |
| 1. 100% of anesthesia workspaces in the Ors in pod 3 were free of bacterial contamination during the implementation period | This will not be measured. Research/evidence supports this outcome | This will not be measured. Research/evidence supports this outcome |
| 2. 100% of patients who underwent surgery in an OR in pod 3 during the implementation period were free of HAI and SSI post-operatively | This will not be measured. Research/evidence supports this outcome | This will not be measured. Research/evidence supports this outcome |
| **Measurement Plan** | | |
| Project Goals | Data Collection Procedures (who, how, when) | Name of Data Collection Tool |
| Project Structure Goals:<br><br>Provide educational materials on hand hygiene via a laminated sheet placed on the anesthesia Pyxis machine (will provide education to providers and reference for practice when placed in anesthesia workspace).<br><br>Provide 2 hand sanitizer bottles conveniently located in the anesthesia workspace (one on the anesthesia Pyxis machine and one of the anesthesia gas machine) | **WHO:** Anesthesia technician and SRNA (Clair Maher)<br><br>**HOW:** Assess all the ORs in pod 3 and complete a data collection tool verifying presence of 2 full hand sanitizer bottles, educational sheet, and visual reminders to hand sanitize before the start of each case. SRNA will place educational sheets and visual reminders in the ORs in pod 3 before the start of the implementation phase.<br><br>**WHEN:** During the 15 week implementation period (9/11/23-12/22/23). | Daily Implementation Report |

| | | |
|---|---|---|
| Provide visual reminders to perform hand hygiene in the anesthesia workspace using colorful laminated signs placed on both the anesthesia Pyxis machine and the anesthesia gas machine). | Education and visual reminders will be placed in ORs on 9/9/23. | |
| Project Process Goals:<br><br>By the end of the 15 week implementation period, 100% of anesthesia providers in pod 3 will report 100% compliance with hand hygiene during the 5 important moments of hand hygiene (before and after touching the patient, before and after administering medication, before donning gloves and after doffing gloves, before and after clean/aseptic technique, before touching clean areas of the workspace) | **WHO:** Anesthesia providers<br><br>**HOW:** Will scan a QR code placed on the anesthesia Pyxis and answer seven questions regarding perceived increase in hand hygiene events (due to education, increased availability of hand sanitizer, and visual reminders) and personal hand hygiene compliance<br><br>**WHEN:** During the four weeks following the implementation period of the project (2/25/24-1/19/24) | Hand Hygiene Compliance Survey |

**Figure 1**

*Ishikawa Fishbone Diagram*

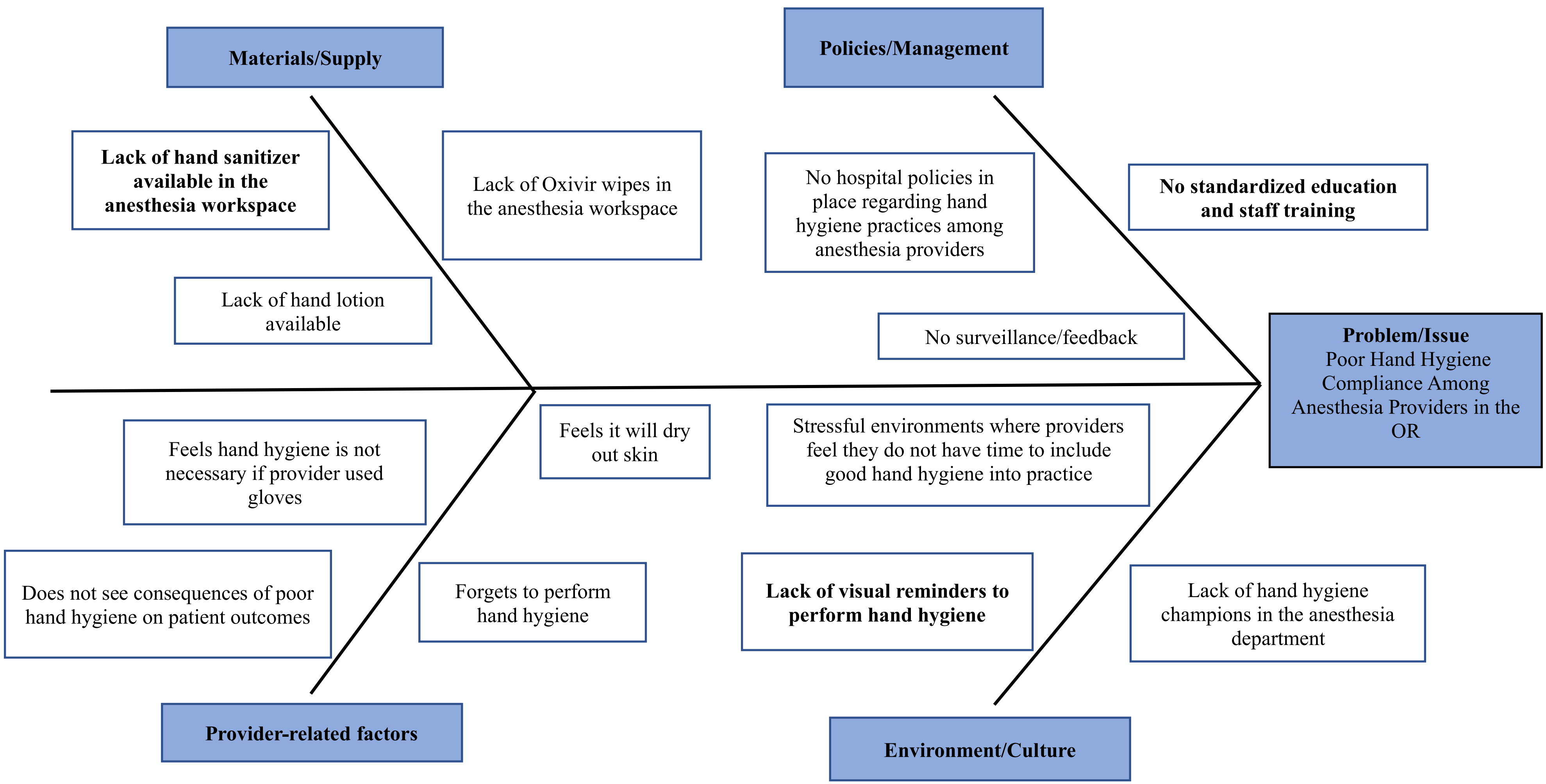
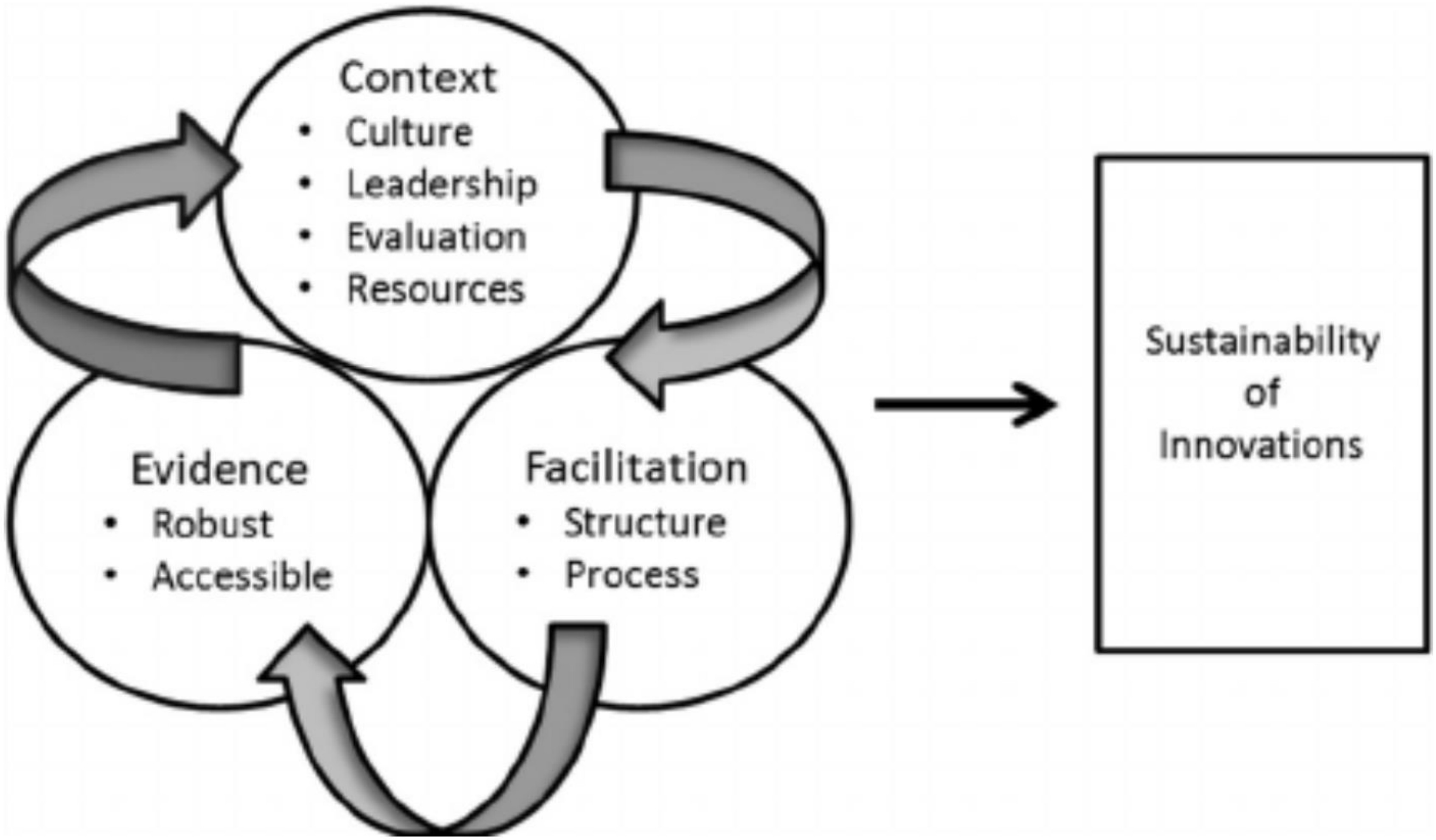


**Figure 2**

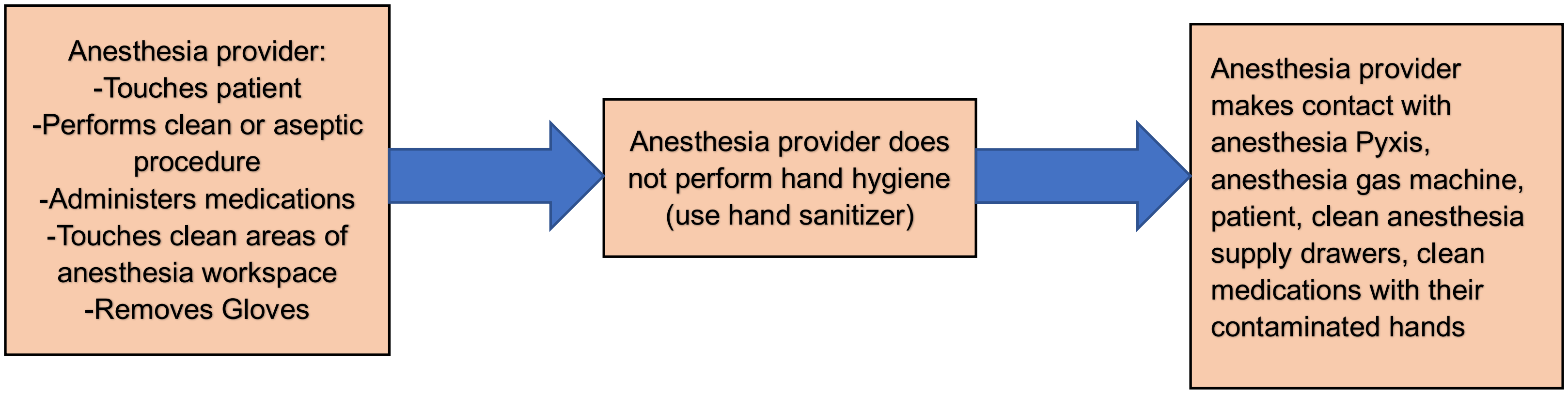
*Promoting Action on Research Implementation in Health Services (PARIHS) Framework*




*Note.* Image referenced from https://www.researchgate.net/figure/258101355_fig1_Figure-1-Conceptual-%E2%80%8Cframework-for-START-project-Adapted-from-the-PARIHS-framework-28

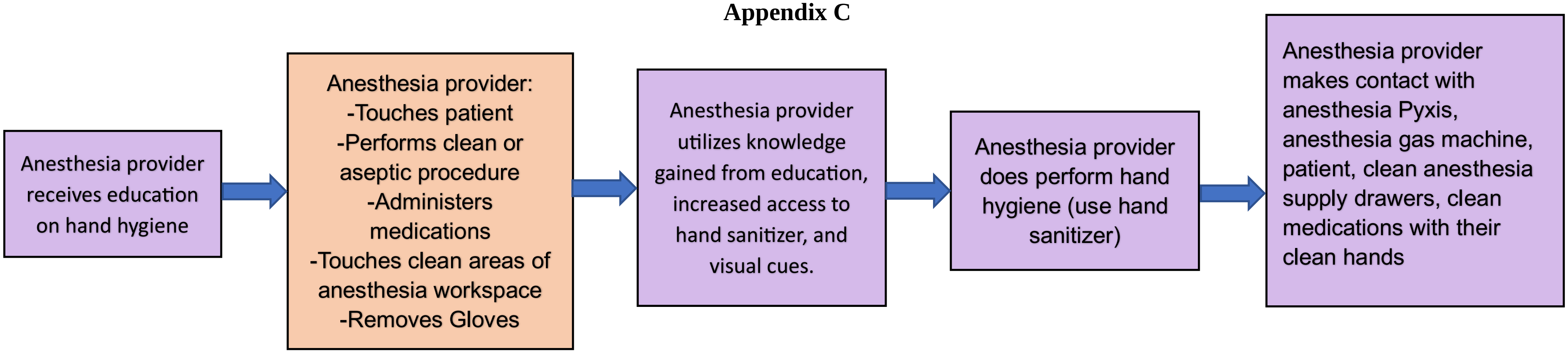
**Figure 3**

*Current and Desired Process Map*




*Note*. Orange: Current Process Steps

**Appendix C**




*Note*. Purple: New, Desired Process Step

## Appendix A

Measures

*Decreasing Anesthesia Workspace Contamination by Increasing Hand Hygiene Compliance*
*Page 1*

# Daily Implementation Report

Record ID ______________________

Does OR 20 have: 2 full bottles of hand sanitizer (1 on anesthesia Pyxis and 1 on anesthesia breathing machine), educational sheet on anesthesia Pyxis, 2 visual reminders to hand sanitize in anesthesia workspace?

○ Yes ○ No

Does OR 21 have: 2 full bottles of hand sanitizer (1 on anesthesia Pyxis and 1 on anesthesia breathing machine), educational sheet on anesthesia Pyxis, 2 visual reminders to hand sanitize in anesthesia workspace?

○ Yes ○ No

Does OR 22 have: 2 full bottles of hand sanitizer (1 on anesthesia Pyxis and 1 on anesthesia breathing machine), educational sheet on anesthesia Pyxis, 2 visual reminders to hand sanitize in anesthesia workspace?

○ Yes ○ No

Does OR 23 have: 2 full bottles of hand sanitizer (1 on anesthesia Pyxis and 1 on anesthesia breathing machine), educational sheet on anesthesia Pyxis, 2 visual reminders to hand sanitize in anesthesia workspace?

○ Yes ○ No

Does OR 24 have: 2 full bottles of hand sanitizer (1 on anesthesia Pyxis and 1 on anesthesia breathing machine), educational sheet on anesthesia Pyxis, 2 visual reminders to hand sanitize in anesthesia workspace?

○ Yes ○ No

Does OR 25 have: 2 full bottles of hand sanitizer (1 on anesthesia Pyxis and 1 on anesthesia breathing machine), educational sheet on anesthesia Pyxis, 2 visual reminders to hand sanitize in anesthesia workspace?

○ Yes ○ No

03/12/2023 12:24pm projectredcap.org REDCap

03/11/2023 2:12pm projectredcap.org REDCap

*Decreasing Anesthesia Workspace Contamination by Increasing Hand Hygiene Compliance*
*Page 2*

# Hand Hygiene Compliance Survey

Did you use hand sanitizer before and after touching the patient?

○ Yes ○ No

Did you use hand sanitizer before and after administering a medication?

○ Yes ○ No

Did you use hand sanitizer before donning gloves and after removing gloves?

○ Yes ○ No

Did you use hand sanitizer before and after clean/aseptic procedures (IV placement, invasive line placement)?

○ Yes ○ No

Did you use hand sanitizer before touching clean areas of the anesthesia workspace (supply drawers, clean medications on the anesthesia Pyxis)?

○ Yes ○ No

Did the education, increased access to hand sanitizer, and visual reminders increase your use of hand sanitizer while administering anesthesia?

○ Yes ○ No

## Appendix B

Site Ethics Procedures and Requirements

1. Student ensures the site has a current site student affiliate agreement. If not, student works with site representative to obtain one
2. Student schedules meeting with Clinical Site Representative, DNP Faculty Advisor, and Unit Leader (if applicable), to plan the project
3. Student submits DNP Project Approval Form
4. Clinical Site Representative documents project approval
5. Administrator/Sponsor documents project approval
6. Student submits site Institutional Review Board (IRB) application for Non-Human Subjects Research (NHSR) determination
7. Student submits documentation of NHSR determination to site person of contact
8. Student submits to School of Nursing IRB (if applicable)
9. Student submits School of Nursing IRB documentation to site person of contact (if applicable)
10. DNP Capstone Project may begin at site

- Site Approval Departments:
  - Nursing and Patient Care Services Research Council
  - Site Institutional Review Board
- Individuals involved in the approval process:
  - Linda Goetz (Site Sponsor): lgoetz@umm.edu
  - Estefania Sanchez (CSR): esanchez@som.umaryland.edu
  - Georgia Spence (site Project Specialist): Georgia.spence@umm.edu
- Dates: TBD

**Appendix C**

Continuous Weekly Survey Compliance Data