

Marian University  
Leighton School of Nursing

Doctor of Nursing Practice  
Final Project Report for Students Graduating in May 2021

Assessing Anesthesia Provider Recognition and Compliance of the World Health Organization

Five Moments of Hand Hygiene in the Operating Room.

Joseph McSherry

Marian University

Leighton School of Nursing

### **Table of Contents**

ABSTRACT .....	3
INTRODUCTION .....	5
Background .....	5
Problem Statement .....	8
Organizational “Gap” Analysis of Project Site .....	8
LITERATURE REVIEW .....	8
THEORETICAL MODEL .....	12
GOALS/OBJECTIVES/EXPECTED OUTCOMES .....	13
PROJECT DESIGN .....	14
Project Site and Population .....	14
Measurement Instrument(s) .....	14
Data Collection Procedure .....	15
Ethical Considerations/Protection of Human Subjects .....	16
DATA ANALYSIS AND RESULTS .....	16
CONCLUSION .....	19
REFERENCES .....	20
APPENDICES	
Appendix A .....	25

Appendix B .....	26
Appendix C .....	27
Appendix D .....	30
SIGNATURE PAGE .....	31

## ABSTRACT

**BACKGROUND AND LITERATURE REVIEW:** Hand hygiene (HH) is the number one way to reduce healthcare associated infections (HAI). These infections account for increased morbidity and mortality and are linked with poor HH among anesthesia personnel. Anesthesia provider HH compliance is low, and with solid HH guidelines available, increasing their compliance is paramount in reducing HAIs.

**PURPOSE:** This study aims to assess anesthesia provider HH recognition and compliance among student registered nurse anesthetists (SRNA) at Marian University and certified registered nurse anesthetists (CRNA) at a large urban academic hospital in St. Louis, Missouri.

**METHODS:** A one-time eleven question survey will be administered online through Qualtrics assessing knowledge and compliance of the WHO five moments of HH in the operating room (OR). The survey is based on a validated survey instrument and consists of five questions regarding moments to perform HH and six questions regarding demographics.

**IMPLEMENTATION PLAN/PROCEDURE:** Over four weeks, the survey will be administered to 170 anesthesia providers to include 101 CRNAs, 68 SRNAs, and 1 MDA. Qualtrics will be utilized to deliver the survey link to respondent emails and collect responses electronically. This project is supported by Marian University, Leighton School of Nursing, Department of Nurse anesthesia faculty.

**IMPLICATIONS/CONCLUSIONS:** Increasing HH among anesthesia providers will reduce HAIs and increase patient outcomes. Multimodal strategies work best, including increased access to HH products and those that include an education element. Long term success of these interventions is related to sustainment efforts of the institution and will likely decrease over time

without them. Understanding current HH recognition and compliance is the first step to increasing HH performance rates and is the focus of this study.

**KEYWORDS:** anesthesia, hand hygiene, compliance, barriers, guidelines, operating room

Assessing Anesthesia Provider Recognition and Compliance of the World Health Organization  
Five Moments of Hand Hygiene in the Operating Room.

## INTRODUCTION

This project is submitted to the faculty of Marian University Leighton School of Nursing as partial fulfillment of degree requirements for the Doctor of Nursing Practice, Nurse anesthesia track. The Centers for Disease Control (CDC) (2016) estimates nearly 1.7 million healthcare associated infections (HAI) each year resulting in approximately 99,000 deaths (Centers for Disease Control, 2016). The effectiveness of HH in the prevention of HAIs is well established (Centers for Disease Control [CDC], 2002; Stewardson & Pittet, 2018; World Health Organization [WHO], 2009). Yet, there is evidence supporting low HH compliance rates by anesthesia providers in the operative setting (Biddle & Shah, 2012; Megeus, Nilsson, Karlsson, Eriksson, & Andersson, 2015) increasing infection risks for patients (Loftus et al., 2011; Stewardson & Pittet, 2018). Improved compliance with established HH guidelines by anesthesia providers has potential to reduce HAIs (WHO, 2009) contributing to medical cost savings and improved patient outcomes (Office of Disease Prevention and Health Promotion [ODPHP], 2020). This project aims to assess anesthesia provider HH recognition and compliance of the WHO five moments of HH in the OR among SRNAs at Marian University and CRNAs at a large, urban, academic hospital in St. Louis, Missouri.

## BACKGROUND

HAIs, or nosocomial infections, are infections that patients acquire while receiving medical and surgical services in hospitals and other health care facilities (Patient Care Link [PCL], 2020). According to the Office of Disease Prevention and Health Promotion (2020), one

out of every twenty-five patients will experience a HAI. These infections detrimentally impact patient safety, prolong hospital stays, increase readmission rates, creates additional institutional and patient financial burdens while potentially limiting reimbursement (Hong et al., 2015; WHO, 2009).

The WHO (2009) considers failure to perform HH as the leading cause of HAIs, thus increased performance of HH is a leading measure to reduce HAIs (Stewardson & Pittet, 2018). Hands play a major role in health care associated pathogen transmission, as they come into direct contact with these organisms, and transmit them (WHO, 2009). As such, a major strategy to reduce the prevalence of HAIs is increased HH performance (CDC, 2002; WHO, 2009). The World Health Organization (2009) put forth evidenced based HH guidelines with recommended HH techniques along with five moments to perform hand hygiene (see Appendix A). These include before touching a patient, before clean/aseptic technique, after body fluid exposure, after touching a patient, and after touching patient surroundings (WHO, 2009).

Anesthesia providers frequently encounter the WHO's (2009) five opportune moments for HH while in the performance of routine anesthesia care making them pivotal in the reduction of HAIs (Loftus et al., 2008; Loftus et al., 2011). Anesthesia providers are frequently touching the patient and the patient environment providing multiple opportunities to perform HH. Of particular concern in the environment was the finding of multi-drug resistant bacteria on the adjustable pressure limiting (APL) valve and the agent dial on the anesthesia machine, which are used numerous times while providing anesthesia (Loftus et al., 2008). Thus, the need to maintain established HH practices for anesthesia providers is paramount.

Nevertheless, with a myriad of evidence demonstrating the effectiveness of HH in reducing HAIs, anesthesia provider HH compliance remains low (Biddle & Shah, 2012; Megeus et al., 2015). Megeus et al. (2015) observed HH compliance of anesthesia providers in 94 surgeries utilizing the WHO (2009) guidelines, noting 2,393 opportunities. Results indicated an overall compliance rate of 8.1% with a low of 2.2% during induction of anesthesia and a high of 15.9% after body fluid exposure. Similar results were found by Biddle & Shah (2012), who observed over 8,000 HH opportunities with an aggregate failure rate of 82%. Regardless of the type of observational study, results consistently indicated that anesthesia providers have an exceptionally low HH compliance rate. Rowlands et al. (2014), for example, used video observation to monitor the WHO (2009) five moments. Again, this study found low anesthesia HH compliance to be 2.9%. In another study using covert direct observations in 28 surgeries over 60 hours, HH compliance was found to be 2% to 8% with anesthesia personnel (Krediet, Kalkman, Bonten, Gigengack, & Barach, 2011).

To account for these low compliance rates, studies have examined barriers to the five moments of HH. Inconvenience to anesthesia workflow and forgetfulness (Pederson et al., 2017), lack of easy access to HH dispensers (Munoz-Price, Patel, Banks, & Arheart, 2014), knowledge deficits regarding the five moments as they relate to anesthesia HH (Fernandez et al., 2015), and irritant contact dermatitis related to frequent HH with alcohol agents, have been documented as associated barriers effecting compliance rates.

The evidence is clear, HH compliance is low among anesthesia providers placing patients at risk for infection and poor outcomes related to pathogen transmission via contaminated hands. This study serves as a first step to recognize HH knowledge deficits and barriers related to the

WHO's (2009) five moments of HH guidelines to improve quality of care among future and current CRNAs.

## PROBLEM STATEMENT

Among anesthesia providers, those that know the WHO's five moments of HH compared with those that do not, will have higher HH compliance rates. Lack of recognition by anesthesia providers of the five WHO's (2009) HH moments coupled with limited access to HH products accounts for two main reasons for decreased compliance among this population (Bellaard-Smith & Gillespie, 2012; Munoz-Price, Patel, Banks, & Arheart, 2014). Focusing interventions on these two barriers, should increase compliance. However, understanding the current state of HH recognition and compliance is the first step and is the focus of this study.

## ORGINATION "GAP" ANALYSIS

Direct observation and partnering with multiple anesthesia providers revealed that many HH opportunities are missed by anesthesia providers to include certified registered nurse anesthetists (CRNA) and anesthesiologists (MDA). HH compliance is well established and is a focus for these providers in many clinical settings. With low compliance rates from anesthesia staff, an obvious best practice gap exists. With a culture that supports evidenced based practice and infection control, the decision was made to assess and increase HH compliance with this project. CRNA use is increasing in Indiana, and with the pivotal nature anesthesia has on affecting HAIs, the relevancy of this project is clear.

## LITERATURE REVIEW

Literature supporting this study was gathered using the Pubmed database. The following search terms (anesthesia hand hygiene, compliance, barriers, guidelines, operating room) yielded 157 results. As the topic of anesthesia provider HH has not been routinely studied, literature falling outside of the five-year cut off mark were included if they involved HH, barriers to HH, anesthesia, guidelines to HH, and interventions to increase HH with anesthesia.

## GUIDELINES

While not specific to anesthesia providers, there is an abundance of literature regarding HH and guidelines by which it should be performed. Most, if not all, of these guidelines rely on the WHO's (2009) five moments of HH recommendations as a foundation such as those found by the CDC, American Association of Nurse Anesthetists (AANA), and the International Society for Infectious Diseases. These include performing correct HH 1) before patient contact 2) before aseptic tasks 3) after body fluid exposure 4) after patient contact and 5) after contact with patient environment (WHO, 2009). The CDC (2002) guidelines expanded on previous versions of the WHO's five moments to perform HH after removing gloves, before moving to a clean body site after touching a dirty site, before eating, and after restroom use. As the nature of HH guidance is inclusive of all environments, Munoz-Price et al. (2013) posited that there were no established guidelines for anesthesia providers. This notion seemed warranted after review of the literature as many studies applied the WHO's (2009) five moments without giving explanation to how these moments are experienced from the anesthesia perspective. For example, contact with body fluids must be considered while in the performance of intubation (Munoz-Price et al., 2019). Ambiguity when clinically applying and lack of detailed explanation related to anesthesia may be associated with knowledge deficits as a barrier to decreased HH compliance. As a leading

body in anesthesia, the (AANA) published HH guidelines to reduce infections related to the practice of anesthesia. However, these guidelines echo previous notions by Munoz-Price et al. (2013), as they mirror the WHO's (2009) HH five moments. The AANA guidelines include the performance of HH before “patient contact, donning protective equipment, and performing invasive procedures (e.g., catheter insertion, epidurals, surgery)” and after “contact with patient’s skin and immediate surroundings (e.g., bedside area), contamination, contact with body fluids and wounds, removing protective equipment, and using the restroom” (American Association of Nurse Anesthetists [AANA], 2015, p. 3). While not explicitly defined for anesthesia, performing HH during the WHO's five moments is a common denominator among all HH guidelines and recommendations. As such, these five moments will be the basis for this study.

## INTERVENTIONS

With established evidence linking poor hand hygiene with HAIs, quality improvement initiatives have evaluated interventions to increase compliance institution wide including with anesthesia. Interventions shown to increase HH compliance include reminders, performance feedback, managerial support (WHO, 2009). Other interventions, such as education and increased access to HH products, have proven more effective. Out of seven studies supporting this project that evaluated hand hygiene compliance interventions, three studies found that increased access to products increased compliance (Koff et al., 2016; Munoz-Price et al., 2014; Parks, Schoeder, & Galgon, 2015), one study found that education promoted increased hand hygiene compliance (Plemmons, Marcenaro, Oermann, Thompson, & Vacchiano, 2019), and three found both interventions to be effective (Bellaard-Smith & Gillespie, 2012; Paul, Kuszajewski, Davenport, Thompson, & Morgan, 2019; Scheithauer et al., 2013). Munoz-Price et

al. (2014) randomized crossover study included forty anesthesia providers with observations of 80 procedures for 157 hours and noted 122 HH events. In this study, placing an alcohol hand dispenser on the anesthesia machine increased compliance from .5 to .8 events per hour which was statistically significant. While this study demonstrated the effectiveness of increasing HH products, others have shown the efficacy of increased education or both regarding HH. A study by Scheithauer et al. (2013) found an increase in compliance by placing HH dispensers on or near anesthesia workstations. Within this study, there were over 12,143 total opportunities for HH observed. Baseline observation compliance was 10% and post intervention compliance was raised to 29%. This study also implemented teaching on hand hygiene moments contributing to increased compliance. Using a convenience sample of CRNAs, Plemmons et al. (2019) compared a preintervention self-survey assessment of HH practices against direct observations of infection control practices related HH with CRNAs. The intervention consisted of a 30-minute education session presented monthly anesthesia staff meetings presenting and discussing current evidence-based guidelines related to HH. Flyers mirroring the education were strategically placed as well. Baseline compliance was 8.6% increasing to 34.5% post intervention. Interestingly, a three month follow up observation noted the compliance rate decreased to 23.3%, which suggested that implemented interventions need sustainment measures to ensure their long-term effects.

As evidenced herein, several interventions have proven effective at increasing HH compliance with anesthesia providers. However, a common theme of failed HH compliance interventions is the lack of accompanying education, (Bolon, 2016). Paul et al. (2019) demonstrated the effectiveness of a multimodal approach within their study. Recognizing that

hand hygiene compliance was low in their institution, they performed a pre and post intervention observation model to assess the effectiveness of increased HH products coupled with education reinforcing the proper moments to perform HH. They observed a total of 1,301 HH opportunities, 436 pre intervention and 432, post intervention, and another 433 sixty days after post implementation. HH compliance was 1.4% preintervention, 43.1% post intervention and 37.9% sixty days post implementation. These results demonstrate the effectiveness of a multimodal approach that includes an education element. They also support other findings, such as that from (Plemmons et al., 2019), that effectiveness of an implemented intervention will decrease with time without supportive maintenance efforts.

The WHO has established HH guidelines that are translatable to the anesthesia provider. With low HH compliance rates and links to HAIs, it is imperative to increase anesthesia provider hand hygiene compliance. As supported by the evidence, the best interventions follow a multimodal approach to include increased access to HH products and increased education regarding HH moments while in the performance of anesthesia. The current study will assess these two notions as the first step toward increasing HH compliance rates among future and current anesthesia providers.

#### EVIDENCE BASED PRACTICE: VERIFICATION OF CHOSEN OPTION

Every HH guideline from the CDCs to the AANAs is based on the WHO (2009) five moments of HH. This evidence based clinical practice guideline (CPG) is the basis of nearly every HH policy in the United States, and many more around the world (WHO, 2009).

Additionally, every observational HH study has utilized this model to guide their assessments and interventions, making it an ideal fit for this project.

## THEORETICAL MODEL

The Iowa model of evidenced based practice will serve as the theoretical framework for this project (see Appendix B). This model focuses on the translation of best evidence into clinical practice. This model was originally developed at the University of Iowa Hospitals and Clinics and guides healthcare professionals with the implementation of research findings into practice (Titler et al., 2001). This model allows for the identification of a clinical problem, such as decreased HH compliance by anesthesia providers, and then focusses on a literature review. The model suggests that if there is sufficient research evidence to guide practice, then initiation of quality improvement may ensue. As in this study, there was sufficient evidence to suggest that anesthesia providers do have low compliance with HH and that SRNAs and CRNAs were not outliers to this variable. Further, there is abundant research demonstrating the effectiveness of HH in reducing HAIs. The model allows for the formation of a team to guide the interventions and assessments and allows for numerous stopping points such as asking if this topic was a priority for the institution (Titler et al., 2001). Following the IOWA model, this project has formed a team to address the gap in practice to include this researcher and Marian University faculty. Additionally, many stopping or redirecting points in the model have been passed including answering yes to whether the topic is a priority. In addition to using the IOWA model for a theoretical framework, the WHO (2009) clinical practice guidelines regarding HH will be the standard upon which this study is based.

## GOALS, OBJECTIVES, EXPECTED OUTCOMES

The goal of this project is to add to the sustainment of best HH practices in the perioperative area among current and future anesthesia providers. This project serves as the first

step in reducing missed opportunities of HH. The main objectives are to assess CRNA and SRNA basic knowledge of the WHO's (2009) five moments of hand hygiene as well as compliance with those five moments. As lack of knowledge of these five moments contributes to low HH compliance rates, it is expected that providers that can name these five moments should be able to correctly identify them in a clinical scenario and perform hand hygiene accordingly. Additionally, participants were given an opportunity to express any barriers preventing successful HH in the perioperative area. It is expected that lack of access to HH products will be noted by the participants as this aligns with literature previously discussed.

### PROJECT DESIGN

This study is utilizing an educational/practice intervention quality improvement design structured to obtain qualitative/quantitative data related to HH compliance.

### PROJECT SITE AND POPULATION

This study will take place online via a survey supported by the Qualtrics platform. The population under study are CRNAs and SRNAs practicing in inpatient and outpatient settings in Indiana, Tennessee, Ohio, and Missouri. SRNAs from Marian practice as students under CRNA or MDA supervision and are routinely left alone during a case providing many HH opportunities while administering anesthesia. The CRNAs included in this study practice independently in St. Louis, MO running their own cases in the OR also having ample HH opportunities while in the performance anesthetic delivery. Context is important as the experience of delivering anesthesia in the OR is routine for these providers as are the opportunities to recognize and perform HH. Additionally, both groups are registered nurses (RN) with multiple years of nursing school and

registered nurse clinical experience in the intensive care unit (ICU), where training on HH occurs regularly and is based on the WHO's (2009) five moments of HH. Therefore, it is expected that both groups should be able to recognize the WHO's (2009) five moments of HH when confronted clinically with an example.

The project needs minimal resources to complete including student access to Qualtrics and functioning current email address of participants. Further resources are not warranted at this time.

## MEASUREMENT INSTRUMENT

To measure the outcomes of this DNP Project the following instrument will be used: WHO's (2019) five moments of HH incorporated into the current survey (see Appendix C). This survey is based on a similar survey put forth by Fernandez et. Al. (2015) which measures recognition of the WHO's (2009) five moments of HH and performance of HH after recognition of those moments. The WHO (2009) five moments of HH include 1) before patient contact 2) before aseptic tasks 3) after body fluid exposure 4) after patient contact and 5) after contact with patient environment. Similar observation tools and surveys have been slightly modified such as that found in a study by Paul, Kuszajewski, Davenport, Thompson, & Morgan (2019), but all include the same five elements put forth by the WHO (2009).

## DATA COLLECTION AND PROCEDURE

Data was collected utilizing a survey created in Qualtrics (see Appendix C). Participant emails were gathered with permission and were added to the Qualtrics email list set forth for this study. A Qualtrics email link was emailed to the participants which would link them directly to the online survey in the Qualtrics system. Participants had a four-week period to complete the

survey. After the first two weeks, an email reminder was sent out to those that had not previously completed the survey. Survey question one asked whether the participant could name the WHO five moments of HH and was answered with a yes or no. The next five questions explored whether the participants could recognize one of the five moments of HH in an anesthesia clinical setting and perform HH in that circumstance. The WHO's five moments of HH guidelines include (1) before touching a patient (2) before clean/aseptic procedure (3) after body fluid exposure (4) after touching a patient (5) after touching patient surroundings. Survey questions two through six corresponded to the WHO moments with question number two corresponding to moment (1), question number three corresponding to moment (2), question number four corresponding to moment (4), question number five corresponding to moment (3), question number six corresponding to moment (5) (see Appendix C). Answers to these questions ranged from never, rarely, sometimes, often, always. The remaining questions sought demographical information. One last open-ended question was left for participants to list any barriers to performing HH in the OR. Answers were recorded in Qualtrics for further review and analysis.

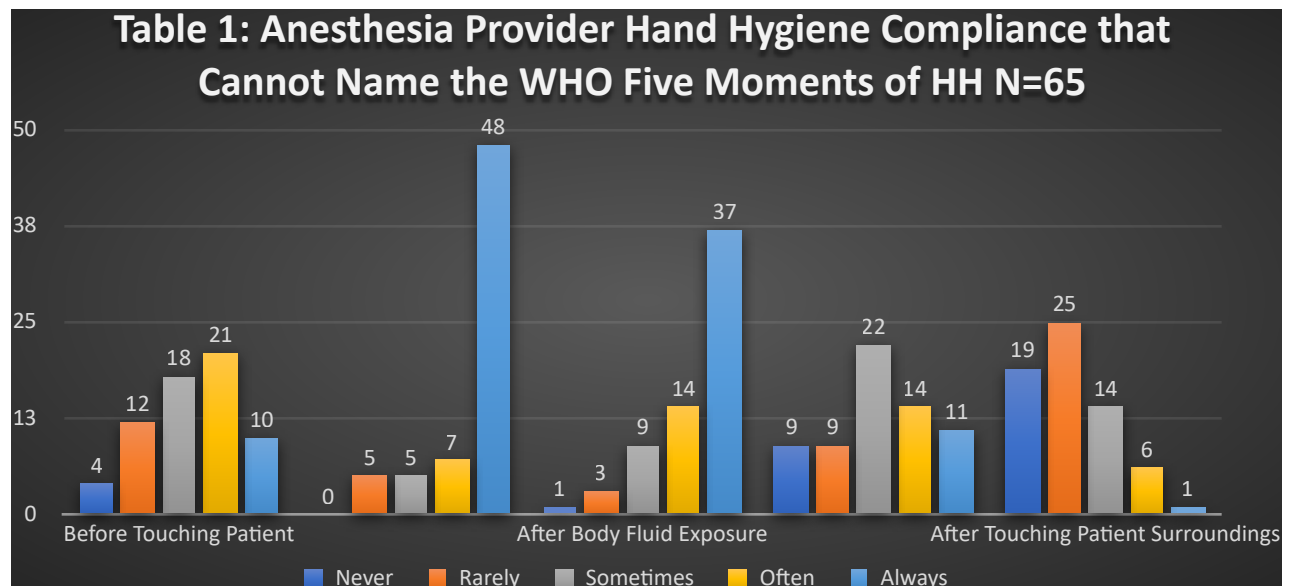
#### ETHICAL CONSIDERATION/PROTECTION OF HUMAN SUBJECTS

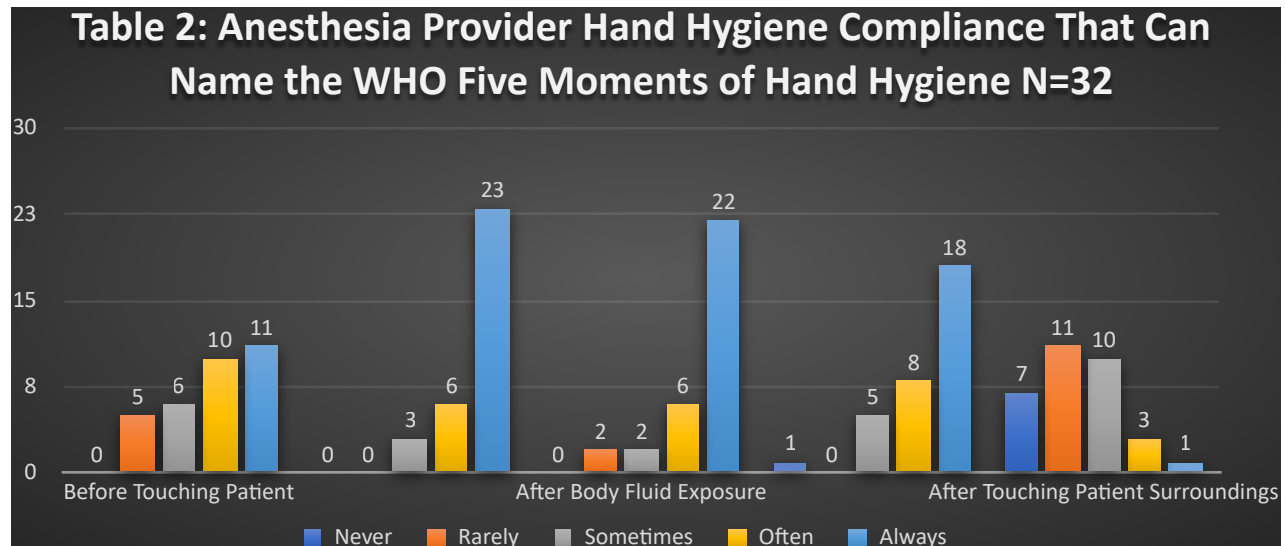
Marian University Institutional Review Board (IRB) approval has been obtained see Appendix D. No patients participated in this study thus eliminating any possible patient harm. Additionally, no personal identifiers of staff or patients were obtained or recorded at any time. Participants received an email link to participate in the survey. Prior to following the link, information was given describing the study and requested participation therein. By following the link, participants were knowingly giving informed consent, as outlined in the email, to

participate in the study with no obligation and the right to cease activity at any time with no penalty. All researchers involved in this project are CITI trained.

### DATA ANALYSIS AND RESULTS

Data was gathered from the survey instrument to include both quantitative and qualitative data. Surveys were sent to 170 anesthesia providers (101 CRNA, 68 SRNA, 1 MDA) with 97 responses for a 57.1% completion rate. The sample size of 97 consisted of 41 SRNAs, 55 CRNAs, 1 MDA. With regards to survey question number one, *I can name the World Health Organization (WHO) five moments of hand hygiene*, only 33%, or 32 respondents, reported that they knew the WHO five moments of HH. Out of that 32, only 1 reported always performing HH at all five moments. Other findings suggested that those that reported knowing the five moments were slightly more compliant than those who did not, but otherwise demonstrated similar reporting patterns in all categories.





WHO guideline standards of HH, which are followed by the CDC and nearly all subsequent HH guideline institutional policies, instruct that HH should be performed in all five areas all the time. As table one and two demonstrate, there is a clear lack of HH recognition and compliance. It was expected that those that could name the five moments would be able to recognize them in a clinical scenario. This was not the case as evidenced by the results. For participants that responded that they knew the five moments, they overestimated their ability to name the five moments, failed to recognize the moments, or failed to perform HH related to barriers or lack of compliance. Reporting that one knows the five moments had no effect on whether those five moments could be recognized and HH performed. The categories “Before clean/aseptic technique” and “after body fluid exposure” showed the highest reports of compliance in both groups followed by “after touching a patient” and “before touching a patient”, which were all slightly higher in the “Can name the WHO moments” group.

Both groups reported lower compliance with “after touching patient surroundings” with only 11 of 97 providers reporting that they “Always” or “Often” perform hand hygiene after this moment. Lack of understanding and definition of what constitutes patient surroundings is one potential variable to explain why this category remained low. However, this again suggests that more education is required to increase HH knowledge deficits.

With regards to barriers to performing HH, respondents noted the lack of access to HH products (42.3%), lack of time between tasks (66%), and the use of irritating agents (14.4%) as potential barriers. These findings align with other studies and reflect the need to increase HH knowledge and reduce barriers that prevent anesthesia providers from the performance of HH in the OR.

Survey results indicated that both knowledge of the WHO five moments of HH and compliance remains low among anesthesia providers which aligns with other similar studies. A clear link between HH performance and infection rates exists, and this study adds to the evidence that increased anesthesia provider knowledge and recognition of the WHO 5 moments of HH is warranted to help reduce HAIs.

This data can guide Marian University and the St. Louis, MO hospital in the implementation of interventions focusing on HH education for current and future anesthesia providers. These results will be disseminated in the form of a poster presentation at Marian University and will be distributed via email to relevant personnel.

## CONCLUSION

With HH efficacy well established in reducing infections (World Health Organization [WHO], 2009), increasing compliance in this area has potential to increase positive outcomes for

surgical patients by reducing their risk of infection exposure. HH compliance in the perioperative area involving anesthesia providers is low (Megeus, Nilsson, Karlsson, Eriksson, & Andersson, 2015). Considering their link from pathogen to patient, increasing hand hygiene compliance among this population is paramount in reducing costly HAIs. Multimodal approaches work best at improving HH, but as evidence suggests, long term effects may dwindle without stakeholder buy in. The current study benefits greatly by having willing and committed stakeholders within the CRNA population and nurse anesthesia training institutions. Considering the importance of this topic, other studies should continue to investigate HH compliance among anesthesia providers. Efforts should focus on best ways to monitor compliance, best interventions, and barriers that currently prevent higher compliance rates. Particularly, efforts of improvement should focus on understanding what constitutes the patient's surroundings, as performing HH after touching this area remained low for the entire sample. Future efforts should focus on understanding potential barriers to HH beyond a lack of understanding of opportune moments, such as providing more access to HH products and understanding how the lack of time to perform HH between tasks can be improved.

## References

- American Association of Nurse Anesthetists. (2015). Infection prevention and control guidelines for anesthesia care. Retrieved November 11, 2019, from [https://www.aana.com/docs/default-source/practice-aana-com-web-documents-\(all\)/infection-prevention-and-control-guidelines-for-anesthesia-care.pdf?sfvrsn=850049b1\\_4](https://www.aana.com/docs/default-source/practice-aana-com-web-documents-(all)/infection-prevention-and-control-guidelines-for-anesthesia-care.pdf?sfvrsn=850049b1_4)
- Bellaard-Smith, E. R., & Gillespie, E. E. (2012, March). Implementing hand hygiene strategies in the operating suite. *Healthcare Infection*, 17(1), 33-37. <https://doi.org/10.1071/HI12002>
- Biddle, C., & Shah, J. (2012, October). Quantification of anesthesia providers' hand hygiene in a busy metropolitan operating room: what would Semmelweis think. *American Journal of Infection Control*, 40(8), 756-759. <https://doi.org/10.1016/j.ajic.2011.10.008>
- Bolon, M. K. (2016, September 1). Hand hygiene: An update. *Infectious Disease Clinics of North America*, 30(3), 591-607. <https://doi.org/10.1016/j.idc.2016.04.007>
- Centers for Disease Control. (2002). Guideline for hand hygiene in health care settings: Recommendations of the healthcare infection control practices advisory committee and the HICPAC/SHEA/APIC/IDSA hand hygiene task force. Retrieved from <https://www.cdc.gov/mmwr/PDF/rr/rr5116.pdf>
- Centers for Disease Control. (2016). <https://www.cdc.gov/hai/index.html>
- Fernandez, P. G., Loftus, R. W., Dodds, T. M., Koff, M. D., Reddy, S., Heard, S. O., ... Brown, J. R. (2015, April). Hand hygiene knowledge and perceptions among anesthesia providers. *Anesthesia and Analgesia*, 120(4), 837-843. <https://doi.org/10.1213/ANE.0000000000000408>

- Hong, T. S., Bush, E. C., Hauenstein, M. F., Lafontant, A., Li, C., Wanderer, J. P., & Ehrenfeld, J. M. (2015, June). A hand hygiene compliance check system: brief communication on a system to improve hand hygiene compliance in hospitals and reduce infection. *Journal of Medical Systems*, 39(6), 1-4. <https://doi.org/10.1007/s10916-015-0253-z>
- Koff, M. D., Brown, J. R., Marshall, E. J., O'Malley, J., Jensen, J. T., Heard, S. O., ... Loftus, R. W. (2016, August). 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.
- Krediet, A. C., Kalkman, C. J., Bonten, M. J., Gigengack, M., & Barach, P. (2011, October). Hand-hygiene practices in the operating theatre: an observational study. *British Journal of Anaesthesia*, 107(4), 553-558. <https://doi.org/10.1093/bja/aer162>
- Loftus, R. W., Koff, M. D., Burchman, C. C., Schwartzman, J. D., Thorum, V., Read, M. E., ... Beach, M. L. (2008, September). Transmission of pathogenic bacterial organisms in the anesthesia work area. *Anesthesiology*, 109(3), 399-407. <https://doi.org/10.1097/ALN.0b013e318182c855>
- Loftus, R. W., Muffly, M. K., Brown, J. R., Beach, M. L., Koff, M. D., Corwin, H. L., ... Yeager, M. P. (2011). Hand contamination of anesthesia providers is an important risk factor for intraoperative bacterial transmission. *Anesthesia and Analgesia*, 112(1), 97-105. <https://doi.org/10.1213/ANE.0b013e3181e7ce18>
- Megeus, V., Nilsson, K., Karlsson, J., Eriksson, B. I., & Andersson, A. E. (2015). Hand hygiene and aseptic techniques during routine anesthetic care: Observations in the operating

- room. *Antimicrobial Resistance and Infection Control*, 4(1), 1-8. <https://doi.org/10.1186/s13756-015-0042-y>
- Munoz-Price, S., Bowdle, A., Johnston, B. L., Bearman, G., Camins, B. C., Dellinger, E. P., ... Birnback, D. J. (2019). Infection prevention in the operating room anesthesia work area. *Infection Control & Hospital Epidemiology*, 40, 1-17. <https://doi.org/10.1017/ice.2018.303>
- Munoz-Price, S., Lubarsky, D. A., Arhear, K. L., Prado, G., Cleary, T., Fajardo-Aquino, Y., ... Birnback, D. J. (2013, October). Interactions between anesthesiologists and the environment while providing anesthesia care in the operating room. *American Journal of Infection Control*, 41(10), 922-924. <https://doi.org/10.1016/j.ajic.2013.03.306>
- Munoz-Price, S., Patel, Z., Banks, S., & Arheart, K. (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>
- Office of Disease Prevention and Health Promotion. (2020). Healthcare associated infections. Retrieved April 21, 2020, from <https://www.healthypeople.gov/2020/topics-objectives/topic/healthcare-associated-infections>
- Parks, C. L., Schoeder, K. M., & Galgon, R. E. (2015). Personal hand gel for improved hand hygiene compliance on the regional anesthesia team. *Journal of Anesthesia*, 29(6), 899-903. <https://doi.org/10.1007/s00540-015-2058-0>
- Patient Care Link. (2020). Healthcare acquired infections. Retrieved from <https://patientcarelink.org/improving-patient-care/healthcare-acquired-infections-hais/>

- Paul, E. T., Kuszajewski, M., Davenport, A., Thompson, J. A., & Morgan, B. (2019, May). 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/10.1016/j.ajic.2018.10.021>
- Pederson, L., Elgin, K., Peace, B., Masroor, N., Doll, M., Sanogo, K., ... Bearman, G. (2017). Barriers, perceptions, and adherence: Hand hygiene in the operating room and endoscopy suit. *American Journal of Infection Control*, 45(6), 695-697. <https://doi.org/10.1016/j.ajic.2017.01.003>
- 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/10.1016/j.ajic.2018.12.009>
- Rowlands, J., Yeager, M. P., Beach, M., Patel, H. M., Huysman, B. C., & Loftus, R. W. (2014, July). Video observation to map hand contact and bacterial transmission in operating rooms. *American Journal of Infection Control*, 42(7), 698-701. <https://doi.org/10.1016/j.ajic.2014.02.021>
- Scheithauer, S., Rosarius, A., Rex, S., Post, P., Heisel, H., Krizanovic, V., ... Lemmen, S. W. (2013, November). 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.2013.02.004>

Stewardson, A. J., & Pittet, D. (2018). Guide to infection control in the hospital. Retrieved September 4, 2019, from [https://www.isid.org/wp-content/uploads/2018/07/ISID\\_InfectionGuide\\_Chapter6.pdf](https://www.isid.org/wp-content/uploads/2018/07/ISID_InfectionGuide_Chapter6.pdf)

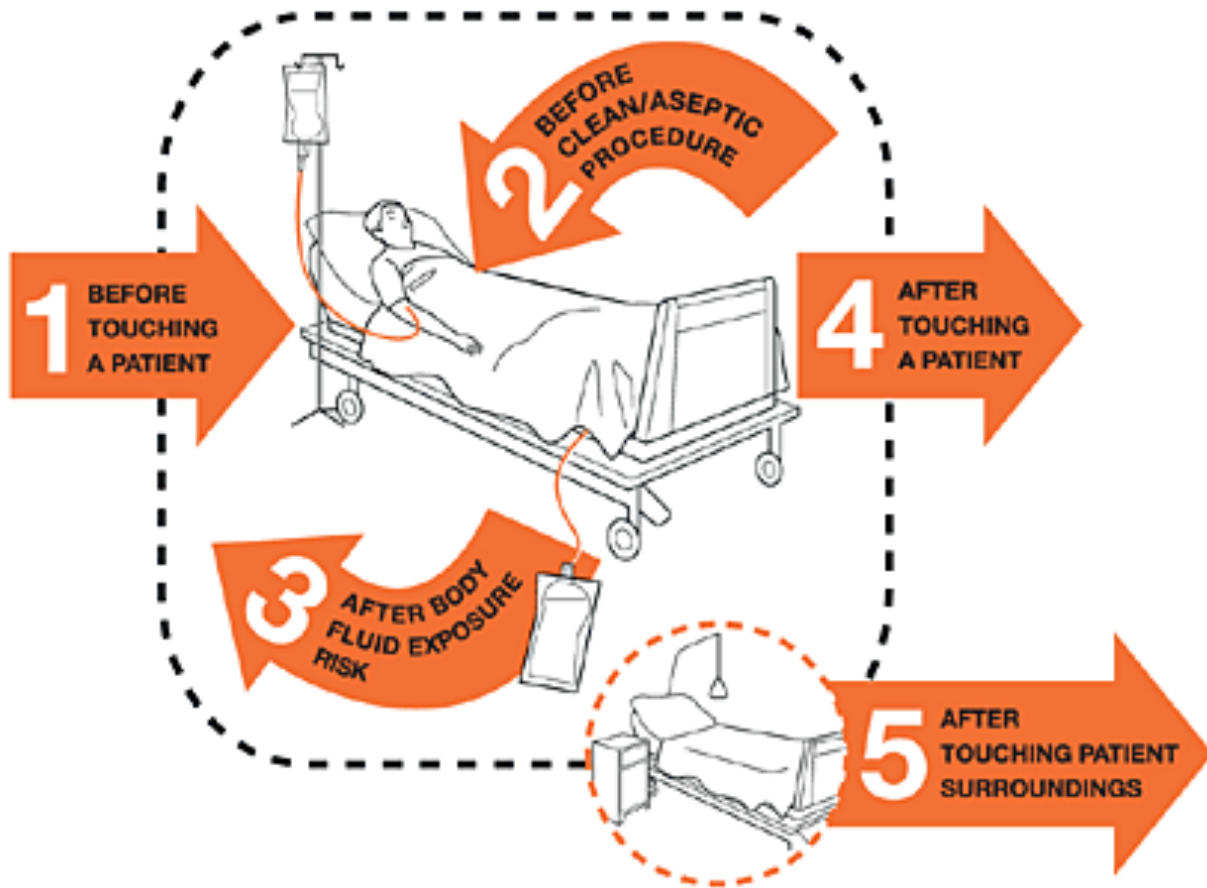
Titler, M. G., Kleiber, C., Steelman, V. J., Rakel, B. A., Budreau, G., Everett, L. Q., ... Goode, C. J. (2001, December). The Iowa model of evidenced-based practice to promote quality care. *Critical Care Nursing Clinics of North America*, 13(4), 497-509.

United States Census Bureau. (2020). QuickFacts Danville town, Indiana. Retrieved from <https://www.census.gov/quickfacts/fact/table/danvilletownindiana/POP060210>

World Health Organization. (2009). WHO guidelines on hand hygiene in health care: A summary. Retrieved from [https://www.who.int/gpsc/5may/tools/who\\_guidelines-handhygiene\\_summary.pdf](https://www.who.int/gpsc/5may/tools/who_guidelines-handhygiene_summary.pdf)

## APPENDIX A

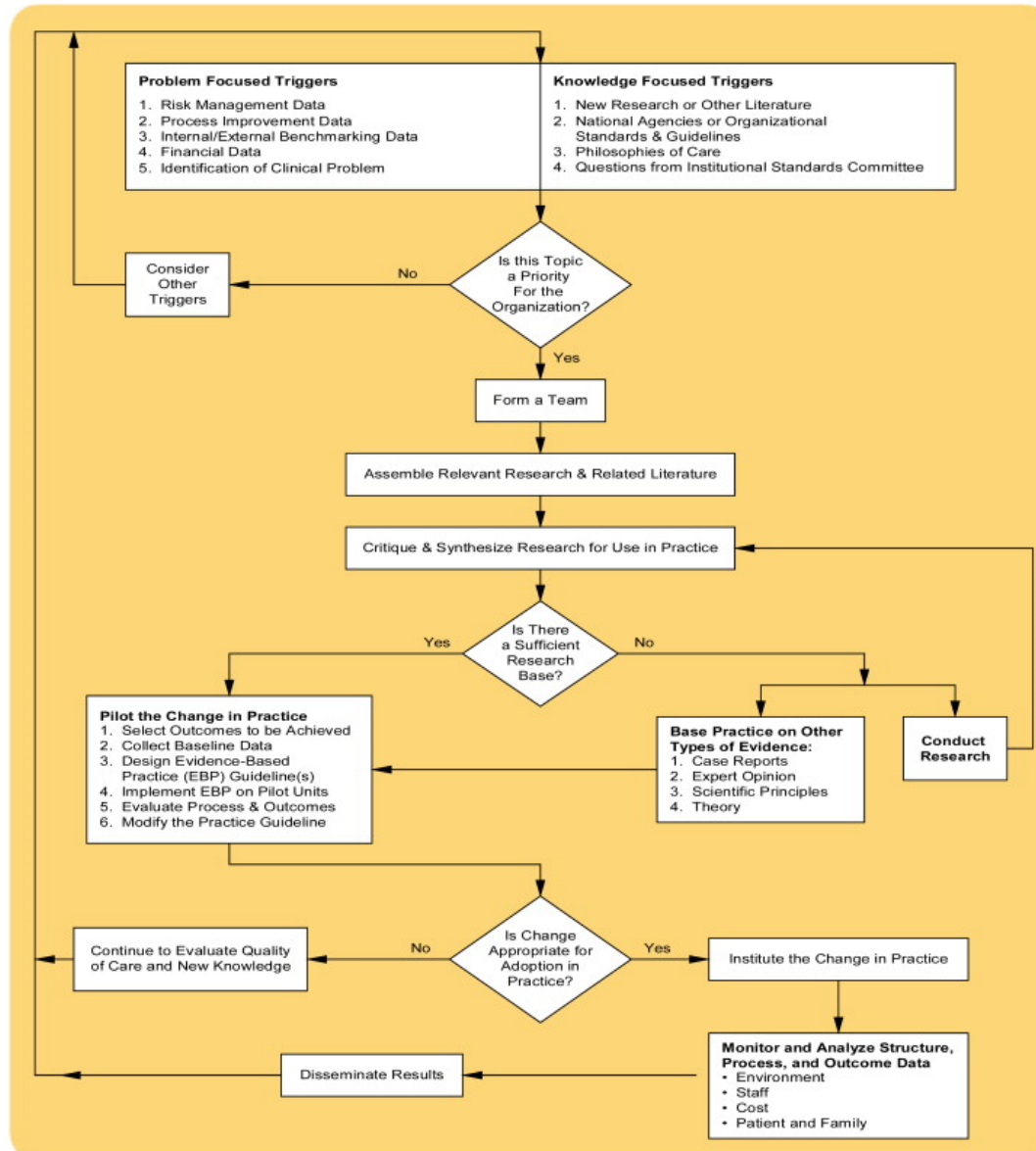
## Who Five Moments of Hand Hygiene



## APPENDIX B

## IOWA Model of Evidenced Based Practice

## The Iowa Model of Evidence-Based Practice to Promote Quality Care



◇ = a decision point

Titler, M.G., C., Steelman, V.J., Rakel, B. A., Budreau, G., Everett, L.Q., Buckwalter, K.C., Tripp-Reimer, T., & Goode C. (2001). The Iowa Model Of Evidence-Based Practice to Promote Quality Care. *Critical Care Nursing Clinics of North America*, 13(4), 497-509.

**REQUESTS TO:**  
Department of Nursing  
University of Iowa Hospitals and Clinics  
Iowa City, IA 52242-1009

## APPENDIX C

## Hand Hygiene Survey Instrument

Q1: I can name the World Health Organization (WHO) five moments of hand hygiene.

- ☐ Yes
- ☐ No

Q2: I perform hand hygiene before placing EKG leads on the patient.

- ☐ Never
- ☐ Rarely
- ☐ Sometimes
- ☐ Often
- ☐ Always

Q3: I perform hand hygiene before placing a peripheral IV.

- ☐ Never
- ☐ Rarely
- ☐ Sometimes
- ☐ Often
- ☐ Always

Q4: I perform hand hygiene after palpating a patient's pulse.

- ☐ Never
- ☐ Rarely
- ☐ Sometimes
- ☐ Often
- ☐ Always

Q5: I perform hand hygiene after performing an intubation.

- ☐ Never
- ☐ Rarely
- ☐ Sometimes
- ☐ Often
- ☐ Always

Q6: I perform hand hygiene after adjusting the patient's operating room (OR) bed height.

- ☐ Never
- ☐ Rarely
- ☐ Sometimes
- ☐ Often
- ☐ Always

Q7: Professional Status

- ☐ SRNA
- ☐ CRNA
- ☐ MD

Q8: Years in Practice

- ☐ less than 1 year
- ☐ 1-5 years
- ☐ 6-10 years
- ☐ 11-15 years
- ☐ 16-20 years
- ☐ greater than 20 years

Q9: Age

- ☐ 20-29 years
- ☐ 30-39 years
- ☐ 40-49 years
- ☐ 50-59 years
- ☐ 60 + years

Q10: Primary Practice environment

- ☐ Outpatient surgery center
- ☐ Hospital based
- ☐ other

Q11: What barriers hinder your performance of hand hygiene in the Operating Room? Choose all that apply

• ☐ lack of access to hand hygiene products

• ☐ lack of time between tasks

• ☐ use of irritating agents

• ☐ x none of the above

• ☐ x other

## APPENDIX D

## Marian University IRB Approval Letter

*Institutional Review Board*

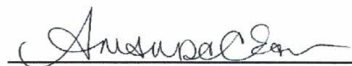
DATE: 12-30-2020  
TO: Joseph McSherry  
FROM: Institutional Review Board  
RE: IRB #S20.196  
TITLE: Assessing Anesthesia Provider Perception and Compliance of the World Health Organization Five Moments of Hand Hygiene in the Operating Room.  
SUBMISSION TYPE: New Project  
ACTION: Determination of Exempt Status  
DECISION DATE: 12-30-2020

The Institutional Review Board at Marian University has reviewed your protocol and has determined the procedures proposed are appropriate for exemption under the federal regulations. As such, there will be no further review of your protocol and you are cleared to proceed with your project. The protocol will remain on file with the Marian University IRB as a matter of record. Please be mindful of the importance of reporting only de-identified, HIPAA-compliant information about the patient in any exhibit or publication.

Although researchers for exempt studies are not required to complete online CITI training for research involving human subjects, the IRB **recommends** that they do so, particularly as a learning exercise in the case of student researchers. Information on CITI training can be found on the IRB's website:

<http://www.marian.edu/academics/institutional-review-board>.

It is the responsibility of the PI (and, if applicable, the faculty supervisor) to inform the IRB if the procedures presented in this protocol are to be modified or if problems related to human research participants arise in connection with this project. Any procedural modifications must be evaluated by the IRB before being implemented, as some modifications may change the review status of this project. Please contact me if you are unsure whether your proposed modification requires review. Proposed modifications should be addressed in writing to the IRB. **Please reference the above IRB protocol number in any communication to the IRB regarding this project.**

  
Amanda C. Egan, Ph.D.

SIGNATURE PAGE

Marian University  
Leighton School of Nursing

Doctor of Nursing Practice  
Final Project Report for Students Graduating in May 2021

Assessing Anesthesia Provider Recognition and Compliance of the World Health Organization

Five Moments of Hand Hygiene in the Operating Room.

Joseph McSherry

Marian University

Leighton School of Nursing

Chair:

Dr. Summerlin-Grady\_\_\_\_\_

\_\_\_\_\_  
(Signature)

Committee members:

Dr. Sara Franco\_\_\_\_\_

Dr. Sara Franco, DNAP, CRNA, APRN  
(Signature)

Date of Submission: April 2021