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Doctor of Nursing Practice Final Project Report

Anesthesia Provider Compliance with Intravenous Injection Port Disinfection Protocols

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Abstract

Background and Review of Literature: Intravenous (IV) catheter-associated bloodstream infections (CABIs) are a substantial problem in healthcare. Recently, intraoperative care was identified as a risk factor for the development of CABIs. Patient IV stopcocks (i.e. injection ports), which are bacterially contaminated during anesthesia administration, serve as a vector for bacterial transmission and subsequent infection development in patients. IV injection port disinfection was shown to reduce this bacterial contamination and decrease postoperative infection rates. Current clinical practice guidelines (CPGs) and hospital policies recommend IV injection port disinfection prior to IV access.

Purpose: The purpose of this DNP project is to determine anesthesia provider compliance with intraoperative IV injection port disinfection protocols and anesthesia provider attitudes regarding intraoperative IV injection port disinfection.

Methods: To investigate this, an online survey will be administered using the survey software program *Qualtrics*.

Implementation Plan/Procedure: Anesthesia providers at IU Health Arnett Hospital will be invited to participate via e-mail. Participation will be entirely voluntary and confidential. All survey responses will be sent to *Qualtrics* and stored in a password protected electronic format.

Implications/Conclusion: The survey completion rate among anesthesia providers was 41.38%. Survey respondents estimated scrubbing the IV injection port 68.83% of the time and allowing drying time after scrubbing the IV injection port 51.33% of the time prior to IV-line access. Only 49.99% of survey respondents agreed that intraoperative IV-line care contributes to bacterial transmission to patients. Furthermore, 58.33% of survey respondents disagreed that intraoperative IV-line care contributes to the development of postoperative infections. These

results suggest that improvement is needed in this area of intraoperative infection control. They also suggest that certain anesthesia provider attitudes regarding intraoperative IV-line care may serve as a rationale for noncompliance. Future research and quality improvement (QI) initiatives should focus on such attitudes as a potential avenue for intervention for improving IV injection port disinfection compliance among anesthesia providers.

Keywords: catheter hub disinfection, anesthesia workplace, stopcock contamination, intraoperative bacterial transmission, intraoperative infection control

Anesthesia Provider Compliance with Intravenous Injection Port Disinfection Protocols

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 (DNP), Nurse Anesthesia track. Disinfection of intravenous (IV) injection ports (a process referred to in nursing as "scrubbing the hub") is a simple evidence-based intervention that has been established in clinical practice guidelines (CPGs) and hospital infection control policies as part of an insertion and maintenance care bundle to prevent IV catheter-associated bloodstream infections (CABIs) (Ista et al., 2016). However, unfortunately, IV CABIs still remain a significant source of morbidity and mortality among hospitalized patients (Ista et al., 2016). According to O'Grady et al. (2011), approximately 250,000 bloodstream infections (BSIs) occur annually in the United States (US), resulting in preventable patient morbidity and mortality and costing the national healthcare system billions of dollars. The purpose of this DNP project is to determine anesthesia provider compliance with intraoperative IV injection port disinfection protocols. In addition to compliance, this DNP project aims to evaluate anesthesia provider attitudes regarding intraoperative IV injection port disinfection. For the purposes of this project, the term "injection port" is used interchangeably with needleless connector (NC), catheter hub, stopcock, or manifold, and refers to any IV-line access point through which medications can be administered intravenously.

Background

For the last several years, an increasing amount of evidence has linked intraoperative care with infection transmission. In a study conducted by Yogaraj, Elward, and Fraser (2002), transportation to the operating room (OR) was identified as an independent risk factor for the

development of CABI. More recently, anesthesia care has been implicated as an independent risk factors for CABIs, suggesting that intraoperative IV-line care is instrumental in infection prevention (Martin, Kallile, Kanmanthreddy, & Zerr, 2017). Current literature suggests that anesthesia providers play a critical role in intraoperative bacterial transmission to patients throughout the course of an anesthetic (Loftus et al., 2008; Martin et al., 2017).

Bacterially contaminated IV stopcocks have repeatedly been recognized as common culprits for bacterial transmission and subsequent infection development (Loftus et al., 2012c; Moureau & Flynn, 2015). In one study, 32% of stopcocks on patients' IV tubing were found to have been contaminated with bacteria during the administration of an anesthetic (Loftus et al., 2012a). Culpatory sources for IV stopcock transmission come from contaminated anesthesia providers' hands and a contaminated anesthesia workspace (Loftus et al., 2012b). Recently, IV stopcock contamination was found to be associated with an increase in postoperative infections and patient morbidity and mortality (Hopf, 2015). Current literature indicates that poor intraoperative IV-line care among anesthesia providers may play a contributory role in IV stopcock bacterial contamination and subsequent infection transmission (Munoz-Price et al., 2013; Martin et al., 2017). However, catheter hub/IV stopcock disinfection has been shown to reduce this contamination and attenuate the inadvertent injection of bacterial organisms during medication administration (Salzman, Isenberg, & Rubin, 1993; Moureau & Flynn, 2015). In fact, in a clinical systematic literature review conducted by Moureau and Flynn (2015), IV catheter hub disinfection was found to be the most important intervention in preventing IV catheter hub bacterial contamination and subsequent injection. Moreover, in a study conducted by Loftus et. al (2012a), reducing IV stopcock bacterial contamination was found to correlate with a reduction in postoperative infections.

Compliance with IV injection port disinfection individually has not been extensively studied; however, it is considered to be universally poor (as low as 10% in some studies) (Moureau & Flynn, 2015). As anesthesia providers frequently handle IV lines during the administration of general anesthesia (GA), it is important to determine their compliance with established infection control policies currently in place. With the recent outbreak of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), the virus responsible for causing COVID-19, stringent intraoperative infection control is arguably now even more critical (WHO, n.d.). Determining anesthesia provider compliance with IV injection port disinfection (i.e. "scrubbing the hub") is necessary to further understand the role anesthesia providers play in infection transmission and prevention. In addition, it is essential prior to developing and implementing successive quality improvement (QI) initiatives to improve compliance (and overall intraoperative infection control practices). Moreover, examining providers' attitudes regarding IV injection port disinfection will help determine which QI initiatives will be most constructive moving forward.

Problem Statement

To investigate the aforementioned clinical problem, the following PICO question was developed:

> Among anesthesia providers [at IU Health Arnett Hospital], what is the current compliance with IV injection port disinfection compared to that required by the facility's policy?

In order to properly assess this, IU Health Arnett's Hospital current Anesthesia Department IV-line disinfection practices will be assessed using a "program evaluation" QI project approach.

Organizational Gap Analysis of Project Site

A gap analysis is a tool often used in healthcare to define current healthcare issues (University of Toronto, n.d.). According to UCLA Health (2016), it is "the method of identifying the difference between current knowledge, skills and/or practices and the desired best practice" (p. 1). Clarifying this "gap" justifies the need for educational intervention and guides implementation of the appropriate teaching and evaluation methods (UCLA Health, 2016; University of Toronto, n.d.). The steps to conducting a gap analysis can be found in *Figure 1* of Appendix A. The first step (i.e. Current State) involves identifying what is currently happening within a realm of healthcare (UCLA Health, 2016). This purpose of this DNP project is to identify the current state of compliance with IV injection port disinfection among anesthesia providers at the project site (IU Health Arnett Hospital). The second step involves defining what the best practice (i.e. Desired State) is in that realm of healthcare (UCLA Health, 2016). In general, best practice is determined by CPGs, which "are specific practice recommendations grouped together, which have been derived from a methodologically rigorous review of the best evidence on a specific topic" (Melnyk & Fineout-Overholt, 2019, p. 19). Best practice regarding anesthesia-related IV-line care at the project site is determined by CPGs published by the CDC and the American Association of Nurse Anesthetists (AANA), and the project site's infection control policies (CDC, 2011; AANA, 2015).

For individual healthcare facilities, best practice is defined by a facility's policies (although often times, facility policies are based on published CPGs). For this DNP project, best practice regarding anesthesia-related IV-line care will be determined by IU Health Arnett Hospital's relevant hospital policies. There is no current policy specific to intraoperative IV-line care at IU Health Arnett Hospital. However, there is a policy concerning IV therapy

administration that applies to "all staff responsible for IV therapy administrations within IU Health Arnett" Hospital, which includes anesthesia staff during intraoperative care (IU Health Arnett Hospital, 2008, para 2). The policy states that "anytime [an] IV is accessed, the needleless connector must be cleansed with alcohol for a minimum of 5 seconds and allowed to dry" (IU Health Arnett Hospital, 2008, para 20). Per Sarah Norkus, the manager of the OR and ancillary perioperative services, this policy extends to stopcocks (and any other IV add-on device), which are routinely used in patient IV tubing in the OR (S. Norkus, personal communication, April 18, 2020).

Current practice regarding anesthesia provider compliance with IV injection port disinfection has not yet been identified at IU Health Arnett Hospital, which demonstrates why this DNP project is appropriate for this site. Determining current practice is the first step in facilitating an appropriate continuing health education (CHE) endeavor to close the "gap" between current practice and best practice (UCLA Health, 2016). The remaining steps of the gap analysis (see *Figure 1* of Appendix A) can be addressed through successive DNP projects and/or QI initiatives.

Review of the Literature

A review of the literature was conducted using several electronic search engines, including *MEDLINE-Ebsco*, *MEDLINE-Ovid*, *CINAHL*, and *PubMed*. Relevant search terms included "central line-associated bloodstream infection," "catheter-associated infection," "catheter hub disinfection," "scrub the hub," "needless connector," "stopcock contamination," "anesthesia provider," "anesthesia workspace," and "intraoperative bacterial transmission." Several different combinations of these search terms ultimately yielded 48 relevant articles. Inclusion criteria included studies published within the last 10 years (unless they were

considered to be landmark), and those pertaining directly to IV injection port disinfection and intraoperative (i.e. anesthesia) infection control. Exclusion criteria included articles older than 10 years (unless they were considered to be landmark). Ultimately, eight relevant articles were used, which included two systematic reviews (one with meta-analysis), one randomized, single-blinded control trial (RCT), one randomized, single-blinded controlled ex vivo study, three prospective randomized observational studies (one with retrospective analysis), and one prospective cohort study. In addition to these articles, CPGs published by the CDC and AANA, and IU Health Arnett Hospital's policies (all of which pertained to IV-line care) were used.

Several themes emerged from the review of literature. To begin, healthcare-associated infections (HCAIs), and CABIs specifically, remain a significant source of morbidity and mortality in patients around the globe and cost healthcare systems billions of dollars (O'Grady et al., 2011, Ista et al., 2016). In the United States alone, 250,000 CABIs are estimated to occur annually; however, only 80,000 of those occur in intensive care units (ICUs) (O'Grady et al., 2011). In a landmark study conducted by Yogaraj et al. (2002), the OR was determined to be an independent risk factor for the development of CABIs. The authors concluded that this risk was attributed to processes of care, rather than existing patient acuity and underlying illness (Yogaraj et al., 2002).

Moreover, anesthesia providers were found to significantly contribute to the transmission of bacteria to patients intraoperatively (Loftus et al., 2008; Loftus et al., 2012b; Hopf, 2015). The primary modes of bacterial transmission came from anesthesia providers' hands, contaminated anesthesia workspaces, and the surrounding OR environment (Loftus et al., 2008; Loftus et al., 2012b). Intraoperative infection control practices, specifically hand hygiene practices, among anesthesia providers have consistently been poor (Loftus et al., 2008: Munoz-Price et al., 2019).

Most studies attribute this poor compliance to the fast-paced work environment and professional culture associated with anesthesia (Loftus et al., 2008; Munoz-Price et al., 2019). Loftus et al. (2008) concluded that variable aseptic practice of anesthesia providers was found to lead to contamination of both patient IV tubing and the anesthesia workspace. Contamination to patient IV tubing, specifically to open-lumen IV stopcocks, frequently occurred during the administration of anesthesia (Loftus et al., 2008; Loftus et al., 2012a; Loftus et al., 2012b).

Contaminated IV stopcocks (i.e. injection ports) were found to be culpatory sources for bacterial transmission (Loftus et al., 2008; Moureau & Flynn, 2015). Potentially pathogenic and multidrug-resistant organisms were transmitted through inadvertent bacterial injection occurring from medication administration during routine anesthesia care (Loftus et al., 2008; Loftus et al., 2012b). Examples of such organisms included methicillin-resistant Staphylococcus aureus (MRSA) and vancomycin-resistant enterococcus (VRE) (Loftus et al., 2008). Injection port disinfection was the most important factor in preventing bacterial contamination and subsequent injection (Loftus et al., 2012c; Moureau & Flynn, 2015). Recently, multiple studies have demonstrated an associative link between intraoperative bacterial contamination and postoperative infections (Loftus et al, 2008; Loftus et al., 2012a). Moreover, the reduction of IV stopcock contamination correlated with a reduction of postoperative infections (Loftus et al., 2012a). However, the statistical significance of these links has not yet been validated, highlighting apparent gaps in the literature (Loftus et al., 2012a).

The implementation of intravenous catheter care bundles is effective in reducing CABIs in intensive care units (ICUs) and hospital wide (Ista et al., 2016). The interventions incorporated in bundles differ widely; however, catheter hub disinfection was commonly included (Ista et al., 2016). Healthcare professionals' compliance with bundle protocols and guidelines is

suboptimum and considered to be a universal problem in healthcare (Moureau & Flynn, 2015; Ista et al., 2016). As catheter care interventions are bundled together, catheter hub (i.e. injection port) disinfection as an independent intervention and its individual effectiveness on reducing CABIs has not been extensively studied. This was a sizeable gap found within the existing relevant literature. Moreover, healthcare provider compliance with catheter hub disinfection has not exclusively been studied. Despite this, current research suggests it is universally poor – as low as 10% in some studies (Moureau & Flynn, 2015).

With regard to CPGs, the CDC strongly recommends scrubbing all IV access ports "with an appropriate antiseptic" (CDC, 2011, p. 20). This recommendation (Category IA) is "strongly supported by well-designed experimental, clinical, [and/or] epidemiologic studies (CDC, 2011, p. 8). The CDC acknowledges that IV access port (i.e. injection port) disinfection is essential to the prevention of transmission of microbes (CDC, 2011). It recognizes that disinfection time may be important but does not recommend a specific disinfection time (CDC, 2011). Current research recommends disinfecting IV access ports for 5-60 seconds (prior to IV access) (Moureau & Flynn, 2015).

The AANA recommends anesthesia providers scrub IV injection ports (NC, stopcocks, etc.) "with an appropriate antiseptic agent and allow to dry according to manufacturer recommendation[s]" (AANA, 2015, p. 22). However, it should be noted that this recommendation is specifically for the access of central venous catheters (CVCs) (AANA, 2015). Currently, the AANA does not have published recommendations addressing the access of peripheral venous catheters (AANA, 2015). It should also be noted that the AANA recommends the CDC's *Guidelines for the Prevention of Intravascular Catheter-Related Infections* for complete guidance on intravascular catheter care (AANA, 2015). Most importantly, the AANA

recommends that anesthesia providers (and other healthcare professionals) defer to "their facility's policy on infection control standard precautions" (AANA, 2015, p. 3).

IU Health Arnett Hospital has several policies pertaining to IV-line care. The facility's "Anesthesia Infection Control" policy states that all peripheral IVs must be disinfected with alcohol prior to access (IU Health Arnett Hospital, 2020). The policy does not indicate a disinfection time (IU Health Arnett Hospital, 2020). Another facility policy, titled "Hanging and Replacement of Intravascular Fluid Administrations Sets – Adults and Pediatrics" states that all NCs (i.e. injection ports) "must be cleansed with alcohol for a minimum of 5 seconds and allowed to dry" any time the IV catheter is accessed (IU Health Arnett Hospital, 2008, para 20). It should be noted that this specific policy uses the aforementioned CDC guidelines as a reference (in additional to multiple other sources).

In order to investigate anesthesia provider compliance with infection prevention protocols, a separate literature review was conducted. Literature was searched for using the electronic databases *MEDLINE-Ebsco*, *MEDLINE-Ovid*, *CINAHL*, and *PubMed*. Different combinations of the following search terms were used: "survey," "compliance," "anesthesia provider," "infection," and "intraoperative infection control." This search strategy ultimately yielded 36 relevant articles. Landmark studies and those published within the last 15 years were included. Studies older than 15 years (unless they were considered to be landmark) were excluded. After applying the inclusion and exclusion criteria, eight relevant articles were used (two of which were used in the previous literature review). These included one systematic literature reviews, five prospective randomized observational studies (three of which implemented covert observation techniques), one survey, and one questionnaire. In addition, the CDC's CPGs on hand hygiene was also used.

Several themes were present in this literature review. First, healthcare provider compliance with infection prevention guidelines has widely been studied and consistently been shown to be poor (CDC, 2002). The CDC (2002) estimated overall hand hygiene compliance amongst all healthcare providers to be roughly 40% (with ranges from 5-81%). Healthcare provider compliance with catheter hub disinfection specifically is less studied, pointing to an apparent gap in the literature. Of the literature available, compliance was cited to be poor (Moureau & Flynn, 2015). In a systematic review conducted by Moureau and Flynn (2015), catheter hub disinfection compliance rates were found to be as low as 10%. However, in a large observational study conducted by Jardim, Lacerda, Soares, and Nunes (2013), compliance rates among all healthcare providers were found to be below 40%. These authors also demonstrated that catheter hub disinfection was the most frequently neglected component of IV-line care bundles (Jardim et al., 2013).

Anesthesia providers in particular have been known to be especially noncompliant with infection prevention protocols (Biddle & Shah, 2012; Munoz-Price et al., 2013; Sahni, Biswal, Gandhi, & Yaddanapudi, 2015). Hand hygiene compliance among anesthesia providers has been estimated at 18% (and as low as 2%) (Krediet et al., 2011; Biddle & Shah, 2012). Most studies cite several barriers that contribute to noncompliance, including a fast-paced work environment, anesthesia culture, and a high rate of patient contact (Krediet et al., 2011; Sahni et al., 2015). Interestingly, there appears to be a difference in hand hygiene compliance between anesthesiologists and nurse anesthetists (Or et al., 2009). According to a large survey study conducted by Or et al. (2009), only 52.6% of anesthesiologists reported practicing hand hygiene, compared to 70.4% of nurse anesthetists.

Compliance with catheter hub disinfection amongst anesthesia providers has not been studied exclusively, highlighting another existing gap in the relevant literature. When it was investigated, it was usually done so secondarily (to hand hygiene compliance or intraoperative bacterial transmission). One observational study by Munoz-Price et al. (2013) demonstrated that anesthesia providers only performed catheter hub disinfections 15% of the time during routine anesthesia administration. Moreover, in a separate study surveying the management of peripheral arterial catheters amongst anesthesia providers, 47% of respondents reported never disinfecting catheter access ports (Reynolds et al., 2013).

In summary, CABIs are a persistent problem in healthcare, and intraoperative care specifically has been implicated as a risk for developing CABIs (Yogaraj et al., 2002; Ista et al., 2016). It has been shown that anesthesia providers transmit bacteria to patients through poor intraoperative infection control practices (Loftus et al., 2008; Loftus et al., 2012b; Hopf, 2015). Bacterial transmission to patient IV tubing, specifically IV injection ports (NCs, stopcocks, etc.) was demonstrated to occur frequently during routine anesthesia care (Loftus et al., 2008; Loftus et al., 2012c). Bacterially contaminated IV injection ports facilitated the inadvertent IV injection of bacteria to patients and was associated with an increase in postoperative infections (Loftus et al., 2008).

In order to reduce bacterial contamination of IV injection ports and prevent subsequent transmission of microbes, CPGs published by the CDC and AANA recommend disinfecting IV injection ports prior to IV access (CDC, 2011; AANA, 2015). Currently, there is no gold standard for the appropriate disinfection technique and time (Moureau & Flynn, 2015). However, in a systematic review conducted by Moureau and Flynn (2015), "scrubbing the hub" with 70% alcohol for 5-60 seconds is most commonly recommended. IU Health Arnett Hospital's policies

recommend disinfecting IV injection ports with alcohol for a minimum of 5 seconds and allowing time to dry (IU Health Arnett Hospital, 2008).

Compliance with evidence-based practice (EBP) recommendations, particularly amongst anesthesia providers, has been grossly understudied. When compliance has been investigated, it has been shown to be universally poor (Krediet et al., 2011; Moureau & Flynn, 2015).

Given that a reduction of bacterial IV injection port contamination (through disinfection) was correlated with a reduction in postoperative infections, more emphasis needs to be placed on intraoperative IV-line care (Loftus et al., 2012a). Establishing anesthesia provider compliance with current EBP recommendations and IU Health Arnett Hospital's policies is the first step in this process. This DNP project will determine anesthesia provider compliance with intraoperative IV injection port disinfection. Secondarily, it will determine anesthesia provider attitudes regarding intraoperative IV injection port disinfection, so that appropriate QI initiatives can be subsequently developed and implemented.

Evidence-Based Practice: Verification of Chosen Option

There is an abundance of research that supports the use of EBP in healthcare. According to Melnyk and Fineout-Overholt (2019), "evidence-based practice enhances healthcare quality, improves patient outcomes, reduces costs, and empowers clinicians" (p. 7). Based on a review of the literature pertaining to intraoperative IV-line care, a program evaluation QI approach will be implemented for this DNP project.

Evidence-Based Practice Model

The EBP model that underpins this DNP project is Stetler's Model of Research Utilization. Originally developed by Cheryl Stetler in 1994, and later revised in 2001, the model was one of the first used for EBP in nursing (White, Dudley-Brown, & Terhaar, 2016). The

model uses a "series of critical-thinking and decision-making steps that are designed to facilitate the effective use of research findings" (Stetler, 2001, as cited in White et al., 2016, p. 8). At large, the model is used to guide the implementation of research evidence into practice (to ultimately affect change). It accomplishes this by focusing on the individual practitioner (rather than the organization) and promoting the use of internal data (from quality improvement projects, practitioner experience data, etc.) and external evidence (from primary research) (White et al., 2016).

Stetler's Model of Research Utilization (see *Figure 2* of Appendix A) employs five sequential phases of research utilization: preparation, validation, comparative evaluation/decision-making, translation/application, and evaluation (White et al., 2016). During the preparation phase, research to be considered for practice implementation is systematically searched for and selected (White et al., 2016). In the following phase, validation, the chosen research is critically appraised using a predetermined and precise methodology (White et al., 2016). The third phase (comparative evaluation/decision-making) involves deciding whether a practice change is achievable (White et al., 2016). According to White et. Al (2016), this decision is made using four criteria: "(a) the substantiating evidence, (b) the fit for implementing the research findings in the setting, (c) the feasibility of implementation, and (d) the evaluation of current practice" (p. 8). After a decision is made, the logistics of research-to-practice implementation are considered and the research is subsequently translated/applied implemented into practice (White et al., 2016). The last phase, evaluation, involves evaluating the implementation using various types and levels of evaluation measures (White et al., 2016). As mentioned previously, this model is used to guide the process of effectively integrating critically appraised research evidence into practice. Ultimately, this will improve the overall quality of

healthcare (White et al., 2016).

This DNP project incorporates the first two phases and portions of the third phase of Stetler's Model of Research Utilization. Preparation, the first phase, facilitates the search of applicable literature pertaining to the intraoperative IV injection port disinfection. Validation, the second phase, guides the appraisal and review of the selected literature. Two of the four criteria used for comparative evaluation/decision-making, the third phase, represent the program evaluation QI design. With this approach, the current practice is evaluated, and evidence is substantiated. As the program evaluation QI design does not involve an intervention, the remainder of the third phase and the final two phases of the model cannot be employed with this DNP project. However, they can be used to guide future DNP projects that expand upon this one.

Goals, Objectives and Expected Outcomes

The main objective of this project is to evaluate the compliance rates of IV injection port disinfection protocols among anesthesia providers at IU Health Arnett Hospital. This will be accomplished using a survey administered through *Qualtrics*, a well-known online survey software program (Qualtrics, n.d.). The secondary objective of this project is to assess the anesthesia providers' attitudes regarding IV injection port disinfection. This will also be accomplished through the *Qualtrics* survey.

The main goals of this DNP project are to evaluate 20 anesthesia provider surveys during Summer 2020 and present the findings to fellow DNP students and IU Health Arnett Hospital anesthesia staff in two separate PowerPoint presentations during August 2020. Although not extensively studied, compliance with IV injection port disinfection among all healthcare providers is universally poor (Moureau & Flynn, 2015). Compliance with IV injection port disinfection among anesthesia providers specifically has not been exclusively examined.

However, anesthesia provider compliance with other intraoperative infection control protocols, particularly hand hygiene, has historically been low (Hopf, 2015). Given this, anesthesia provider compliance rates for IV injection port disinfection are expected to be low. Despite this, evaluating current compliance rates, whatever they may be, is necessary prior to facilitating QI initiatives.

Project Design/Methods

This DNP project will implement a program evaluation QI design. However, evaluation will come from self-assessment rather than objective observation (which is frequently used to conduct patient care compliance audits in hospitals today). Using a self-assessment survey administered through *Qualtrics*, practice behaviors and attitudes regarding IV injection port disinfection practices will be evaluated among anesthesia providers at IU Health Arnett Hospital. All actively practicing anesthesia providers at IU Health Arnett Hospital will be invited to participate via an e-mail composed by the DNP project's principal investigator (PI) (see Appendix C), and forwarded to them by Adrienne Merrick, Lead CRNA at IU Health Arnett Hospital (A. Merrick, personal communication, May 20, 2020). Participation will be entirely voluntary and anonymous. The survey will remain open for a two-week period, during which a reminder e-mail will be sent to all potential participants by Mrs. Merrick (A. Merrick, personal communication, May 20, 2020). All data will be collected and stored through *Qualtrics*. After the two-week period, the survey will close, and all collected data will then be summarized, analyzed, and presented under **Data Analysis and Results**.

Project Site and Population

The DNP project will take place at Indiana University (IU) Health Arnett Hospital. Part of the greater IU Health system, IU Health Arnett Hospital is a level III trauma center located in

Lafayette, Indiana (Indiana State Department of Health, n.d.; Indiana University Health, n.d.). The hospital houses 191 inpatient beds and offers a full set of healthcare services ranging from pediatrics to orthopedics (Indiana University Health, n.d.). In addition to the main hospital, an ambulatory surgery center (ASC) and medical office building are located on the premises (IU Health, 2016). There are six technologically advanced ORs within the main hospital that can accommodate complex surgeries, such as open hearts, craniotomies, and DaVinci procedures (IU Health, 2016). There are six ORs within the ASC (although typically only four are in use) (S. Bormann, personal communication, November 29, 2019). In 2016, IU Health Arnett Hospital achieved Magnet status, which recognizes excellence in nursing and patient care (IU Health, 2016). Although IU Health Arnett Hospital primarily serves the surrounding rural communities, it services a diverse patient population (Indiana University Health, n.d.).

Key stakeholders in the project include Dr. Stanley Weber, Medical Director of Anesthesia, and Adrienne Merrick, Lead CRNA. Dr. Weber will assure that the proper bureaucratic and legal channels are taken regarding this project, particularly when project findings are disseminated and future publication is discussed (Dr. S. Webber, personal communication, September 23, 2019). The participants of this DNP project will be consenting anesthesia providers at IU Health Arnett Hospital, which include both anesthesiologists and nurse anesthetists. Participants will be recruited through an e-mail invitation composed by the project's PI (see Appendix C).

Currently, there are 11 anesthesiologists and 18 nurse anesthetists actively practicing at IU Health Arnett Hospital, including Dr. Weber and Mrs. Merrick (S. Bormann, personal communication, April 15, 2020). This group of anesthesia providers comprise both men and women of varying ages and levels of experiences (two months to 32 years) (S. Bormann,

personal communication, April 15, 2020). IU Health Arnett Hospital employs a medically directed anesthesia care team (ACT) model (S. Bormann, personal communication, April 15, 2020). Anesthesiologists typically oversee 2-3 ORs simultaneously; however, they can oversee up to four (S. Bormann, personal communication, April 15, 2020). They are required to be present in the OR during critical times (i.e. induction and emergence of GA), and must remain available throughout the entirety of each case. Outside of this, CRNAs deliver anesthesia autonomously (but in close conjunction with the overseeing anesthesiologist). Both anesthesiologists and CRNAs are staffed in shifts, and OR assignments are based on patient volume, acuity, and throughput, available OR staff, and various other factors.

There are several factors that will facilitate the implementation of this DNP project. There is considerable hospital interest in infection control and prevention, which is expected to increase as a result of the coronavirus pandemic currently unfolding (WHO, n.d.). In addition, there is engaged endorsement of the project from IU Health Arnett Hospital Anesthesia Department management (i.e. Dr. Weber and Mrs. Merrick). Despite these facilitators, there are certain constraints to this project. The main barrier to DNP project implementation will be a lack of willingness to participate by anesthesia providers. This will be addressed by creating a survey will be user-friendly, concise, and easily accessible (i.e. available via computer or mobile device), all of which have been shown to increase survey participation (Qualtrics, 2019). Additionally, all participants will be assured that no personally identifiable information will be collected, and any future publication will protect the identity of the healthcare facility (and subsequently, the anesthesia providers).

Measurement Instruments

In order to measure the outcomes of this DNP project, an online self-assessment survey was designed using *Qualtrics*. The survey has two categories of questions – "Practice Behaviors" and "Attitudes". The "Practice Behaviors" questions were designed using IU Health Arnett Hospital's policies pertaining to IV lines and the CDC's *Audit Tool for Hemodialysis Injectable Medication Administration* (see *Figure 3* of Appendix A). This aforementioned audit tool is endorsed by CDC and currently used in hemodialysis (HD) catheter care compliance audits (CDC, n.d.). The "Attitudes" questions were developed from the themes identified from an extensive literature review. The survey used in this DNP project can be found in Appendix B. As mentioned previously, for the purposes of this DNP project, "injection port" refers to a NC, catheter hub, stopcock, manifold, or any other IV-line access point through which medications can be administered intravenously.

Data Collection Procedures

All potential participants will be invited to participate via an e-mail composed by the DNP project's PI (see Appendix C) and forwarded by Adrienne Merrick, Lead CRNA at IU Health Arnett Hospital (A. Merrick, personal communication, May 20, 2020). The e-mail will contain an anonymous link for an online self-assessment survey administered through *Qualtrics*. As mentioned previously, *Qualtrics* is a well-known online survey software program frequently used by companies and universities for research purposes (Qualtrics, n.d.). Participation will be entirely voluntary and confidential. For those anesthesia providers who choose to participate, upon survey completion, all survey responses will be sent to *Qualtrics* and stored in a password protected electronic format. In order to protect the professional reputations of the anesthesia

providers and the Anesthesia Department at IU Health Arnett Hospital, no personally identifiable data will be collected, and all survey responses will remain anonymous.

Ethical Considerations/Protection of Human Subjects

Marian University Internal Review Board (IRB) approval was obtained prior to initiating this DNP project. Initially, the project was deemed "non-exempt" by the IRB and subsequently underwent an expedited review. The official IRB Determination Form was submitted as soon as the proposal was approved (see Appendix D). An amendment to the project's methodology was later submitted and approved by the IRB, which changed its review status to "exempt" (see Appendix E). An informed consent process was disclosed via e-mail (see Appendix C). No patient data will be collected, so the Health Insurance Portability and Accountability Act of 1996 (HIPPA) is not applicable to this project. No personally identifiable data will be collected from the anesthesia provider participants. In addition, all of the data collected in connection with this project will only be disclosed with permission from IU Health Arnett Hospital. There are no ethical concerns or risks associated with this project.

Data Analysis and Results

There are 29 anesthesia providers at IU Health Arnett Hospital who were eligible to participate in this DNP project. Of these 29 anesthesia providers, 12 completed the self-assessment survey, which translated to a survey completion rate of 41.38%. Demographic data was not collected from survey participants. However, the eligible participant sample size (i.e. anesthesia providers at IU Health Arnett Hospital) was diverse, including men and women anesthesiologists and nurse anesthetists of varying ages and levels of experiences (S. Bormann, personal communication, April 14, 2020).

Data analysis was conveniently and automatically performed using *Qualtrics*. For the "Practice Behaviors" portion of the survey (see Appendix B), respondents estimated performing hand hygiene 67.00% of the time, on average, prior to IV-line access. Survey respondents estimated donning clean gloves 61.00% of the time, on average, prior to IV-line access. Survey respondents estimated scrubbing the IV injection port for 5 seconds with an appropriate disinfectant 68.83% of the time, on average, prior to IV-line access. Lastly, survey respondents estimated allowing drying time after scrubbing the IV injection port 51.33% of the time, on average, prior to IV-line access. These averages (i.e. means), along with their corresponding standard deviations and variances, can be found in Appendix F. Although IV injection port disinfection has not been exclusively investigated, compliance rates with certain infection control practices among anesthesia providers (i.e. hand hygiene, sterile technique, etc.) have consistently been shown to be poor (Biddle & Shah, 2012; Munoz-Price et al., 2013; Sahni, Biswal, Gandhi, & Yaddanapudi, 2015). Studies commonly cite barriers, such as the fast-paced workflow of anesthesia care and high rate of hand hygiene opportunities, that contribute to poor compliance (Krediet et al., 2011; Sahni et al., 2015). Despite these barriers, based on the survey responses, there is room for improvement among anesthesia providers in this area of intraoperative infection control.

Regarding the "Attitudes" portion of the survey (see Appendix B), 83.33% of respondents agreed (i.e. somewhat agree, agree, or strongly agree) that IV injection ports should be disinfected prior to IV-line access. Of all the survey respondents, 75.00% agreed (i.e. somewhat agree, agree, or strongly agree) that intraoperative IV-line care contributes to IV injection port bacterial contamination. Only 49.99% of survey respondents agreed (i.e. somewhat agree, agree, or strongly agree) that intraoperative IV-line care contributes to bacterial

transmission to patients. Furthermore, only 33.33% of survey respondents agreed (i.e. somewhat agree or agree) that intraoperative IV-line care contributes to the development of postoperative infections. In fact, 58.33% of survey respondents disagreed (i.e. somewhat disagree, disagree, and strongly disagree) with the aforementioned statement. Percentages of each survey response can be found in Appendix G.

These responses suggest a possible rationale for poor compliance with IV injection port disinfection (in addition to the barriers mentioned in previous studies) during intraoperative anesthesia delivery. In other words, if anesthesia providers do not believe that intraoperative IV-line care contributes to post-operative infection development in patients, this perhaps explains why they may not comply with IV-line care infection control protocols. Moreover, addressing this belief through specific education may serve as an intervention to improve compliance moving forward (i.e. changing anesthesia providers' attitudes about intraoperative IV-line care may assist in changing their intraoperative practice behaviors surrounding it). Although current research has not demonstrated an explicit causative relationship between intraoperative IV-line care and postoperative infections, an increasing amount of evidence suggests an associative relationship (Loftus et al, 2008; Loftus et al., 2012a). Due to this increasingly suggestive relationship, intraoperative IV-line care is arguably even more important. As such, more emphasis should be placed on IV injection port disinfection.

Limitations

There are several limitations to this study. To begin, the study's sample size is small (n = 12) and comes from a single institution, both of which limit its generalizability. Future research should incorporate larger sample sizes from multiple institutions to determine if these results are consistent and generalizable amongst anesthesia providers. In addition, the data collected from

this study came from self-assessment (subjective) rather than direct observation (objective). The accuracy of self-assessments, particularly within the healthcare realm, has long been in question (Kruger & Dunning, 1999). A psychological phenomenon, known as the Dunning-Kruger effect, shows that underperformers tend to overestimate their performance and overperformers tend to underestimate their performance (Kruger & Dunning, 1999). Based on this effect, the self-assessment survey responses (i.e. those in the "Practice Behaviors" section of the survey) may be inaccurate and/or over-inflated. Future research should focus on collecting objective, observational data to compare and contrast with the data collected in this project.

Conclusion

In conclusion, CABIs are a persistent and substantial problem in healthcare, resulting in patient morbidity and mortality and preventable healthcare systems costs (CDC, 2011; Ista et al., 2016). Intraoperative bacterial transmission to patient IV tubing, specifically IV injection ports (NCs, stopcocks, etc.), was demonstrated to occur frequently during routine anesthesia care as a result of poor infection control practices (Loftus et al., 2008; Loftus et al., 2012c; Munoz-Price et al., 2013). This bacterial contamination contributed to inadvertent bacterial transmission and subsequent infection development in patients (Loftus et al., 2008). Current clinical practice guidelines (CPGs) and hospital policies recommend disinfecting IV injection ports prior to IV access.

In order to address this aforementioned clinical problem, intraoperative anesthesia provider practices and attitudes regarding IV injection port disinfection among anesthesia providers at IU Health Arnett Hospital were examined using an online survey administered through *Qualtrics*. All collected data was subsequently analyzed using *Qualtrics*. The completion rate for the survey was 41.38%. Compliance with intraoperative IV injection port

disinfection among anesthesia providers was 68.83% (mean), suggesting room for improvement. In addition, only 33.33% of survey respondents agreed that intraoperative IV-line care contributes to the development of postoperative infections in patients. This belief among anesthesia providers may provide a justification for poor compliance with intraoperative IV-line infection control protocols. Given the link between IV injection port disinfection and postoperative infections, intraoperative IV-line care should be more heavily emphasized (Loftus et al., 2012a). Future work is needed to optimize intraoperative infection control practices, and specifically IV injection port disinfection, during anesthesia care.

References

American Association of Nurse Anesthetists (AANA). (2015). Infection prevention and control guidelines for anesthesia care [PDF file]. Retrieved from https://www.aana.com/docs/default-source/practice-aana-com-web-documents-(all)/infection-prevention-and-control-guidelines-for-anesthesia-care.pdf

Biddle, C., & Shah, J. (2012). Quantification of anesthesia providers' hand hygiene in a busy metropolitan operating room: What would Semmelweis think? *AJIC: American Journal of Infection Control*, *40*(8), 756–759. https://doi.org/10.1016/j.ajic.2011.10.008

Bonnel, W., & Smith, K. (Eds.). (2018). *Proposal writing for clinical nursing and DNP projects* (2nd ed.). New York, NY: Springer Publishing Company.

Centers for Disease Control and Prevention (CDC). (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. *Morbidity and Mortality Weekly Report: Recommendations and Reports*, *51*(Rr-16), 1–45.

Centers for Disease Control and Prevention (CDC). (2011). Guidelines for the prevention of intravascular catheter-related infections [PDF file]. Retrieved from https://www.cdc.gov/hai/pdfs/bsi-guidelines-2011.pdf

Centers for Disease Control and Prevention (CDC). (n.d.). Injection safety: Medication preparation & administration audit tool [PDF file]. Retrieved from https://www.cdc.gov/dialysis/PDFs/collaborative/Hemodialysis-InjectionSafety-Observations.pdf

Davidson, J. U. (2003). Example knowledgebase development template. In Rankin, S. H.,

Dumas, M. A., & Reavis, C. (Eds.), *Grantsmanship: Developing a program of research, Appendix B* (p. 77-78). Washington, DC: National Organization of Nurse Practitioner Faculties.

Hopf, H. (2015). Bacterial reservoirs in the operating room. *Anesthesia and Analgesia, 120*(4), 700-2. https://dx.doi.org/10.1213/ANE.0000000000000247

Indiana State Department of Health. (n.d.). Trauma centers. Retrieved from https://www.in.gov/isdh/24972.htm

Indiana University (IU) Health Arnett Hospital. (2008). Hanging and replacement of intravascular fluid and administration sets – Adults and pediatrics. Retrieved from https://iuhealth-arnett.policystat.com/policy/7294748/latest/

Indiana University (IU) Health Arnett Hospital. (2020). Anesthesia infection control. Retrieved from https://iuhealth-arnett.policystat.com/policy/7110211/latest/

Indiana University (IU) Health. (2016). Committed to our communities: 2016 Community benefit report [PDF File]. Retrieved from https://cdn.iuhealth.org/resources/0950-1019_Community_Benefit_Report_WEB.PDF?mtime=20180117144229

Indiana University (IU) Health. (n.d.). IU Health Arnett physicians. Retrieved from https://iuhealth.org/for-providers/join-us/iu-health-arnett-physicians

Ista, E., Van, D., Kornelisse, R., Van, D., Vos, M., Boersma, E., & Helder, O. (2016). Effectiveness of insertion and maintenance bundles to prevent central-line-associated bloodstream infections in critically ill patients of all ages: A systematic review and meta-analysis. *The Lancet. Infectious Diseases, 16*(6), 724-734. https://dx.doi.org/10.1016/S1473-3099(15)00409-0

Jardim, J. M., Lacerda, R. A., Soares, N. J. D., & Nunes, B. K. (2013). Evaluation of practices

for the prevention and control of bloodstream infections in a government hospital. *Revista Da Escola De Enfermagem*, *47*(1), 38–45. https://doi.org/10.1590/S0080-62342013000100005

Krediet, A. C., Kalkman, C. J., Bonten, M. J., Gigengack, A. C., & Barach, P. (2011). Hand-hygiene practices in the operating theatre: an observational study. *British Journal of Anaesthesia*, *107*(4), 553–8. https://doi.org/10.1093/bja/aer162

Kruger, J., & Dunning, D. (1999). Unskilled and unaware of it: how difficulties in recognizing one's own incompetence lead to inflated self-assessments. *Journal of Personality and Social Psychology*, *77*(6), 1121–34.

Loftus, R., Koff, M., Burchman, C., Schwartzman, J., Thorum, V., Read, M., . . . Beach, M. (2008). Transmission of pathogenic bacterial organisms in the anesthesia work area. *Anesthesiology, 109*(3), 399-407. https://dx.doi.org/10.1097/ALN.0b013e318182c855

Loftus, R., Brindeiro, B., Kispert, D., Patel, H., Koff, M., Jensen, J., . . . Brown, J. (2012a). Reduction in intraoperative bacterial contamination of peripheral intravenous tubing through the use of a passive catheter care system. *Anesthesia and Analgesia, 115*(6), 1315-23. https://dx.doi.org/10.1213/ANE.0b013e31826d2aa4

Loftus, R., Brown, J., Koff, M., Reddy, S., Heard, S., Patel, H., . . . Yeager, M. (2012b). Multiple reservoirs contribute to intraoperative bacterial transmission. *Anesthesia and Analgesia, 114*(6), 1236-48. https://dx.doi.org/10.1213/ANE.0b013e31824970a2

Loftus, R., Patel, H., Huysman, B., Kispert, D., Koff, M., Gallagher, J., . . . Brown, J. (2012c).

Prevention of intravenous bacterial injection from health care provider hands: The importance of catheter design and handling. *Anesthesia and Analgesia, 115*(5), 1109-19. https://dx.doi.org/10.1213/ANE.0b013e31826a1016

Martin, L., Rampersad, S., Geiduschek, J., Zerr, D., & Weiss, G. (2013). Modification of anesthesia practice reduces catheter-associated bloodstream infections: A quality improvement initiative. *Paediatric Anaesthesia, 23*(7), 588-96. https://dx.doi.org/10.1111/pan.12165

Martin, L., Kallile, M., Kanmanthreddy, S., & Zerr, D. (2017). Infection prevention in pediatric anesthesia practice. *Pediatric Anesthesia, 27*(11), 1077-1083. https://dx.doi.org/10.1111/pan.13252

Melnyk, B. M., & Fineout-Overholt, E. (2019). *Evidence-based practice in nursing and healthcare: A guide to best practice* (4th ed.). Philadelphia, PA: Wolters Kluwer.

Moureau, N. F., & Flynn, J. (2015). Disinfection of needleless connector hubs: Clinical evidence systematic review. *Nursing Research and Practice, 2015,* 1-20. https://dx.doi.org/10.1155/2015/796762

Munoz-Price, L. S., Lubarsky, D., Arheart, K., Prado, G., Cleary, T., Fajardo-Aquino, Y., . . . Birnbach, D. (2013). Interactions between anesthesiologists and the environment while providing anesthesia care in the operating room. *AJIC: American Journal of Infection Control, 41*(10), 922-924. https://dx.doi.org/10.1016/j.ajic.2013.03.306

Munoz-Price, L. S., Bowdle, A., Johnston, B. L., Bearman, G., Camins, B. C., Dellinger, E. P., . . . Birnbach, D. J. (2019). Infection prevention in the operating room anesthesia work area. *Infection Control & Hospital Epidemiology*, *40*(1), 1–17. https://dx.doi.org/10.1017/ice.2018.303

O'Grady, N., Alexander, M., Burns, L., Dellinger, E., Garland, J., Heard, S., . . . Healthcare Infection Control Practices Advisory Committee. (2011). Guidelines for the prevention of intravascular catheter-related infections. *American Journal of Infection Control, 39*(4), 1-34. https://dx.doi.org/10.1016/j.ajic.2011.01.003

Or, R. C., Hsieh, T. K., Lan, K. M., Kang, F. C., Chen, Y. H., & So, E. C. (2009). Profile of anesthetic infection control in Taiwan: A questionnaire report. *Journal of Clinical Anesthesia*, *21*(1), 13–8. https://doi.org/10.1016/j.jclinane.2008.06.014

Qualtrics. (2019). The Qualtrics handbook of question design [PDF file]. Retrieved from https://success.qualtrics.com/rs/542-FMF-412/images/The%20Qualtrics%20handbook%20of%20question%20design.pdf

Qualtrics. (n.d.). Online survey software. Retrieved from https://www.qualtrics.com/core-xm/survey-software/

Reynolds, H., Dulhunty, J., Tower, M., Taraporewalla, K., & Rickard, C. (2013). A snapshot of guideline compliance reveals room for improvement: A survey of peripheral arterial catheter practices in Australian operating theatres. *Journal of Advanced Nursing*, *69*(7), 1584–94. https://doi.org/10.1111/jan.12018

Sahni, N., Biswal, M., Gandhi, K., & Yaddanapudi, S. (2015). Quantification of hand hygiene compliance in anesthesia providers at a tertiary care center in northern India. *American Journal of Infection Control*, *43*(10), 1134–6. https://doi.org/10.1016/j.ajic.2015.05.035

Salzman, M., Isenberg, H., & Rubin, L. (1993). Use of disinfectants to reduce microbial contamination of hubs of vascular catheters. *Journal of Clinical Microbiology, 31*(3), 475-9.

University of California Los Angeles (UCLA) Health. (2016). Course planning tip sheet: Gap

analysis [PDF File]. Retrieved from https://www.uclahealth.org/nursing/workfiles/Education%20Courses/ContinuingEducation/ce-GapAnalysis-052016.pdf

University of Toronto. (n.d.). Quick tips: Initiating a learning needs assessment – Gap analysis of health care issues [PDF File]. Retrieved from https://www.cpd.utoronto.ca/newsletter/2009_fall/Quick_Tips_initiating_a_learning_needs_assesment__Gap_Analysis_of_health_care_issues.pdf

White, K., Dudley-Brown, S., & Terhaar, M. (Eds.). (2016). *Translation of evidence into nursing and health care* (2nd ed.). New York, NY: Springer Publishing Company, LLC.

World Health Organization (WHO). (n.d.). Naming the coronavirus disease (COVID-19) and the virus that causes it. Retrieved from https://www.who.int/emergencies/diseases/novel-coronavirus-2019/technical-guidance/naming-the-coronavirus-disease-(covid-2019)-and-the-virus-that-causes-it

Yogaraj, J. S., Elward, A. M., Fraser, V. J. (2002). Rate, risk factors, and outcomes of nosocomial primary bloodstream infection in pediatric intensive care unit patients. *Pediatrics*. 110(3), 481-485. https://dx.doi.org/10.1542/peds.110.3.481

Appendix A

Current State	Desired State	Identified Gap	Gap due to knowledge, skill and/or practice	Methods used to Identify Professional Practice Gap
What is currently happening?	What should be happening?	Difference between what is and what should be.	Why do you think the current state exists? What is the underlying or root cause?	What evidence do you have to validate the gap exists?

Figure 1. Steps to Conducting a Gap Analysis. Taken from University of California Los Angeles (UCLA) Health. (2016). Course planning tip sheet: Gap analysis [PDF File]. Retrieved from https://www.uclahealth.org/nursing/workfiles/Education%20Courses/ContinuingEducation/ce-GapAnalysis-052016.pdf

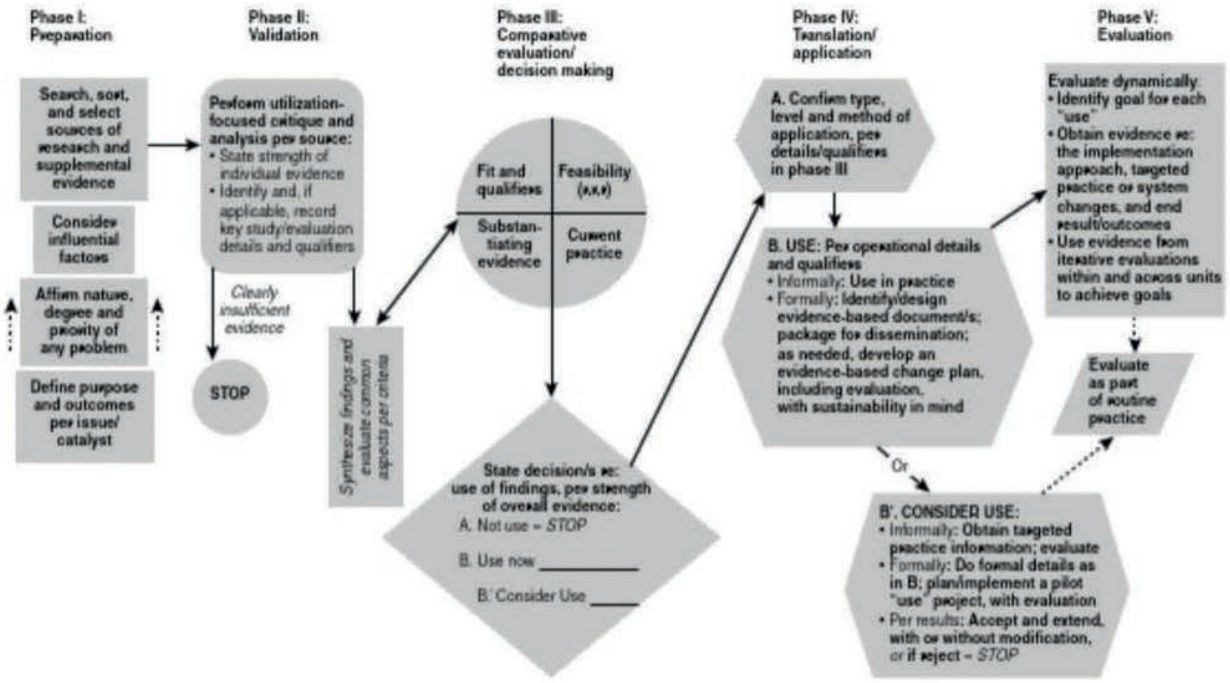
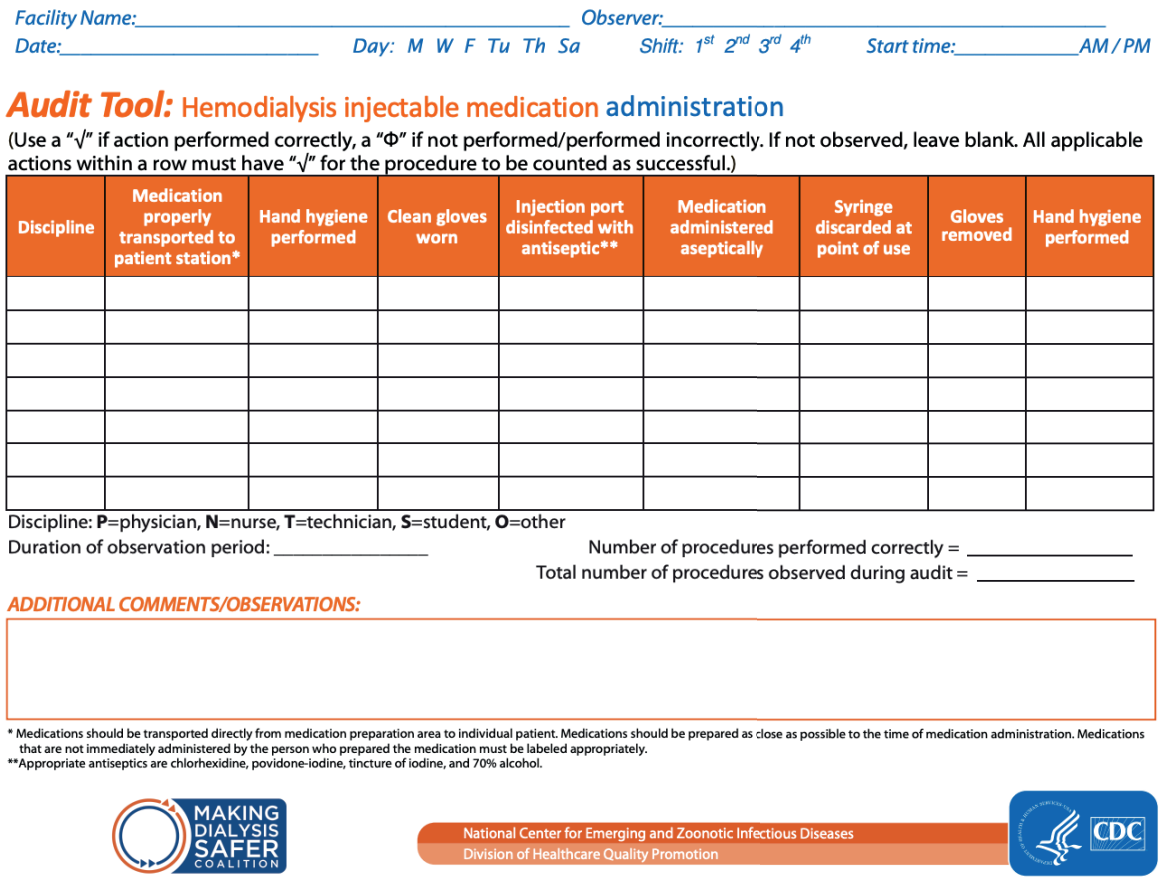


Figure 2. Stetler's Model of Research Utilization. "r, r, r," refers to risk factors, resources, and readiness of others to be involved. Taken from White, K., Dudley-Brown, S., & Terhaar, M.

(Eds.). (2016). *Translation of evidence into nursing and health care* (2nd ed.). New York, NY: Springer Publishing Company, LLC.



Facility Name:_____ Observer:_____
Date:_____ Day: M W F Tu Th Sa Shift: 1st 2nd 3rd 4th Start time:_____AM / PM

Audit Tool: Hemodialysis injectable medication administration

(Use a "√" if action performed correctly, a "Φ" if not performed/performed incorrectly. If not observed, leave blank. All applicable actions within a row must have "√" for the procedure to be counted as successful.)

Discipline	Medication properly transported to patient station*	Hand hygiene performed	Clean gloves worn	Injection port disinfected with antiseptic**	Medication administered aseptically	Syringe discarded at point of use	Gloves removed	Hand hygiene performed

Discipline: **P**=physician, **N**=nurse, **T**=technician, **S**=student, **O**=other

Duration of observation period: _____ Number of procedures performed correctly = _____

Total number of procedures observed during audit = _____

ADDITIONAL COMMENTS/OBSERVATIONS:

* Medications should be transported directly from medication preparation area to individual patient. Medications should be prepared as close as possible to the time of medication administration. Medications that are not immediately administered by the person who prepared the medication must be labeled appropriately.
**Appropriate antiseptics are chlorhexidine, povidone-iodine, tincture of iodine, and 70% alcohol.

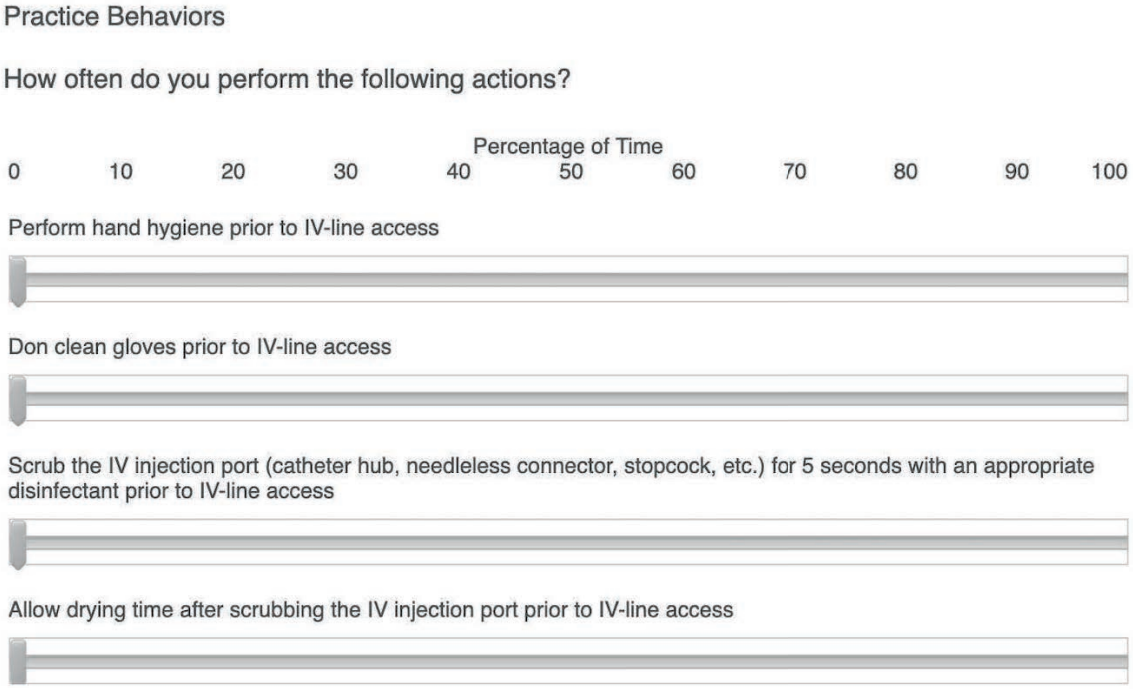
MAKING DIALYSIS SAFER COALITION

National Center for Emerging and Zoonotic Infectious Diseases
Division of Healthcare Quality Promotion

CDC

Figure 3. CDC's Audit Tool for Hemodialysis Injectable Medication Administration. Taken from Centers for Disease Control and Prevention (CDC). (n.d.). Injection safety: Medication preparation & administration audit tool [PDF file]. Retrieved from https://www.cdc.gov/dialysis/PDFs/collaborative/Hemodialysis-InjectionSafety-Observations.pdf

Appendix B
Qualtrics Survey



Attitudes

How much do you agree with the following statements:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
IV injection ports (catheter hubs, needleless connectors, stopcocks, etc.) should be disinfected prior to IV-line access	○	○	○	○	○	○	○
Intraoperative IV-line care contributes to IV injection port bacterial contamination	○	○	○	○	○	○	○
Intraoperative IV-line care contributes to bacterial transmission to patients	○	○	○	○	○	○	○
Intraoperative IV-line care contributes to the development of postoperative infections	○	○	○	○	○	○	○

Appendix C
Informed Consent E-mail

DNP Project Survey

Hello everyone!

My name is Brittany Brechbuhl, and I am a senior SRNA at Marian University. (For those of you that may recognize my name, I had my first clinical rotation at IU Health Arnett Hospital from May to August 2019). For my DNP project, I am assessing current practice behaviors and attitudes regarding intravenous (IV) injection port disinfection during routine anesthetic care. For the purposes of this study, "IV injection port" refers to IV catheter hubs, needleless connectors, and/or stopcocks (basically, any port where IV lines can be accessed).

I would greatly appreciate your participation in my brief 8-question survey, which should take less than 5 minutes to complete via computer or mobile device. By selecting the link, you are consenting to participate. Upon completion, your survey responses will be sent to Qualtrics, where data will be stored in a password protected electronic format. Qualtrics will not collect any information that can personally identify you. Therefore, your survey responses will remain anonymous.

This survey will remain open until June 4th.

https://marian.co1.qualtrics.com/jfe/form/SV_8waua2n27fgWhDv

If you have any trouble accessing the survey, please contact me at bbrechbuhl545@marian.edu or Dr. Stelflug at bstelflug@marian.edu.

Thank you in advance for your time! Stay safe!

Brittany Brechbuhl
BSN, RN, CCRN-CMC-CSC, SRNA
Marian University DNP-CRNA Class of 2021

Appendix D
Institutional Review Board Determination Form

MARIAN UNIVERSITY
Indianapolis ®

Institutional Review Board

DATE:	03-31-2020
TO:	Brittany Brechbuhl
FROM:	Institutional Review Board
RE:	IRB #B19.125
TITLE:	Anesthesia Provider Compliance with Intravenous (IV) Catheter Hub Disinfection
SUBMISSION TYPE:	New Project
ACTION:	Determination of Non-Exempt Status (Expedited Review)
DECISION DATE:	03-31-2020

The Institutional Review Board at Marian University has reviewed your protocol and has determined the procedures you have proposed are appropriate and approved under the federal regulations. As such, there will be no further review of your protocol and you are cleared to proceed with your project. Your protocol will remain on file with the Marian University IRB as a matter of record.

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. IRB approved protocols are administratively closed after one year. Should you need to extend, you must submit a renewal for approval at least one month before the one year date. The IRB will send you an annual report document in which you may request the protocol remain open. **Please reference the above IRB protocol number in any communication to the IRB regarding this project.**

[IRB Chair Name]
Chair, Marian University Institutional Review Board

Appendix E

Institutional Review Board Amendment Form

MARIAN UNIVERSITY
Indianapolis ®

Institutional Review Board

DATE:	05-13-2020
TO:	Brittany Brechbuhl
FROM:	Institutional Review Board
RE:	IRB #B19.125.A2005
TITLE:	Anesthesia Provider Compliance with Intravenous Injection Port Disinfection Protocols
SUBMISSION TYPE:	Request for Amendment to an Approved Study
ACTION:	Approval of Amendment to Study
DECISION DATE:	05-13-2020

The Institutional Review Board at Marian University has reviewed your protocol and has determined that the amendment(s) proposed are acceptable. As such, there will be no further review of your protocol and you are cleared to proceed with your project. Your protocol will remain on file with the Marian University IRB as a matter of record.

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.**

_____

[IRB Chair Name]
Chair, Marian University Institutional Review Board

Appendix F
Standard Deviation, Mean, and Variance for Practice Behavior Survey Items

Survey Item	Mean	Standard Deviation	Variance
Perform hand hygiene prior to IV-line access	67.00	39.41	1553.50
Don clean gloves prior to IV-line access	61.00	36.33	1320.17
Scrub the IV injection port (catheter hub, needleless connector, stopcock, etc.) for 5 seconds with an appropriate disinfectant prior to IV-line access	68.83	34.66	1201.31
Allow drying time after scrubbing the IV injection port prior to IV-line access	51.33	35.27	1244.06

Appendix G
Percentage Results for Attitude Survey Items

Survey Item	Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree Nor Disagree	Somewhat Agree	Agree	Strongly Agree
IV injection ports should be disinfected prior to IV-line access	0%	8.33%	0%	8.33%	8.33%	33.33%	41.67%
Intraoperative IV-line care contributes to IV injection port bacterial contamination	0%	16.67%	8.33%	0%	16.67%	33.33%	25.00%
Intraoperative IV-line care contributes to bacterial transmission to patients	0%	25.00%	0%	25.00%	8.33%	33.33%	8.33%
Intraoperative IV-line care contributes to the development of postoperative infections	8.33%	33.33%	16.67%	8.33%	8.33%	25.00%	0%