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Best Practice Policy Recommendation for Neuraxial Anesthesia Skin Antiseptic Solutions

Kyle Adams

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BEST PRACTICE POLICY RECOMMENDATION FOR NEURAXIAL ANESTHESIA
SKIN ANTISEPTIC SOLUTIONS

by

Kyle H. Adams

A Doctoral Project
Submitted to the Graduate School,
the College of Nursing and Health Professions
and the School of Leadership and Advanced Nursing Practice
at The University of Southern Mississippi
in Partial Fulfillment of the Requirements
for the Degree of Doctor of Nursing Practice

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ABSTRACT

A clinical affiliate hospital in Mississippi lacked a best practice clinical policy regarding the most appropriate skin preparation solution to use prior to neuraxial anesthesia. The evidence showed that alcoholic chlorhexidine is the optimal solution due to advanced characteristics which help reduce infection. Reducing infections can potentially reduce further complications for the patient, hospitalization length, and cost. Also, chlorhexidine was found safe to use for neuraxial anesthesia if cross-contamination is avoided and adequate drying time is allowed. Lastly, alcoholic povidone-iodine is an appropriate alternate if 0.5% chlorhexidine is unavailable.

A best practice clinical policy was formulated and presented to a panel of experts, which included a certified registered nurse anesthetist, anesthesiologist, health policy expert, and infection preventionist due to their advanced knowledge and daily involvement with the current topic. Data was gathered via an evaluation tool which assessed the panels' input on whether the findings were useful, were of high quality, and would have an impact on the facility.

The majority of the panel strongly agreed that the information presented was useful, was of high quality, would pose an impact on the facility, and that the policy should be adopted. The general concern among the panel of experts was that 0.5% chlorhexidine is not readily available in individual applicators. Chlorhexidine with a 2% concentration is readily available, but this concentration is not recommended for lumbar puncture due to a higher risk of neurotoxicity. Therefore, 0.5% chlorhexidine in 70% alcohol should be chosen for skin preparation prior to neuraxial anesthesia as a result of strong supporting evidence.

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DEDICATION

I would like to dedicate this paper to my lovely wife who has provided the patience and encouragement that I have needed to complete this journey. To my family and friends, thank you for your love and support throughout this process.

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LIST OF ABBREVIATIONS

<i>AANA</i>	American Association of Nurse Anesthetists
<i>CDC</i>	Centers for Disease Control and Prevention
<i>CMS</i>	Centers for Medicare & Medicaid Services
<i>CRNAs</i>	Certified Registered Nurse Anesthetists
<i>DNP</i>	Doctor of Nursing Practice
<i>FDA</i>	Food and Drug Administration
<i>HAI</i> s	health acquired infections
<i>IRB</i>	Institutional Review Board
<i>MRSA</i>	Methicillin-resistant Staphylococcus
<i>NYSORA</i>	New York School of Regional Anesthesia
<i>SRNAs</i>	student registered nurse anesthetists
<i>SSI</i> s	surgical site infections
<i>USM</i>	The University of Southern Mississippi

CHAPTER I - INTRODUCTION

Nosocomial infections or health acquired infections (HAIs), are infections acquired through the hospital that are often preventable yet can pose a risk on patient safety (Centers for Disease Control and Prevention [CDC], 2016). The CDC (2016) reported that 721,800 estimated total infections occurred in acute care hospitals in 2011, 75,000 of which resulted in death. Furthermore, 38% of HAIs in surgical patients resulted in surgical site infections (SSIs) (Safe Care Campaign, 2017). Evidence shows that when health professionals are aware of HAIs and act to prevent them, the rate of HAIs decreases by 70% (CDC, 2016). Because HAIs are largely preventable, health professionals' awareness of practices which lead to HAIs and attempt to reduce the rate of infections is crucial. In addition, reducing HAIs has the potential to decrease hospital reimbursement penalties (Centers for Medicare & Medicaid Services [CMS], 2018). While some efforts have been made successful in reducing the rates of HAIs over the years, continuing to research ways to reduce these infections is pertinent.

The operating room is a setting where distinct measures are taken to ensure sterility and prevent infectious complications postoperatively. Standard precautions, such as proper handwashing, hygiene, and wearing appropriate surgical gloves, masks, and gowns, can pose as barriers to contamination (American Association of Nurse Anesthetists [AANA], 2015; Campbell et al., 2014; Davies, 2017; Hebl, 2006). Another measure to reduce postoperative infection is choosing the most appropriate antiseptic solution to disinfect the skin prior to neuraxial anesthesia. Neuraxial anesthesia is a type of regional anesthesia, specifically a central neuraxial block, placed into either the epidural space or subarachnoid space (Nagelhout & Plaus, 2014). Osterman and Martin

(2011) reported that 61% of more than 1.8 million women in labor received epidural/spinal anesthesia in 2008, concluding that the majority of women in labor do receive neuraxial anesthesia. Improper use of neuraxial anesthesia, though, can cause extremely serious infectious complications. These complications can include skin infections, meningitis, epidural abscess, encephalitis, sepsis, bacteremia, and many others (Nagelhout & Plaus, 2014).

Problem Description

The absence of a best practice recommendation regarding the most appropriate skin antiseptic solution to use prior to neuraxial anesthesia presented a gap in the literature. Available knowledge has shown that chlorhexidine is the superior antiseptic solution of choice for overall skin antisepsis; however, compliance with this recommendation in regard to neuraxial anesthesia has been inconsistent. In addition, a clinical affiliate hospital in Mississippi lacks a clinical policy on the topic of which skin antiseptic solution should be used for neuraxial anesthesia. This finding was important to this investigation due to the increased risk for HAIs which affect patient safety, quality care, and hospital reimbursement. Therefore, the purpose of this Doctor of Nursing Practice (DNP) project was to analyze best practice for neuraxial anesthesia skin antiseptic solutions and develop a best practice policy recommendation based on these findings.

Available Knowledge

Due to the prevalence and severity of HAIs and SSIs, the inconclusive data regarding the primary antiseptic solution for neuraxial anesthesia, and the lack of a clinical policy regarding neuraxial anesthesia at a clinical affiliate hospital in Mississippi,

a thorough examination of available knowledge was conducted on the topic to clarify the data, analyze best practice for neuraxial anesthesia skin preparation, and develop a best practice policy. A literature matrix, shown in Appendix A, was created to synthesize the relevant evidence. The main themes of the literature reviewed were (a) the importance of standard precautions, (b) a comparison of two common skin antiseptic solutions, chlorhexidine and povidone-iodine, (c) the effects of alcohol in conjunction with antiseptic solutions, (d) the safety of chlorhexidine during neuraxial anesthesia, and (e) alternative solutions to alcoholic chlorhexidine.

The Importance of Clinical Policies

Hospital administrators and faculty create, approve, and implement policies within every department in order to promote standardization of practice and ultimately best ensure patient safety (PolicyMedical, n.d.). Numerous guidelines outline policies, such as current literature and accreditation organizations. Therefore, policies are written extremely clearly, cautiously, and precisely so that all involved will understand their duties and responsibilities. Because policies are very thorough, numerous components are involved in creating a policy, including a policy number, area, title, subject, effective date, and rationale (Boise State University, 2018).

Standard Precautions

Within all aspects and levels of nursing, standard precautions are required to ensure sterility and help prevent HAIs. These precautions include but are not limited to, thoroughly and appropriately washing hands, removing all jewelry, using sterile surgical gloves, and wearing surgical masks. Proper clinical practice guidelines include using standard precautions to promote optimal aseptic techniques (AANA, 2015; Campbell et

al., 2014). Hebl (2006) conducted a systematic review and found that standard precautions should be used to prevent or reduce infections. In addition, Davies (2017) discussed that using standard precautions can help prevent rare yet dangerous neuraxial infections.

Lack of standard precaution adherence can cause HAIs, which lead to (a) further complications for the patient, (b) increased length of hospitalization, and (c) increased cost for the hospital (Kirkland, Briggs, Trivette, Wilkinson, & Sexton, 1999). When comparing infected to uninfected patients, Kirkland et al. (1999) found that (a) more than twice as many infected patients died during their initial hospitalization, (b) infected patients had almost twice as long hospitalizations, (c) infected patients were more likely to be readmitted to the hospital, and (d) infected patients contributed to almost twice as much direct costs during their initial hospitalization, a difference of \$3,644 per person. Ultimately, standard precautions are crucial to prevent nosocomial infections and other complications in hospitals and should be of utmost priority.

Chlorhexidine versus Povidone-Iodine

Currently, chlorhexidine and povidone-iodine are the two leading skin antiseptic solutions for neuraxial anesthesia. Chlorhexidine has been shown to be the most effective, superior skin antiseptic solution than other alternatives, such as povidone-iodine, due to advanced characteristics, mechanism of action, and ability to reduce infection rates. Chlorhexidine has advanced characteristics such as fast onset, increased duration, decreased incidence of skin reaction, superior efficacy, and adherence to the skin (AANA, 2015; AANA, 2017; Checketts, 2012; Davies, 2017; Edmiston et al., 2013; Fernandes, Fonseca, Rosa, Simões, &, Duarte 2011; Hui, Varadharajan, Yousefzadeh,

Davies, & Siddiqui, 2017; Mangram, Horan, Pearson, Silver, & Jarvis, 1999; New York School of Regional Anesthesia [NYSORA], 2017; Reynolds, 2008).

The mechanism of action for chlorhexidine is likely the reason why chlorhexidine has such advanced characteristics and is thus considered the most superior skin antiseptic solution. Kinirons et al. (2001) found that their participants who received alcoholic chlorhexidine antiseptic solution preoperatively were less likely to have colonization of microorganisms compared to those who received aqueous povidone-iodine ($p = 0.02$). Other researchers found that the participants who were treated with chlorhexidine in alcohol showed significantly less bacterial colonization (14.4%) and reduced post-operative surgical wound infection (2%) compared to the participants who were treated with povidone-iodine (31.2% and 3.2%, respectively) (Paocharoen, Mingmalairak, & Apisarnthanarak, 2009). Lastly, the AANA guidelines (2015) stated that chlorhexidine dressings for epidural catheters have shown to be effective in reducing skin entry-point colonization. Chlorhexidine's ability to reduce microorganism and bacterial colonization as well as reduce skin entry-point colonization allows for it to be an appropriate and successful solution for preventing infections.

In addition, chlorhexidine has shown through clinical studies to lower infection rates compared to povidone-iodine, which is likely due to advanced characteristics and mechanism of action (Darouiche et al., 2010; Edmiston et al., 2013; Noorani, Rabey, Walsh, & Davies, 2010). Another group of researchers conducted a meta-analysis that showed significant improvements in choosing chlorhexidine instead of povidone-iodine (Lee, Agarwal, Lee, Fishman, & Umscheid, 2010). First, chlorhexidine usage was associated with less SSIs compared to povidone-iodine (adjusted risk ratio, 0.64 [95%

confidence interval, [0.51–0.80]). Second, chlorhexidine usage resulted in fewer positive skin cultures when compared to povidone-iodine (adjusted risk ratio, 0.44 [95% confidence interval, 0.35–0.56]). Third, after performing a cost analysis, the researchers found that choosing chlorhexidine would result in \$16 to \$26 savings per surgical case and \$349,904 to \$568,594 savings per year at the particular hospital evaluated (Lee et al., 2010). Levin et al. (2011) found that their participants who received chlorhexidine and alcohol as their skin antiseptic prior to their gynecological laparotomies showed a significantly reduced rate of SSIs by 10% compared to their povidone-iodine counterparts ($p = 0.011$). Lastly, researchers who screened participants for Methicillin-resistant *Staphylococcus aureus* (MRSA) found that those who tested positive for MRSA and were treated with chlorhexidine showed positive results including reduced wound complications (Chen, Chivukula, Jacobs, Tetreault, & Lee, 2012). Therefore, chlorhexidine has been shown through numerous research studies to be effective in reducing SSI rates as a result of its mechanism of action and superior characteristics.

The Effects of Alcohol Combined with Chlorhexidine

While chlorhexidine alone has proven to be extremely effective and superior compared to other skin antiseptic solutions, alcohol advances the qualities of chlorhexidine, making the two in conjunction the most appropriate solution. Antiseptic solutions with alcohol are considerably more effective due to alcohol's characteristics such as immediate onset, increased efficacy, broad spectrum range, decreased risk for complications, and cost-effectiveness (Fernandes et al., 2011; Hemani & Lepor, 2009). The Infection Control Guide for certified registered nurse anesthetists (CRNAs) and the Infection Prevention and Control Guidelines for Anesthesia Care both recommend

choosing chlorhexidine with alcohol for skin preparation as a result of characteristics from both solutions in conjunction (AANA, 2013; AANA, 2015). In fact, Hui et al. (2009) discovered that the majority of anesthesiologists surveyed choose chlorhexidine with alcohol as their primary antiseptic solution.

The Safety of Chlorhexidine for Neuraxial Anesthesia

Ample controversy has ensued involving chlorhexidine and its safety during neuraxial anesthesia; however, various researchers have found chlorhexidine to not only be safe but also appropriate for neuraxial anesthesia (Campbell et al, 2014; Edmiston et al., 2013; Hampl, Steinfeldt, & Wulf, 2014). Various sources report that chlorhexidine is safe to use as long as appropriate precautions are followed prior to skin puncture to prevent chlorhexidine from reaching the cerebrospinal fluid and causing neurologic complications. These preventative measures include (a) isolating the alcoholic chlorhexidine from other drugs and equipment, (b) allowing the chlorhexidine to dry adequately before puncturing the skin, and (c) checking or changing one's gloves before continuing with the procedure (Campbell et al., 2014; CareFusion, 2014a). Avoiding cross-contamination can help prevent neuraxial complications (Davies, 2017). Alcoholic chlorhexidine is recommended to be applied twice for maximum efficacy and should be allowed adequate drying time, approximately 30 seconds after each application, prior to skin puncture (American Society of Anesthesiologists Task Force on Infectious Complications Associated with Neuraxial Techniques, 2011; Campbell et al., 2014; Davies, 2017).

Additionally, the concentration of chlorhexidine is important to note since concentrations greater than 0.5% used for neuraxial anesthesia have been said to cause

neurotoxicity (AANA, 2015). The concentration 0.5% chlorhexidine in alcohol is safely recommended for central nervous blocks (Campbell et al., 2014; CareFusion, 2014a). In addition, NYSORA (2017) recommends choosing 0.5% chlorhexidine in 70% alcohol for spinal anesthesia and lumbar puncture. While 0.5% chlorhexidine is the preferred concentration as it is the lowest and safest, evidence states that 2% concentration of chlorhexidine does not result in a higher rate of neurological complications (CareFusion, 2014a; Sviggum et al., 2012). However, 2% chlorhexidine has not been approved by the Food and Drug Administration (FDA) for a lumbar puncture (CareFusion, 2014b).

Alternative Solutions

Although chlorhexidine in alcohol, specifically 0.5% chlorhexidine, has clinically shown to be the most superior antiseptic solution for neuraxial anesthesia, another appropriate option is available. As previously mentioned, alcohol added to chlorhexidine accelerates and improves the qualities of chlorhexidine. Therefore, alcohol added to 10% povidone-iodine can also be effective for neuraxial anesthesia, although not the preferred solution of choice (AANA, 2013; AANA, 2015; AANA, 2017; Macias et al., 2013). This alternative would be an appropriate secondary choice for neuraxial anesthesia if 0.5% chlorhexidine in alcohol was unavailable.

Rationale

A review of the evidence revealed a lack of a clinical best practice policy regarding which skin antiseptic solution should be chosen by CRNAs prior to neuraxial anesthesia. The validity of standard precautions, the importance of preventing HAIs and SSIs, and the potential to decrease hospital reimbursement rates reiterated the need for a relevant policy. Based on the available knowledge presented above, chlorhexidine,

specifically paired with alcohol, was recognized as the most superior skin antiseptic solution (Checketts, 2012; Darouiche et al., 2010; Kinirons et al., 2001; Lee et al., 2010; Levin et al., 2011; Noorani et al., 2010; Paocharoen et al., 2009). Choosing the most appropriate solution has the potential to show positive results for the patient and hospital, such as lower HAIs, improve patient care, decrease reimbursement penalties, and standardize practice among CRNAs as a result of a best practice clinical policy (CMS, 2018; PolicyMedical, n.d.). Therefore, based on the available knowledge presented above, choosing 0.5% chlorhexidine in alcohol was recommended as the most efficient and appropriate for skin preparation prior to neuraxial anesthesia.

Specific Aims

The purpose of this DNP project was to analyze best practice for neuraxial anesthesia skin antiseptic solutions and develop a best practice policy recommendation based on these findings. The specific aim of investigating the two common neuraxial anesthesia skin antiseptic solutions, chlorhexidine, and povidone-iodine, was being conducted because neuraxial anesthesia is common, especially in pregnant women during labor, and that improper use of neuraxial anesthesia can result in serious complications, such as meningitis or sepsis. Therefore, the goal of this report was to reveal relevant evidence to develop a best practice policy recommendation for a clinical affiliate hospital in Mississippi. As a result, this new policy would assist with improving patient safety and quality of care, decreasing reimbursement penalties and standardizing practice among CRNAs by following protocol.

Summary

Health acquired infections are largely preventable when health professionals are more aware and knowledgeable of the situation and best practice (CDC, 2016). Proper skin antisepsis prior to neuraxial anesthesia can aid in reducing HAIs. However, a gap in the literature was noted due to lack of a best practice clinical policy regarding the most appropriate skin preparation solution prior to neuraxial anesthesia. Current evidence shows various themes related to choosing the most appropriate skin antiseptic solution prior to neuraxial anesthesia to help reduce HAIs. The themes presented by evidence include (a) the importance of standard precautions, (b) the superiority of chlorhexidine to povidone iodine, (c) the beneficial properties of alcohol in conjunction with chlorhexidine, (d) the safeness of chlorhexidine during neuraxial anesthesia, and (e) the acceptable substitution of alcoholic povidone iodine if alcoholic chlorhexidine is unavailable (Checketts, 2012; Darouiche et al., 2010; Kinirons et al., 2001; Lee et al., 2010; Levin et al., 2011; Noorani et al., 2010; Paocharoen et al., 2009).

Clinical policies are vital components of organizations to help promote standardization of practice and ensure patient safety (PolicyMedical, n.d.). Specifically, proposing a new clinical policy regarding proper skin antisepsis prior to neuraxial anesthesia would support reducing HAIs and hospital reimbursement penalties (CMS, 2018). Therefore, the purpose of this DNP project was to develop a best practice policy recommendation based on current available knowledge regarding neuraxial anesthesia skin preparation.

CHAPTER II – METHODS

Context

The current best practice investigation regarding neuraxial anesthesia skin antiseptic solutions was conducted at a clinical affiliate hospital in Mississippi. The 512-bed facility typically has a total census between 300 and 400 patients. On average, an estimated 10,400 total surgical cases are scheduled, including obstetric cases, per year. Many of these cases require neuraxial anesthesia. In addition, approximately 45 CRNAs are employed in this facility, all of whom administer neuraxial anesthesia if needed and make the choice of their preference for skin antiseptics.

Intervention, Study of the Intervention, and Measures

After completing clinical rotations at various surgical facilities in Mississippi, no distinct policy existed at a clinical affiliate hospital for which skin antiseptic solution, as well as appropriate application methods to use, prior to neuraxial anesthesia. In addition, a gap in the literature was noted regarding which solution is appropriate and recommended for skin preparation prior to neuraxial anesthesia specifically. Therefore, available knowledge was examined and synthesized to determine the best practice for skin preparation prior to neuraxial anesthesia. Search terms used to identify relevant information included “chlorhexidine,” “povidone-iodine,” “skin preparation,” “neuraxial anesthesia,” “epidural,” “guidelines,” and “application.” Literature databases used were Google Scholar, Academic Search Premier, CINAHL, Health Source: Nursing/Academic Edition, and MEDLINE. Applying these search terms in these databases using Boolean operators resulted in 1,037 articles. Inclusion criteria for narrowing the use of these articles were (a) publication during or following the year 1999, (b) comparisons between

chlorhexidine and povidone-iodine, (c) solutions used for neuraxial anesthesia, (d) appropriate concentrations for solutions, (e) guidelines for the appropriate solution, and (f) proper application methods for the solutions. Exclusion criteria for the articles were those which negated the inclusion criteria.

Commonalities, as well as differences, were found among the reviewed evidence, but the most common theme studies showed was that chlorhexidine is the superior skin antiseptic solution for skin preparation prior to neuraxial anesthesia if chosen in the correct concentration and if applied properly (Checketts, 2012; Darouiche et al., 2010; Kinirons et al., 2001; Lee et al., 2010; Levin et al., 2011; Noorani et al., 2010; Paocharoen et al., 2009). Studies showed that failure to abide by recommendations regarding concentration and application can cause serious complications such as meningitis and sepsis (Davies, 2017).

With the synthesized available knowledge, a report of findings, as shown in Appendix B, was created and presented to a panel of experts along with a best practice policy recommendation, shown in Appendix C. Meetings were requested for involvement among a panel of experts from a CRNA, an anesthesiologist, a health policy expert, and an infection preventionist. The CRNA and anesthesiologist were asked to participate on the panel due to their advanced knowledge and daily involvement in performing neuraxial anesthesia and choosing appropriate skin antiseptic solutions. The health policy expert was asked to participate due to her advanced knowledge of policy development and logistical information. Lastly, the infection preventionist was requested to join the panel due to her knowledge of the current hospital policies and cost associations. Each of

these members are experts in their field and would be able to provide adequate details and feedback on the current topic.

An evaluation tool, shown in Appendix D, was developed and used to gather feedback on the presented data, including the usefulness of information, quality of work, and the potential impact on the facility. This feedback was used to alter the policy recommendation and develop an executive summary (Appendix E). Next, the executive summary and policy recommendation were presented to the chief anesthesiologist for the anesthesia department to share the best evidence policy recommendation regarding neuraxial anesthesia skin preparation with the facility.

Consent to participate in research was gathered by each member of the panel of experts following an oral presentation of research procedures. An evaluation tool was administered to the panel of experts in-person along with the policy recommendation for feedback. The evaluation tool included questions which gathered expert opinion and feedback on the usefulness and quality of information, potential impact, and suggestions for additions to aide in revising the policy recommendation (Friedman, 2003; Ray, 2017). The participants were requested not to include any identifying information on their surveys; therefore, results were kept confidential. Data was kept on a personal computer which required passcode entry, and files were kept in a locked drawer. Data was retained until project completion, then all files were permanently deleted from the storage device and written documentation was shredded.

Since no clinical policy existed at a clinical affiliate hospital in Mississippi regarding which skin antiseptic solution is best to use prior to neuraxial anesthesia and since a gap in the literature was noted, two best practice policy recommendation options,

shown in Appendix C, were presented to the chief anesthesiologist. The protocol for application of the chosen solution, based on the evidence, was two applications of the solution for 30 seconds each in back and forth strokes of the solution with at least 30 seconds of dwell time following both applications (CareFusion, 2014a; Horlocker, 2010). Option A is that CRNAs will use 0.5% chlorhexidine with 70% alcohol for neuraxial anesthesia following the aforementioned protocol. Option B is that 10% povidone-iodine in alcohol will be used for neuraxial anesthesia due to strong supporting evidence stating that povidone-iodine is an appropriate alternative solution if chlorhexidine is unavailable.

Steps

1. The project was proposed to this DNP project's team.
2. After approval from the DNP project team, application for approval was submitted to the IRB through The University of Southern Mississippi (USM). The IRB approval letter is shown in Appendix F.
3. Next, an anesthesiologist, CRNA, health policy expert, and an infection preventionist were requested to serve as a panel of experts. Each member of the panel was orally presented research procedures and provided consent to participate in research.
4. Then, a report of findings (Appendix B) and a clinical policy recommendation (Appendix C) were developed based on available knowledge and presented to the panel of experts. The panel of experts was given the opportunity to provide feedback via an evaluation tool (Appendix D), which was used to alter the policy recommendation.

5. An executive summary (Appendix E) was developed and presented to the chief anesthesiologist along with a copy of the updated policy recommendation.
6. Lastly, the DNP project was evaluated by the DNP project team based on the provided rubric.
7. Dissemination of information was at the USM graduate scholarship day in September of 2018.

Analysis

Qualitative data was collected via the evaluation tool (Appendix D), and feedback was gathered in face-to-face policy presentations. This data was entered into a table, shown in Table 1, to analyze common responses or concerns. This information was utilized to revise the policy recommendation to present along with the executive summary (Appendix E). No statistical analysis was done; however, the information was analyzed qualitatively.

Ethical Considerations

An ethical consideration to the policy was the possibility of providing two levels of care, should the anesthesia provider choose to use povidone-iodine (Option B) instead of 0.5% chlorhexidine in alcohol (Option A) for neuraxial anesthesia. Although Option A is the best solution to use based on available knowledge, Option B is in place for instances of allergy or unavailability of Option A. In addition, 2% chlorhexidine has not been approved by the FDA for lumbar puncture; therefore, choosing this concentration for neuraxial anesthesia would be an ethical consideration.

Summary

A clinical affiliate hospital lacked a best practice clinical policy regarding which skin antiseptic solution should be chosen for skin preparation prior to neuraxial anesthesia. Therefore, available knowledge was examined and synthesized to determine the best practice for skin preparation prior to neuraxial anesthesia. The available knowledge showed that 0.5% chlorhexidine in alcohol is the superior skin antiseptic solution and that failure to abide by such recommendations can result in serious neuraxial complications.

A report of findings (Appendix B) and a best practice policy recommendation (Appendix C) were created based on available knowledge and presented to a panel of experts. The panel of experts included a CRNA, an anesthesiologist, a health policy expert, and an infection preventionist, as they were deemed relevant stakeholders due to their advanced knowledge and daily involvement with the current topic. The panel of experts were individually provided with a copy of the report of findings and policy recommendation along with an evaluation tool (Appendix D) to gather feedback on the presented data, including the usefulness of information, quality of work, and the potential impact on the facility. This feedback was used to alter the policy recommendation and develop an executive summary (Appendix E), which was presented to the chief anesthesiologist to share with the anesthesia department.

CHAPTER III - RESULTS

A panel of experts was given a report of findings (Appendix B) and a best practice policy recommendation (Appendix C) based on the available knowledge involving the optimal skin antiseptic solution to choose prior to neuraxial anesthesia. Data was gathered via an evaluation tool (Appendix D), which assessed members of a panel of experts' input on whether the information presented through the report of findings was found useful, was of high quality, and would have an impact on the facility. The members of the panel were also given the opportunity to identify whether or not they believed the policy should be adopted at a clinical affiliate hospital in Mississippi along with the ability to provide feedback in-person or on the evaluation tool. The responses to the prompts and questions on the evaluation tool are shown in Table 1.

The members of the panel of experts included a CRNA, an anesthesiologist, a health policy expert, and an infection preventionist, as they were deemed relevant stakeholders due to their advanced knowledge and daily involvement with the current topic. All four members of the panel strongly agreed that the information presented was useful and of high quality. Three of the members strongly agreed that the suggestions provided would have a potential impact on the facility while the other member agreed with this statement. All four members reported that they believe the best practice policy should be adopted. The main conclusion of feedback among the panel of experts was the concern that the recommended concentration is not readily available commercially. For instance, one member stated, "Availability of 0.5% chlorhexidine would be a barrier since we currently don't have this concentration available." Another member stated, "If

the manufacturer provided 0.5% chlorhexidine.” The panel of experts agreed with the policy recommendation as presented and offered no feedback for revision.

Table 1

Panel of Experts' Beliefs on the Proposed Best Practice Policy

Evaluation Tool Questions and Prompts	Panelist #1	Panelist #2	Panelist #3	Panelist #4
The information presented was useful.	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
The information presented was of high quality.	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
The suggestions provided will have a potential impact on the facility.	Strongly Agree	Agree	Strongly Agree	Strongly Agree
Do you believe this new best practice policy proposed should be adopted?	Yes	Yes	Yes	Yes
Other Feedback	“Strong recommendation. Something the IPs have been following for the past year. Very interested to see how this recommendation turns out!”	“Availability of 0.5% chlorhexidine would be a barrier since we currently don't have this concentration available.”	“If the manufacturer provided 0.5% chlorhexidine.”	

Summary

Qualitative data found via the evaluation tool showed that 100% of the panel of experts strongly agreed that the information presented was useful and of high quality, while 75% strongly agreed that the suggestions provided would have a potential impact on the facility. Each member of the panel of experts believed the best practice policy should be adopted. The general conclusion of feedback was the concern that the recommended concentration is not commercially available. The panel of experts provided no further feedback for revision of the policy.

CHAPTER IV – DISCUSSION

Summary

It is crucial for healthcare professionals to be updated with current research and use appropriate, evidence-based practice in order to improve patients' outcomes, reduce HAIs, and reduce hospital expenses (Kirkland et al., 1999; Lee et al., 2010). Increasing health professionals' awareness of HAIs can significantly decrease the rate of HAIs (CDC, 2016). In addition to aseptic techniques and standard precautions, another way to help reduce HAIs caused by SSIs is choosing the appropriate skin antiseptic solution for neuraxial anesthesia. Proper skin antisepsis prior to neuraxial anesthesia is vital due to the large number of neuraxial anesthesia administered daily, including the majority of laboring women who receive epidurals (Osterman & Martin, 2011). Additionally, improper neuraxial anesthesia administration can cause serious infectious complications (Nagelhout & Plaus, 2014).

The absence of evidence-based recommendations and a policy at a clinical affiliate hospital in Mississippi regarding the most appropriate skin antiseptic solution prior to neuraxial anesthesia poses a risk on both the patient and hospital due to a lack of consistency and accountability of patient care regarding proper skin antisepsis. Chlorhexidine, particularly with alcohol, has clinically shown to be superior due to its advanced qualities including fast onset, long duration, and strong penetration compared to other antiseptic solutions; however, improper use of chlorhexidine can cause neurotoxicity. Chlorhexidine has been shown through numerous research studies to be effective in reducing SSI rates and hospital costs as a result of its mechanism of action and superior characteristics.

Synthesis of the currently available knowledge was that 0.5% chlorhexidine concentration with 70% alcohol is the most effective, appropriate skin antiseptic solution to use prior to neuraxial anesthesia if allowed to dry thoroughly after application and if cross-contamination is avoided. If 0.5% chlorhexidine is unavailable, evidence shows that 10% povidone-iodine in alcohol is an acceptable alternative solution. Increasing anesthesia providers' awareness of the current research can increase their compliance with the new recommendation (Ioscovich et al., 2014). Therefore, a new policy based on this current evidence-based practice was proposed to the chief anesthesiologist to review current evidence and share the policy recommendation with the facility.

Interpretation

A synthesis of available knowledge involving skin antiseptic solutions to use prior to neuraxial anesthesia was individually presented in-person to each member of the chosen panel of experts, which included a CRNA, an anesthesiologist, a health policy expert, and an infection preventionist. This investigation conformed to multiple of the DNP Essentials, shown in Appendix G, which outline the fundamentals involved in obtaining a DNP degree (American Association of Colleges of Nursing, 2006). Following this presentation, the panel of experts was given the opportunity to provide feedback via a provided evaluation tool (Appendix D), which was used to edit the executive summary. This feedback was personally presented to the chief anesthesiologist via an executive summary (Appendix E), which included the policy recommendation.

Limitations

Limitations of the current investigation included a small sample size of the number on the reviewing panel and busy workstyle of the panel of experts. The report of

findings (Appendix B), policy recommendation (Appendix C), and the short, clear evaluation tool (Appendix D) were personally presented to each member of the panel of experts in an organized, succinct manner to minimize the limitation of the members' business. Members of the panel of experts were also given the opportunity to confidentially mail in their response.

Conclusion

The final evidence-based policy recommendation has the potential to (a) establish standardization of practice, (b) best ensure patient safety, and (c) help reduce HAIs caused by improper skin antisepsis prior to neuraxial anesthesia. Based on the feedback from the panel of experts, if the manufacturer produced a convenient, individual applicator of 0.5% chlorhexidine, as recommended by the evidence, the facility would be more prone to using it; however, the manufacturer does not currently produce 0.5% chlorhexidine in individual applicators as it is not believed to be economically substantial (CareFusion, 2014). Therefore, future research should be conducted on the subject to aid in increasing awareness of the importance of proper skin antisepsis prior to neuraxial anesthesia to help decrease HAIs as well as to prompt the manufacturer to produce the lowest, safest concentration of chlorhexidine in convenient, individual applicators.

APPENDIX A – Literature Matrix

Author/Year/ Title	Level/ Grade	Design	Sample/Data Collection	Findings	Limitations	Recommendations
Campbell, J. P., et al. (2014). Safety guideline: Skin antiseptics for central neuraxial blockade	Level 1; Grade A	Clinical practice guidelines based on RCT data	RCT data – see reference list within article	Standard precautions should be used to promote optimal aseptic techniques. Chlorhexidine in alcohol should be used prior to performing the central nerve block. Certain measures should be taken to prevent chlorhexidine from reaching the CSF, including keeping it away from other drugs and equipment used for the CNB, allowing the chlorhexidine to dry before puncturing the skin, and checking one's gloves before continuing with the procedure.	N/A	Standard precautions should be used to promote optimal aseptic techniques. Chlorhexidine in alcohol should be used prior to performing the central nerve block. Certain measures should be taken to prevent chlorhexidine from reaching the CSF, including keeping it away from other drugs and equipment used for the CNB, allowing the chlorhexidine to dry before puncturing the skin, and checking one's gloves before continuing with the procedure.
Checketts, M. R. (2012). Wash and go – but with what? Skin antiseptic solutions for central neuraxial block	Level 4; Grade D	Editorial	N/A	Chlorhexidine is a more effective skin antiseptic than povidone-iodine as a result of its faster onset, increased duration, decreased incidence of reactions to the skin, and the strength of penetrating and adhering to the skin.	N/A	Choose chlorhexidine over povidone iodine as a skin antiseptic solution if possible.

Chen, A. F., Chivukula, S., Jacobs, L. J., Tetreault, M. W., & Lee, J. Y. (2012). What is the prevalence of MRSA colonization in elective spine cases?	Level V, Grade D	Retrospective review	Data was collected by researchers retrospectively reviewing a previously conducted study from 2010 in which patients underwent elective spine surgery.	Among the 503 patients screened for MRSA, 14 (2.8%) tested positive for MRSA and 34 (3.1%) showed wound complications. Among the patients who were positive for MRSA or wound complications, those who were treated with chlorhexidine showed positive results including reduced wound complications. This is likely a result of early screening and treatment.	The researchers were unable to verify that the patients truly used the chlorhexidine appropriately.	Chlorhexidine is appropriate to use following spinal surgery to help reduce the rate of skin infections.
Darouiche, R. O. (2010). Chlorhexidine-alcohol versus povidone-iodine for surgical-site antiseptics	Level 2; Grade B	Prospective, randomized clinical trial	849 participants Participants were placed in one of two groups. One group received chlorhexidine preoperatively and the other received povidone iodine preoperatively. The researchers monitored participants' surgical site for any occurrence of infection within 30 days after surgery	Participants who received the chlorhexidine preoperatively had a significantly lower rate of infection at the surgical site compared to the participants who received povidone iodine preoperatively. In addition, participants who received chlorhexidine had significantly more protection against superficial incisional infections and deep incisional infections; however, these	A possible limitation to this study is that hospital staff were allowed to continue using their current medical practices, which could have altered results, to remain ethical.	Based on this study, it is recommended to choose chlorhexidine instead of povidone iodine for preoperative cleansing to prevent surgical-site infection after surgery.

				participants did not have significantly more protection against organ-space infections.		
Davies, J. (2017). Neurologic complications of neuraxial analgesia/ anesthesia: infections.	Level IV, Grade C	Expert report	N/A	Standard precautions are necessary for reducing the risk of neuraxial infections. Chlorhexidine in alcohol has shown to be more effective than povidone iodine by rapidly destroying bacteria, penetrating and cleaning hair follicles, limiting skin irritation, and working for multiple hours. Two applications of chlorhexidine are more effective. Anesthesia providers should carefully avoid cross contamination.	This was a report of findings, not a clinical study.	Chlorhexidine in alcohol should be chosen over other solutions as a result of its effectiveness and efficiency. Chlorhexidine should be applied twice for maximum efficacy. Providers should carefully avoid cross contamination of chlorhexidine.
Edmiston, C. E. et al. (2013). Reducing the risk of surgical site infections: Does chlorhexidine gluconate provide a risk reduction benefit?	Level III, Grade B	Review	64 articles	Chlorhexidine rarely contributes to skin irritation. Washing with 2% or 4% chlorhexidine prior to admission has shown to be a safe way to reduce risk of surgical site infection. Chlorhexidine has shown to be safe and	Review article, not original research	Chlorhexidine is not only appropriate for cleansing prior to admission for surgery to reduce SSIs, but it is also safe and effective for neuraxial anesthesia.

				effective for skin preparation prior to neuraxial anesthesia without causing neurological risk.		
HAMPL, K., STEINFELDT, T., & WULF, H. (2014). Spinal anesthesia revisited: toxicity of new and old drugs and compounds.	Level III, Grade B	Review	43 articles	While chlorhexidine can cause neurological complications, if used appropriately, it is the most effective skin antiseptic solution.	Review article, not original research	Chlorhexidine should be handled with care to prevent neurological complications.
Hebl, J. R. (2006). The importance and implications of aseptic techniques during regional anesthesia	Grade I; Level A	Systematic Review	N/A	Among the articles analyzed, there was inconclusive data regarding the frequency and likelihood of reducing clinical infections. Also, more research should be conducted to determine definitive recommendations.	N/A	To help prevent or reduce infections: Thoroughly and appropriately wash hands Remove all jewelry In conjunction with hand washing, use sterile surgical gloves Wear surgical masks Use alcohol-based chlorhexidine antiseptic solutions to help reduce the likelihood of bacterial colonization
Hemani, M. L. & Lepor, H. (2009). Skin preparation for the prevention of surgical site infection: Which agent is best?	Level III, Grade B	Review	19 articles	Antiseptic solutions with alcohol are much more effective due to characteristics of alcohol such as fast acting, broad spectrum, and cost effective.	Review article, not original research	Choose antiseptic solutions with alcohol when available for increased potency.
Horlocker, T. T. (2010). Practice advisory for	Level IV, Grade C	Practice Advisory	N/A	Chlorhexidine, specifically with alcohol, should be chosen for	Study design	Allow chlorhexidine adequate drying time prior to skin puncture.

the prevention, diagnosis, and management of infectious complications associated with neuraxial techniques: Preliminary report by ASA task force on infectious complications associated with neuraxial techniques.				skin preparation when available. In addition, chlorhexidine should be allowed adequate drying time prior to skin puncture to prevent cross contamination.		
Hui, C., Varadharajan, R., Yousefzadeh, A., Davies, S., & Siddiqui, N. T. (2017). Aseptic techniques for labour epidurals: A survey and review of neuraxial anesthesia practice	Level 3, Grade C	Experimental	A survey was administered to 1,047 anesthesiologists currently practicing in Canada, of which 439 (42%) responded. Among those who participated, 40% were employed at a non-teaching facility, while the other 60% were employed at teaching hospitals. Data collected from the survey including their practicing experience, hand cleaning techniques, antiseptic solutions, and number of	The researchers discovered through their survey that the majority of participants (68%) report that they choose chlorhexidine with alcohol as their primary antiseptic solution compared to povidone iodine (32%). Also, physicians employed at teaching hospitals were more likely to report choosing chlorhexidine with alcohol as opposed to povidone iodine. This is likely a result of teaching hospitals being more updated with the current research and evidence based knowledge that	One limitation of this study was the self-administered survey, which could have led to biased results.	As a result of this study, it would be recommended to use chlorhexidine as the preferred antiseptic solution of choice since it has been shown through research to be superior to others. This was shown by the anesthesiologists' choices who were employed at teaching hospitals.

			support persons in the room.	chlorhexidine is the superior antiseptic solution choice. Chlorhexidine has shown to be the most effective skin antiseptic solution as a result of its lengthier efficacy than others and its higher potency effect.		
Ioscovich, A., Davidson, E. M., Orbach-Zinger, S., Rudich, Z., Ivry, S., Rosen, L. J., ... Ginosar, Y. (2014). Performance of aseptic technique during neuraxial analgesia for labor before and after the publication of international guidelines on aseptic technique.	Level I, Grade B	RCT	135 anesthesiologists completed the survey prior to guideline publication in 2006, and 127 anesthesiologists completed the survey following guideline publication in 2009.	Following publication of the American Society of Regional Anesthesia (ASRA) guidelines in 2006, anesthesiologists showed improvements in the use of aseptic techniques, such as handwashing ($p = 0.0004$), wearing a mask ($p < 0.0001$), wearing a hat/cap ($p = 0.0011$), and wearing a sterile gown ($p < 0.0001$). Although insignificant, survey results did show an improvement in the removal of jewelry ($p = 0.26$).	Self-reported survey	These findings suggest that increasing anesthesia providers' awareness of appropriate aseptic techniques would also increase their following of these aseptic techniques.
Kinirons, B. (2001). Chlorhexidine	Level I,	Randomized	96 patients younger than	Patients in the group who received the	There was an uncontrollable lack of	Alcoholic chlorhexidine is the preferred antiseptic

versus povidone iodine in preventing colonization of continuous epidural catheters in children	Grade A	controlled trial	15 years of age. The children were randomly placed into one of two groups to receive either an alcoholic chlorhexidine solution or an aqueous povidone iodine solution before epidural catheter insertion. The insertion site and catheter tips were both cultured to determine the yield of colony-forming units.	alcoholic chlorhexidine antiseptic solution preoperatively were less likely to have colonization of microorganisms compared to those who received aqueous povidone iodine, thus concluding that alcoholic chlorhexidine was the more effective and appropriate antiseptics before epidural catheter insertion.	blindness as a result of colored solutions; however, this would have only affected the physicians, not the microbiologists or whomever removed the catheter. Another limitation was the short duration of epidural use. In addition, the increased amount of antibiotic used could have resulted in skewed data.	solution for epidural catheters because it showed to be more effective and appropriate compared to aqueous povidone iodine.
Kirkland, K., Briggs, J., Trivette, S., Wilkinson, W., & Sexton, D. (1999). The impact of surgical-site infections in the 1990s: attributable mortality, excess length of hospitalization, and extra costs.	Level I, Grade B	Experimental	510 total patients or 255 pairs. Patients were matched based on baseline characteristics and either infected or uninfected.	Infected patients had longer hospitalizations, higher direct costs, higher death rates, higher ICU admission rates, and higher risk for hospital readmission.	Selection bias	Aseptic techniques are vital to help reduce the risk of infection since infected patients contribute to increased hospitalizations, ICU admissions, hospital readmission, and direct costs.
Lee, I., Agarwal, R., Lee, B., Fishman, N., & Umscheid, C. (2010). Systematic	Level I, Grade A	Meta-analysis	9 RCTs totaling 3,614 patients	This meta-analysis showed significant improvements in choosing chlorhexidine instead of	Article selection, such as excluding studies not published in English	Not only is chlorhexidine the safest skin antiseptic solution due to reduced SSIs, but it also results in cost savings.

review and cost analysis comparing use of chlorhexidine with use of iodine for preoperative skin antisepsis to prevent surgical site infection.				povidone iodine. First, chlorhexidine usage was associated with less SSIs compared to povidone iodine (adjusted risk ratio, 0.64 [95% confidence interval, [0.51–0.80]). Second, chlorhexidine usage resulted in fewer positive skin cultures when compared to povidone iodine (adjusted risk ratio, 0.44 [95% confidence interval, 0.35–0.56]). Third, after performing a cost analysis, the researchers found that choosing chlorhexidine would result in \$16 to \$26 savings per surgical case and \$349,904 to \$568,594 savings per year at the particular hospital evaluated.		
Levin, I., Amer-Alshiek, J., Avni, A., Lessing, J. B., Satel, A., & Almog, B. (2011). Chlorhexidine and alcohol versus povidone-	Level I, Grade B	Retrospective RCT	256 total participants were patients undergoing gynecological laparotomies were divided into two groups. One group (n=145) was treated with povidone	The group who received chlorhexidine and alcohol as their skin antisepsis prior to their gynecological laparotomies showed a significantly reduced rate of	N/A	Chlorhexidine with alcohol should be chosen instead of povidone iodine with alcohol for skin antisepsis for patients undergoing gynecological laparotomies to reduce the risk of SSIs.

iodine for antiseptics in gynecological surgery.			iodine followed by povidone iodine with alcohol. The other group (n=111) was treated with chlorhexidine followed by alcohol. Groups were evenly divided based on medical history, baseline characteristics, and procedure characteristics.	SSIs by 10% compared to their counterparts (p = 0.011).		
Macias, J. H. (2013). Chlorhexidine is a better antiseptic than povidone iodine and sodium hypochlorite because of its substantive effect	Level 1 grade A	Experimental	30 participants volunteered for the first step, in which four skin areas were tested for bacteria, two of which were treated with sodium hypochlorite or alcoholic chlorhexidine. The second group tested for povidone iodine.	Chlorhexidine and hypochlorite showed no significant differences; however, they both were significantly different than the two control solutions, rubbing alcohol and basal control. Chlorhexidine was the only solution to report a substantive effect.	This study did not measure for differences below 100 CFUs, which would have produced more specific results. The power was small to detect skin reactions. Also, chlorhexidine was tested in conjunction with alcohol, which makes it difficult to determine which component was more effective in preventing infection.	While chlorhexidine is the preferred antiseptic solution, povidone iodine and sodium hypochlorite are effective as well.

Noorani, A., Walsh, S. R., & Davies, R. J. (2010). Systematic review and meta-analysis of preoperative antisepsis with chlorhexidine versus povidone-iodine in clean-contaminated surgery	Level I/ Grade A	Systematic Review/ Meta-Analysis	Six studies were included for review, in which there were 5,031 patients.	Chlorhexidine showed to significantly reduce postoperative SSIs when compared to povidone iodine (p = 0.019).		
Osterman, M. J. K., & Martin, J. A. (2011). Epidural and spinal anesthesia during labor: 27-state reporting area, 2008.	Level IV, Grade C	Statistics Report	1,829,302 singleton vaginal deliveries including all races from 27 states	61% of mothers from all deliveries received epidural anesthesia.	Data following birth was excluded. Mothers who had C-sections were excluded. Any other form of pain relief was not mentioned.	Epidural/spinal anesthesia should be administered appropriately, including using the proper skin antiseptic solution, since the majority of women in labor receive epidurals.
Paocharoen, V., Mingmalairak, C., Apisarnthanarak, A. (2009). Comparison of surgical wound infection after preoperative skin preparation with 4% chlorhexidine and povidone iodine: a prospective randomized trial.	Level I, Grade A	RCT	Five hundred participants undergoing general surgery were divided into two groups. Group one (n=250) was treated with povidone iodine prior to surgery for skin antisepsis, while group two (n=250) was treated with 4% chlorhexidine and 70%	Group 2, the chlorhexidine in alcohol group, showed significantly less bacterial colonization (14.4%) compared to group 1, the povidone iodine group (31.2%). In addition, group 2 showed reduced post-operative surgical wound infection (2%) compared to group 1 (3.2%).	The researchers did not include skin reaction information from patients who had chlorhexidine.	Chlorhexidine in alcohol should be chosen for skin preparation for general surgery cases to reduce bacterial colonization and post-operative surgical wound infection.

			isopropyl alcohol.			
Reynolds, F. (2008). Neurological infections after neuraxial anesthesia	Level 5, Grade D	Systematic review		Multiple studies have shown that chlorhexidine is the most effective skin antiseptic solution as a result of its quick onset, acceleration by alcohol, extended duration, and efficacy. Chlorhexidine has also been shown to reduce the risk of bacterial infections, particularly <i>Staphylococcus aureus</i> .		
Sviggum, H. P. et al. (2012). Neurologic complications after chlorhexidine antiseptics for spinal anesthesia	Level 3; Grade C	Retrospective chart review	57 cases of patients who met criteria that were 18 years or older who received spinal anesthesia from 2006 to 2010. Data was collected through chart reviews.	Five neurologic complications occurred among the cases reviewed, all of which resolved completely within 30 days. These results conclude that chlorhexidine can be used as a preoperative skin antiseptics without increasing the risk of neurologic complications.	Retrospective design could have resulted in missing information as well as lack of indicating a true cause and effect relationship.	Although chlorhexidine has a history of causing neurological complications in patients who undergo spinal anesthesia, this article suggests that this is not a legitimate concern and that chlorhexidine can be used without increasing the risk of neurologic complications.

APPENDIX B - Report of Findings

Report of Findings

Background

Health acquired infections (HAIs) are largely preventable when health professionals are more aware and knowledgeable of the situation and best practice. Such infections affect numerous patients annually, can result in surgical site infections, and can be severe enough to result in death (Centers for Disease Control and Prevention [CDC], 2016; Safe Care Campaign, 2017). Therefore, increasing health professionals' awareness and knowledge of appropriate ways to prevent or reduce the risk of HAIs can make an effort in reducing these significant infections.

Standard precautions, such as proper handwashing and wearing appropriate surgical gloves and masks, can pose as barriers to contamination and help reduce the risk of HAIs (American Association of Nurse Anesthetists [AANA], 2015; Campbell et al., 2014; Davies, 2017). Additionally, choosing the most appropriate antiseptic solution to use to disinfect the skin prior to neuraxial anesthesia can help reduce HAIs. Evidence shows that chlorhexidine is the superior antiseptic solution for overall skin antisepsis; however, compliance with this recommendation in regards to neuraxial anesthesia has been inconsistent. Therefore, the purpose of this Doctor of Nursing Practice (DNP) project is to analyze best practice for neuraxial anesthesia skin antiseptic solutions and develop a best practice policy based on these findings.

Available Knowledge

Current evidence shows various themes related to choosing the most appropriate skin antiseptic solution prior to neuraxial anesthesia to help reduce HAIs. The first theme is that standard precautions, including disinfecting the skin prior to neuraxial anesthesia, can help to prevent or reduce infections as well as reducing further complications for the patient, decreasing hospitalization, and decreasing hospital cost (Davies, 2017; Kirkland, Briggs, Trivette, Wilkinson, & Sexton, 1999). The second theme is that chlorhexidine has shown to be the most superior skin antiseptic solution as a result of its advanced characteristics, such as fast onset and increased duration, and its ability to reduce infection rates, microorganism and bacterial colonization, and skin entry-point colonization (AANA, 2015; Darouiche et al., 2010; Davies, 2017; Edmiston et al., 2013; Fernandes, Fonseca, Rosa, Simões, & Duarte, 2011; & Noorani, Rabey, Walsh, & Davies, 2010). The third theme found in the evidence is that alcohol advances the qualities of chlorhexidine, making the two in conjunction the most appropriate solution (AANA, 2015; Fernandes et al., 2011). The fourth theme is that chlorhexidine is safe to use for neuraxial anesthesia if appropriate precautions are followed prior to skin puncture (Campbell et al, 2014; Edmiston et al., 2013; Hampl, Steinfeldt, & Wulf, 2014). Preventative measures include (a) isolating the alcoholic chlorhexidine from other drugs and equipment, (b) allowing the chlorhexidine to dry adequately before puncturing the skin, and (c) checking or changing one's gloves before continuing with the procedure (Campbell et al., 2014; CareFusion, 2014). The fifth and final theme is that alcoholic

povidone-iodine is an appropriate alternative solution if 0.5% chlorhexidine in alcohol is unavailable (AANA, 2015; Macias et al., 2013).

Suggestions for Best Practice

As a result of the available knowledge, including (a) the importance of standard precautions to reduce HAIs, (b) the superiority of chlorhexidine mixed with alcohol, and (c) the safety of chlorhexidine during neuraxial anesthesia, 0.5% chlorhexidine in 70% alcohol is recommended for skin preparation prior to neuraxial anesthesia. If unavailable, alcoholic povidone-iodine is an appropriate alternative.

References

American Association of Nurse Anesthetists (AANA). (2015). Infection prevention and control guidelines for anesthesia care. Retrieved 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_2](https://www.aana.com/docs/default-source/practice-aana-com-web-documents-(all)/infection-prevention-and-control-guidelines-for-anesthesia-care.pdf?sfvrsn=850049b1_2)

Campbell, J. P., Plaat, F., Checketts, M. R., Bogod, D., Tighe, S., Moriarty, A., & Koerner, R. (2014). Safety guideline: Skin antisepsis for central neuraxial blockade. *Anaesthesia*, 69(11), 1279-1286. doi:10.1111/anae.12844

CareFusion. (2014). Retrieved from: [IP_Safety-Guideline-skin-antisepsis-for-central-neuraxial-blockade-response_TB_EN.pdf](#)

Centers for Disease Control and Prevention (CDC). (2016). Healthcare-Associated Infections: HAI Data and Statistics. Retrieved from <https://www.cdc.gov/hai/surveillance/>

- Darouiche, R. O., Wall Jr, M. J., Itani, K. M., Otterson, M. F., Webb, A. L., Carrick, M. M., ... & AlSharif, A. (2010). Chlorhexidine–alcohol versus povidone–iodine for surgical-site antisepsis. *New England Journal of Medicine*, 362(1), 18-26. doi: 10.1056/NEJMoa0810988
- Davies, J. (2017). Neurologic complications of neuraxial analgesia/anesthesia: infections. Retrieved from <http://www.clinicalpainadvisor.com/anesthesiology/neurologic-complications-of-neuraxial-analgesia-anesthesia-infections/article/582819/>
- Edmiston, C. E., Bruden, B., Rucinski, M. C., Henen, C., Graham, M. B., & Lewis, B. L. (2013). Reducing the risk of surgical site infections: Does chlorhexidine gluconate provide a risk reduction benefit? *American Journal of Infection Control*, 41(5), 49-55. doi: 10.1016/j.ajic.2012.10.030
- Fernandes, C. R., Fonseca, N. M., Rosa, D. M, Simões, C. M., & Duarte, N. M. (2011). Brazilian Society of Anesthesiology recommendations for safety in regional anesthesia. *Revista Brasileira de Anestesiologia*, 61(5), 668-694. doi: 10.1590/S0034-70942011000500016
- Hampl, K. Steinfeldt, T., & Wulf, H. (2014). Spinal anesthesia revisited: toxicity of new and old drugs and compounds. *Current Opinion in Anesthesiology*, 27(5), 549-555. doi: 10.1097/ACO.0000000000000108
- Kirkland, K., Briggs, J., Trivette, S., Wilkinson, W., & Sexton, D. (1999). The impact of surgical-site infections in the 1990s: attributable mortality, excess length of hospitalization, and extra costs. *Infection Control & Hospital Epidemiology*, 20(11), 725-730. doi:10.1086/501572

- Macias, J. H., Arreguin, V., Munoz, J. M., Alvarez, J. A., Mosqueda, J. L., & Macias, A. E. (2013). Chlorhexidine is a better antiseptic than povidone iodine and sodium hypochlorite because of its substantive effect. *American Journal of Infection Control*, 41(7), 634-637. doi: 10.1016/j.ajic.2012.10.002
- Noorani, A., Rabey, N., Walsh, S. R., & Davies, R. J. (2010). Systematic review and meta-analysis of preoperative antisepsis with chlorhexidine versus povidone-iodine in clean-contaminated surgery. *British Journal of Surgery*, 97, 1614–1620. doi:10.1002/bjs.7214
- Safe Care Campaign. (2017). Preventing Surgical Site Infections: Definition and Statistics. Retrieved from <http://www.safecarecampaign.org/ssi.html>

APPENDIX C - Policy Recommendation

Policy Area: Anesthesia Department	Subject: Neuraxial Anesthesia
Title of Policy: Skin Preparation for Neuraxial Anesthesia	Number:
Effective Date:	Supersedes:
Approved Date:	Approved by:
Revision Date:	

1. **Rationale or background to policy:** to help reduce rates of hospital acquired infections and surgical site infections. Standard precautions, such as proper handwashing, hygiene, and wearing appropriate surgical gloves, masks, and gowns, can pose as barriers to contamination. Available knowledge shows that 0.5% chlorhexidine in alcohol is the most superior and safest skin antiseptic solution to use prior to neuraxial anesthesia. The literature supports chlorhexidine with alcohol as a result of its advanced characteristics, such as fast onset and increased duration, as well as its ability to reduce infection rates, microorganism and bacterial colonization, and skin entry-point colonization

2. **Policy:** All anesthesia providers will choose 0.5% chlorhexidine in 70% alcohol for skin preparation prior to performing neuraxial anesthesia while also following standard precautions. If this concentration is unavailable, then 10% povidone iodine in alcohol will be chosen.

3. **Procedure:**
 1. All anesthesia providers will follow standard precautions before performing neuraxial anesthesia. Standard precautions include: (a) removing all jewelry and artificial nails, (b) performing appropriate hand hygiene, and (c) wearing appropriate sterile surgical gloves and masks. Wearing cover gowns is optional.
 2. All anesthesia providers will choose 0.5% chlorhexidine in 70% alcohol for skin preparation prior to performing neuraxial anesthesia. The anesthesia provider will apply two applications of the solution for 30 seconds each in back and forth strokes with at least 30 seconds of dwell time following both applications, unless otherwise noted on the manufacturer's instructions.
 3. If 0.5% chlorhexidine in 70% alcohol solution is unavailable, the anesthesia provider will choose 10% povidone iodine in alcohol. The application method of the alcoholic povidone iodine will follow the manufacturer's instructions along with adequate drying time.
 4. If a patient has an allergy or sensitivity to one of the aforementioned solutions, the anesthesia provider will choose the alternative solution.

APPENDIX D - Evaluation Tool

Evaluation Tool

Please rate the following questions by circling your answer.

1. The information presented was useful.

Strongly Disagree Disagree Neutral Agree Strongly Agree

2. The information presented was of high quality.

Strongly Disagree Disagree Neutral Agree Strongly Agree

3. The suggestions provided will have a potential impact on the facility.

Strongly Disagree Disagree Neutral Agree Strongly Agree

4. Do you believe this new best practice policy proposed should be adopted? (circle one)

YES NO

5. If you selected "no" for question 4, please explain:

6. Please provide any suggestions for additions or critique.

APPENDIX E – Executive Summary

Executive Summary of Best Practice Policy Recommendation for Neuraxial Anesthesia

Skin Antiseptic Solutions

Kyle Adams

The University of Southern Mississippi

The Student Registered Nurse Anesthetist convened a panel of experts to evaluate the collective evidence and develop an evidence-based clinical policy recommendation on the most appropriate neuraxial anesthesia skin antiseptic solution. Presented is the executive summary of the full report, “Best Practice Policy Recommendation for Neuraxial Anesthesia Skin Antiseptic Solutions,” which will be printed and presented at the University of Southern Mississippi College of Nursing in September 2018.

This policy recommendation regarding the use of 0.5% chlorhexidine in alcohol for skin preparation prior to neuraxial anesthesia is provided to promote standardization of practice and ultimately best ensure patient safety. The purpose of this quality improvement project was to analyze best practice for neuraxial anesthesia skin antiseptic solutions and develop a best practice policy based on these findings.

The current policy recommendation is evidence-based and should be integrated with the anesthesia provider’s professional judgment and the individual patient’s needs and preferences.

Available Knowledge

A gap in the literature was noted due to lack of a best practice clinical policy regarding the most appropriate skin preparation solution prior to neuraxial anesthesia. Current literature shows various themes related to choosing the most appropriate skin antiseptic solution prior to neuraxial anesthesia to help reduce hospital-acquired infections. The first theme is that standard precautions, including disinfecting the skin prior to neuraxial anesthesia, can help to prevent or reduce infections as well as reducing further complications for the patient, decreasing hospitalization, and decreasing hospital cost. The second theme is that chlorhexidine has shown to be the most superior skin antiseptic solution as a result of its advanced characteristics, such as fast onset and increased duration, and its ability to reduce infection rates, microorganism and bacterial colonization, and skin entry-point colonization. The third theme found in the literature is that alcohol advances the qualities of chlorhexidine, making the two in conjunction the most appropriate solution. The fourth theme is that chlorhexidine is safe to use for neuraxial anesthesia if appropriate precautions are followed prior to skin puncture. These preventative measures include (a) isolating the alcoholic chlorhexidine from other drugs and equipment, (b) allowing the chlorhexidine to dry adequately before puncturing the skin, and (c) checking or changing one's gloves before continuing with the procedure. The fifth and final theme is that alcoholic povidone-iodine is an appropriate alternative solution if 0.5% chlorhexidine in alcohol is unavailable.

Process

Data was gathered via an evaluation tool which assessed members of a panel of experts' input on whether the information presented through a report of findings was found useful, was of high quality and would have an impact on the facility. The panel of experts included a certified registered nurse anesthetist, an anesthesiologist, a health policy expert, and an infection preventionist, as they were deemed relevant stakeholders due to their advanced knowledge and daily involvement with the current topic. Each member of the panel was given the opportunity to identify whether or not they believed the proposed policy should be adopted along with an area to provide feedback. After discussing the report of findings and proposed policy, the majority of the panel of experts strongly agreed that the information presented was useful, of high quality, and would pose an impact on the facility. The panel also agreed that the policy should be adopted. The main feedback presented by the panel of experts was the concern that 0.5% chlorhexidine is not readily available in convenient individual packs.

Policy Recommendation

It is recommended that 0.5% chlorhexidine in 70% alcohol is used prior to neuraxial anesthesia based upon current evidence; however, this concentration is not readily available as a swab stick. Chlorhexidine with a 2% concentration is readily available as a swab stick but is not recommended for lumbar puncture due to its higher risk of neurotoxicity. Therefore, 0.5% chlorhexidine in 70% alcohol should be chosen for skin preparation prior to neuraxial anesthesia as a result of strong supporting evidence.

Alternatively, if 0.5% chlorhexidine in alcohol is unavailable, alcoholic povidone-iodine is an acceptable choice.

Policy Area: Anesthesia Department	Subject: Neuraxial Anesthesia
Title of Policy: Skin Preparation for Neuraxial Anesthesia	Number:
Effective Date:	Supersedes:
Approved Date: Revision Date:	Approved by:

1. **Rationale or background to policy:** to help reduce rates of hospital-acquired infections and surgical site infections. Standard precautions, such as proper handwashing, hygiene, and wearing appropriate surgical gloves, masks, and gowns, can pose as barriers to contamination. Available knowledge shows that 0.5% chlorhexidine in alcohol is the most superior and safest skin antiseptic solution to use prior to neuraxial anesthesia. The literature supports chlorhexidine with alcohol as a result of its advanced characteristics, such as fast onset and increased duration, as well as its ability to reduce infection rates, microorganism and bacterial colonization, and skin entry-point colonization
2. **Policy:** All anesthesia providers will choose 0.5% chlorhexidine in 70% alcohol for skin preparation prior to performing neuraxial anesthesia while also following standard precautions. If this concentration is unavailable, then 10% povidone-iodine in alcohol will be chosen.

3. Procedure:

1. All anesthesia providers will follow standard precautions before performing neuraxial anesthesia. Standard precautions include: (a) removing all jewelry and artificial nails, (b) performing appropriate hand hygiene, and (c) wearing appropriate sterile surgical gloves and masks. Wearing cover gowns is optional.
2. All anesthesia providers will choose 0.5% chlorhexidine in 70% alcohol for skin preparation prior to performing neuraxial anesthesia. The anesthesia provider will apply two applications of the solution for 30 seconds each in back and forth strokes with at least 30 seconds of dwell time following both applications, unless otherwise noted on the manufacturer's instructions.
3. If 0.5% chlorhexidine in 70% alcohol solution is unavailable, the anesthesia provider will choose 10% povidone-iodine in alcohol. The application method of the alcoholic povidone-iodine will follow the manufacturer's instructions along with adequate drying time.
4. If a patient has an allergy or sensitivity to one of the aforementioned solutions, the anesthesia provider will choose the alternative solution.

References

American Association of Nurse Anesthetists (AANA). (2013). Infection control guide for certified registered nurse anesthetists. Retrieved from:

[https://www.aana.com/docs/default-source/practice-aana-com-web-documents-\(all\)/infection-control-guide-for-crnas-archived.pdf?sfvrsn=e8ff45b1_2](https://www.aana.com/docs/default-source/practice-aana-com-web-documents-(all)/infection-control-guide-for-crnas-archived.pdf?sfvrsn=e8ff45b1_2)

American Association of Nurse Anesthetists (AANA). (2015). Infection prevention and control guidelines for anesthesia care. Retrieved 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_2](https://www.aana.com/docs/default-source/practice-aana-com-web-documents-(all)/infection-prevention-and-control-guidelines-for-anesthesia-care.pdf?sfvrsn=850049b1_2)

American Association of Nurse Anesthetists (AANA). (2017). Analgesia and anesthesia for the obstetric patient practice guidelines. Retrieved from:

[https://www.aana.com/docs/default-source/practice-aana-com-web-documents-\(all\)/analgesia-and-anesthesia-for-the-obstetric-patient.pdf](https://www.aana.com/docs/default-source/practice-aana-com-web-documents-(all)/analgesia-and-anesthesia-for-the-obstetric-patient.pdf)

American Society of Anesthesiologists Task Force on Infectious Complications Associated with Neuraxial Techniques. (2011). Practice advisory for the prevention, diagnosis, and management of infectious complications associated with neuraxial techniques. *Anesthesiology*, *112*(3), 530-545. doi: 10.1097/ALN.0b013e3181c4c7d8.

Boise State University. (2018). Policy and procedures writing guide. Retrieved from:

<https://policy.boisestate.edu/policy-writing-guide/>

Campbell, J. P., Plaat, F., Checketts, M. R., Bogod, D., Tighe, S., Moriarty, A., & Koerner, R. (2014). Safety guideline: Skin antisepsis for central neuraxial blockade. *Anaesthesia*, *69*(11), 1279-1286. doi:10.1111/anae.12844

- CareFusion. (2014a). Retrieved from: IP_Safety-Guideline-skin-antiseptis-for-central-neuraxial-blockade-response_TB_EN.pdf
- CareFusion. (2014b). ChlorPrep 3 mL applicator. Retrieved from:
https://www.bd.com/Documents/in-service.../IP_ChlorPrep-3mL-Poster_IM_EN.pdf
- Centers for Disease Control and Prevention (CDC). (2016). Healthcare-Associated Infections: HAI Data and Statistics. Retrieved from
<https://www.cdc.gov/hai/surveillance/>
- Checketts, M. R. (2012). Wash & go—but with what? Skin antiseptic solutions for central neuraxial block. *Anaesthesia*, 67(8), 819-822. doi: 10.1111/j.1365-2044.2012.07263.x
- Chen, A. F., Chivukula, S., Jacobs, L. J., Tetreault, M. W., & Lee, J. Y. (2012). What is the prevalence of MRSA colonization in elective spine cases? *Clinical Orthopaedics and Related Research*, 470(10), 2684–2689. doi: 10.1007/s11999-012-2316-5
- Darouiche, R. O., Wall Jr, M. J., Itani, K. M., Otterson, M. F., Webb, A. L., Carrick, M. M., ... & AlSharif, A. (2010). Chlorhexidine–alcohol versus povidone–iodine for surgical-site antiseptis. *New England Journal of Medicine*, 362(1), 18-26. doi: 10.1056/NEJMoa0810988
- Davies, J. (2017). Neurologic complications of neuraxial analgesia/anesthesia: infections. Retrieved from <http://www.clinicalpainadvisor.com/anesthesiology/neurologic-complications-of-neuraxial-analgesiaanesthesia-infections/article/582819/>

- Edmiston, C. E., Bruden, B., Rucinski, M. C., Henen, C., Graham, M. B., & Lewis, B. L. (2013). Reducing the risk of surgical site infections: Does chlorhexidine gluconate provide a risk reduction benefit? *American Journal of Infection Control, 41*(5), 49-55. doi: 10.1016/j.ajic.2012.10.030
- Fernandes, C. R., Fonseca, N. M., Rosa, D. M., Simões, C. M., & Duarte, N. M. (2011). Brazilian Society of Anesthesiology recommendations for safety in regional anesthesia. *Revista Brasileira de Anestesiologia, 61*(5), 668-694. doi: 10.1590/S0034-70942011000500016
- Hampl, K., Steinfeldt, T., & Wulf, H. (2014). Spinal anesthesia revisited: toxicity of new and old drugs and compounds. *Current Opinion in Anesthesiology, 27*(5), 549-555. doi: 10.1097/ACO.000000000000108
- Hebl, J. R. (2006). The importance and implications of aseptic techniques during regional anesthesia. *Regional anesthesia and pain medicine, 31*(4), 311-323. doi: 10.1016/j.rapm.2006.04.004
- Hemani, M. L., & Lepor, H. (2009). Skin preparation for the prevention of surgical site infection: Which agent is best? *Reviews in Urology, 11*(4), 190–195.
- Horlocker, T. T. (2010). Practice advisory for the prevention, diagnosis, and management of infectious complications associated with neuraxial techniques: Preliminary report by ASA task force on infectious complications associated with neuraxial techniques. *The Journal of the American Society of Anesthesiologists, 73*(4), 35-37.

- Hui, C., Varadharajan, R., Yousefzadeh, A., Davies, S., & Siddiqui, N. T. (2017). Aseptic techniques for labour epidurals: A survey and review of neuraxial anesthesia practice. *Canadian Journal of Infection Control*, 32(1), 25-30.
- Ioscovich, A., Davidson, E. M., Orbach-Zinger, S., Rudich, Z., Ivry, S., Rosen, L. J., ... Ginosar, Y. (2014). Performance of aseptic technique during neuraxial analgesia for labor before and after the publication of international guidelines on aseptic technique. *Israel Journal of Health Policy Research*, 3(9). doi: 10.1186/2045-4015-3-9
- Kinirons, B., Mimoz, O., Lafendi, L., Naas, T., Meunier, J. F., & Nordmann, P. (2001). Chlorhexidine versus povidone iodine in preventing colonization of continuous epidural catheters in children: A randomized, controlled trial. *The Journal of the American Society of Anesthesiologists*, 94(2), 239-244. doi: 10.1097/00000542-200102000-00012
- Kirkland, K., Briggs, J., Trivette, S., Wilkinson, W., & Sexton, D. (1999). The impact of surgical-site infections in the 1990s: attributable mortality, excess length of hospitalization, and extra costs. *Infection Control & Hospital Epidemiology*, 20(11), 725-730. doi:10.1086/501572
- Lee, I., Agarwal, R., Lee, B., Fishman, N., & Umscheid, C. (2010). Systematic review and cost analysis comparing use of chlorhexidine with use of iodine for preoperative skin antisepsis to prevent surgical site infection. *Infection Control & Hospital Epidemiology*, 31(12), 1219-1229. doi:10.1086/657134

- Levin, I., Amer-Alshiek, J., Avni, A., Lessing, J. B., Satel, A., & Almog, B. (2011). Chlorhexidine and alcohol versus povidone-iodine for antisepsis in gynecological surgery. *Journal of Women's Health, 20*(3): 321-324. doi: 10.1089/jwh.2010.2391
- Macias, J. H., Arreguin, V., Munoz, J. M., Alvarez, J. A., Mosqueda, J. L., & Macias, A. E. (2013). Chlorhexidine is a better antiseptic than povidone iodine and sodium hypochlorite because of its substantive effect. *American journal of infection control, 41*(7), 634-637. doi: 10.1016/j.ajic.2012.10.002
- Mangram, A. J., Horan, T. C., Pearson, M. L., Silver, L. C., & Jarvis, W. R. (1999). Guideline for prevention of surgical site infection. *Infection Control and Hospital Epidemiology, 20*(4), 250-278. doi: 10.1086/501620
- Nagelhout, J. J., & Plaus, K. L. (2014). *Nurse anesthesia* (5th ed.) St. Louis, MO: Saunders/Elsevier
- New York School of Regional Anesthesia. (2017). Spinal anesthesia. Retrieved from: <https://www.nysora.com/spinal-anesthesia>
- Noorani, A., Rabey, N., Walsh, S. R., & Davies, R. J. (2010). Systematic review and meta-analysis of preoperative antisepsis with chlorhexidine versus povidone-iodine in clean-contaminated surgery. *British Journal of Surgery, 97*, 1614-1620. doi:10.1002/bjs.7214
- Osterman, M. J. K., & Martin, J. A. (2011). Epidural and spinal anesthesia during labor: 27-state reporting area, 2008. *National Vital Statistics Reports, 59*(5). Hyattsville, MD: National Center for Health Statistics.
- Paocharoen, V., Mingmalairak, C., & Apisarnthanarak, A. (2009). Comparison of

surgical wound infection after preoperative skin preparation with 4% chlorhexidine and povidone iodine: a prospective randomized trial. *Journal of the Medical Association of Thailand*, 92(7): 898-902.

PolicyMedical. (n.d.). Dos and don'ts of policy writing. Retrieved from:

<https://www.hcca-info.org/Portals/0/PDFs/Resources/library/DOs%20and%20DONTs%20of%20Policy%20Writing.pdf>

Reynolds, F. (2008). Neurological infections after neuraxial anesthesia. *Anesthesiology Clinics*, 26(1), 23-52. doi: 10.1016/j.anclin.2007.11.006

Safe Care Campaign. (2017). Preventing Surgical Site Infections: Definition and Statistics. Retrieved from <http://www.safecarecampaign.org/ssi.html>

Sviggum, H. P., Jacob, A. K., Arendt, K. W., Mauermann, M. L., Horlocker, T. T., & Hebl, J. R. (2012). Neurologic complications after chlorhexidine antiseptics for spinal anesthesia. *Regional anesthesia and pain medicine*, 37(2), 139-144. doi: 10.1097/AAP.0b013e318244179a

APPENDIX F - IRB Approval Letter



INSTITUTIONAL REVIEW BOARD
118 College Drive #5147 | Hattiesburg, MS 39406-0001
Phone: 601.266.5997 | Fax: 601.266.4377 | www.usm.edu/research/institutionalreviewboard

NOTICE OF COMMITTEE ACTION

The project has been reviewed by The University of Southern Mississippi Institutional Review Board in accordance with Federal Drug Administration regulations (21 CFR 26, 111), Department of Health and Human Services (45 CFR Part 46), and university guidelines to ensure adherence to the following criteria:

- The risks to subjects are minimized.
- The risks to subjects are reasonable in relation to the anticipated benefits.
- The selection of subjects is equitable.
- Informed consent is adequate and appropriately documented.
- Where appropriate, the research plan makes adequate provisions for monitoring the data collected to ensure the safety of the subjects.
- Where appropriate, there are adequate provisions to protect the privacy of subjects and to maintain the confidentiality of all data.
- Appropriate additional safeguards have been included to protect vulnerable subjects.
- Any unanticipated, serious, or continuing problems encountered regarding risks to subjects must be reported immediately, but not later than 10 days following the event. This should be reported to the IRB Office via the "Adverse Effect Report Form".
- If approved, the maximum period of approval is limited to twelve months.
Projects that exceed this period must submit an application for renewal or continuation.

PROTOCOL NUMBER: 18060412
PROJECT TITLE: Best Practice Policy Recommendation for Neuraxial Anesthesia Skin Antiseptic Solutions
PROJECT TYPE: Doctoral Dissertation
RESEARCHER(S): Kyle Adams
COLLEGE/DIVISION: College of Nursing
DEPARTMENT: School of Leadership and Advanced Practice Nursing
FUNDING AGENCY/SPONSOR: N/A
IRB COMMITTEE ACTION: Exempt Review Approval
PERIOD OF APPROVAL: 06/19/2018 to 06/18/2019
Edward L. Goshorn, Ph.D.
Institutional Review Board

APPENDIX G - DNP Essentials

Doctor of Nursing Practice Essentials		How the Essential is Completed
I.	Scientific Underpinnings for Practice	By reviewing relevant evidence conducted on the topic
II.	Organizational and Systems Leadership for Quality Improvement and Systems Thinking	By communicating with relevant stakeholders to promote a best practice clinical policy and patient safety
III.	Clinical Scholarship and Analytical Methods for Evidence Based Practice	By concluding best clinical practices as evidenced by the literature
V.	Health Care Policy for Advocacy in Health Care	By presenting a best practice clinical policy recommendation regarding skin antisepsis for neuraxial anesthesia.
VI.	Interprofessional Collaboration for Improving Patient and Population Health Outcomes	By communicating with a panel of experts chosen due to their advanced knowledge and daily involvement on the current topic
VII.	Clinical Prevention and Population Health for Improving the Nation's Health	By educating the panel of experts on available knowledge and proposing a policy recommendation to aide in reducing health acquired infections
VIII.	Advanced Nursing Practice	By evaluating evidence-based practice to propose a clinical policy and promote further research

REFERENCES

- American Association of Colleges of Nursing (AACN). (2006). The essentials of doctoral education for advanced practice nursing. Retrieved from <http://www.aacn.nche.edu/dnp/Essentials.pdf>
- American Association of Nurse Anesthetists (AANA). (2013). Infection control guide for certified registered nurse anesthetists. Retrieved from: [https://www.aana.com/docs/default-source/practice-aana-com-web-documents-\(all\)/infection-control-guide-for-crnas-archived.pdf?sfvrsn=e8ff45b1_2](https://www.aana.com/docs/default-source/practice-aana-com-web-documents-(all)/infection-control-guide-for-crnas-archived.pdf?sfvrsn=e8ff45b1_2)
- American Association of Nurse Anesthetists (AANA). (2015). Infection prevention and control guidelines for anesthesia care. Retrieved 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_2](https://www.aana.com/docs/default-source/practice-aana-com-web-documents-(all)/infection-prevention-and-control-guidelines-for-anesthesia-care.pdf?sfvrsn=850049b1_2)
- American Association of Nurse Anesthetists (AANA). (2017). Analgesia and anesthesia for the obstetric patient practice guidelines. Retrieved from: [https://www.aana.com/docs/default-source/practice-aana-com-web-documents-\(all\)/analgesia-and-anesthesia-for-the-obstetric-patient.pdf](https://www.aana.com/docs/default-source/practice-aana-com-web-documents-(all)/analgesia-and-anesthesia-for-the-obstetric-patient.pdf)
- American Society of Anesthesiologists Task Force on Infectious Complications Associated with Neuraxial Techniques. (2011). Practice advisory for the prevention, diagnosis, and management of infectious complications associated with neuraxial techniques. *Anesthesiology*, 112(3), 530-545. doi: 10.1097/ALN.0b013e3181c4c7d8.

Boise State University. (2018). Policy and procedures writing guide. Retrieved from:
<https://policy.boisestate.edu/policy-writing-guide/>

Campbell, J. P., Plaat, F., Checketts, M. R., Bogod, D., Tighe, S., Moriarty, A., & Koerner, R. (2014). Safety guideline: Skin antisepsis for central neuraxial blockade. *Anaesthesia*, 69(11), 1279-1286. doi:10.1111/anae.12844

CareFusion. (2014a). Retrieved from: IP_Safety-Guideline-skin-antisepsis-for-central-neuraxial-blockade-response_TB_EN.pdf

CareFusion. (2014b). ChloroPrep 3 mL applicator. Retrieved from:

https://www.bd.com/Documents/in-service.../IP_ChloroPrep-3mL-Poster_IM_EN.pdf

Centers for Disease Control and Prevention (CDC). (2016). Healthcare-Associated Infections: HAI Data and Statistics. Retrieved from
<https://www.cdc.gov/hai/surveillance/>

Centers for Medicare & Medicaid Services (CMS). (2018). Hospital-Acquired Condition Reduction Program. Retrieved from <https://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/AcuteInpatientPPS/HAC-Reduction-Program.html>

Checketts, M. R. (2012). Wash & go—but with what? Skin antiseptic solutions for central neuraxial block. *Anaesthesia*, 67(8), 819-822. doi: 10.1111/j.1365-2044.2012.07263.x

Chen, A. F., Chivukula, S., Jacobs, L. J., Tetreault, M. W., & Lee, J. Y. (2012). What is the prevalence of MRSA colonization in elective spine cases? *Clinical Orthopaedics and Related Research*, 470(10), 2684–2689. doi: 10.1007/s11999-012-2316-5

- Darouiche, R. O., Wall Jr, M. J., Itani, K. M., Otterson, M. F., Webb, A. L., Carrick, M. M., ... & AlSharif, A. (2010). Chlorhexidine–alcohol versus povidone–iodine for surgical-site antisepsis. *New England Journal of Medicine*, *362*(1), 18-26. doi: 10.1056/NEJMoa0810988
- Davies, J. (2017). Neurologic complications of neuraxial analgesia/anesthesia: infections. Retrieved from <http://www.clinicalpainadvisor.com/anesthesiology/neurologic-complications-of-neuraxial-analgesia-anesthesia-infections/article/582819/>
- Edmiston, C. E., Bruden, B., Rucinski, M. C., Henen, C., Graham, M. B., & Lewis, B. L. (2013). Reducing the risk of surgical site infections: Does chlorhexidine gluconate provide a risk reduction benefit? *American Journal of Infection Control*, *41*(5), 49-55. doi: 10.1016/j.ajic.2012.10.030
- Fernandes, C. R., Fonseca, N. M., Rosa, D. M., Simões, C. M., & Duarte, N. M. (2011). Brazilian Society of Anesthesiology recommendations for safety in regional anesthesia. *Revista Brasileira de Anestesiologia*, *61*(5), 668-694. doi: 10.1590/S0034-70942011000500016
- Friedman, R. M. (2003). A conceptual framework for developing and implementing effective policy in children's mental health. *Journal of Emotional and Behavioral Disorders*, *11*, 11-18. doi: 10.1177/106342660301100103
- Hampl, K., Steinfeldt, T., & Wulf, H. (2014). Spinal anesthesia revisited: toxicity of new and old drugs and compounds. *Current Opinion in Anesthesiology*, *27*(5), 549-555. doi: 10.1097/ACO.000000000000108

- Hebl, J. R. (2006). The importance and implications of aseptic techniques during regional anesthesia. *Regional anesthesia and pain medicine*, 31(4), 311-323. doi: 10.1016/j.rapm.2006.04.004
- Hemani, M. L., & Lepor, H. (2009). Skin preparation for the prevention of surgical site infection: Which agent is best? *Reviews in Urology*, 11(4), 190–195.
- Horlocker, T. T. (2010). Practice advisory for the prevention, diagnosis, and management of infectious complications associated with neuraxial techniques: Preliminary report by ASA task force on infectious complications associated with neuraxial techniques. *The Journal of the American Society of Anesthesiologists*, 73(4), 35-37.
- Hui, C., Varadharajan, R., Yousefzadeh, A., Davies, S., & Siddiqui, N. T. (2017). Aseptic techniques for labour epidurals: A survey and review of neuraxial anesthesia practice. *Canadian Journal of Infection Control*, 32(1), 25-30.
- Ioscovich, A., Davidson, E. M., Orbach-Zinger, S., Rudich, Z., Ivry, S., Rosen, L. J., ... Ginosar, Y. (2014). Performance of aseptic technique during neuraxial analgesia for labor before and after the publication of international guidelines on aseptic technique. *Israel Journal of Health Policy Research*, 3(9). doi: 10.1186/2045-4015-3-9
- Kinirons, B., Mimos, O., Lafendi, L., Naas, T., Meunier, J. F., & Nordmann, P. (2001). Chlorhexidine versus povidone iodine in preventing colonization of continuous epidural catheters in children: A randomized, controlled trial. *The Journal of the American Society of Anesthesiologists*, 94(2), 239-244. doi: 10.1097/00000542-200102000-00012

- Kirkland, K., Briggs, J., Trivette, S., Wilkinson, W., & Sexton, D. (1999). The impact of surgical-site infections in the 1990s: attributable mortality, excess length of hospitalization, and extra costs. *Infection Control & Hospital Epidemiology*, 20(11), 725-730. doi:10.1086/501572
- Lee, I., Agarwal, R., Lee, B., Fishman, N., & Umscheid, C. (2010). Systematic review and cost analysis comparing the use of chlorhexidine with use of iodine for preoperative skin antisepsis to prevent surgical site infection. *Infection Control & Hospital Epidemiology*, 31(12), 1219-1229. doi:10.1086/657134
- Levin, I., Amer-Alshiek, J., Avni, A., Lessing, J. B., Satel, A., & Almog, B. (2011). Chlorhexidine and alcohol versus povidone-iodine for antisepsis in gynecological surgery. *Journal of Women's Health*, 20(3): 321-324. doi: 10.1089/jwh.2010.2391
- Macias, J. H., Arreguin, V., Munoz, J. M., Alvarez, J. A., Mosqueda, J. L., & Macias, A. E. (2013). Chlorhexidine is a better antiseptic than povidone iodine and sodium hypochlorite because of its substantive effect. *American journal of infection control*, 41(7), 634-637. doi: 10.1016/j.ajic.2012.10.002
- Mangram, A. J., Horan, T. C., Pearson, M. L., Silver, L. C., & Jarvis, W. R. (1999). Guideline for prevention of surgical site infection. *Infection Control and Hospital Epidemiology*, 20(4), 250-278. doi: 10.1086/501620
- Nagelhout, J. J., & Plaus, K. L. (2014). *Nurse anesthesia* (5th ed.). St. Louis, MO: Saunders/Elsevier
- New York School of Regional Anesthesia (NYSORA). (2017). Spinal anesthesia. Retrieved from: <https://www.nysora.com/spinal-anesthesia>

- Noorani, A., Rabey, N., Walsh, S. R., & Davies, R. J. (2010). Systematic review and meta-analysis of preoperative antisepsis with chlorhexidine versus povidone-iodine in clean-contaminated surgery. *British Journal of Surgery*, *97*, 1614–1620. doi:10.1002/bjs.7214
- Osterman, M. J. K., & Martin, J. A. (2011). Epidural and spinal anesthesia during labor: 27-state reporting area, 2008. *National Vital Statistics Reports*, *59*(5). Hyattsville, MD: National Center for Health Statistics.
- Paocharoen, V., Mingmalairak, C., & Apisarnthanarak, A. (2009). Comparison of surgical wound infection after preoperative skin preparation with 4% chlorhexidine and povidone iodine: a prospective randomized trial. *Journal of the Medical Association of Thailand*, *92*(7): 898-902.
- PolicyMedical. (n.d.). Dos and don'ts of policy writing. Retrieved from: <https://www.hcca-info.org/Portals/0/PDFs/Resources/library/DOs%20and%20DONTs%20of%20Policy%20Writing.pdf>
- Ray, L. (2017). How to write nursing policies & procedures.
- Reynolds, F. (2008). Neurological infections after neuraxial anesthesia. *Anesthesiology Clinics*, *26*(1), 23-52. doi: 10.1016/j.anclin.2007.11.006
- Safe Care Campaign. (2017). Preventing Surgical Site Infections: Definition and Statistics. Retrieved from <http://www.safecarecampaign.org/ssi.html>
- Sviggum, H. P., Jacob, A. K., Arendt, K. W., Mauermann, M. L., Horlocker, T. T., & Hebl, J. R. (2012). Neurologic complications after chlorhexidine antisepsis for spinal anesthesia. *Regional anesthesia and pain medicine*, *37*(2), 139-144. doi: 10.1097/AAP.0b013e318244179a