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An Evidence-Based Teaching Plan for Preventing Wrong-Site Block Placement During Regional Anesthesia

Mark A. Michetti

Kristen E. Newbrough

AN EVIDENCE-BASED TEACHING PLAN FOR PREVENTING WRONG-SITE BLOCK PLACEMENT DURING REGIONAL ANESTHESIA

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Mark A. Michetti

Kristen E. Newbrough

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Author: **Kristen Newbrough**

Author: **Mark Michetti**

Approved by:

Robert W. Simon, DNP, CRNA, CHSE
DNP Team Chair

Mindy Tait, PhD, MBA, CRNP, FNP-BC
DNP Team Member

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Submitted in partial fulfillment of the requirements for the Degree of Doctor of Nursing Practice.

To my family and Natalie, who have been unfailingly patient and provided me with endless support and guidance throughout this process. I couldn't have done it without you. And to my amazing and dedicated DNP partner, Kristen.

-Mark

I dedicate this academic success to my family, Dan, and my friends- I would not have made it to this point without you all! Thank you for answering my endless phone calls and providing me with constant encouragement and support. I also dedicate this to my DNP partner, Mark- from PICU RNs to future CRNAs, you have always had my back!

-Kristen

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Abstract

Wrong-site regional anesthetic block placement is a threat to patient safety and quality perioperative care. The adverse outcomes for patients, providers, and institutions demonstrate safety risks that are linked to inconsistent use of comprehensive guidelines in clinical practice. The purpose of this Doctor of Nursing Practice Project is to create a comprehensive evidence-based Teaching Plan for preventing wrong-site block (WSB) placement during regional anesthetic induction and for use in institutions by anesthesia providers to prevent wrong-site anesthetic block placement. The teaching plan focuses on four main constructs to prevent WSBs, which include the incidence of WSBs, the consequences of WSBs, significant contributing factors to WSBs, and proposed methods to prevent WSBs. Following the literature review and development of a draft Teaching Plan, a Qualtrics survey was distributed to an expert panel for completion of a content validity form. The final draft Teaching Plan serves as an educational guide for clinicians to use in safe regional anesthetic management.

Keywords: wrong-site, regional, block, perioperative, patient, safety, guidelines, teaching plan

An Evidence-Based Teaching Plan for Preventing Wrong-Site Block Placement During Regional Anesthesia

Background

Regional nerve blocks are administered by anesthesia providers for reducing pain during surgery. In addition to pain control during surgical procedures, regional nerve blocks are appreciated for their benefits to patients. For example, regional nerve blocks provide extended analgesia post-operatively and limit the opioid requirement, which prevents postoperative complications. Although regional anesthesia provides many benefits to the patient during the intraoperative and postoperative periods, wrong-site blocks (WSBs), a specific type of wrong-site surgery, are one of the most common adverse anesthesia events (American Society of Anesthesiologists [ASA], 2017) and a patient safety threat.

WSBs may result in significant harm to patients. Research has shown that WSBs contribute to many instances of wrong-site procedures, surpassing the occurrence of wrong-site surgery (Hudson et al., 2015). Between 2004 to 2015, the Pennsylvania Patient Safety Reporting System (PA-PSRS) received 182 reports of WSBs (Deutsch et al., 2018). These reported adverse events had various poor outcomes affecting patients' health. Disparities in prevalence among different types of WSBs exist. Specifically, femoral nerve blocks have a higher occurrence of WSB in comparison to upper extremity, sciatic, paravertebral, lumbar plexus, and miscellaneous nerve blocks (Hudson et al., 2015). Therefore, there needs to be a greater focus to prevent WSB when surgeries require an inherently higher risk nerve block such as a femoral nerve block.

Four leading consequences of WSB include local anesthetic systemic toxicity (LAST), wrong-site surgery, neurologic injury, and toll on the patient (Deutsch et al., 2018). LAST can progress from mild symptoms such as numbness and tinnitus to severe symptoms such as seizures and cardiovascular collapse. In addition to the four leading consequences of WSB, there are other serious consequences that affect patients due to a WSB including respiratory depression, phrenic nerve palsy, hematoma, psychological trauma, vascular injury, infection, and opportunity cost (Deutsch et al., 2018). Specifically, opportunity cost refers to the inconvenience of a canceled procedure due to individual error (Deutsch et al., 2018). A clinical scenario of phrenic nerve paralysis in a patient discussed by Deutsch et al. (2018) was due to a wrong side block performed with the additional correct side block. As a result of bilateral block-induced phrenic nerve paralysis, the patient required mechanical ventilation until the block wore off (Deutsch et al., 2018). Other patient outcomes include increased length of hospitalization, prolonged immobility, and poor medical/pain therapy. Less noted measurable consequences include patients' loss of confidence and trust in their healthcare system and providers' loss of confidence and satisfaction in the care provided (ASA, 2017). On an institutional level, providers and hospitals directly involved in WSB events may suffer from legal claims made against them (Mira, 2018).

Legal claims stemming from adverse events in regional anesthesia are significant. Between 2006 and 2016, researchers analyzed closed malpractice claims and found negligence in 'Technical Knowledge/Performance' as a contributing factor associated with 93% of filed claims. This refers to fault found with the anesthesia provider during a procedure (Saba et al., 2019). In specific events, there was injection of local anesthetic

into the wrong site and/or blocking the wrong nerve entirely (Saba et al., 2019). Payments for settled cases demonstrate the severity of financial problems of adverse regional anesthesia events. Of the settled cases during the study period, the median payout was $134,000 and the interquartile range was $324,423.25 (Saba et al., 2019).

WSBs administered for regional analgesia or pain procedures have reporting rates as high as wrong-site surgery rates (ASA, 2017). The International Registry of Regional Anesthesia reported a WSB incidence rate of 2.59 per 10,000 blocks (ASA, 2017). Additionally, at a local level, Pennsylvania data displayed a WSB incidence rate of 1.28 per 10,000 blocks (ASA, 2017).

In 1998, orthopedic surgeons were first to identify the problem of wrong-site surgery, reporting a 25% incidence rate throughout the course of their careers (ASA, 2017). High rates of wrong-site surgery encouraged national organizations to institute the *Sign your Site* national campaign by the American Academy of Orthopedic Surgeons and the Universal Protocol by the Joint Commission in 2004 (ASA, 2017). Although wrong-site surgery occurrences declined following the implementation of these protocols, the incidence rate of WSBs did not decrease since the Universal Protocol was not required or implemented specifically for regional blocks (ASA, 2017).

The practice of marking the site prior to a regional nerve block remains inconsistent across institutions. Although the surgical site marking is a component of the pre-procedure verification process across institutions, the additional marking for the nerve block remains a missing piece of the pre-procedure routine amongst anesthesia providers. According to Clarke (2014), the use of the universal protocol for regional anesthesia should be a separate perioperative procedure, specifically a separate

verification from the surgical site itself. The marking serves as a reference point for the anesthesia provider performing the block, which should be verified by both the consent form and the patient. Although a block marking has demonstrated more benefit than harm, it is important to recognize the disadvantage of an extra mark. Further, it may be mistaken as the surgical site marking (Clarke, 2014). The Pennsylvania Patient Safety Authority conducted a survey to measure the usage of the marking policy for regional anesthetic blocks and if the implementation led to a reduction of reports of wrong-site blocks (Clarke, 2014). This survey was fueled by the high percentage of wrong-site blocks in Pennsylvania. Prior to the survey, wrong-site blocks accounted for 121 (21%) of the 571 wrong-site procedures in operating rooms (Clarke, 2014). After implementation of the regional marking policy, the decrease in wrong-site nerve blocks was statistically significant, represented by a p value of <0.05 (Clarke, 2014).

Personnel, environmental pressure, and poor adherence to existing protocols are major factors attributed to causing WSBs (ASA, 2017). According to Hudson et al. (2015), anesthesia teams working without a designated nerve block service were responsible for many WSBs because they were responsible for intraoperative nerve block placement and many other complicated tasks. The same researchers determined several factors that led to WSBs in a root cause analysis. These factors were explicit violations of standards of practice, which highlights the significance of WSBs as being preventable adverse events. Patients experienced a WSB due to ill-performed timeouts, providers not participating in timeouts, inadequately trained staff participating in regional block placement, improper patient positioning, and the absence of a regional block site marking (Hudson et al., 2015). Also, poor communication among members of the surgical team

may contribute to WSBs. One solution posed was performance of a standardized post-anesthesia hand-off (Urdaneta, 2019). In addition to miscommunication among surgical team members, the operating room schedule may have misinformation leading providers to obtain incorrect consent. For example, the laterality of procedures may be incorrect on the OR schedule and must be verified by the surgical consent and patient prior to performing any regional anesthetic block or procedure (Clarke, 2014). Another strategy to improve communication may include addition of a pre-procedure verification process between the patient and care team. However, the focus on surgical team communication surrounding regional anesthetic time-out is lacking.

According to the American Association of Nurse Anesthesiology [AANA] (2014), anesthesia providers did not perform a formal timeout for 26 cases between 2004 and 2006, involving local anesthetics or nerve blocks. Institutions and healthcare providers are responsible when unsafe, miscalculated anesthesia care occurs; this warrants a change in current practice.

This project has been approved by the Frank J. Tornetta faculty. Drs. Kost, Betron, and Simon view this topic as an anesthesia safety threat. See Appendix A.

Problem Statement

Regional anesthesia can be more effective than general anesthesia in specific surgical circumstances; however, patients can experience adverse outcomes if anesthesia personnel do not perform safe regional anesthesia practice. Consistent adherence to evidence-based guidelines or lack of guidelines for regional nerve block placement in perioperative settings is a current problem. Although the rates of incidence for WSBs exceed the rates of wrong-site surgery, there is still less focus and policy development for

preventing WSBs (Hudson et al., 2015). Recent statistics demonstrate this problem. Among 682 wrong-site surgery occurrences, from 2004 to 2015, 26.7% involved WSBs (Deutsch et al., 2018).

Factors contributing to WSBs have been reported in current case reports. Universal protocol of time-out is either not performed or there are pertinent team members missing from the time-out, for example the circulating nurse or the surgeon (ASA, 2017). Peripheral nerve blocks may also be placed in areas outside of the OR, mainly in the pre-operative area, and performed by other anesthesia team members not involved in the case (ASA, 2017). Another emphasis is patients' confirmation during verification of the correct surgical site. Although patient consent is an important aspect of the pre-operative process, patients who may have confusion or cognitive issues are trusted to verify the correct site (ASA, 2017). Instances where consent for the surgical procedure is not available at the time of the block or where the surgical site is not yet marked are factors contributing to WSBs (ASA, 2017). Production pressure in the operating room and distraction are two other major contributing factors to WSBs (ASA, 2017). WSBs are detrimental to patient outcomes and remain a safety threat in institutions.

Purpose

The purpose of this Doctor of Nursing Practice Project is to create a comprehensive evidence-based Teaching Plan for preventing WSB placement during regional anesthetic induction and for use in institutions by anesthesia providers to prevent WSBs.

Project Question

What are the evidence-based components of a comprehensive teaching plan for anesthesia providers to use in institutions for preventing wrong-site block (WSB) placement during regional anesthesia induction?

Conceptual Definitions

- *Regional anesthesia* is defined as a technique involving administration of a local anesthetic agent into a nerve or central cavity, whether peripheral, spinal or epidural, to inhibit pain while preserving patient consciousness (Folino & Mahboobi, 2021).
- *Peripheral nerve block* is defined as a specific type of regional anesthesia that targets a specific nerve or bundle of nerves to block pain sensations in a specific area of the body (Healthwise, 2020).
- *Wrong-site surgery* is defined as "a surgical or other invasive procedure performed on the wrong side, site, or patient, or an incorrect procedure performed on the patient" (Yonash & Taylor, 2020, p. 27).
- *Correct site placement* is defined as successful targeting with the needle and infiltration of an anesthetic agent into the desired anatomical location when placing anesthetic blocks (Folino & Mahboobi, 2021).
- *Anesthesia providers* are anesthesiologists and certified registered nurse anesthetists (CRNAs) who are trained in the department of anesthesia and are strongly familiar with indications, placement technique, and complications of each specific type of regional nerve block (Chang et al., 2021).

Review of the Literature

PICO- Based Problem Statement

The project question is: What are the evidence-based components of a comprehensive teaching plan for anesthesia providers to use in institutions for preventing wrong-site block (WSB) placement during regional anesthesia induction?

Search Process Methods

The initial search process yielded 1,945 articles from 6 databases: La Salle University's Summon, Cochrane Library, CINAHL, Medline, PubMed, and ProQuest One Academic (See Table 1). Keyword search terms used during the literature search included: regional anesthesia time-out, anes*, regional anes*, wrong-site regional anes*, nerve block*, complication* with the Boolean operator "AND" for searches. Inclusion criteria for the research articles included articles published between 2012-2022, articles written in the English language, full-text articles, peer reviewed articles, and regional anesthetic blocks performed by anesthesia personnel. Exclusion criteria for the research articles included blocks performed by surgical personnel and neuraxial blocks. Duplicate articles across multiple databases were omitted. The search process yielded a total of 8 articles that met inclusion criteria and would be analyzed in matrix format (See Table 2). The Johns Hopkins Nursing Evidence Based Practice Research Evidence Appraisal Tool was used to appraise the articles. Evidence levels (I-V) and quality (A & B) were identified.

Appraised Studies

Harris et al. (2021) performed a before-after quasi-experimental study about a regional anesthesia time-out policy. The authors instituted several enhancements to an existing pre-anesthetic time-out process for peripheral nerve block placement. The

authors wanted to evaluate how effective these changes were in preventing WSB incidence. In a before-after quasi-experimental design, Harris et al. (2021) compared the rate of WSB occurrence. The sampling for this study occurred in a single institution over 13 years. Data came from a total of 160,857 upper and lower extremity blocks. Specifically, upper extremity blocks included axillary, infraclavicular, interscalene, and supraclavicular, and lower extremity blocks included adductor canal, ankle, fascia iliaca, femoral, popliteal, psoas compartment, and sciatic (Harris et al., 2021). During the years 2003-2006 (before period), the original time-out process for nerve blocks remained in practice. During the years 2007-2016 (after period), the researchers made two significant adjustments to the time-out process. The first revision involved the circulating/block nurse keeping all nerve block needles from the anesthesia provider until the time-out was performed. The second revision required the nurse to remain at the bedside until the nerve block was started, which was designed to promote efficiency and reduce errors (Harris et al., 2021). Analysis of WSB incidence between these periods revealed significant results for WSB prevention. During the study period, a quality assessment/performance improvement (QA/PI) division kept daily statistics, by manually tallying data, about procedural records from paper charts. For data analysis, bar chart and forest plot production, the authors used SAS software version 9.4 and R software version 3.5.1. To ensure accurate data collection, all WSBs were reported to the New York Patient Occurrence Reporting and Tracking System (Harris et al., 2021).

Before the time-out policy change, WSB occurrence per 10,000 blocks was 1.10. Following the time-out revisions, WSBs dropped to an incidence rate of 0.24. Data analysis described a relative risk of 0.17 and a p value of 0.015 (Harris et al., 2021). Also,

lower extremity blocks had fewer reports of WSB compared to upper extremity blocks following this implementation. Data analysis described a relative risk of 0.14 and a p value of 0.021 (Harris et al., 2021). Since this study was limited to a single institution, the authors indicated that these revisions to a nerve block time-out may not be practical for other institutions. The authors also mentioned risk of bias due to a before-after study design (Harris et al., 2021). These revisions to a pre-anesthetic time-out encouraged greater team dynamics and safety focus during peripheral nerve block placement. Additionally, the authors identified lower extremity blocks as having a higher risk for WSB (Harris et al., 2021). This study highlighted the importance of policy refinement and compliance to existing standards of practice. Continuing education and adjustments to existing processes should be a goal for other institutions.

Kwofie and Uppal (2020) performed a systematic review of the literature relevant to wrong-site nerve block (WSNB). The authors descriptively analyzed the literature to showcase common evidence and arguments surrounding this regional anesthesia issue. The purpose of this study was to focus on the incidence of WSNB and explore the risk factors, consequences, and strategies used to prevent them (Kwofie & Uppal, 2020). The authors limited their search to yield evidence reported in the last 10 years. Also, with the help of an experienced medical librarian, they used PubMed as the single source of information on this topic. The authors then investigated all 763 references for WSNB relevance and ultimately included 34 citations in this review (Kwofie & Uppal, 2020).

Per 10,000 blocks, the rate of WSNB incidence varied from 0.5-5.1 (Kwofie & Uppal, 2020). While the Pennsylvania Patient Safety Authority reported a 42% decline in WSNBs over 2004-2019, the authors suppose this may be related to a drastic increase in

the total number of nerve blocks being performed (Kwofie & Uppal, 2020). The authors determined significant consequences of WSNB included wrong-site surgery, local anesthetic toxicity, canceled or delayed surgery, aborted regional anesthetic technique, and a decline in patient confidence in the healthcare system (Kwofie & Uppal, 2020). The authors also identified 4 categories of risk factors including 'Patient', 'Practitioner', 'Procedural', and 'Organizational'. Some 'Patient' factors were poor communication, unilaterality, and abnormal anatomy. 'Practitioner' factors were provider change, production pressure, and lack of adherence to a checklist, among many others. 'Procedural' factors included position/environmental change, distractions, and a delay between timeout and procedure. Lastly, 'Organizational' factors were a lack of safety culture, blocks outside the operating room, and inadequate policies (Kwofie & Uppal, 2020). Prevention strategies included a procedural marking, checklists for nerve block procedures, time-out/stop moment, cognitive reminders/aids, physical reminders/aids, team dynamics, and auditing and quality assurance. The authors mentioned that the evidence is limited and that further research must be done to incorporate multiple prevention methods. Several implications for practice have been laid out by the authors. A site marking policy for surgery and nerve blocks, cognitive aids and physical reminders, such as posters, and an institution-specific checklist and time-out will encourage compliance. Additionally, maintaining a culture of safety and continually evaluating the effectiveness of preventive measures as well as the knowledge of providers via auditing is essential (Kwofie & Uppal, 2020).

Henshaw et al. (2019) performed a retrospective review of a quasi-experimental study across two sister institutions under the umbrella of Wake Forest Baptist Health in

Winston Salem, North Carolina. According to the Joint Commission, a wrong-site surgery consists of any invasive procedure that exposes patients to more than minimal risk and that is performed on the wrong patient, on the wrong side, or at the wrong site (Henshaw et al., 2019). Wrong-site nerve blocks (WSNB) are included within the definition of wrong-site surgery; moreover, WSNBs are far more common than wrong-site surgery. Sampling from a tertiary care hospital, a level-one trauma center and training facility, and an outpatient surgical center compiled a total of 46,013 nerve blocks. The purpose of this study was to investigate the usage of a pre-procedural regional anesthesia-specific checklist and its impact on decreasing WSNB incidence. The study directly compared the rate of WSNB in the pre-intervention group to the rate of WSNB in the post-intervention group (Henshaw et al., 2019). IRB approval was obtained prior to the study and informed consent was waived. The full study ran from July 1, 2009 to June 30, 2017. The pre-intervention group took place in 2010-2011 while the post-intervention group took place in 2012-2017 (Henshaw et al., 2019). Neuraxial anesthesia was amongst the exclusion criteria, while peripheral nerve blocks were included. The rates of WSNB were compared between the two groups using a Fisher's exact test and 95% CI were determined. Data analysis was performed using SAS, V.9.4 (Henshaw et al., 2019). In order to obtain data, a retrospective review of the safety database was performed. All safety events within the system database are filed in real-time by the front-line providers involved in the adverse events (Henshaw et al., 2019).

The incidence of WSNB between 2010-2017 is analyzed in this study. The ratio of analgesic to anesthetic nerve blocks in the study was 3.61 to 1 (Henshaw et al., 2019). In the 2-year pre-intervention phase of the study, there were a total of 4 WSNBs out of

10,123 peripheral nerve blocks performed. This data resulted in a calculated incidence rate of 3.95 per 10,000 blocks, with a 95% CI 1.26 to 9.53 (Henshaw et al., 2019). In the 6-year post-intervention phase of the study, there were a total of zero WSNB out of 35,890 peripheral nerve blocks performed. This data resulted in a calculated incidence of 0 per 10,000 blocks, with a 95% CI 0 to 0.84 (Henshaw et al., 2019). The data was statistically significant with a p value of 0.0023, showing that a pre-procedural regional anesthetic checklist reduces incidence of WSNB (Henshaw et al., 2019). Although there was statistical significance in the data analysis, limitations of the study exist. Due to the study's retrospective design, it is not possible to determine causality between the use of the checklist and lower rate of WSNBs (Henshaw et al., 2019). If a prospective study was performed, randomizing patients to a non-checklist group would be unsafe and unethical. Another limitation to the study was that some assumptions were used to calculate annual block totals, which introduced the potential for inaccurate block totals (Henshaw et al., 2019). Due to the apprehension of reporting safety events, it is possible some providers involved in WSNBs did not report the events, leading to inaccurate data. Overall, the implementation of the regional anesthesia procedural check-list significantly reduced the rate of WSNBs and should be introduced to institutions that are lacking in this process.

Deutsch et al. (2018) conducted a systematic review of the literature to highlight the occurrence of wrong-site nerve blocks (WSBs) across institutions. The authors also aimed to identify common contributing factors to WSB incidence and patient outcomes. In this review, Deutsch et al. (2018) stressed the importance of preventive measures, emphasizing evidence-based methods published in the literature. The authors analyzed 70 publications that focused on wrong-site surgery with specific mention of WSB. The

authors used 14 different data categories in a data collection tool to analyze relevant publications. These categories included: primary literature search publication or secondary reference, publication year, source of information, type of document, type of article, geographic location, mention of 'Pennsylvania' and/or the 'Pennsylvania Patient Safety Authority', type of nerve block, description of wrong site nerve block incidence, consequences, contributing factors, suggestions and recommendations, findings, and lastly, direct nerve-block site process controls (Deutsch et al., 2018).

Due to variations in specificity and denominators among the 70 publications, the authors could not collectively provide numerical evidence regarding the incidence of WSB. However, 4 publications that used a common denominator of 10,000 blocks reported an incidence rate of 0.52-5.07 (Deutsch et al., 2018). The authors also determined the most frequently reported consequences of WSB were local anesthetic systemic toxicity (LAST), potential to lead to wrong-site surgery, neurologic injury, and costs to the patient. The collected body of literature exposed a significant amount of influences leading to WSB. Time constraints, personnel factors, poorly visible or lack of site marking, and miscommunication were leading contributors, among many others (Deutsch et al., 2018). The authors were challenged to establish contextual and theoretical relationships from all publications because of inconsistent constructs, which is a significant limitation of this study. Future research must maintain focus on the incidence of WSB but more importantly, evaluate preventive measures. According to Deutsch et al. (2018), WSB prevention is centered on a standardized approach to care; furthermore, providers must ensure appropriateness of the procedure, clear identification, and constant confirmation between the patient and healthcare providers.

Mancone et al. (2018) implemented a quality improvement project at a military institution. The authors aimed to identify the usefulness of the LAST Double Check Checklist in preventing wrong-site nerve blocks along with other complications of regional anesthesia. The checklist was implemented in two 30-day trials, which included a total sample size of 350 regional blocks. An expert group in regional anesthesia developed the checklist, which included "Look up (NPO, beta-HCG, proper block(s), lab review, medications, imaging), Allergies, Supplemental blocks (any other indicated block), Talk to team (surgical team, anesthesia in room), Laterality (consent, laterality form signed), Anticoagulation (medication list, post-op anticoagulation plans), Signed (initialed by surgeon and anesthesia), and Time-out (complete and signed)" (Mancone et al., 2018). For data collection, the department of anesthesia had a staff meeting to inform anesthesia personnel of this new checklist. The regional bay nurse was also involved in recording checklist usage and any delays encountered (Mancone et al., 2018).

During the trial of implementing the checklist, there were no reports of procedures being performed on patients taking anticoagulants (Mancone et al., 2018). There were also no reports of case delays while using the checklist in the regional bay. Post-implementation of the checklist demonstrated no events reported over an 11-month period, following greater than 1,000 regional anesthetics (Mancone et al., 2018). Limitations of this study include the short time period of the trials and the overall short time period implementing the checklist. A limitation of the checklist includes the absence of a prompt to perform an additional time-out for patients receiving multiple site blocks (Mancone et al., 2018). Another limitation to using the checklist is the additional time it takes to perform; however, there were no OR delays documented in the trials performed.

The LAST Double Check Checklist was part of a quality improvement project at one military institution and can be implemented at other institutions to provide safe regional anesthetic delivery. The checklist provides mnemonics that are easy for providers to quickly run through their heads, and can be tailored to meet the needs of other institutions.

Slocomb and Pattullo (2016) describe the implementation of the "Stop Before You Block" (SB4YB) initiative in an Australian teaching hospital setting. The SB4YB is a pre-procedure pause to identify and confirm the correct side of a regional anesthetic block (Slocomb & Pattullo, 2016). This study was a quality improvement project that examined the benefits of an educational program to inform the anesthesia staff and the perioperative nurses and assistants of the importance of the SB4YB pause prior to regional anesthetic procedures. The project not only focused on the anesthesia staff, but also the nurses who were involved with initiating the time-out prior to every block. In addition to the educational sessions, posters were placed in all areas where blocks were performed, along with email reminders to staff to continue to use and document the SB4YB (Slocomb & Pattullo, 2016). To improve compliance, SB4YB stickers with a checkbox were also placed in areas where regional anesthetic blocks were being performed. Researchers completed chart audits to assess the compliance rate of staff using the SB4YB time-out (Slocomb & Pattullo, 2016). The Operating Room Medical Information System (ORMIS) was used to collect patient identification numbers who received a regional block. Data was collected over a 3-month period, from October 27, 2014 to January 28, 2015. A total of 274 patients were initially identified as having received a regional anesthetic; however, after excluding neuraxial and bilateral blocks, a

sample of 197 remained for the study (Slocomb & Pattullo, 2016). The authors reviewed the charts to determine if the SB4YB was performed for each block. Inclusion criteria for the study included all unilateral blocks with potential for WSB. Exclusion criteria were neuraxial blocks, ophthalmology blocks, and bilateral blocks (Slocomb & Pattullo, 2016). The data was analyzed using Microsoft Excel and SPSS Statistical software version 22 (Slocomb & Pattullo, 2016).

The quality improvement project had an initial goal of 80% compliance of SB4YB (Slocomb & Pattullo, 2016). Out of the 197 blocks, staff performed the SB4YB for 113, yielding a compliance rate of 57.4% (Slocomb & Pattullo, 2016). The 84 blocks that did not have a SB4YB pre-procedure pause were further evaluated for potential reasons for non-compliance. Contributing factors included emergency cases, procedures performed outside of the OR, and procedures performed by visiting anesthesia personnel. The compliance rate for emergency procedures was 46.5% compared to the 63.5% compliance rate for elective procedures (Slocomb & Pattullo, 2016). Documentation and adherence of SB4YB was lower than anticipated following the educational sessions that were performed. Slocomb and Pattullo (2016) identified the necessity for a change in culture as well as the educational programs to fully enforce the compliance of SB4YB. It is important to recognize the importance of education and cultural change in all institutions when implementing a change in practice. Limitations to the study included the small sample size from a single institution and the reliance on documentation rather than observation of SB4YB performance (Slocomb & Pattullo, 2016). The study also recommended the implementation of a formal block time-out prior to all unilateral regional anesthetic blocks.

Hudson et al. (2015) conducted a retrospective analysis of a large multihospital system in Pennsylvania. Thirteen hospitals within the University of Pittsburgh Medical Center Health System (UPMCHS) participated. The authors wanted to assess the risk factors contributing to WSBs and the overall incidence of WSBs. Researchers paid particular attention to unilateral peripheral nerve block placement since all reported WSBs occurred in this scenario (Hudson et al., 2015). Data collection occurred over a 10-year period between 2002-2012 and the total number of patients who received a peripheral nerve block was 85,915 (Hudson et al., 2015). The authors obtained data on total nerve blocks and unilateral WSB using quality improvement and patient billing data (Hudson et al., 2015). Later in the study period, the authors presented another focus regarding a mandatory timeout policy prior to nerve block placement. Previously, all hospitals in this study used a varying method to verify block placement, but this timeout was a policy change that was instituted for all hospitals in the health system to promote uniformity in practice (Hudson et al., 2015). The authors examined the relationship of this timeout change and the incidence of WSB. The authors performed statistical analyses using R version 3.0.1.

A total of 9 WSBs were reported during this study. Out of the total 85,915 patients, results showed a WSB incidence rate of 1.05 per 10,000 blocks and in patients who only received a unilateral block (70,441), the incidence rate was 1.28 per 10,000 blocks (Hudson et al., 2015). Also, hospitals with a dedicated acute interventional perioperative pain service (AIPPS) had reduced WSB occurrences compared to hospitals with an integrated operating room (OR)/AIPPS, demonstrating an incidence rate of 0.84 and 1.51 (per 10,000), respectively (Hudson et al., 2015). Femoral nerve blocks had the

most significant number of reported WSB. The researchers did not find a positive association between timeout policy presence and the number of WSBs (Hudson et al., 2015). The small number of reported WSB made it difficult for the authors to determine significance in risk factors. Also, the authors struggled to distinguish efficacy in prevention methods due to the infrequency of WSBs in this study (Hudson et al., 2015). In this study, lower extremity nerve blocks were performed more frequently than upper extremity nerve blocks and contributed to higher WSB incidence rates. This is important for practice as position changes are required for femoral bocks, which causes confusion and potentially disrupts patients from identifying errors during block placement (Hudson et al., 2015). A higher error rate for specific nerve blocks should influence providers to be more cautious and extra-alert when performing such blocks. A dedicated nerve block team is also a superior system when compared to a typical integrated team. This is evidenced by reduced production pressure, consistency in care, and a better reported patient experience (Hudson et al., 2015). The authors suggest there should be more routine use and continuing education about existing timeout policies. While the results of this study showed a limited association between WSBs and a timeout, the authors perceived a positive influence that timeouts reduce the incidence of WSBs (Hudson et al., 2015). More research must be done to determine the effectiveness of timeouts preventing WSB.

Russell et al. (2013) performed a retrospective data review to showcase the importance of integrating nurses into safe regional anesthetic delivery. The purpose of the retrospective data review was to evaluate the efficacy of a block nurse team in preventing wrong-sided blocks, increasing perioperative efficiency, and increasing OR productivity

(Russell et al., 2013). The study took place at Duke University Hospital and specifically examined the orthopedic surgery service. The orthopedic service was chosen for its high volume of patients requiring regional anesthesia. Pre-implementation data in the year 2009 was compared to post-implementation data in 2010. The sample of OR cases and pre-operative regional blocks in 2009 was 1,450 and 610, respectively. In 2010, the sample was 1,640 total OR cases and 728 pre-operative regional blocks. In order to measure the efficacy of the implementation of a block nurse team, researchers examined the number of WSBs, the number of OR delay start times, perioperative efficiency (measured by meeting the goal of 45 minute OR turnover), the total number of orthopedic patients, and the percentage of orthopedic patients receiving blocks (Russell et al., 2013).

This study revealed that implementation of a specialized regional anesthesia block nurse team increased patient safety and improved perioperative efficiency. Following this implementation, there were zero wrong-sided blocks performed (Russell et al., 2013). In addition to the increased patient safety, OR efficiency also improved, which was demonstrated by a 26% increase in perioperative efficiency and a 12% increase in service productivity (Russell et al., 2013). Benefits of the block nurse team include increased patient safety, increased perioperative efficiency, decreased OR start time delays, and increased OR productivity (Russell et al., 2013). Barriers to using a block nurse team include cost of training nurses, additional staff nurse requirements, requirement of a dedicated regional anesthesia space, and acceptance among nursing staff of the change in practice (Russell et al., 2013). Due to the benefits of the block nurse team demonstrated by the results of the study, a block nurse team is something for other institutions to consider in order to improve patient safety. A limitation of this study is the small sample

size at a single institution. In addition to the small sample size, the specific types of regional blocks were not discussed in the study.

Related Literature

Clarke (2014) identified wrong-side anesthesia blocks as the most common wrong-site event according to the Pennsylvania Safety Authority in the academic year 2013-2014. The year 2013-2014 comprised a total of 45 wrong-site surgeries, with 7 of the 45 being wrong-side anesthesia blocks (Clarke, 2014). The Pennsylvania Safety Authority reported a total of 122 wrong-side anesthesia blocks out of 586 wrong-site surgeries for the decade, which prompted a change in practice to prevent this type of wrong-site surgery. Clarke (2014) evaluated the usefulness of a regional block site marking as a way to prevent WSBs. Since administration of a regional anesthetic block falls under the umbrella of a perioperative procedure, usage of the three steps of the Universal Protocol is recommended. The disadvantage and advantage of the separate marking for a regional anesthetic block has not been tested in practice; however it has been debated in theory (Clarke, 2014). The advantage of the regional anesthetic marking is the clear reference point of the block (Clarke, 2014). Although it provides a clear reference point for the anesthesia personnel, it can be mistaken for the surgical mark and lead to wrong-site operation (Clarke, 2014). The Pennsylvania Safety Authority did not identify superiority of site marking versus no site marking, and therefore conducted a survey in Pennsylvania to assess the practice by which acute care hospitals and ambulatory surgical facilities mark their regional anesthesia sites (Clarke, 2014).

The Pennsylvania Safety Authority survey consisted of two questions: “Does your medical facility have a policy or procedure that requires the anesthesia provider to mark

the anesthesia site where a regional or local anesthetic block will be administered? If yes, when was this policy or procedure implemented" (Clarke, 2014)? Sixty-nine facilities responded to the survey, and a total of 29 facilities indicated the implementation of a marking policy after reporting of WSBs began. An additional 2 facilities said they had implemented a marking policy prior to the reporting of WSBs (Clarke, 2014). Within the 29 facilities, 5 WSBs occurred following the policy implementation, compared to a pre-policy implementation of 25 WSBs (Clarke, 2014). The researchers performed a comparative analysis to distinguish the pre-policy implementation number of WSBs versus the post-policy implementation number of WSBs over an equal time period. During the balanced pre- and post-implementation periods, facilities reported 12 WSBs before the policy change and 3 WSBs after the policy change (Clarke, 2014). Within the analysis, 18 facilities reported no WSBs in either the pre- or post-implementation period and 1 facility had 1 WSB in each period (Clarke, 2014). Additionally, 9 facilities had fewer WSBs and 1 facility had more wrong-site blocks after implementing the marking policy change. Overall, the policy change was statistically significant in reducing WSBs, with a sign test of 9/10 and a p value <0.05 (Clarke, 2014). In addition to the overall reduction of WSBs, there were no reports of the regional anesthetic site marking leading to an incorrect surgical procedure (Clarke, 2014).

After further analysis of the policy change in marking the regional anesthetic site, considerations were recommended to optimize the usefulness of the marking. Considerations include marking the regional anesthetic site after the surgeon marks the surgical site to avoid confusion in the surgeon's marking process (Clarke, 2014). The regional site marking must wait until after verification is complete regarding the

schedule, surgical consent, history and physical, patient's understanding, surgeon's site mark, and anesthesia consent (Clarke, 2014). The convention of the regional site mark must be distinguishable from the convention of the surgical site mark (Clarke, 2014). The regional site marking must be referenced in the time-out for the procedure block (Clarke, 2014). Finally, the regional site mark should not be present in the prepped and draped surgical field (Clarke, 2014). Following the survey and comparative analyses, the Pennsylvania Safety Authority encourages departments of anesthesia to independently mark regional anesthetic sites.

In 2008, the World Health Organization developed a list of evidence-based guidelines, which formed the foundation of the 'Surgical Safety Checklist'. This was created to reduce patient harm stemming from preventable surgical errors. The checklist was designed to enhance perioperative communication and promote consistency in safe surgical care (World Health Organization, 2008). Checklists, like the WHO 'Surgical Safety Checklist', have become a gold standard in compliance and safe medicine. Furthermore, checklists reduce variability and prevent errors from happening in complex, busy environments (Mulroy et al., 2014). However, checklists for regional anesthesia procedures, such as peripheral nerve block placement, are rare.

Researchers pooled survey results from anesthesia program directors and anesthesia fellowship graduates during the year 2013 to understand their experience using a pre-block safety checklist (Mulroy et al., 2014). Survey respondents provided feedback on the appropriateness of a nerve block checklist and what components of the checklist are essential. Forty-four program directors and 122 graduates participated and greater than 75% of both groups agreed that a checklist was valuable. More specifically, site

verification and marking, patient identification, and a time-out were useful (Mulroy et al., 2014). Program directors disagreed or expressed neutral feelings for several components of the proposed checklist. Seven directors (20%) recommended removing DNR status from the checklist and 19 (43%) felt it was unnecessary to include aseptic technique and availability of resuscitation equipment as checklist items (Mulroy et al., 2014). Responses from the graduates revealed similar opinions. Adherence to safety guidelines remains a problem for regional nerve blocks; however, checklists provide explicit instructions in a stepwise format that can enhance adherence (Mulroy et al., 2014). After receiving expert feedback, the researchers proposed a final checklist to include 9 steps. Steps 1 through 9 is as follows: identify patient (using 2 criteria), review allergies and anticoagulation status, confirm surgical procedure/consent, confirm block plan with site marked, all equipment is present and drugs are labeled, resuscitation equipment is readily available, apply appropriate ASRA monitors, use aseptic technique, and perform a "time out" before needle insertion for every new block, position change, and/or team change (Mulroy et al., 2014).

Implementing a checklist for peripheral nerve block placement is essential for preventing WSB and ensuring patient safety. Although, provider commitment and checklist format undoubtedly varies from one institution to the next. Mulroy et al. (2014) admits that checklist steps and documentation requirements may be distracting and lead to time constraints for anesthesia providers. Nonetheless, this 9-step checklist can be a useful model for other hospitals. Depending on local needs, components of this checklist can be added or removed.

A reduction in WSB incidence is rooted in checklist compliance. Investigations

into the efficacy of the WHO 'Surgical Safety Checklist' explicitly show that a checklist compliance rate of at least 80% leads to a significant reduction in perioperative complications among patients (McLellan et al., 2018). Therefore, researchers of a single institution performed a quality improvement project to demonstrate how to improve peripheral nerve block checklist compliance to at least 80%. The study was conducted in 2 phases over a 12-month period. The pre-intervention 6-month phase included 280 procedures and the post-intervention 6-month phase included 316 procedures (McLellan et al., 2018). The researchers employed multiple methods to improve checklist compliance. These included immediate and distinct placement of the checklist in all block locations, an educational campaign showcasing checklist benefits, mandatory recording of the checklist use in the block room database, fitting ultrasound machines with a "Stop Before You Block" reminder, and monthly reporting of checklist usage during the study period (McLellan et al., 2018). Following implementation of these strategies, compliance to using the block service regional anesthesia checklist increased from 31% to 91%, demonstrating statistical significance (McLellan et al., 2018). While checklists have historically led to improvements in safe patient care, there still remains an opposition to using them. McLellan et al. (2018) outline several possible downsides to using a checklist. Specifically, checklists have the potential to lead to distraction, reduced situational awareness, cognitive overload, and increased time pressure. These factors may negatively affect the quality of anesthesia care patients receive. In an effort to disprove the negative influences of a checklist, McLellan et al. (2018) measured secondary outcomes that reflect the overall quality of care, following enhanced compliance to the block service regional anesthesia checklist. Secondary outcomes relate to multiple

domains of quality care, which include safety, effectiveness, patient-centeredness, efficiency, timeliness, and equitability (McLellan et al., 2018). The researchers determined no statistical difference between the pre- and post-intervention groups in any of the metrics used to reflect these domains of quality. Moreover, there was no difference in patients requiring opioids in recovery, immediate complications, patient satisfaction, or procedure delays (McLellan et al., 2018). These outcomes emphasize that compliance to regional anesthesia checklists contributes to safety during nerve block placement and preserves the overall quality of care.

Two incidents of a wrong-sided block prompted another study aimed at improving compliance to a time-out checklist. At a level one trauma academic hospital, researchers observed personnel involved in nerve block placement and recorded baseline compliance to each element of an existing timeout checklist. Initial clinical observations shockingly revealed only 20% compliance (Arbizo et al., 2022). Strategies were then introduced to enhance compliance to the timeout process over a 5-month intervention period. Arbizo et al. (2022) emphasized the importance of multidisciplinary communication and the need to include anesthesiologists, residents, nurses, and administrators throughout the timeout process. Anesthesia residents were responsible for communicating with the preoperative nurses to ensure they would be present for a nerve block. The residents also communicated with surgeons a day prior to confirm patients that needed a nerve block and encourage surgeons to mark the surgical site early to avoid delays in the block process (Arbizo et al., 2022). Through a flow diagram, the researchers illustrated necessary steps required from patient arrival in the preoperative area to nerve block time. This remained visible in all preoperative areas for staff education and to

encourage compliance. Prior to initiating sedation and following all necessary prep, the anesthesia attending led a timeout in the presence of the preoperative nurse; the time-out checklist was completed simultaneously (Arbizo et al., 2022). The initial 3 weeks of the intervention period were devoted to educating staff on the timeout process, their new roles, and for allowing staff feedback (Arbizo et al., 2022). Significant findings resulted after the 5-month study period. Preoperative nurse presence during the time-out increased from 20% to 80%, completion of all components of the time-out checklist increased from 20% to 85%, and a time-out prior to sedation and block start time improved from 66% to 100% completion (Arbizo et al., 2022). This study was conducted at a single institution with a limited number of nerve blocks performed. While results cannot be generalized, the study advocates for the presence and collaboration of the entire perioperative team for peripheral nerve block placement.

The Stop-Before-You-Block (SBYB) initiative was designed to prevent anesthesia personnel from performing wrong-side regional anesthetic nerve blocks. The goal of the SBYB campaign was to remind the person performing the block to pause just before needle insertion to confirm the correct side of the block (Hopping et al., 2018). Although posters and visual aids may serve to remind providers to pause prior to injection of the needle, the action of pausing at the correct time before the block is the responsibility of the provider. Hopping et al. (2018) reported that the SBYB did not have a significant impact on reducing wrong-side blocks, which led to the development of the Mock-Before-You-Block (MBYB) initiative. The MBYB requires the provider performing the nerve block to use an empty syringe to mock the block before injecting local anesthetic (Hopping et al., 2018). A survey distributed in the UK was created to

examine the adherence to the SBYB or MBYB, as well as to examine the rates of wrong-side blocks. The survey included 208 respondents, with a combined 3,623 total years of practice amongst participants (Hopping et al., 2018). The survey results revealed 62 wrong-side blocks reported by 51 respondents. The recognition of WSB varied, with the majority (57%) recognized almost immediately and 41% recognized within minutes. Only 2% of respondents reported recognizing WSB hours later (Hopping et al., 2018). Following the determination of the rate of WSB, respondents were asked to report contributing factors they found as possible causes of WSBs. Distractions were the primary predisposing factors to the WSB event, with 69% of respondents reporting rushing or teaching as primary distractions (Hopping et al., 2018). A third of respondents (31%) admitted to not performing the SBYB "pause" moment (Hopping et al., 2018). Other reported contributing factors to WSBs included changing the patient position, misleading skin marks, miscommunication, incorrect consent forms, and poorly placed surgical marks (Hopping et al., 2018). The survey identified that many providers performed the SBYB at an earlier time than recommended, and therefore did not aid in preventing WSBs. The MBYB initiative was predicted to be more efficacious due to the assumptions that wrong side blocks are immediately recognized and that there has been no instances of immediately performing successive wrong side blocks of the same type (Hopping et al., 2018).

Haslam et al. (2022) outlines the new national guidelines in the UK to prevent wrong-side blocks in the operating room. As previously mentioned in the Hopping et al. 2018 study, the SBYB moment was either not being performed or being performed at the wrong time. Haslam et al. (2022) describes the SBYB as three distinct phases.

Preparation, the stop moment, and the local anesthetic injection are all separate steps in the SBYB algorithm. The assistant for performing the nerve block is responsible for confirming completion of all preparation prior to handing the needle to the anesthesia provider performing the block (Haslam et al., 2022). Prior to the block, the assistant and the blocker confirm that the prepared site is the correct side and site. They must confirm using the surgical site marking and consent form that was previously checked upon arrival to the operating room (Haslam et al., 2022). The new guidance is not supported by conclusive evidence yet; however, evidence thus far is showing it is far more effective than the original SBYB practice or other existing policies (Haslam et al., 2022). Future research regarding this new practice in the UK will focus on how interruptions to the process will be best managed, how to best remind people to perform this procedure, and if assistants will be willing to speak up if the provider misses a step or does not comply with the procedure (Haslam et al., 2022). Since this is a new policy implemented in the UK, future research will determine how effective it is in preventing WSBs.

Theoretical Framework

The Donabedian (1988) model is closely aligned with the focus of this study. From this framework, three main constructs are proposed as a way to outline and evaluate quality of healthcare. These constructs are structure, process, and outcomes. According to Ayanian and Markel (2016), Avedis Donabedian emphasized that measures of quality could be reliably obtained by establishing links between structure and process to measurable outcomes. In his article on assessing quality of care, Donabedian stated, "Good structure increases the likelihood of good process, and good process increases the likelihood of good outcomes" (Donabedian, 1988, p. 1147).

The main concept of structure refers to the organization of procedural components that may include equipment, staff, or system parts. The concept of process considers the coordination of structural parts and delivery of care. Additionally, the concept of outcomes determines quality results (Finkleman, 2018). WSBs is an undesirable outcome stemming from a variety of inconsistencies in regional anesthesia practice. The structural component of this project includes the policy and procedure on placement of peripheral nerve blocks.

The goal of this DNP project is to develop an evidence-based teaching plan to eliminate wrong-site blocks that lead to adverse outcomes. By examining the structure, processes, and outcomes of regional anesthesia within healthcare institutions, quality care can be achieved through education using evidence-based teaching plans. Within the conceptual definitions of this paper, the Teaching Plan is associated with structure. A published Teaching Plan on safe placement of peripheral nerve blocks represents a structure in the context of the Donabedian (1988) model. Finkelman (2018) explains that when examining an organization's structure, the goal is to determine how the institution's elements are put together and how the parts impact quality. Responsible anesthesia providers fall under the element of process. As defined by Chang et al. (2021), responsible anesthesia providers are those who are trained in the department of anesthesia to safely provide anesthesia and place regional anesthetic blocks.

Finkelman (2018) describes the process construct of the Donabedian model as how parts of a system function independently and how they interact with each other. The providers within a healthcare system play an important role in how processes are carried out. The placement of regional anesthesia and peripheral nerve blocks also fall under the element of process. They both encompass anesthesia providers' techniques of how

regional anesthesia should be performed based on current evidence. Both the structure and processes of an institution play a role in the outcomes, or results. By improving structures and processes, outcomes can be improved to provide quality care. Correct site placement is a desired outcome of anesthesia processes; wrong-site surgery is an adverse outcome examined in this DNP project.

Outcome rates on WSBs are due to inconsistent application and adherence to best practices when administering regional anesthesia. The goal of this project is to reduce the occurrence of WSBs by creating an evidence-based teaching plan.

Method

Design

The design for this DNP project is an evidence-based Teaching Plan. The evidence-based Teaching Plan is designed to serve as an educational tool to highlight 4 main constructs related to wrong-site blocks (WSB). The 4 main constructs used to design this Teaching Plan include the incidence of WSBs, the consequences of WSBs, significant contributing factors to WSBs, and proposed methods to prevent WSBs. The Teaching Plan is designed for personnel involved in the delivery of regional anesthesia, including the anesthesia team and the perioperative nursing team. An expert panel was selected in order to complete an Expert Content Validity Form. The expert panel consisted of anesthesiologists and nurse anesthetists (CRNAs) who take part in delivery of regional anesthesia, specifically unilateral peripheral nerve blocks. An Expert Content Validity Form was created for topic experts to assess the aspects of the draft Teaching Plan prior to revising. The final Teaching Plan is established and can be presented via PowerPoint presentation for relevant staff members in a future DNP project.

The implementation of an evidence-based Teaching Plan in an institution falls under the idea of workplace learning. Finkelman (2018) describes workplace learning as a way that individuals or groups recognize and interpret a need for change. Workplace learning significantly improves error prevention, staff self-reflection on performance, and individual and organization performance outcomes (Finkelman, 2018). The evidence-based Teaching Plan will promote workplace learning and improve patient safety by describing the problem of WSBs and the proposed evidence-based methods of preventing WSBs.

Sample and Setting

There are multiple sources of data that comprise the sample of this project. The first source includes the appraised empirical evidence published in current literature. Throughout all the evidence, 4 main focuses included the incidence of WSB, consequences of WSB, significant contributors to WSB, and proposed methods to prevent WSB. These 4 constructs formed the content for an evidence-based Teaching Plan. The second source includes feedback from anesthesia professionals via a Content Validity Form. We aimed to identify the perceived utility of this Teaching Plan and more specifically components of the Plan that are useful or unnecessary. The goal was to target anesthesia professionals from various hospitals to review the Content Validity Form. In order to achieve significant results, the goal was to receive feedback from at least 50% of the anesthesia experts who received the survey.

Ethical Considerations

This DNP project was submitted to the Einstein Health Network (EHN) Institutional Review Board (IRB) for review. An exemption status was submitted since

data was sourced from published literature and anonymous expert reviewers, and there was no involvement of human subjects. A copy of the IRB letter noting human subject research exemption is provided in Appendix C. The PDs addressed additional HIPAA regulations by providing answers to the following criteria:

- The activity description
- The plan for data use (Who will have access to the data? Will data be shared outside of Einstein? How long will it be stored?)
- The plan for data protection (e.g. limited access, where and how data will be stored, data coded, de-identification, password protection, etc.)
- Any materials submitted within this determination and that will be used to carry out your planned activity
    - Any surveys/ questionnaires
    - Data collection sheet (s)
    - Master/Linking sheet
    - Description of recruitment activities including invitations (if applicable)
- Other relevant information not listed above

Answers were submitted to EHN's IRB for review. La Salle University accepted EHN's approval of this project as non-human research and has provided a letter that explains no additional IRB approval is required. Experts were briefed on the purpose and method of data collection as well as the plan for data security and preservation of anonymity. Furthermore, data received from experts was stored in a coded manner that corresponds to the field of expertise (ie: anesthesiologist or CRNA). There were no incentives for

expert reviewer participation. There were no risks encountered for participants; however, they had to devote a portion of their time to fill out the Content Validity Form. There are several benefits to participation. Participants will have a comprehensive overview of current evidence on safe practice of peripheral nerve blocks. Also, participants can assess their habits of practice during nerve block placement to what is considered standard and suggested practice.

Instrumentation

The instruments for this project include the Teaching Plan, which is constructed from current evidence regarding WSB, and the Expert Content Validity Form. The Expert Content Validity Form was used by field experts to measure the utility and significance of the Teaching Plan. The Teaching Plan includes components and themes that address the 4 main constructs regarding WSBs and its utility was measured by experts grading the relevance of each component. The Content Validity Index (CVI) score was calculated with the results from the Index Validity Form.

Procedures for Data Collection

Data collection for the content analysis was obtained from a search of the literature in the last 10 years (2012-2022) and aimed to discover the best evidence surrounding WSBs. The content analysis focuses on the four main constructs of the Teaching Plan, including the incidence of WSBs, the consequences of WSBs, significant contributing factors to WSBs, and proposed methods to prevent WSBs. After IRB approval was obtained, the Expert Content Validity Form was disseminated to a panel of anesthesiologists and CRNAs who were deemed “experts.” Communication with experts was maintained via email and participants were allowed 2 weeks to respond. Responses

were kept anonymous by coding participants according to their respective field of expertise. Data collection was obtained from multiple institutions to ensure variability among organizations. Content areas within each of the 4 constructs were determined for analysis.

Data Analysis

Content Analysis

After reviewing the current and significant literature, the PDs determined the most important and recurring themes. These themes were organized into codes (Table 3), which outlined the structure of the Teaching Plan. For each theme, the PDs gathered relevant supporting evidence from the literature review and agreed on applicability to the Teaching Plan. The PDs then formed statements, which reflected specific findings and evidence-based interventions from the broad literature search, to build the educational component. The final draft of the content analysis was reviewed by the Project Team's Chair and Reader and received approval. The content analysis was fundamental for guiding the development of the Teaching Plan.

Teaching Plan Development

The content analysis was developed in reference to the 4 main constructs identified to prevent WSBs and included in the Teaching Plan. The purpose of the learning activity is listed at the top of the Teaching Plan along with the learning objectives for each section of the activity. The content for each objective, methods of proposed instruction and media, and estimated time spent on each subject are listed in the table. The proposed method of teaching is a face-face PowerPoint presentation to be used in future project dissemination. The Project Chair and Project Reader approved the

content for each objective prior to sending the validity survey to the expert panel of reviewers.

Expert Review Data Analysis

None of the experts provided qualitative feedback, therefore, the feedback received from anesthesia experts was strictly quantitative. The data was organized and analyzed in Google Sheets to calculate I-CVI and S-CVI/Ave scores. The PDs used 2 different question types in the survey, which were a 3-point scale and a rank order scale from 1-5. For the 3-point scale, content areas of the Teaching Plan were graded a score of 0, 0.5, or 1 if the expert selected 'Not Significant', 'Somewhat Significant', and 'Highly Significant', respectively. For content area questions using the rank order scale, experts who labeled the top 2 items as an outlier (ranking of 3-5) scored a 0. Experts who labeled the top item as a ranking of 2 or the second top item as a 1 or 2 scored a 0.5. Lastly, experts who labeled the top item as a ranking of 1 scored a 1.

PDs calculated I-CVI scores for each content area by taking the total scores of each item column and dividing by the total number of experts. Individual content areas that had I-CVI scores less than 0.78 were not accepted and required revision. PDs calculated the S-CVI/Ave score by adding all of the content area I-CVI scores and dividing by the total number of content areas.

Results

Content Analysis

Table 3 provides the content supporting the components of the Teaching Plan. The results are found in Appendix A, which represents the final Teaching Plan.

The Expert Content Validity Form was sent to 15 expert reviewers via the Qualtrics online site through La Salle University. Eight experts completed the survey, yielding a 53% response rate. The 15 expert reviewers included 8 CRNAs and 7 anesthesiologists from various institutions including Abington Hospital, Cooper University Hospital, Einstein Healthcare Network, and St. Luke's University Hospital - Bethlehem. The survey responses were kept anonymous and did not include personally identifiable information.

Content areas 1-5 in the Teaching Plan were not included in the Expert Content Validity Form. These content areas included incidence of WSB and consequences of WSB, which the PDs deemed as background information not requiring expert feedback. Content areas 6-13 in the Teaching Plan were included in the Expert Content Validity Form. These content areas address the contributors to WSB and the methods of preventing WSB. The PDs included these content areas in the survey to distinguish the most important aspects of each construct related to the experts' baseline knowledge and current clinical practice.

The range of I-CVIs was 0.75 to 0.94, with a mean I-CVI of 0.86. The lowest I-CVI score, 0.75, originated in content area 10 in the Teaching Plan. This content area described the importance of a designated team of perioperative nurses designated for nerve block placement in preventing WSB. Fifty percent of experts found the team of designated perioperative nurses to be 'Somewhat Significant' in preventing WSB while the other 50% of experts deemed the team of perioperative nurses 'Highly Significant' in preventing WSB. The highest I-CVI scores were in content areas 6 (Procedural Contributing Factors to WSB), 11 (Performance of a Time-Out to Prevent WSB), and 13

(Performance of Stop Before You Block to Prevent WSB) with I-CVIs of 0.94. Results are depicted in Table 4.

Revised Teaching Plan

After reviewing validity scores, PDs accepted all but 1 I-CVIs. Content area 10 in the Teaching Plan achieved an I-CVI score of 0.75, which is less than the validity threshold of 0.78. This content area focused on integration of a designated team of perioperative registered nurses for preventing WSBs. It is important to note that none of the experts graded this item as 'Not Significant'; moreover, half of the experts agreed that it was 'Somewhat Significant' and the other half agreed that it was 'Highly Significant'. Reflecting on this, the PDs agreed to keep this item in the Teaching Plan. Based on these results, the PDs believe that experts' perception on the benefit of a designated registered nurse team may be influenced by their current practice and/or hospital culture. PDs discussed some potential reasons why experts may feel this way. For example, nurse staffing may be less robust in some institutions compared to others, leaving fewer nurses to participate strictly in nerve block placement. Also, some hospitals may not perform enough regional anesthesia to support the use of a designated team.

It is clearly evident in the literature that a designated team of perioperative nurses can prevent WSBs. These teams reduce the occurrence of WSBs, improve perioperative efficiency, and ensure continued safe practice during nerve block placement. Therefore, this content item remained in the final draft of the Teaching Plan.

Discussion

Wrong-site nerve block during regional anesthesia is a well documented issue in anesthesia and still remains a threat to patient safety. In an effort to emphasize this safety

threat and educate the anesthesia community, the PDs created a Teaching Plan that outlines essential constructs related to WSBs. Current studies published in the last 10 years guided the literature review and helped the PDs determine 4 constructs. The Teaching Plan can be used as an educational tool that showcases the incidence of WSBs, the consequences of WSBs, significant contributing factors to WSBs, and proposed methods to prevent WSBs.

Content analysis helped generate foundational teaching points to include in the Teaching Plan content column. Once the PDs agreed on pertinent content, the initial draft was reviewed by the Project Chair and Project Reader. Following their review, the PDs made relevant changes to the Teaching Plan. Content items for the Teaching Plan were organized into an Expert Content Validity Form and this form was then distributed to a total of 15 anesthesia experts via an online survey. These 15 experts belonged to 4 different health systems. The PDs received 8 responses and calculated CVI scores from these results. I-CVI scores ranged from 0.75 to 0.94 and the S-CVI/Ave was 0.86.

The final draft of the Teaching Plan is an educational guide that can help clinicians throughout regional anesthetic management. It strongly supports evidence-based practice for addressing and combating the anesthesia safety issue of WSBs. The Teaching Plan includes an overall purpose with 4 distinct learning outcomes. Additionally, there are individual objectives and associated content areas that underscore information extrapolated from the literature. For each objective and content area there is an outlined method of instruction and an allotted time period for teaching the content. Evaluation of learning outcomes could be done via a multiple-choice test or a questionnaire. However, the PDs agreed this could be done at a later period.

There was a wide range of study designs that supported the basis of this project. Studies ranged from retrospective design to quality improvement projects to systematic reviews. The PDs found that this variety of study design shared common themes surrounding this anesthesia safety issue.

Summary of Major Findings

The DNP project identified a need for further education on the prevention of WSBs. Although the expert survey revealed overall consistency among responses related to contributing factors and prevention of WSBs, there still remains inconsistency of prevention methods across institutions. The expert review panel consisted of anesthesiologists and CRNAs from various institutions in order to examine common practices across different hospitals. The content validity survey examined the top contributors to WSBs, specifically ranking patient and provider factors, procedural factors, and organizational factors. Significance of prevention methods were also examined including a regional nerve block site marking, a team of perioperative nurses specific to regional anesthesia, nerve block time-out, nerve block checklist, and the stop-before-you-block initiative.

Relating to personal practice and experience, experts identified the most likely contributing factors to WSB. Experts linked ‘poor communication’ and ‘lack of patient verification’ as the most significant patient/provider factors. For procedural factors, they identified ‘lack of a timeout’ and ‘absent regional block site marking’ as most significant. Lastly, ‘production pressure’ and ‘lack of a safety culture’ were the 2 most significant organizational factors contributing to WSB.

The goal of this project has been met following the completion of an evidence-based Teaching Plan, which can increase anesthesia providers' knowledge on the prevalence of WSBs, consequences of WSBs, contributing factors to WSBs, and prevention methods. The PDs established content validity of the Teaching Plan through the I-CVI scores.

The 4 major constructs of the Teaching Plan included incidence of WSB, consequences of WSB, contributors to WSB, and methods of prevention. A total of 13 content areas were addressed on the Teaching Plan. Included among these content areas are the incidence of WSB at international and local levels, disparities of types of WSB, direct patient insults of WSB, other potential outcomes of WSB, patient or practitioner contributing factors to WSB, procedural contributors to WSB, and organizational contributors to WSB. Additionally, methods of prevention for WSB was the final content area including regional nerve block site marking, team of perioperative registered nurses designated for nerve block placement, performance of a time-out, important components to use in a nerve block checklist, and usage of "Stop Before you Block." Content areas 1-5 in the Teaching Plan were not included in the Expert Content Validity Form. These content areas included incidence of WSB and consequences of WSB, which the PDs deemed as background information not requiring expert feedback. Of the 8 content areas that were evaluated by the expert panel, the only content area that did not meet validity was the team of perioperative registered nurses designated for nerve block placement. With an I-CVI of 0.75, the PDs decided the content area should be revised based on consideration of different institutions and their staffing.

Limitations

A limitation to this project was the small sample size of expert reviewers for the content validity analysis. Although the sample consisted of providers across various institutions, the small sample size still remains a limitation. Another limitation to the project was the low percentage of time (out of total anesthesia experience) that experts reported performing nerve blocks. Only 1 respondent reported spending 51-75% of time in nerve blocks, 2 reported spending 26-50% of time in nerve blocks, and 4 reported spending 0-25% of time in nerve blocks. The demographic question could be worded differently in the future, specifying time spent participating in the regional anesthesia process, rather than "doing regional anesthesia." This would address the providers who are involved in the block process, and not specifically the block itself. Many CRNAs are involved in the safe process of regional anesthesia from ensuring consent, site marking, and time-out are complete, but may be assisting the anesthesiologist in the block placement. This varies across institutions and is another reason to broaden the sample size. Surgery centers are a very popular site for regional anesthesia and nerve block placement; therefore, a future consideration should include a greater sample of providers from this type of surgical environment.

Implications

The goal of the DNP project is to provide education to anesthesia providers, both experienced and novice, through use of the validated Teaching Plan regarding safe practice of peripheral nerve blocks. The finalized Teaching Plan may serve as a guideline for future DNP student registered nurse anesthetists (SRNAs) to use for dissemination. The project may be disseminated through PowerPoint Presentation to anesthesia

providers and registered nurses during educational meetings. Case studies may be useful to display examples of WSB and promote discussion around key prevention methods. In order to effectively disseminate this project, future PDs will need to consider the availability of anesthesia staff and registered nurses for the education session and offer it at times conducive for staffing.

Areas for future research include maintaining up-to-date evidence-based research regarding prevention strategies for WSB. Additionally, contributing factors to WSB should remain a topic of further research to continue to provide awareness of the potential factors leading to WSB. As anesthesia continuously evolves, clinicians are using regional anesthesia more frequently for both procedural anesthesia and post-operative pain management. Future project development and dissemination of this project will provide updated evidence-based practice recommendations in providing safe regional anesthesia.

In reference to what experts identify as the most significant contributors to WSB, institutions and providers should improve their culture of safety, take the necessary time to ensure checks are complete, communication is thorough, and involve patients throughout the whole process. Although experts identified these several factors as most significant, it is still opinion-based. Further, all the contributing factors to WSB that the PDs outlined in the Teaching Plan are truly relevant and still hold significance according to current literature.

The PDs are aware of local institutions expanding regional anesthesia usage and proficiency. Specifically, hospitals are training more staff to place peripheral nerve blocks. This trend validates the significance of this Teaching Plan. It is also an

encouragement for anesthesia clinicians to stay rehearsed and knowledgeable on evidence-based practice for peripheral nerve block placement.

Conclusion

The focus of this paper is on the safety threat of wrong-site peripheral nerve blocks in regional anesthesia. Patient health and healthcare outcomes suffer from WSBs. It is a very preventable safety issue. A needs assessment at an academic medical center was conducted, which supported the significance of this project. This safety issue was explored in current literature and as a result, a Teaching Plan was developed to underscore the incidence of WSBs, consequences of WSBs, contributing factors to WSBs, and methods to prevent WSBs. This project serves as an educational resource for hospitals to use during quality improvement initiatives to better regional anesthesia delivery. The ultimate goal is to reduce the occurrence of WSBs and improve patient outcomes.

References

American Association of Nurse Anesthesiology. (2014). *Patient-centered perianesthesia communication: Practice considerations.* https://www.aana.com/docs/default-source/practice-aana-com-web-documents-(all)/professional-practice-manual/patient-centered-perianesthesia-communication.pdf?sfvrsn=7a0049b1_4

American Society of Anesthesiologists. (2017). Learning from others: A case report from the anesthesia incident reporting system. *Anesthesiology, 81*(4), 40-42.

Arbizo, J. C., Dalal, K., Lao, V., Rosinia, F., & Adejuyigbe, T. (2022). Safe preoperative regional nerve blocks. *BMJ Open Quality, 11*(1), 1-7. doi: 10.1136/bmjoq-2021-001370.

Ayanian, J. Z., & Markel, H. (2016). Donabedian's lasting framework for health care quality. *New England Journal of Medicine, 375*(3), 205-207. http://dx.doi.org/10.1056/NEJMp1605101

Chang, A., Dua, A., Signh, K., & White, B. A. (2021). *Peripheral nerve blocks*. StatPearls Publishing. https://www.ncbi.nlm.nih.gov/books/NBK459210/

Clarke, J. R. (2014). Quarterly update on wrong-site surgery: Marking for regional anesthetic blocks. *Pennsylvania Patient Safety Advisory, 11*(3), 136-140.

Deutsch, E. S., Yonash, R. A., Martin, D. E., Atkins, J. H., Arnold, T. V., & Hunt, C. M. (2018). Wrong-site nerve blocks: A systematic literature review to guide principles for prevention. *Journal of Clinical Anesthesia, 46*, 201-111. https://doi.org/10.1016/j.jclinane.2017.12.008

Donabedian, A. (1988). The quality of care: How can it be assessed? *JAMA, 260*(12), 1743-1748. 10.1001/jama.260.12.1743

Finkelman, A. (2018). *Quality improvement: A guide for integration in nursing*. Jones & Bartlett Learning.

Folino, T. B., & Mahboobi, S. K. (2021). *Regional anesthetic blocks.* StatPearls Publishing. https://www.ncbi.nlm.nih.gov/books/NBK563238/

Harris, S. N., Ortolan, S. C., Edmonds, C. R., Fields, K. G., & Liguori, G. A. (2021). Fewer wrong-site peripheral nerve blocks following updates to anesthesia time-out policy. *The Musculoskeletal Journal of Hospital for Special Surgery, 17*(2), 180-184. https://doi.org/10.1177/1556331621993079

Haslam, N., Bedforth, N., & Pandit, J. J. (2022). 'Prep, stop, block': Refreshing 'stop before you block' with new national guidance. *Anaesthesia, 77,* 372-375. doi:10.1111/anae.15647

Healthwise. (2020, May 27). *Peripheral nerve blocks for anesthesia.* University of Michigan Health. https://www.uofmhealth.org/health-library/rt1576

Henshaw, D. S., Turner, J. D., Dobson, S. W., Jaffe, J. D., Reynolds, J. W., Edwards, C. J., & Weller, R. S. (2019). Preprocedural checklist for regional anesthesia: Impact on the incidence of wrong site nerve blockade (an 8-year perspective). *British Medical Journal, 44*, 201-205. doi:10.1136/rapm-2018-000033

Hopping, M., Merry, A. F., & Pandit, J. J. (2018). Exploring performance of, and attitudes to, stop- and mock- before- you- block in preventing wrong-side blocks. *Anaesthesia, 73,* 421-427. doi:10.1111/anae.14167

Hudson, M. E., Chelly, J. E., & Lichter, J. R. (2015). Wrong-site nerve blocks: 10 year experience in a large multihospital health-care system. *British Journal of Anesthesia, 114*(5), 818-824. https://doi.org/10.1093/bja/aeu490

Kwofie, K., & Uppal, V. (2020). Wrong-site nerve blocks: Evidence-review and prevention strategies. *Current Opinion in Anesthesiology, 33*(5), 698-703. doi:10.1097/ACO.0000000000000912

Mancone, A. G., Dickey, A. R., Fitzgerald, B. M., Krause, G. P., & Dhanjal, S. T. (2018). LAST double check- A comprehensive pre-regional checklist for the busy institution. *Military Medicine, 183*, 281-285. doi: 10.1093/milmed/usx220.

McLellan, E. J., Hade, A. D., Pelecanos, A., & Okano, S. (2018). Introduction of a mandatory pre-block safety checklist into a regional anaesthesia block room service: A quality improvement project. *Anaesthesia Intensive Care, 46*(5), 504-509. doi: 10.1177/0310057X1804600512

Mira, T. (2018, September 24). Insights for anesthesia practitioners on wrong-site nerve blocks. *Anesthesia Insider.* https://www.anesthesiallc.com/publications/blog/entry/insights-for-anesthesia-practitioners-on-wrong-site-nerve-blocks

Mulroy, M. F., Weller, R. S., & Liguori, G. A. (2014). A checklist for performing regional nerve blocks. *Regional Anesthesia and Pain Medicine, 39*(3), 195-199. doi: 10.1097/AAP.0000000000000075

Russell, R. A., Burke, K., & Gattis, K. (2013). Implementing a regional anesthesia block nurse team in the perianesthesia care unit increases patient safety and perioperative efficiency. *Journal of Perianesthesia Nursing, 28*(1), 3-10. http://dx.doi.org/10.1016/j.jopan.2012.06.007

Saba, R., Brovman, E. Y., Kang, D., Greenberg, P., Kaye, A. D., & Urman, R., D. (2019). A contemporary medicolegal analysis of injury related to peripheral nerve blocks. *Pain Physician, 22*(4), 389-399.

Slocomb, P., & Pattullo, S. (2016). A site check prior to regional anaesthesia to prevent wrong-sided blocks. *Anaesthesia and Intensive Care, 44*(4), 513-516. doi: 10.1177/0310057X1604400404.

Urdaneta, F. (2019). A time-out for anesthesia professionals. *Official Journal of the Anesthesia Patient Safety Foundation, 34*(2), 36.

World Health Organization. (2008, July 9). *Safe surgery saves lives: The second global patient safety challenge*. WHO world alliance for patient safety. https://pubmed.ncbi.nlm.nih.gov/23762968/

Yonash, R. A. & Taylor, M. A. (2020). Wrong-site surgery in Pennsylvania during 2015–2019: A study of variables associated with 368 events from 178 facilities. *Patient Safety, 2*(4), 24-39. https://doi.org/10.33940/data/2020.12.2

Yusoff, M. S. B. (2019). ABC of content validation and content validity index calculation. *Education in Medicine Journal, 11*(2), 49–54. https://doi.org/10.21315/eimj2019.11.2.6

Table 1

Search Process Review of Literature

N					
Database	Total Articles	Articles Remaining After Title Review	Articles Remaining After Abstract Review	Articles Retrieved and Examined	Articles that fit Inclusion Criteria
La Salle University's Summon	53	12	10	7	3
Cochrane Library	177	7	1	0	0
CINAHL	539	13	7	5	1
Medline	544	32	6	4	2
PubMed	612	29	14	7	2
ProQuest One Academic	20	8	5	1	0

Total Article Sum	1,945	101	43	24	8

Note. Number of duplicate articles removed

Table 2

Review of Literature Matrix Systematized Review

Database #Article First, Author, Year (Full citation in References)	Purpose of Study Major Variables (IV, DV) or Phenomenon	Theory/ Conceptual Framework	Design	Measurement Major Variables (Instrument)	Data Analysis (Name of Statistics, Descriptive, Inferential, and Results)	Findings	Evidence Level of Research & Quality Johns Hopkins Nursing Evidence - Based Practice
PubMed #1 Harris, 2021	To examine the occurrence of WSB after implementing enhancements to an existing time-out process. IV= revised time-out process DV= number of WSB	None	Before-after quasi-experimental study	Quality assessment/performance improvement (QA/PI) division of the anesthesia department kept daily statistics, by manually tallying data, about procedural records from paper charts	Relative risks with 95% confidence intervals (CIs) and Fisher's exact tests compared the incidence of WSB before and after time-out process enhancement. The Breslow-Day test was used to determine	Before the time-out policy change, WSB occurrence per 10,000 blocks was 1.10 (between 2003 and 2006). Following the time-out enhancements, WSBs dropped to an incidence rate of 0.24. Relative risk was 0.17 and p value = 0.015. Also, lower extremity blocks	II-B

				from 2003 to 2016. All WSBs were reported to the New York Patient Occurrence Reporting and Tracking System. Any recorded WSB was extracted for root cause analysis.	whether the association of WSB occurrence and enhanced time-out process varied by different upper and lower extremity blocks.	had fewer reports of WSB following this new implementation when compared to upper extremity blocks. Relative risk was 0.14 and p value = 0.021.	
PubMed #2 Kwofie, 2020	To focus on the incidence of wrong-site nerve blocks (WSNB) and explore the risk factors, consequences, and strategies used to prevent them.	None	Systematic review without meta-analysis	With the assistance of an experienced medical librarian, researchers gathered literature from the last 10 years using a single database, PubMed. One of the authors investigated and included all articles that	Descriptive analysis about several factors regarding WSNB including incidence and frequency, risk factors, consequences, and prevention strategies.	The authors identified an incidence range of 0.5-5.1 per 10,000 blocks in the reported literature. WSNB frequency rates have dropped 42% over the years 2004 to 2019 according to The Pennsylvania Patient Safety Authority. Significant consequences of	I-A

				were relevant to WSNB.		WSNB include wrong-site surgery, local anesthetic toxicity, canceled or delayed surgery, and aborted regional anesthetic technique. Four categories of risk factors were identified as 'Patient', 'Practitioner', 'Procedural', and 'Organizational'. Prevention strategies included a procedural marking, checklists for nerve block procedures, time-out/stop moment, cognitive reminders/aids, physical reminders/aids, team dynamics, and auditing and quality assurance.	

La Salle University's Summon #1 Henshaw, 2019	The purpose of this study is to demonstrate the effectiveness of a pre-procedural checklist in preventing wrong-site nerve blocks (WSNB). The study directly compares the incidence of WSNB events occurring both before and after implementation of the checklist. IV= implementation of pre-procedural checklist DV= number	None	Retrospective review of quasi-experimental study	The study ran from July 1, 2009 to June 30, 2017. The study was conducted in two sister institutions. Both institutions were part of the Wake Forest Baptist Health system in Winston Salem, North Carolina. All peripheral nerve blocks were included in the analysis, while neuraxial procedures were excluded. The pre-intervention group took place in 2010-2011 while the	WSNBs were calculated per 10,000 peripheral nerve block procedures that occurred either prior to implementation of a checklist or after. The number of WSNBs that occurred during the study period was determined by searching the institutional safety database that tracks adverse events. The rate of WSNB in the pre-intervention	In the pre-intervention time period of 2010-2011, four WSNBs were performed out of a total of 10,123 peripheral nerve blocks. This resulted in an incidence of 3.95 per 10,000 procedures, 95% CI 1.26-9.53. In the post-intervention time period of 2012-2017, zero WSNBs out of 35,890 total nerve blocks occurred. This resulted in an incidence of 0 per 10,000 procedures, 95% CI 0-0.84. The p value of 0.0023 shows a statistical	II-A

	of WSBs			post-intervention group took place in 2012-2017. All peripheral nerve blocks were included in analysis regardless of if they were performed for analgesia or anesthesia.	and post-intervention groups were compared using the Fisher's exact test and 95% CI were determined. Data analysis was performed using SAS, V.9.4. The safety events were filed in real-time by the front-line providers involved in the event.	significance between the pre and post intervention groups.	
Medline #1 Deutsch, 2018	To identify the incidence, consequences, and variables that influence the occurrence	None	Systematic review with meta-analysis	Data was collected from primary research, commentaries, and guidelines	The Preferred Reporting Items for Systematic Review and Meta-analyses	Regarding incidence of WSB, 4 publications that used a common denominator of 10,000 blocks	I-A

	of WSB as well as promoting preventive measures.			using CINAHL, PubMed, and Embase electronic databases between 2004-2015.	(PRISMA). Descriptive statistics and analysis were used to present the findings.	reported an incidence rate of 0.52-5.07. Frequently reported consequences included local anesthetic systemic toxicity (LAST), potential to lead to wrong-site surgery, neurologic injury, and costs to the patient. Leading contributors to WSB included time pressure, personnel factors, poorly visible or lack of site marking, and poor communication.	
CINAHL #1 Mancone, 2018	The National Quality Forum and Joint Commission	None	Quality improvement project	The LAST Double Check Checklist was created to be	There were no reported procedures performed on	LAST Double Check Checklist includes the mnemonics “Look	V-B

	identify wrong-site peripheral nerve blocks as “never events.” The LAST Double Check Checklist was developed with the goal of identifying and eliminating errors associated with delivery of regional anesthesia. IV= LAST Double Check checklist DV= errors in delivering regional anesthesia			used prior to every regional anesthetic performed in the regional bay. The checklist was implemented in two 30 day trials. Members of the anesthesia team were encouraged to provide feedback after using the new checklist. During the 30 day trial of the checklist, a total of 350 regional anesthetics were performed.	patients taking anticoagulants during the two 30 day trials.	up, Allergies, Supplemental blocks, Talk to team, Laterality, Anticoagulation, Signed, Time-out.” The goal of the checklist is to be a comprehensive checklist that addresses multiple aspects of patient safety.	
Medline #2	To examine	None	Quality	The primary	After	The QI project	V-B

Slocombe, 2016	the “Stop Before You Block” (SB4YB) initiative in an Australian teaching hospital. The SB4YB educational program was aimed at implementing a block time-out prior to regional anesthesia to prevent wrong-sided blocks.		improvement project	outcome was the usage of the SB4YB time-out. A secondary outcome was to identify factors that led to non-performance of the SB4YB. This was measured by reviewing patient charts. Compliance of SB4YB was assessed by auditing the charts. The ORMIS (Operating Room Medical Information System) was used to identify patient identification numbers and	reviewing patient charts to identify patients who received regional anesthesia, a total of 274 patient charts were identified. 77 were excluded due to bilateral or neuraxial blocks being performed. 197 charts remained, which showed a compliance of SB4YB rate of 57.4% (113 of 197 blocks). Emergency procedures had a	aimed for an 80% compliance rate of SB4YB. The review of the charts showed only a 57.4% compliance rate. Contributing factors to the SB4YB not being performed were blocks for emergency procedures, blocks outside of the operating room, and blocks performed by visiting anesthesia personnel.	

				identify cases where regional anesthesia was used. Inclusion criteria was all unilateral blocks with potential for WSB. Exclusion criteria were bilateral blocks and neuraxial blocks. Ophthalmology blocks were also excluded since the surgeon primarily places these blocks.	compliance rate of 46.5% and elective procedures had a compliance rate of 63.5%. The data was descriptively analyzed using Microsoft Excel and the SPSS Statistics software version 22.		
La Salle University's Summon #2 Hudson,	To assess the risk factors contributing to wrong-site blocks (WSB)	None	Retrospective cohort study	Over a 10-year period between 2002 and 2012, data on total nerve blocks	Statistical analysis was based on univariate analysis using	A total of 9 WSBs, including bilateral and unilateral, were recorded out of 85,915 patients,	III-A

2015	and the overall incidence of wrong-site blocks in a multi-hospital healthcare system. Researchers also evaluated the efficacy of a new timeout policy for block placement. IV= new timeout policy DV= WSB incidence			and unilateral WSB was collected using quality improvement and patient billing data. The University of Pittsburgh Department of Anesthesiology (UPMCHS) oversaw this process to ensure accurate records.	Fisher's exact test. This test determined an association between the frequency of WSB with respect to the specific unilateral block and the type of service performing the block. Fisher's exact test was also used to compare the frequency of WSB to wrong-site surgery as a whole. Pairwise comparisons and a Bonferroni correction	which yielded an incidence rate of 1.05 per 10,000 blocks. More specifically, 70,441 received only unilateral blocks and the WSB incidence rate was 1.28 (per 10,000). Hospitals with a dedicated block/pain service team (AIPPS) had reduced WSB occurrences compared to hospitals with an integrated operating room (OR) team, demonstrating an incidence rate of 0.84 and 1.51 (per 10,000), respectively. During the period without a	

					were used for multiple comparisons. To determine causation of WSB frequency after the introduction of the new timeout policy, root cause analysis (RCA) was performed.	mandatory timeout policy (2002-2010), there were 6 WSBs out of 43,131 patients with an incidence rate of 1.39 (per 10,000). After mandating a timeout policy, 3 WSBs occurred out of 42,784 patients with an incidence rate of 0.70 (per 10,000). However, researchers did not find an association between policy presence and the number of WSBs.	
La Salle University's Summon #3 Russell, 2013	To identify the efficacy of a regional anesthetic block nurse team in	None	Retrospective data review	A block nurse team was implemented at Duke University Hospital in	Results indicated that after implementation of a regional anesthetic	The inclusion of nursing personnel is vital to overall patient safety. The results of the retrospective data	III-B

	preventing WSBs and increasing patient safety.			January of 2010 as a patient safety initiative. A retrospective data review of patients on the orthopedic service was performed one year later to determine its efficacy. Efficacy of the block team was measured by number of wrong-sided blocks performed, patient safety, and perioperative efficiency. Data from 2009, pre-implementation, was compared with data from	block nurse team, zero wrong-sided blocks occurred. Perioperative efficiency was increased by 26% and service productivity was increased by 12%.	review showed increased patient safety, represented by zero WSBs after implementation of a regional anesthetic block nurse team. Specialized education for participation on the block nurse team is key to effectively improve patient safety.	

				2010, post-implementation. The data revealed the number of wrong-sided blocks, the number of delays to OR start times, perioperative efficiency (meeting goal of 45 minute turnover time), total number of orthopedic surgery patients, and percentage of patients receiving preoperative regional anesthesia.			

Table 3

Directed Content Analysis

Code	Citations (full citation in references)	Educational Component
Wrong site nerve block (WSB) is a regional anesthesia safety issue	American Society of Anesthesiologists [ASA] (2017) Hudson et al. (2015)	● Wrong-site blocks (WSBs), a specific type of wrong-site surgery, are one of the most common adverse anesthesia events and a patient safety threat (American Society of Anesthesiologists [ASA], 2017). ● WSBs contribute to many instances of wrong-site procedures, surpassing the occurrence of wrong-site surgery (Hudson et al., 2015).
The incidence of WSBs is significant	Kwofie & Uppal (2020) ASA (2017) Deutsch et al. (2018)	● Per 10,000 blocks, the rate of WSNB incidence varied from 0.5-5.1 (Kwofie & Uppal, 2020). ● The International Registry of Regional Anesthesia reported a WSB incidence rate of 2.59 per 10,000 blocks (ASA, 2017). ● Between 2004 to 2015, the Pennsylvania Patient Safety Reporting System (PA-PSRS) received 182 reports of WSBs (Deutsch et al., 2018). ● Pennsylvania data displayed a WSB incidence rate of 1.28 per 10,000 blocks (ASA, 2017).
Different peripheral nerve blocks carry a higher incidence of WSB	Hudson et al. (2015)	● Femoral nerve blocks have a higher occurrence of WSB in comparison to upper extremity, sciatic, paravertebral, lumbar plexus, and miscellaneous nerve blocks (Hudson et al., 2015). ● Position changes are required for femoral bocks, which

		causes confusion and potentially disrupts patients from identifying errors during block placement (Hudson et al., 2015).
WSBs directly impact patient health and safety outcomes	Deutsch et al. (2018)	● Four leading consequences of WSB include local anesthetic systemic toxicity (LAST), wrong-site surgery, neurologic injury, and toll on the patient (Deutsch et al., 2018). ● There are other serious consequences that affect patients due to a WSB including respiratory depression, phrenic nerve palsy, hematoma, psychological trauma, vascular injury, infection, and opportunity cost (Deutsch et al., 2018).
WSBs lead to other negative patient outcomes	ASA (2017) Mira (2018) Kwofie & Uppal (2020)	● Patients experience increased length of hospitalization, prolonged immobility, and poor medical/pain therapy (ASA, 2017). ● Providers and hospitals directly involved in WSB events may suffer from legal claims made against them (Mira, 2018). ● Patients experience canceled or delayed surgery, aborted regional anesthetic technique, and a decline in confidence in the healthcare system (Kwofie & Uppal, 2020). ● Less measurable consequences include providers' loss of conscience and satisfaction in the care provided (ASA, 2017).

Provider error and/or patient factors contribute to WSB	ASA (2017) Urdaneta (2019) Deutsch (2018) Kwofie & Uppal (2020)	● Pertinent team members may be missing from the time-out, for example the circulating nurse or the surgeon (ASA, 2017). ● Poor communication among members of the surgical team may contribute to WSBs (Urdaneta, 2019). ● Personnel factors include changes in personnel, novice care providers, cognitive error, reliance on memory, incompetence, complacency, and fatigue (Deutsch et al., 2018). ● Some 'Patient' factors include poor communication, unilaterality, and abnormal anatomy (Kwofie & Uppal, 2020). ● Some 'Practitioner' factors include provider change and lack of adherence to a checklist (Kwofie & Uppal, 2020).
Procedural factors contribute to WSB	Kwofie & Uppal (2020) Hudson et al. (2015) ASA (2017)	● Procedural factors include position/environmental change, distractions, and a delay between timeout and procedure (Kwofie & Uppal, 2020). ● Contributing factors include ill-performed timeouts, providers not participating in timeouts, inadequately trained staff participating in regional block placement, improper patient positioning, and the absence of a regional block site marking (Hudson et al., 2015). ● Instances where consent for the surgical procedure is not available at the time of the block or where the surgical site is not yet marked contribute to WSBs (ASA, 2017).

Gaps in organizational structure and policies lead to WSB	ASA (2017) Kwofie & Uppal (2020) Mulroy et al. (2014) Deutsch et al. (2018) Clarke (2014)	● Production pressure in the operating room and distraction are two major contributing factors to WSBs (ASA, 2017). ● Some 'Organizational' factors include a lack of safety culture, blocks outside the operating room, and inadequate policies (Kwofie & Uppal, 2020). ● Checklists for regional anesthesia procedures, such as peripheral nerve block placement, are rare (Mulroy et al., 2014). ● Non Adherence to safety policies such as, a time-out, presence of all staff in the room at start of procedure, checking consent, and site verification (Deutsch et al., 2018). ● The operating room schedule may have misinformation, leading providers to obtain incorrect consent (Clarke, 2014). ● Laterality of procedures may be incorrect on the OR schedule (Clarke, 2014).
Regional anesthesia site marking aims to prevent WSB	Clarke (2014) Kwofie & Uppal (2020)	● The advantage of the regional anesthetic marking is the clear reference point of the block (Clarke, 2014). ● The regional site marking must wait until after verification is complete regarding the schedule, surgical consent, history and physical, patient's understanding, surgeon's site mark, and anesthesia consent (Clarke, 2014). ● Prevention strategies included a procedural marking, checklists for nerve block procedures, time-out/stop moment, cognitive reminders/aids, physical reminders/aids, team dynamics, and auditing and quality assurance (Kwofie & Uppal, 2020).

Integration of a designated team of perioperative registered nurses prevents WSBs	Hudson et al. (2015) Russel et al. (2013) Harris et al. (2021)	● Anesthesia teams working without a designated nerve block service were responsible for many WSBs because they were responsible for intraoperative nerve block placement and many other complicated tasks (Hudson et al., 2015). ● Hospitals with a dedicated acute interventional perioperative pain service (AIPPS) have reduced WSB occurrences compared to hospitals with an integrated operating room (OR)/AIPPS (Hudson et al., 2015). ● Implementation of a block nurse team increases patient safety, increases perioperative efficiency, decreases OR start time delays, and increases OR productivity (Russell et al., 2013). ● Having the perioperative nurse remain at the bedside until the nerve block is started promotes efficiency and reduces errors (Harris et al., 2021). ● A reduction in WSB is seen when a circulating/block nurse is responsible for distributing necessary tools (needles, medication) to an anesthesia provider upon completion of a time-out (Harris et al., 2021).
Performance of a comprehensive time-out prevents WSB	Slocomb & Patullo (2016) Harris et al. (2021) Henshaw et al. (2019)	● A formal block time-out is recommended prior to all unilateral regional anesthetic blocks (Slocomb & Patullo, 2016). ● The success of a nerve block time-out is greatest when all team members are engaged, interdisciplinary communication is clear, and there is minimal time between the time-out and block placement (Harris et al., 2021). ● Patient participation in a time-out is essential for confirming the correct patient, surgery, and laterality (Henshaw et al., 2019).

		● Provider responsibilities in a regional anesthetic time-out should include ensuring completion of anesthesia evaluation and consent, marking the site prior to needle placement, stating each block to be performed with correct laterality, pausing between each block, and re-initiating a time-out if any team member leaves the bedside (Henshaw et al., 2019). ● Repeating a time-out for any subsequent nerve blocks, especially ones that require re-positioning, prevents WSB occurrence (Henshaw et al., 2019).
Checklist components	Mulroy et al. (2014) Arbizo et al. (2022) Mancone et al. (2018)	● Checklists, like the WHO 'Surgical Safety Checklist', have become a gold standard in compliance and safe medicine as they reduce variability and prevent errors (Mulroy et al., 2014). ● The anesthesia pre-block timeout checklist should include the anesthesia personnel and the pre-operative RN and be completed immediately prior to sedation and regional anesthesia (Arbizo et al., 2022). ● The checklist includes verification of the patient with two identifiers, completion of surgical consent with laterality, surgical site marking, anesthesia consent, anesthesia site marking, ensuring all necessary equipment is available, verification of local anesthetic, and evaluation of communication (Arbizo et al., 2022). ● Components of another checklist for regional anesthesia include: identify patient (using 2 criteria), review allergies and anticoagulation status, confirm surgical procedure/consent, confirm block plan with site marked, all equipment is present and drugs are labeled, resuscitation equipment is readily available, apply appropriate ASRA monitors, use aseptic

		technique, and perform a "time out" before needle insertion for every new block, position change, and/or team change (Mulroy et al., 2014). ● Checklist mnemonics such as, "LAST-LAST" (Look-up, Allergies, Supplemental blocks, Talk-to-team, Laterality, Anticoagulation, Signed, Time-out), are useful for simplicity and completeness (Mancone, 2018).
"Stop Before You Block" (SB4YB) initiative prevents WSB	Slocomb & Patullo (2016) Hopping et al. (2018) Haslam et al. (2022)	● The SB4YB is a pre-procedure pause to identify and confirm the correct side of a regional anesthetic block (Slocomb & Pattullo, 2016). ● The goal of the SBYB campaign was to remind the person performing the block to pause just before needle insertion to confirm the correct side of the block (Hopping et al., 2018). ● Although posters and visual aids may serve to remind providers to pause prior to injection of the needle, the action of pausing at the correct time before the block is the responsibility of the provider (Hopping et al., 2018). ● Preparation includes preparing drugs and equipment, utilization of ultrasound imaging, positioning the patient, and cleaning the site (Haslam et al., 2022). ● Stopping just before the block allows the anesthesia provider to verify with the assistant and the patient that the preparation is complete and the mark and consent are correct (Haslam et al., 2022). ● The nerve block is then performed immediately following the SB4YB moment (Haslam et al., 2022).

Table 4

Expert Content Validity Scores (N = 8)

	***S-CVI / Ave* = 0.86**	***Validity Met / Not Met***
	5-Point-Scale ***3-Point-Scale*** ***I-CVI***	***Item Accepted / Revised / Rejected***
1. Contributors to WSB *Patient/Practitioner* ● Poor communication ● Absence of perioperative/anesthesia members ● Provider complacency and fatigue ● Poor checklist adherence ● Lack of patient verification	I-CVI: 0.81	Met / Accepted
2. Contributors to WSB *Procedural* ● Lack of a timeout ● Absent regional block site marking ● Patient repositioning (dual nerve block) ● Distractions ● Delay between timeout and nerve block placement	I-CVI: 0.94	Met / Accepted
3. Contributors to WSB *Organizational* ● Lack of safety culture ● Production pressure ● Lack of a checklist ● Lack of specifically trained personnel	I-CVI: 0.81	Met / Accepted

● Absence of a designated location for nerve block placement		
4. Methods to Prevent WSB *Regional Nerve Block Site Marking* ● Provides a clear reference point for block placement ● Distinguishable from the surgical site marking	I-CVI: 0.81	Met / Accepted
5. Methods to Prevent WSB *Team of Perioperative Registered Nurses Designated for Nerve Block Placement* ● Ensures that all perioperative/anesthesia members are present ● Consistency in completion of perioperative and pre-block tasks ● Increases OR productivity ● Reduces start time delays	I-CVI: 0.75	Not Met / Revised
6. Methods to Prevent WSB *Perform a Time-out* ● 2 patient identifiers (name, DOB, MRN) ● Surgical consent ● Anesthesia consent ● Allergies ● Patient verifies accuracy of identifiers, consents, and allergies	I-CVI: 0.94	Met / Accepted
7. Methods to Prevent WSB *Important Components to Use in a Nerve Block Checklist* ● Timeout complete ● Ensure presence of surgical site marking ● Ensure presence of nerve block site marking ● Verify surgical/anesthesia consent ● Confirm type of block being performed and laterality ● Verify local anesthetic and dose to be given ● Ensure presence of necessary equipment (ASA monitors, ultrasound, sedation, & oxygen)	I-CVI: 0.88	Met / Accepted

● Ensure all team members are in agreement of plan		
8. Methods to Prevent WSB *Stop Before you Block* ● PREPARATION: drugs and equipment, ultrasound scan, position patient, and clean site ● STOP: Just before you block, check mark and consent with patient ● BLOCK: Immediately perform nerve block	I-CVI: 0.94	Met / Accepted

Figure 1

Expert Content Validity Data Form

	Item 1	**Item 2**	**Item 3**	**Item 4**	**Item 5**	**Item 6**	**Item 7**	**Item 8**
Expert 1	0.5	1	0.5	1	0.5	1	1	1
Expert 2	1	1	1	1	0.5	1	0.5	1
Expert 3	1	1	1	1	1	1	1	1
Expert 4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Expert 5	0.5	1	0.5	1	0.5	1	1	1
Expert 6	1	1	1	0.5	1	1	1	1
Expert 7	1	1	1	0.5	1	1	1	1
Expert 8	1	1	1	1	1	1	1	1
Total Significant Count	6.5	7.5	6.5	6.5	6	7.5	7	7.5
Total Expert Count	8	8	8	8	8	8	8	8
I-CVI Scores	0.81	0.94	0.81	0.81	0.75	0.94	0.88	0.94
S-CVI/Ave Scores	0.86							

Figure 2

Qualtrics Survey

Wrong-Site Blocks Survey

Start of Block: Default Question Block

Q1 Please select your profession.

- ○ CRNA (1)
- ○ Anesthesiologist (2)
- ○ Other healthcare provider (3)

Q2 How many years of experience do you have in regional anesthesia?

- ○ 1-5 years (1)
- ○ 6-10 years (2)

○ 11-15 years (3)

○ Greater than 15 years (4)

Q3 What percentage of your practice is spent doing regional anesthesia?

○ 0-25% (1)

○ 26-50% (2)

○ 51-75% (3)

○ Greater than 75% (4)

Q4 In your opinion, rank the order of patient or provider factors that contribute to wrong-site block (WSB) from 1 being most likely to 5 being least likely.

_____ Poor communication (1)
_____ Absence of perioperative/ anesthesia members (2)
_____ Provider complacency and fatigue (3)
_____ Poor checklist adherence (4)
_____ Lack of patient verification (5)

Q5 In your opinion, rank the order of procedural factors that contribute to WSB from 1 being most likely to 5 being least likely.
_____ Lack of a time-out (1)
_____ Absent regional block site marking (2)
_____ Patient repositioning (dual nerve block) (3)
_____ Distractions (4)
_____ Delay between time-out and nerve block placement (5)

Q6 In your opinion, rank the order of organizational factors that contribute to WSB from 1 being most likely to 5 being least likely.
_____ Lack of a safety culture (1)
_____ Production pressure (2)
_____ Lack of a checklist (3)
_____ Lack of specifically trained personnel (4)
_____ Absence of a designated location for nerve block placement (5)

Q7 Rate the significance of a regional nerve block site marking for preventing WSB.

- [ ] Not significant (1)
- [ ] Somewhat significant (2)
- [ ] Highly significant (3)

☐ Comment required if 'Not significant' selected (4)

_____

Q8 Rate the significance of a designated team of perioperative registered nurses for nerve block placement for preventing WSB.

☐ Not significant (1)

☐ Somewhat significant (2)

☐ Highly significant (3)

☐ Comment required if 'Not significant' selected (4)

_____

Q9 Rate the significance of performing a time-out prior to nerve block placement for preventing WSB.

☐ Not significant (1)

☐ Somewhat significant (2)

- [ ] Highly significant (3)
- [ ] Comment required if 'Not significant' selected (4)

Q10 Rate the significance of using a nerve block checklist for preventing WSB.

- [ ] Not signifcant (1)
- [ ] Somewhat significant (2)
- [ ] Highly significant (3)
- [ ] Comment required if 'Not significant' selected (4)

Q11 Rate the significance of performing a 'Stop Before You Block' moment (pause just before needle insertion, verify preparation is complete, and laterality is correct) for preventing WSB.

- [ ] Not significant (1)

- [ ] Somewhat significant (2)
- [ ] Highly significant (3)
- [ ] Comment required if 'Not significant' selected (4)

Appendix A

Draft and Final Teaching Plan

La Salle University
School of Nursing and Health Sciences
Graduate Nursing Program
Draft and Final Teaching Plan

Title of Educational Activity: The Anesthesia Specific Patient Safety Threat of Wrong-Site Nerve Block and Evidence-Based Strategies for Prevention

Teachers: Mark Michetti and Kristen Newbrough

1. Following completion of the educational intervention, the anesthesia provider will become aware of the incidence of WSBs at a national and local level.
2. Following completion of the educational intervention, the anesthesia provider will understand patient consequences of WSBs.
3. Following completion of the educational intervention, the anesthesia provider will be able to determine the varying contributing factors to WSBs.
4. Following completion of the educational intervention, the anesthesia provider will demonstrate the various methods of prevention to WSBs.

Purpose: Following the completion of this learning activity, participants will be able to identify the incidence of WSBs, consequences of WSBs, contributing factors to WSBs, and methods to prevent WSBs.

Objectives	Content for Each Objective	Methods of Instruction & Media	Time

Following completion of the teaching intervention, the anesthesia providers will:			
1. Compare and contrast the incidence of WSB at an international vs. local (PA) level	**Incidence of WSB:** *International Level* ● WSB incidence is 2.59 per 10,000 blocks ● The rates of WSBs exceed the rates of wrong-site surgery *Local Level (Pennsylvania)* ● PA WSB incidence varies from 0.5-5.1 per 10,000 blocks	PowerPoint® Presentation	10 minutes
2. Distinguish disparities in prevalence among different types of WSBs.	**Incidence of WSB:** *Disparities in Types of WSB* ● Repositioning for double lower extremity nerve blocks introduces higher risk ● Femoral nerve blocks have a higher WSB occurrence	PowerPoint® Presentation	5 minutes
3. Compare and contrast the consequences of WSBs related to direct patient insults and other potential patient outcomes.	**Consequences of WSB** *Direct Patient Insults* ● Local anesthetic systemic toxicity (LAST) ● Wrong site surgery ● Neurologic injury ● Respiratory depression *Other Potential Outcomes* ● Toll on the patient ● Psychological trauma ● Canceled or delayed surgery ● Aborted regional anesthetic technique	PowerPoint® Presentation	10 minutes

	• Legal claims • Increased length of hospitalization • Patient dissatisfaction		
4. Categorize the 3 types of contributing factors to WSBs	**Contributors to WSB** • Patient/Practitioner • Procedural • Organizational	PowerPoint® Presentation	5 minutes
5. Link contributing factors to WSB as they relate to the patient or practitioner	**Contributors to WSB** *Patient/Practitioner* • Poor communication • Absence of perioperative/anesthesia members • Provider complacency and fatigue • Poor checklist adherence • Lack of patient verification	PowerPoint® Presentation	5 minutes
6. Link contributing factors to WSB as they relate to the procedure	**Contributors to WSB** *Procedural* • Lack of a timeout • Absent regional block site marking • Patient repositioning (dual nerve block) • Distractions • Delay between timeout and nerve block placement	PowerPoint® Presentation	5 minutes
7. Link contributing factors to WSB as they relate to the organization	**Contributors to WSB** *Organizational* • Lack of safety culture • Production pressure • Lack of a checklist • Lack of specifically trained personnel	PowerPoint® Presentation	5 minutes

	• Absence of a designated location for nerve block placement		
8. Demonstrate an understanding of the 5 methods to prevent WSBs	**Prevention Methods** • Regional nerve block site marking • Team of perioperative registered nurses designated for nerve block placement • Perform a time-out • Important components to use in a nerve block checklist • Stop before you block	PowerPoint® Presentation	5 minutes
9. Demonstrate how a regional nerve block site marking prevents WSBs	**Methods to Prevent WSB** *Regional Nerve Block Site Marking* • Provides a clear reference point for block placement • Distinguishable from the surgical site marking	PowerPoint® Presentation	5 minutes
10. Comment on the use of a specific block team of registered nurses for the prevention of WSBs	**Methods to Prevent WSB** *Team of Perioperative Registered Nurses Designated for Nerve Block Placement* • Ensures that all perioperative/anesthesia members are present • Consistency in completion of perioperative and pre-block tasks • Increases OR productivity • Reduces start time delays	PowerPoint® Presentation	5 minutes
11. Determine key components in a time-out for preventing WSBs	**Methods to Prevent WSB** *Perform a Time-out* • 2 patient identifiers (name, DOB, MRN) • Surgical consent • Anesthesia consent	PowerPoint® Presentation	5 minutes

	● Allergies ● Patient verifies accuracy of identifiers, consents, and allergies		
12. Explain important components in a checklist to prevent WSBs	**Methods to Prevent WSB** *Important Components to Use in a Nerve Block Checklist* ● Timeout complete ● Ensure presence of surgical site marking ● Ensure presence of nerve block site marking ● Verify surgical/anesthesia consent ● Confirm type of block being performed and laterality ● Verify local anesthetic and dose to be given ● Ensure presence of necessary equipment (ASA monitors, ultrasound, sedation, & oxygen) ● Ensure all team members are in agreement of plan	PowerPoint® Presentation	5 minutes
13. Evaluate the practice of "Stop Before you Block" for the prevention of WSBs	**Methods to Prevent WSB** *Stop Before you Block* ● PREPARATION: drugs and equipment, ultrasound scan, position patient, and clean site ● STOP: Just before you block, check mark and consent with patient ● BLOCK: Immediately perform nerve block	PowerPoint® Presentation	5 minutes

The incidence of wrong-site peripheral nerve block is a significant safety threat to regional anesthesia. The Teaching Plan embodies current and evidence-based research regarding this safety threat. The Teaching Plan encompasses the main consequences, contributing factors, and methods of prevention of WSBs. Following completion of the presentation, anesthesia providers will understand essential steps and specific barriers to provide safe, high quality care to patients receiving peripheral nerve block placement.

Appendix B

Expert Analysis

Expert Content Validity Check	
Directions:	Content Experts: Please critique the conceptual definitions. Type suggestions in the space provided. Please add comments.
Conceptual Definitions: ***Regional anesthesia*** - A technique involving administration of a local anesthetic agent into a nerve or central cavity, whether peripheral, spinal or epidural, to inhibit pain while preserving patient consciousness. ***Peripheral nerve block*** - A specific type of regional anesthesia that is injected near a specific nerve or bundle of nerves to block pain sensations in a specific area of the body. ***Wrong-site surgery*** - A surgical or other invasive procedure performed on the wrong side, site, or patient, or an incorrect procedure performed on the patient. ***Correct site placement*** - Successful targeting with the needle and infiltration of an anesthetic agent into the desired anatomical location when placing anesthetic blocks. ***Anesthesia providers*** - Anesthesiologists and certified registered nurse anesthetists (CRNAs) who are trained in the department of anesthesia and are strongly familiar with indications, placement technique, and complications of each specific type of regional nerve block.	
Items/Components/Content	Content Experts: Please answer all items of the Qualtrics Survey. Thank you very much for your participation.

Incidence of WSB: *International Level* ● WSB incidence is 2.59 per 10,000 blocks ● The rates of WSBs exceed the rates of wrong-site surgery *Local Level (Pennsylvania)* ● PA WSB incidence varies from 0.5-5.1 per 10,000 blocks				
Incidence of WSB: *Disparities in Types of WSB* ● Repositioning for double lower extremity nerve blocks introduces higher risk ● Femoral nerve blocks have a higher WSB occurrence				
Consequences of WSB *Direct Patient Insults* ● Local anesthetic systemic toxicity (LAST) ● Wrong site surgery ● Neurologic injury ● Respiratory depression *Other Potential Outcomes* ● Toll on the patient ● Psychological trauma				

● Canceled or delayed surgery ● Aborted regional anesthetic technique ● Legal claims ● Increased length of hospitalization ● Patient dissatisfaction				
Contributors to WSB *Patient/Practitioner* ● Poor communication ● Absence of perioperative/anesthesia members ● Provider complacency and fatigue ● Poor checklist adherence ● Lack of patient verification	Rank order 1-5 for significant contributors 1 = most likely 5= least likely			
Contributors to WSB *Procedural* ● Lack of a timeout ● Absent regional block site marking ● Patient repositioning (dual nerve block) ● Distractions ● Delay between timeout and nerve block placement	Rank order 1-5 for significant contributors 1 = most likely 5= least likely			
Contributors to WSB	Rank order			

Organizational ● Lack of safety culture ● Production pressure ● Lack of a checklist ● Lack of specifically trained personnel ● Absence of a designated location for nerve block placement	1-5 for significant contributors 1 = most likely 5= least likely			
Methods to Prevent WSB *Regional Nerve Block Site Marking* ● Provides a clear reference point for block placement ● Distinguishable from the surgical site marking	0 = not relevant	0.5 = somewhat relevant	1 = highly relevant	Comment
Methods to Prevent WSB *Team of Perioperative Registered Nurses Designated for Nerve Block Placement* ● Ensures that all perioperative/anesthesia members are present ● Consistency in completion of perioperative and pre-block tasks ● Increases OR productivity ● Reduces start time delays	0 = not relevant	0.5 = somewhat relevant	1 = highly relevant	Comment
Methods to Prevent WSB *Perform a Time-out*	0 = not relevant	0.5 = somewhat relevant	1 = highly relevant	Comment

• 2 patient identifiers (name, DOB, MRN) • Surgical consent • Anesthesia consent • Allergies • Patient verifies accuracy of identifiers, consents, and allergies				
Methods to Prevent WSB *Important Components to Use in a Nerve Block Checklist* • Timeout complete • Ensure presence of surgical site marking • Ensure presence of nerve block site marking • Verify surgical/anesthesia consent • Confirm type of block being performed and laterality • Verify local anesthetic and dose to be given • Ensure presence of necessary equipment (ASA monitors, ultrasound, sedation, & oxygen) • Ensure all team members are in agreement of plan	0 = not relevant	0.5 = somewhat relevant	1 = highly relevant	Comment
Methods to Prevent WSB *Stop Before you Block*	0 = not relevant	0.5 = somewhat relevant	1 = highly relevant	Comment

● PREPARATION: drugs and equipment, ultrasound scan, position patient, and clean site ● STOP: Just before you block, check mark and consent with patient ● BLOCK: Immediately perform nerve block				

Appendix C

Einstein IRB Exemption Letter

Human Subjects Research Determination

November 2, 2022

Type of Review: Initial

Project Title: Evidence based guideline for preventing wrong site block placement

Investigator: Robert Simon

IRB ID: IRB-2023-1040

Dear Robert Simon ,

The planned activity noted above was reviewed by a member of the EHN IRB and determined not to be human subjects research. This decision only applies to the planned activity described in the materials provided to the IRB. As the person accountable for the conduct of the activity, you are responsible for ensuring that it is conducted as described in the materials provided.

Before this project can be initiated, you must email Derrick Crump, the Chief Privacy Officer, the following to confirm all HIPAA regulations will be followed:

- **The activity description**
- **The plan for data use (Who will have access to the data? Will data be shared outside of Einstein? How long will it be stored?)**
- **The plan for data protection (e.g. limited access, where and how data will data be stored, data coded, deidentification, password protection, etc.)**
- **Any materials submitted within this determination and that will be used to carry out your planned activity:**

    - **Any surveys/questionnaires**
    - **Data collection sheet(s)**
    - **Master/Linking sheet**
    - **Description of recruitment activities including invitations (if applicable)**
- **Other relevant information not listed above**

If any data that is being collected for this project will be used for student requirements to earn a degree for an external school or institution (ie, doing the study and collecting data for your dissertation, Master's Degree, etc, you must contact Tahirah Harrigan to confirm that all student requirements have been met and Derrick Crump, the Chief Privacy Officer, to confirm that a data sharing agreement is needed and/or signed.

Please note that any data collected for this activity cannot be analyzed and presented for another purpose, unless an updated project description and analysis plan is approved by the IRB. Although much can be learned from these types of activities and sharing your findings is strongly encouraged, this activity as currently described cannot be referred to as "human subject research" when discussed in publications and presentations. Innovative Programs (IP) and Quality Improvement (QI) projects should not be described or analyzed as a "study" or "research" in publications or presentations, but should be clearly identified as a "program", "program evaluation" or "QI project". An acceptable statement that could be included in the manuscript would be, "This project was reviewed and determined not to meet the definition of human subject research by the EHN IRB."

If you wish to analyze and present the data collected for your project/program as part of a human subject research study, please call the IRB Office at 215-456-7217 to discuss whether a new application must be submitted to the IRB for review prior to initiating this activity.

Sincerely,
Beth Lynch, CIP

Senior IRB Analyst

Appendix D

La Salle IRB Exemption Letter

18 February 2022

TO: Patricia Dillon, PhD, RN
Chair of Graduate, RN to BSN and RN to MSN Nursing Programs

FROM: Susan C. Borkowski, Ph.D.
Chair, Institutional Review Board

RE: Post BSN - DNP Anesthesia Students' Projects

The La Salle University Institutional Review Board [IRB] accepts Einstein Hospital's IRB assessment of the Post BSN - DNP Anesthesia Students' Projects as non-human research.

These projects focus on quality improvement and do not involve human subjects. Based on the Einstein determination, La Salle's IRB does not require the submission of a formal IRB proposal.