DEVELOPMENT AND EVALUATION OF A NURSE ANESTHETISTS DIRECTED NO INTERRUPTION ZONE DURING INDUCTION OF ANESTHESIA IN AN ACADEMIC LEVEL I PEDIATRIC TRAUMA MEDICAL CENTER

An Evidence-Based Scholarly Project

Submitted to the College of Health Professions

in Partial Fulfillment of the

Requirements for the Degree

Doctor of Nursing Practice

Ruth A. Lambert

Wilmington University

August 2022

Wilmington University
College of Health Professions
Doctor of Nursing Practice Program

We hereby approve the Doctor of Nursing Practice project of

Ruth A. Lambert

Candidate for the degree of Doctor of Nursing Practice

Signature on File
Dr. Joanne Fletcher, EdD, MSN, RN, ACM RN__
DNP Project Advisor

____
Date

Signature on File
Dr. Matthew McCoy, DNP, CRNA___
DNP Project Team Member

____
Date

ACCEPTED

Signature on File
____
Denise Z. Wells, EdD, MSN, RN
Dean, College of Health Professions

____
Date

Title: Development and Evaluation of a Nurse Anesthetist Directed No Interruption Zone During Induction of Anesthesia in an Academic Level I Pediatric Trauma Medical Center

Author: Ruth A. Lambert

DNP Project Advisor: Dr. Joanne Fletcher

DNP Project Team Member: Dr. Matthew McCoy

Noise is frequently elevated in the operating room (OR) due to the required complex equipment and the necessary presence of a multidisciplinary team to care for a patient. Anesthetic induction (AI) is a critical time in the intraoperative environment, where excessive noise can have harmful effects on patient care. Anesthesia providers (AP), during the high-task load period of AI, must demonstrate assiduous behavior. Exorbitant noise results in distractions with consequences of increased stress, diminished communication, and decreased concentration of these providers. Patient safety becomes jeopardized as noise peaks. Decibel (dB) readings in the OR average at 60 dB, higher than the World Health Organization's (WHO) guidelines of 35 dB for a hospital setting (Center for Disease Control, 2019). A No Interruption Zone (NIZ) at an Atlantic Coast, Level I pediatric trauma center was implemented in the OR to decrease dB readings during AI to enhance patient safety. Decibel readings at this east coast Atlantic Coast Level I trauma center averaged 67 dB during AI prior to NIZ implementation. After educating the intraoperative multidisciplinary team to baseline dB compared to national guidelines, the NIZ initiative ensued. The NIZ included strategic placement of signs and posters around the surgical suite, documentation of the numbers of providers in the OR, and recording of dB readings from patient entrance into the OR until the AP was ready. Post NIZ data analysis revealed a statistically significant, $p < .001$, decrease in dB readings proving use of a NIZ is effective in decreasing noise during anesthetic induction.

Keywords: operating room, patient safety, anesthesia, noise, distractions, no interruption zone

ACKNOWLEDGMENTS

First and foremost, I would like to thank my advisor, Dr. Joanne Fletcher for her support and guidance throughout this process. The completion of my NIZ project would not have been possible without her wealth of knowledge, honest opinions, many emails and Zoom meetings. She always kept the doors of communication open, inspired me, and encouraged me when at times I was uncertain of what direction to take.

Vital to my project, project mentor, Dr. Matthew McCoy, was always available to discuss my concerns, gave guidance on paths to pursue, and helped me overcome numerous obstacles.

Dr. Kimberly Russo, a team member, with her “go team” attitude, endurance of far too many conversations and texts at all hours of the day and night, and unfathomable guidance encouraged me to persevere on more than she will ever know.

Dr. Leslie Jackson, a team member, encouraged me from the start to pursue the DNP degree. Her encouragement, flexibility, and willingness to assist in any way she possibly could remained enlightening.

Melinda Brown, CRNA, team member, her willingness to assist me and her countless hours of recording data were instrumental in obtaining adequate data for this project.

My sister and best friend, Rannie Kloud, who listened to countless frustrations and pushed me forward at times when I was ready to quit. I will never be able to repay her for her patience.

Finally, my children, Taylor, Kyle, and Ethan, near or far, whom many hours were taken away from during this process, their patience and understanding regarding how important this achievement was for me, was endless. They are my joy.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS

AI – anesthetic induction

AORN – Association of periOperative Room Nurses

AP – anesthesia provider

APSF - anesthesia patient safety foundation

ASA - American Society of Anesthesiologist

CDC – Center for Disease Control

CIC – Case Irrelevant Conversation

COVID – coronavirus disease

CRNA – Certified registered nurse anesthetist

dB – decibel

DNP – Doctor of Nursing Practice

EMR – electronic medical record

EPA – Environmental Protection Agency

ER – Emergency Room

HIPAA – Health Insurance Portability and Accountability Act

JCAHO – Joint Commission on Accreditation of Healthcare Organizations

NIZ – No Interruption Zone

OMF – oral and maxillofacial

OR – operating room

PICOT – Population, Intervention, Comparison, Outcome, and Time

PICU – pediatric intensive care unit

PHI – Protected Health Information

QI – Quality Improvement

SD – Secure Digital

SPA – Society for Pediatric Anesthesia

SRNA – student registered nurse anesthetist

WHO – World Health Organization

CHAPTER ONE

INTRODUCTION

Problem Description

Anesthetic induction, the process of rendering a patient unconscious and ready for the surgical procedure to begin, requires anesthesia providers (AP) to focus on the patient with the utmost concentration. The AP may be faced with changes in heart rate and blood pressure, allergic reactions, difficulty securing a patient's airway, placing a regional anesthetic, and a variety of other taxing events (de Santana Lemos & de Brito Poveda, 2019). A stressful period at baseline is further complicated with the addition of extraneous noise.

The existence of noise in the OR is twofold. First, some noise may be warranted, such as noise generated from counting surgical instruments required before surgery begins or communication between the surgeon and OR nurse regarding medications the surgeon may need to give to the patient on the surgical field (Ford & Fencl, 2020). Unwarranted noise, however, generated by traffic in and out of the OR by non-nonessential staff members, extraneous conversation not applicable to patient care, cell phones, pagers, and music has been associated with distracting anesthesia providers. The multidisciplinary team that is present to care for a patient intraoperatively must respect each other's task load at any given time to limit distractions and provide safe patient care, particularly during the critical phase of anesthetic induction (Shetty et al., 2021).

Various regulatory agencies and well-renown associations representative of intraoperative personnel have made statements regarding noise and its effects on health care providers (Association of periOperative Nurses, 2020; Committee on Quality

Management and Departmental Administration, 2020; Fu et al., 2021; Gulsen et al., 2021; The Joint Commission 2017; Kondisko, 2017; Van Pelt & Weinger, 2017; Wang et al., 2017). Noise levels in the OR, an average of 60 dB, are persistently well-above federal regulatory agencies recommendations (Wang, 2017). The Environmental Protection Agency (EPA) recommends noise levels not exceed 45 dB during the day or 35 dB at night in the OR. The WHO guidelines suggest noise not to exceed 30 dB at night and 35 dB during the day in the OR (Gulsen, 2021). The CDC (2019) specifies speech intelligibility and performance are negatively affected by increased noise. The CDC also states noise over 70 dB may damage hearing for a prolonged period.

The American Society of Anesthesiologists (ASA), instrumental in maintaining and raising anesthetic care standards, recommends limiting AP distractions that diminish focus to encourage a safe patient care environment and encourage a system approach (Committee on Quality Management and Departmental Administration, 2020). The Joint Commission (2017), promoting the highest quality of safe and effective care, has reiterated that noise in the OR affects concentration, results in poor task performance, diminished cognition, and can lead to ineffective communication, which is a leading contributing factor to adverse events. The Association of periOperative Room Nursing (AORN) recognizes distracting noise and how it interrupts patient care during the critical phase of anesthetic induction (AORN, 2020). Despite these recommendations, noise remains problematic in the OR. Distractions, interruptions, and disturbances during critical times of anesthetic care of a patient can result in deleterious and costly effects on a patient and the organization.

Medication errors (ME) and adverse drug events (ADE) are identified as patient safety concerns in the intraoperative period in a notorious, monumental publication by the Institute of Medicine Committee on Quality of Health Care in America (2000), *To Err is Human*. Critical incidents in anesthesia are related to drug administration errors and medication errors. This publication deems the current systems are bad, not the good people that use them. In a prospective observational study by Nanji et al. (2017), 22.6% of the participants were CRNAs, 32.7% were anesthesiologists, and 44.7% were house staff. Two hundred seventy-seven operations were observed. Of these 277 operations observed , 124 (44.8%) operations were identified with one or more ME and/or ADE. In these 124 operations with noted errors, an overall 193 events were detected. Causes of these medication errors and adverse drug events were preventable in 153 (79.3%) cases. The induction period of anesthesia accounted for 53.9% (104) of the total 193 ME/ADE events. The 104 events were primarily a result of inappropriate doses(47.1%), and failure to act (31.4%). Dose calculation mislabeling of medication syringes was the cited cause of these errors. Anesthesia provider vigilance and attention to detail are necessary components during AI with its extraordinary multitasking behavior. Diminished speed of response and accuracy may be affected by undesirable sound and distractions taxing the provider and jeopardizing patient safety (Kondisko, 2017).

Every anesthetic is associated with its own sets of risks. Noise, however, in a pediatric OR presents a unique situation compared to an adult OR. A child may enter the OR crying, anxious, screaming, a parent and/or a child life specialist may be present; these factors make induction more tenuous, time-consuming, and present their sources of distraction (Kelly & Cooper, 2017). Adult patients enter the operating room without a family member and already have an intravenous (IV) catheter that was inserted in the preoperative area. The in-situ IV catheter provides immediate access in which the AP can provide medication through. They are frequently able to communicate and express their concerns and follow directions. An AP can often secure an adult airway quickly after medications are given. Contrary, a pediatric patient frequently presents to the OR without IV access, requiring the anesthesia provider to place a mask filled with noxious anesthetic gases over the patient's face, eliciting further noise in addition to crying and talking. Once the pediatric patient is unconscious, an IV catheter is placed, and medications are given. Therefore, this period is lengthier when compared to an adult AI.

The time frame in which a mask is placed over the child's face until they are rendered unconscious is an excitatory phase that causes the child to move sporadically, have an accelerated heart rate, and an airway stimulation resulting in a laryngospasm. A laryngospasm, the closing of the patient's airway, may be life-threatening as it prevents the AP from breathing for the patient and providing the patient with oxygen. At the same time, they have no IV access to treat this phenomenon. As a result, heart rate and blood pressure may decrease, and oxygen saturation falls (Siddiqui, 2021). In addition, noise during this time can hinder communication amongst APs, preventing hearing the distinct noise a laryngospasm makes, causing alarms to be missed, and concentration to be interrupted.

Once a patient's airway is secured, procedures routinely performed in an awake adult need to be performed after a child is asleep, such as an epidural or central line, before anesthesia is ready. Therefore, pediatric AI is more time-consuming and can require additional cognition to make life saving decisions as anatomy changes with age and medication calculations are based on the patient's weight. The AI phase may be considerably longer than an adult AI, allowing those with low tasks loads to be distracted from patient care as the AP with high task loads must become more focused.

In an anesthesia provider survey sent to 53 staff members (Crockett, 2019), 79.2 % of participants felt music, extraneous conservations, and loud noise impaired communication during induction. However, after instituting a Distraction-Free Induction Zone, the percentage of distractions decreased from 61% to 15 % in ENT ORs. Through education of perioperative staff, the OR nurse taking accountability for music, and the anesthesia provider reminding staff of the need for quiet during induction, the Distraction-Free Induction Zone was extended to all ORs, and a 15% statistically significant decrease in distractions was noted.

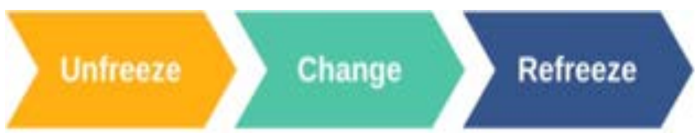
There is no current process or policy in the OR at this Level I pediatric trauma center located on the Atlantic Coast regarding noise during critical periods. The necessity for quiet, focus, and rigorous attention to detail of the AP is unbeknownst to the OR personnel. When a pediatric patient is brought into the room, staff enter and exit the room at will, music is playing, banging of instruments occurs, multiple extraneous conversations continue, and noise culminates. In addition, a variety of nonessential providers remain in the room, including equipment representatives and numerous trainees. The exorbitant increase in the number of distractions, disturbances, and interruptions hinders safe, efficient patient care the AP is trying to provide during induction of anesthesia, warranting a process to be launched.

Patients are unable to advocate for themselves when they are anesthetized. Likewise, pediatric patients are often unable to advocate for themselves before being anesthetized. Paramount to nursing advocacy emphasizes all patients are entitled to efficient, safe, quality care (Chism, 2019). Patient advocacy through the introduction of a NIZ will decrease dB readings, limit unwarranted noise, and emphasize patient safety during the critical phase of AI.

Rationale

The operating room is an ever-changing, complex environment. Adaption through interprofessional collaboration and agreement regarding change is vital for its sustenance. To elicit a change in the current process, this Evidence Based Project (EBP) is on Kurt Lewin's theory of change (see Figure 1). **Figure 1**

Understanding Lewin's Change Management Model



Lewin's theory of change involves three steps: unfreezing, change, and refreezing and is widely used in nursing. The three-stage theory initiates change by unfreezing an undesired behavior, initiating a change, and refreezing behavior for the desired change to occur. Driving forces that equal restraining forces create a state of equilibrium, a balance of forces, for the sustenance of the current processor or behavior (Hussain et al., 2020). The driving forces encourage change, whereas restraining forces oppose it. Lewin believed unfreezing occurs by decreasing resisting forces, increasing driving forces, or combining the two alters the existing equilibrium allowing change to occur.

The current readiness for change must be assessed for the established equilibrium to be altered to elicit change. The Change Theory postulates restraining forces often have emotional connections and can occur secondary to fear of change or belief a change is unnecessary. Change can be dynamic; therefore, all stakeholders' values, feelings, and thoughts should be assessed and listened to when possible. Support of critical stakeholders is accomplished by educating the need to transform the current process. Driving forces must surpass restraining forces to achieve change. Unfreezing the status quo can be accomplished by driving behavior away from the existing behavior, the status quo, and decreasing resistant forces toward the new behavior (Petiprin, 2020). Motivational readiness for change is vital to unfreeze the current behavior. The need for change must be shown to be more productive than the current process. During the change process, communication of the benefits of the new method is consistently reinforced. Refreezing the new behavior, reinforcing it, and making it the new norm elicits sustenance of the new process (Burnes, 2019).

Resistance to change of the status quo is not uncommon. Barriers encountered to change can be related to lack of knowledge concerning the issue at hand, education level, status, misunderstandings of the scope and contribution of each profession, and poor communication (Zaccagnini & Pechacek, 2021). The organizational need for change cannot be simplified. Change is multifactorial and buy-in is needed from all key stakeholders. Barriers must be overcome by driving forces to elicit, sustain, and refreeze the new behavior. Education to noise and its distractions, their effects on APs, and the potential to jeopardize patient safety, encourages unfreezing of this behavior. With evidence of the effectiveness that a change in behavior results via NIZ findings, current organizational culture can be broken, unfrozen, and refrozen with the affirmation of the new process.

Distractions in the OR suite are common; ORs are associated with noise well above WHO and EPA guidelines (Alshammari et al., 2017; Arabaci & Olner, 2020; Fu et al., 2020; Gui et al., 2021; Monoghan et al., 2020; Riutort, 2020; Wang et al., 2017); numerous types of distractions exist during critical phases of anesthetic patient care. Noise hinders cognition, communication, and the ability to multitask (Gui et al., 2021). Arabaci (2020) revealed different team members experience increased stress levels at various times during intraoperative patient care related to their current task load. Anesthesia providers experienced the most significant stress and anxiety related to unwarranted distractions during anesthetic induction and emergence, the time of their heaviest task load. In addition, noise impacted AP recognition of alarms and multitasking ability (Keller, 2018).

One common goal of OR personnel that exists is safe, efficient care of the highest standards. Noise reduction strategies encouraged by the AORN are associated with creating a culture of safety (AORN, 2020). Reductions in dB readings by as little as 3 dB are perceived as halving the volume of noise: reiterating the worthiness of change with a NIZ (Keller, 2018). Concrete evidence to alleviate noise and its dangerous effects is crucial in reinforcing a translation, change, and safety into practice.

Education of OR personnel, unfreezing to the current dB readings in the ORs, and the deleterious effects of the noise of the distractions can validate the need for change to the existing organizational practice. Through utilizing Lewin's theory, the unfreezing stage presents the driving forces of facts, encourages communication, is non-accusatory, and explains the NIZ initiative.

The ASA (2020) and the AORN (2020) suggest using a NIZ protocol to reduce distractions during critical phases of anesthesia. The NIZ, the change, limits traffic, extraneous conversations, nonessential providers' presence, use of cell phones and pagers, and stops music playing. The shift in behavior via utilization of a NIZ, its minimal cost, and sound evidence of diminished dB readings encourage establishment or refreezing. Refreezing will be inspired by a team approach, reinforced by the placement of NIZ signs on all OR door entrances and yearly modules required for new orienteers and OR personnel. Sustenance will be successful through engagement of all providers.

Specific Aims

A PICOT formatted question is used in EBP to find the best relevant evidence by searching the existing literature (Melnyk & Fineout-Overholt, 2019). The formulated question guides the search for evidence. The PICOT question utilized for this DNP EBP initiative was: For personnel in the operating room, how does the implementation of a NIZ during anesthetic induction, compared to current practice, affect decibel readings in six weeks? The specific aim of this DNP scholar's project was to decrease dB readings in the OR during the critical time of anesthetic induction. This aim, used as a conduit, was to enhance patient safety during the crucial time of anesthetic induction.

The complexity of patient care in the OR necessitates a multidisciplinary staff with diverse skills that must be integrated with interprofessional collaboration. Unfortunately, the multitasking team present in the OR is often unaware of the tasks of others, and the extraneous impact noise can result in it (Keller, 2018). With its effects of distractions, interruptions, and disruptions of anesthesia providers, noise is associated with various adverse outcomes (McMullan et al., 2019).

Using a NIZ in a QI initiative by Crocket (2019) resulted in a culture change, improved the current process, and diminished distractions during general anesthesia. In this Atlantic Coast, Level I trauma center, it has been stated by many anesthesia providers that noise is of concern during anesthetic induction; providers often must ask for quiet, further distracting them from patient care and preventing them from multitasking efficiently and safely. Comparison of dB readings pre- and post-NIZ implementation will prove a reduction in dB readings with the use of a NIZ. These findings, collected over a 6-week time frame, will provide an opportunity to educate the diverse team of the potential for patient harm and measures that can be taken to avoid them. Increasing communication and collaboration, stressing teamwork, affords the opportunity for behavioral modification. Ameliorating anesthesia providers' stress, anxiety, and fatigue during AI with noise mitigation diminishes the potentially deleterious effects that may ensue (Arabaci, 2020).

Definition of Terms

The following conceptual and operational definitions of terms were used throughout the project:

- *Anesthetic induction* (AI) is defined as the state of unconsciousness, loss of protective reflexes, elicited by medications, limiting pain and mobility (Siddiqui & Kim, 2021).
- *Decibel* (dB) is defined as a unit used to measure the intensity of sound as perceived by our ears (CDC, 2019).

- *Evidence-Based Practice* (EBP) is defined as using the most current, high-quality research and clinical expertise to improve the health and safety of patients (Melnyk & Fineout-Overholt, 2019).
- *No Interruption Zone* (NIZ) is defined as a controlled environment in which distractions and noise are minimized (AORN, 2020).

Chapter Summary

Chapter one introduced the concept of a no interruption zone (NIZ) initiative to diminish noise during the critical time of anesthetic induction. The problems associated with noise in the OR were then discussed, followed by the rationale, and aims for implementing a NIZ. Next, the Lewin theory of change that guided this evidence-based DNP project was reviewed. Lastly, terms used throughout this evidence-based DNP project were defined. Chapter two will render the search strategy used for this DNP project, an explanation of the Ohio State University EBP model adapted to this project, and an extensive literature review of the available knowledge specific to this NIZ initiative.

CHAPTER TWO

LITERATURE REVIEW

Search Strategy

An extensive electronic database search was executed. Databases scrutinized were comprised of the Cochrane Database of Systematic Reviews, Cumulative Index to Nursing and Allied Health Literature (CINAHL) Plus with Full Text, Online Medical Literature Analysis and Retrieval System Online (MEDLINE), Pub Med Medline. Additional references were obtained from bibliographies of literature reviewed and references cited in key sources. An exhaustive search for literature encompassing noise and its effects on the operating room personnel, focusing on distractions, was performed to examine this EBP's PICOT question. Key search terms extracted from the PICOT question included: operating room, no interruption zone, anesthesia, distractions, noise, patient safety. Other terms affiliated with adverse effects of noise, including the surgeon, music, and anesthesia residents, were added to the search terms when a limited number of articles were discovered. Inclusion criteria of research studies utilized standards of high quality and consistent clinical evidence (Melynyk & Foran, 2020) that addressed the PICOT question. Search-limiting phrases included the English language.

Further exclusion criteria consisted of studies that did not address the PICOT question, only mentioned surgeon, use of regional anesthetics alone, obstetrical cases, and procedures involving COVID positive patients. These articles did not provide information regarding general anesthetics, which is the primary focus of this EBP and elicited various confounding factors. All efforts were made to ensure the literature search would provide superior evidence.

EBP Model

The Ohio State University (OSU) EBP Model was used to guide this initiative. This model primarily addresses the need for change in organizational healthcare culture using EBP to improve patient care outcomes. Mentoring is considered a pivotal component to integrate research via EBP into clinical practice (Reavy, 2021). This Level I pediatric trauma center is a primary pediatric clinical site for student registered nurse anesthetists (SRNAs), CRNAs mentor DNP students from three university hospital's anesthesia schools. In addition, advanced practice nurses (APN) facilitate education and assist in research endeavors to doctorate-level students.

To implement EBP, the OSU Model suggests defining and assessing the current culture and its readiness to change. The culture of the status quo, despite anesthesia providers' complaints that noise is distracting, demonstrates the need and readiness for change in the current process. The enthusiasm for change has been confirmed as many CRNAs using EBP are involved in QI projects; research is encouraged in this teaching hospital and rewarded with a monetary clinical ladder, particularly for DNP employees. In addition, several mentor positions are available in surgical services at this Level I pediatric trauma center. For stakeholders to move toward incorporating a change using EBP, current literature regarding noise and patient safety, the institution's noise levels, and the use of low-cost noise mitigating processes will aid this Level 1 trauma center clinicians' beliefs in this EBP. The move toward utilization of EBP as evidenced by the NIZ process will be solidified. The OSU Model results in a continued and sustained EBP culture that the proven results of this EBP have fortified.

Available Knowledge

Genesis of Operating Room Noise

Noise is ubiquitous in the OR and often unavoidable due to the complex equipment required for the surgical procedure and the presence of an extensive multidisciplinary team necessary for safe, efficient patient care. Broom et al. (2011), the first study to correlate the concept of a sterile cockpit used by aviation pilots to AI, identified various extraneous causes of noise, including loud conversations, music, singing, slamming of doors, and dropped equipment. Distracting conversations occurred during 40% of induction phases and 93% of emergence phases.

In a literature review by Mackenzie and Foran (2020), an average of 10.1 distractions or interruptions occurring every hour in seven articles focused on distractions and interruptions. The distractions and interruptions were caused by traffic, music, pagers, phones, CIC, teaching, equipment, crying children, procedural, environmental, movement, coordination issues, and the patient themselves.

Van Harten (2020) noted >1000 CIC and >700 door movements for 58 surgical cases. An average of 28.1 door movements per hour (*SD* = 14.5) and 4.0 nursing CIC (*SD* = 5.5) per hour occurred during anesthetic induction. Door movement accounted for 63% of the overall distractions during AI. In comparison, CIC accounted for 32% of the distractions. Team members often showed no awareness of the high task load of sub-team members during team members' period of low task load. Despite door movement accounting for a majority of the disruptions, CIC was associated with a more significant physical and psychological burden of AP.

Ford and Fencl (2020) identified required surgical and anesthetic equipment and instrumentation, patient monitoring equipment, music, personal electronic devices (PEDs), the number of personnel present contributing to movement distractions, traffic, and additional CIC noise generating sources posing distractions.

In a study of performance during robotic-assisted surgery, a mean rate of 15.80 (*SD* = 2.18) flow disruptions occurred per hour. The rates of observed disruptions were highest for OR traffic, CIC then procedural issues (Weber et al., 2018). Noise related to the required high-capacity ventilation systems of the OR, inability to turn off alarms, and sound generated from the use of necessary equipment are unavoidable. An environment of quiescence may be used to limit undesirable sound and its generated distractions during high task load periods.

A prospective observational study (Roberts et al., 2021) in a tertiary hospital in New Zealand assessed the frequency, type, and impact of distractions in the OR over three months. A distracting event was noted an average of 56 times per hour for 57 procedures. Door openings accounted for 721 events, and 1152 other distracting events were documented. The most common distraction was case irrelevant conversation that interrupted operative flow.

Shetty et al. (2020) questionnaire to 290 anesthesia and surgical providers showed 80% of the providers believed noise adversely affected communication, 77% concentration, 58% teamwork, performance in general 50%, and 61% increased stress level. Music was controversial in such that 73% prefer music, 18% do not prefer music, and 9% may prefer music, while 73% considered music calming. The noise intensity had the most significant impact on providers, not the type.

Padmakumar et al.'s (2017) survey of 517 medical students, the Leeds Advanced Trauma Life Support faculty group, the Court of Examiners of the Royal College of Surgeons of England, and surgical trainees sitting the Member of the Ryal College of Surgeons exam, 78% of respondents perceived music did not adversely influence them. However, the mention in current literature was noted to reflect surgeons' and anesthetists' opinions that performance may be enhanced or diminished by music.

A literature review by Fu et al. (2021), specific to noise and music and the perception and attitudes towards them, discussed music and its effects on staff performance perception and patient safety. The prevailing theme of music played during a majority of ORs around the globe, with 60-90% positive feedback and subjective opinions on concentration and performance were either unaffected or improved. However, while 60% of respondents were unaffected or positively influenced by music, music-related distractions were contrarily felt to reduce speech's auditory perception and increase repeated requests occurrences.

Multiple studies suggest a team decision in the genre, tempo, and volume of music that should be played as well as critical times when it should be turned off or turned down (Padmakumar et al., 2017; Shetty et al., 2021). Music choice is multifaceted and varies amongst providers.

AORN (2020) identifies distractions and noise levels as increasing the potential risk for error. Distractions may be resultant from mechanical equipment, ventilation systems, powered surgical instruments, acoustics specific to the OR, conversations, traffic in and out of the room, monitor alarms, music devices, pagers, overhead paging systems, and communication devices.

The ecumenical thought of noise acting as a distraction to anesthesia providers is not a new concept. Simple, cost-effective measurements must be taken to mitigate stressors that ultimately result in an anxious provider with altered clinical reasoning, thereby increasing the chance of error. The effect noise has on a provider, their performance, and ultimately their patient must be limited (McMullen et al., 2019).

Recommendations, Guidelines, and Decibel Readings in the Operating Room

Average noise levels in the operating room often exceed the recommendations of the WHO at 35 dB and the EPA at 45 dB (Wang et al., 2017; Gui et al., 2021; Gulsen et al., 2020). In addition, the defined limits of noise by the National Institute for Occupational and Health (NIOSH) are not to exceed exposure of 88 dB for four hours, 85 dB for eight hours and recommend average hospital noise of 45 dB or less (CDC, 2019). Unfortunately, mean noise levels noted at this Level I trauma center were at 61 dB, well above the standard recommendations.

Noise elevation in the operating room is universal regardless of organizational size or geographic location. For example, daily mean dB readings were 60.90 at a university setting in Turkey (Gulsen, 2020). In a pediatric institution using 49 surgical cases, the mean noise level during AI was 61 dB. The median maximal noise level was noted as 81.4 dB, well above the guidelines of the WHO and EPA (Monoghan et al., 2020). Noise monitored in 23 ORs in a tertiary care hospital in China noted 100% of dB measurements also exceeded the acceptable standards varying from 59.2-72.3 dB (Wang et al., 2017).

A prospective randomized single blindfolded study at a pediatric university setting measured dBs in 26 ORs. The equivalent continuous noise level (LEQ) was 52.08

dB, which correlated with a clinically significant $p < .0001$ from the recommended 40 dB. Phase 1, anesthetic induction, had 1.25 incidents of room traffic per minute, $p < .0001$ (Alshamari et al., 2017).

At the Anesthesia Patient Safety Foundation (APSF) conference in 2017, 94% of attendees agreed distractions are prevalent in the OR. Distractions in the OR and their threat to patient safety were deemed unappreciated by 84%, 87% agreed distractions should be minimized to decrease the risk of error, and 95% surveyed stressed the importance of reducing the potential impact of inherent distractions. These OR distractions were identified as follows: alarms from monitors, personal electronic use, performing other procedures averting attention from monitoring the patient, such as a regional anesthetic, electronic medical record, and extraneous conversation. The APSF recommended developing policies for acceptable and unacceptable use of personal electronic devices (PED), selecting, and "modulating" music played, enhancing communication, "teamwork," prioritizing alarms, and use of a "sterile cockpit" during critical periods.

During the 2021 Anesthesia Patient Safety Foundation (APSF) meeting, David Gaba (Stanford/VA Palo Alto) stressed distractions can cause a "significant risk for lapses in vigilance and missing or delayed responses to critical activities at a time when extraordinary multitasking behavior is prudent" (p. 2).

Discernment of Disruptions and the Providers

Disruptions vary in severity and their impact on practitioners. Noise pollution has been associated with higher error rates and patient complications (Keller, 2018). Crockett et al. (2019) stated, “even momentary inefficiency while administering anesthesia can lead to serious errors and serious consequences for the patient” (p. 1).

Operating room personnel experience high task loads at different times. Periods of high task load for anesthesia often is a low task low period for OR nurses and surgeons. Anesthetic induction, a critical time for anesthesia providers that requires intense focus, extraordinary multitasking capabilities, and a high degree of clinical reasoning, may find the OR staff with minimal work to do as they wait for the patient to be ready for the surgical procedure. The OR team is often unaware of noise that may cause other team members to become distracted. Thus, interruptions during AI are often dangerous and unwelcome.

Distractions, interruptions, and disturbances are well-documented in the literature to adversely affect OR team concentration during high task loads. Noise contributed to human error in 83% of the professional respondents from a survey to 50 United Kingdom hospitals. Further results identified 77% of respondents felt concentration was adversely affected, and 80% felt communication was adversely affected (Padmakumar et al., 2017). A descriptive, single-blind study (Gulsen et al., 2020) using a visual analog scale (VAS) found 82.6 % of surgeons, nurses, and other staff members were psychologically and physiologically affected, 93.5% psychologically affected, and 84.4 % physiologically affected by noise.

Slagle et al. (2018) examined self-initiated nonclinical distractions amongst AP and their effects on vigilance, anesthesia workload and the incidence of nonroutine events. High task load periods were associated with little or no self-initiated distractions. Workloads during maintenance of anesthesia were low and self-initiated distractions were observed 99.6% during this time. The most common distraction was personal internet use. Events were rarely associated with self-initiated distractions suggestive of AP ability to self-manage nonclinical activities and continue to use sound judgment.

A questionnaire by Shetty et al. (2021) to 290 surgeons and anesthesiologists pertaining to noise and its effects resulted in the following: limit number of people in the room (87.9%), noise decreases concentration (85.5%), communication amongst staff affected (86.2%), deteriorates the quality of teamwork (83.8%), and increases stress level (87.6%). Thus, patent care is hampered by distractions rendered by noise.

Enser's prospective crossover volunteer study researched a lack of awareness of noise and its effects on comprehension (2017), exposed anesthesia residents to various dB sounds eliciting a quiet and a noisy environment and evaluated their reasoning and concentration skills in each using a script concordance test (SCT) of authentic clinical situations. Concentration was assessed using a visual analog scale (VAS). VAS= 8 in a noisy environment and VAS = 3 in a quiet environment, $p < .0001$. Concentration was 50% lower in the noisy environment. Kondisko's (2017) evidence-based project, quality improvement initiative, discovered a lack of awareness of the effects of noise ($p = .006$), noise and its contribution to error ($p = .000$).

Intrusive ambient noise impairs cognition, clinical reasoning, and speech intelligibility. Alshammari et al. (2017) prospective study recording dB readings during AI in 26 ORs noted that chatter and CIC accounted for 95% of their readings above 70 dB. Forty eight percent of the CIC and chatter was nonessential. A survey of surgeons and anesthesiologists (Shetty et al., 2021) reaffirms anesthesia providers are not alone in their concerns for diminished performance when unwarranted noise occurs: decreased concentration (85.5%), reduced communication (86.2%), harm to patient safety (86.2%), increased stress (87.6%). A guided recall study in a 700-bed rural hospital in North America identified strain for all professional groups at different times. Anesthesia providers identified induction as the most stressful, while surgeons identified the middle of the surgical procedure as most strenuous (Keller, 2020). Results reaffirm the need to educate personnel on high task load periods for each team member and respect the impact of noise on their performance.

Several surveys to OR personnel have revealed consistency with the presence of unnecessary noise and its negative effects on provider performance. In a survey by Crocket et al. (2018) to 53 OR personnel, 52.8% (n = 28) of respondents noticed unnecessary conversations, music, or loud noises during induction of anesthesia often, 35.8% sometimes (n = 19), 7% always (n = 3.5), and 0% never (n = 0). Of the responses to these distractions, 58.% said they were affected by personnel hearing noise/alarms, 52.8% responded yes to patient care during an emergency,79.2% replied yes to communication with other staff, and 49.1% said yes to reduced vigilance while providing patient care.

Van Pelt (2017) noted an agreement amongst APSF attendees that distractions existed 94% of the time during critical times of anesthetic care; 84% agreed non-anesthesia providers underestimate the impact distractions have on patient safety; 87% agreed it is prudent to diminish distractions to decrease human error; 95% agreed there is potential to minimize inherent distractions and their impact on patient safety. McNeer et al. (2017) used the NASA-TLX index to assess task load, stress, and fatigue in anesthesia residents by noise distractions. Mental demand was significant at $p = .045$. Noise is consistently a hindrance for anesthesia providers.

A literature review of 47 articles concluded a break in attention by unnecessary distractions during the high workload period of anesthetic induction renders the anesthesia provider's task performance to be suboptimal. The expected vigilance of such providers becomes impaired and contributes to poor patient outcomes (Riutort, 2020).

In December of 2021, a national survey was sent to an undisclosed number of anesthesia providers, including this scholar, from the Society of Pediatric Anesthesia (SPA) to measure anesthesia providers' perceptions of noise levels during critical periods of anesthesia and its potential effects on patient care, as well as interventions institutions have adopted. The survey results will be published later with the purpose to guide collaborative quality improvement projects across multiple institutions. SPA clearly recognizes the need for the mitigation of noise and seeks ways to diminish it, as noise can affect patient and provider.

Noise Reduction Strategies

The consensus throughout literature deems OR noise intrusive and identifies simple measures to mitigate it that are inexpensive and effective (AORN, 2020; Enser et al., 2017; Crocket et al., 2018; Keller et al., 2018; Riutort et al., 2020; Van Harten et al., 2020). Elimination of all noise is not feasible (AORN, 2020). Monoghan et al. (2020) suggests deciphering the range of distractions to "relatively unavoidable, completely unnecessary and easily avoidable" (p. 4).

Diminution of distractions, created by door openings, of a multidisciplinary orthopedic OR team in a large, academic, metropolitan, Level 1 trauma center was associated with a quality improvement initiative. Staff was educated on baseline pre-intervention findings, and the effects distractions have on all providers. Postage of signs, and accountability and behavioral interventions ensued. Creation of guidelines for door entry and exit, and a juxtaposition in break frequency began. Results found total door openings pre-intervention were 124.3, and post-intervention that number decreased to 86.7. Door openings were decreased on average of 22%, statistically significant with p = .0011, limiting overall distractions.

Segregation of the necessity for various noise sources allows mediation of unnecessary noise that may be mitigated through the institution of a process and/or policy. Noise generated from the ventilation system or complex monitors and equipment needed during a procedure is unavoidable; equipment noise volumes may be turned down (AORN, 2020). Traffic unrelated to the procedure and CIC is entirely unnecessary. Music, often repeatedly asked to be turned down and can mask alarms and communication, is easily avoidable; music can be turned off. Noise generated from patient alarms is relatively unavoidable; volumes may be turned down enough so that a provider may still hear them (AORN, 2020; ASA, 2020). Pagers and cell phones are relatively unavoidable as these intrusions may be case-related, and volumes on these devices may be turned down. These measures are easily implemented through personnel education to diminish the risk of error and patient harm (Van Pelt et al., 2017).

The normalization of deviance, the status quo, continues to exist as change may be inherently difficult for staff members. The hierarchy generated from various educational levels (nurse vs. physician, physician vs. CRNA, scrub technician vs. OR nurse, etc., and fear of retaliation and adverse consequences if one speaks up with regards to CIC, traffic, pagers, etc., can prevent the substantiation of limiting noise pollution. The awareness of the need for silence is not vocalized (Van Harten et al., 2020). Despite title or experience, team members should be empowered to ask for quiet during critical periods (Mackenzie & Foran, 2020). The gap between interprofessional behaviors needs to be bridged to enhance patient safety and ensure team communication.

Problems and errors occur because of systems or process failures. A systems approach, standardization, renders the organization responsible for personnel accountability, encouraging patient safety. Broom et al. (2011), are frequently referenced in the literature. The article depicts situational awareness as a key nontechnical skill to diminish distractions necessary for the sophisticated care required during AI. This article is the first to identify the use of an aviation-style sterile cockpit for induction and emergence of anesthesia, correlating the two to take-off and landing of an airplane, the sterile cockpit warrants cease of all nonessential conversation and activities.

Crocket et al. (2019) tested interventions during AI to diminish noise, including having the OR nurse turn the music off, visual cues placed on OR door entrances, anesthesia providers using a verbal cue for silence at AI, and educational awareness of OR staff, surgeons, and anesthesiologists as to the distractions noise causes during AI and the concern for patient safety. As a result, the percentage of cases with distractions decreased from 61% to 15%.

A combination of education and visual cues using posters and signs have proven to be important interventions for creating a culture of safety. A mere increase in decibel readings by three doubles the perceived noise; a gain of 6 dB increases the perceived volume of noise by 50%; the converse is also true. Noise reduction, even by a few decibels, is worthwhile to enhance patient safety (Keller, 2020)

Chapter Summary

Chapter two presented in sequence the search strategy used for obtaining a valid literature review of noise and its related threats to patient safety in the OR, and a review of the EBP Model of Ohio State University and its relationship with this DNP project. An extensive literature review revealed the paucity of noise-reducing strategies in the OR and supported the NIZ initiative for this evidence-based DNP project. Chapter three will provide a thorough examination of the methodology of this DNP project. The context and study of the NIZ intervention will be described in detail. The evaluative measures of this intervention will then be discussed, followed by the analysis of the results and an explanation of how and why these measures were chosen to assess the NIZ intervention. An overview of the project's budget will then be presented. Lastly, ethical considerations for this project with regards to organizational structure and culture will be reviewed.

CHAPTER THREE

METHODOLOGY

Context

The setting for this evidence-based project was a 260 bed Level 1 pediatric trauma center located on the Atlantic Coast. This hospital is affiliated with a large urban university medical school, various residency, and fellowship programs, two SRNA programs, two nursing schools, and at any given time has a variety of other trainees throughout the system. Teaching and research are encouraged system wide.

There are 14 operating rooms, of which six are the same approximate size and contain similar equipment. Each operating room is designated for a particular surgical specialty due to the approximation of equipment located outside of the room and the size of the OR necessary for that surgery. For example, ophthalmology and dental procedures require less equipment and are routinely performed in a smaller OR. Orthopedic procedures are most often performed in ORs 9 and 10 due to their proximity to specialized equipment and X-ray machinery. For these reasons, these six operating rooms were chosen to implement the NIZ. An additional two operating rooms (OR 3 and 11) of the same size and containing similar equipment were also included after week one to capture neurosurgery and ENT procedures for a total of eight ORs.

A pediatric population of convenience with patients from birth to 18 years of age undergoing procedures utilizing general anesthesia with the following surgical specialties were included; general surgery, urology, plastics surgery, gastroenterology, orthopedics, gynecology, ophthalmology, neurosurgery, dental procedures, and ear, nose, and throat surgery. A minimum of 60 cases were planned to be observed.

The recent rebranding of this institution encourages communication and a culture of safety with the theme of Closing the Loop of Care for patients and families. As a result of this new mantra, quality improvement projects are facilitated by patient safety officers and management to improve patient care.

The Society for Pediatric Anesthesia (SPA) sent out a national survey in December of 2021 (R. Lambert personal communication, December 15, 2021, Appendix A) to measure anesthesia providers' perceptions of the severity of noise levels occurring in the OR during critical phases of anesthesia, its effects on patient care and any interventions that have been adopted. The results of this survey were slated to guide future collaborative multi-institutional QI projects.

Well-known to the anesthesia department is the noise occurring during AI. Noise and its effects on communication and patient safety had been mentioned by various providers at monthly department meetings. The concerns of the anesthesia department were brought to the OR nursing management team in such that the importance of quiet during AI was mentioned frequently in the morning huddle. Morning huddle with the OR staff occurs every morning at 6:45am, before the start of surgical cases and reviews of staff callouts for the day, incident reports, missing or faulty equipment, and a variety of safety concerns. Recently, as increased concerns over noise and its interference with AP communication during AI, and the necessity to limit noise during AI has been mentioned.

Baseline data was collected for 28 surgical cases prior to the NIZ intervention. Decibel readings collected revealed an average dB of 65.54 ±2.12, well above the WHO guidelines of 35 dB and greater than the average OR reading of 60 dB from the current literature. The average number of staff present during AI was 8.11 ±2.13 but peaked at 16 staff members. These findings were presented via a PowerPoint presentation to the surgical staff, anesthesia department, and the OR staff. As a result of this educational presentation organizational supports included PSOs, members of the anesthesia department, the OR surgical director, chief of the anesthesia department, chair of the anesthesia department, the CMO who is also an attending anesthesiologist, the OR nurse educator, OR float supervisors, the OR nurse manager, various surgeons, and operating room staff.

The pediatric operating room requires a diverse team to care for our most vulnerable patients, children. Minimal staff present during AI includes a scrub nurse or a scrub technologist, an operating room nurse, and between one and three anesthesia providers. As a large teaching hospital that performs a variety of general surgery procedures and complex procedures on medically complex patients, additional staff present may include the surgeon, surgical fellows, residents, medical students, nursing students, OMF fellow, ER resident, PICU fellow, OMF fellow, X-ray technologist, equipment representatives, an OR nursing float supervisor, a nurse liaison, and observational visitors. The presence of extensive staff alone can increase noise drastically during AI.

Both the AORN (2020), Committee on Quality Management and Departmental Administration (2020), Joint Commission (2017) and the SPA (2020) endorse interventions to limit noise during critical times of surgical care to prevent verbal and nonverbal miscommunications and lapses in cognition which affect task management, technical skills, and decision making and can cause human error.

Collaboration with nursing is essential. The AORN statement specifically recommends utilizing a NIZ during counting of instruments and labeling of specimens, this was reflected upon by this DNP scholar when presenting the NIZ concept to the OR staff to engage this practice during other critical parts of the case, such as AI. Additional education elucidates high task load vs. load task load time periods for each service and the respective need for limiting noise. One example reiterated to elicit buy in from the OR staff was the AORN and Joint Commissions guidelines for limiting noise during surgical counts and specimen labeling.

To engage surgical staff, the importance to limit traffic was stressed as increased traffic is known to increase post-op surgical infection rates. Interest, engagement, and commitment by all parties to optimize function, is prudent to legitimize the NIZ. Verbal and email correspondence with the Physician Director of Surgical Services was continued throughout the project (Appendix B). The Surgical Director sent the baseline PowerPoint to all surgical staff a week before the initiation of the NIZ and continued to encourage staff to support this EBP (Appendix C and Appendix D). Creation of a positive, non-retaliative, teamwork environment to increase communication and collaboration amongst different services was prudent.

Interventions

The NIZ was utilized over a 6-week time span. Operating room number, surgical specialty, total number of people present in the OR and decibel readings were recorded from the time the patient entered the OR until the time the anesthesia provider deemed they were ready for the surgical team by touching the Anesthesia Ready (AR) tab in the patient's EMR. The NIZ was performed on random days at random times from 7:00am to

7:00pm, Monday through Friday, in random operating rooms previously noted of same size and containing similar amounts of equipment.

For this EBP, this scholar, the team leader, designated three DNP prepared CRNAs well versed in QI initiatives, EBP, and mentoring students. The responsibilities as team leader included purchase, maintenance and appropriate use of Reed Meter, creation of signs, posters, and PowerPoint presentations, ensuring appropriate placement of each, reminders to staff at weekly OR morning huddles and anesthesia department weekly meetings of NIZ initiation and usage, encourage mention in presurgical huddle with surgeons, field questions and concerns regarding NIZ, and maintain frequent communication with team members and statisticians. The team members included the four staff CRNA: the lead DNP, CRNA, a DNP, a CRNA that is the associate director of a local nurse anesthesia program, a CRNA that is a recent DNP graduate, and a CRNA that works Monday through Friday. Schedules of the team members varied according to days and shifts worked. The diversity in schedules assured this scholar the ability to acquire cases on assorted days and times of the week. The team was educated on how to use a dB meter, where to place it, informed to ensure the NIZ was mentioned during the patient care huddle, assure signs were placed appropriately on OR doors, and how to use a Word document (Appendix E) to record additional data during the NIZ time frame. Team members were encouraged to contact the team leader with questions, concerns, or suggestions verbally and via email communication (Appendix F).

Decibel meters have been used to record accurate so various healthcare settings and in occupational environments (Alshammari, 2017; Arabaci , 2020; Broom et al., 2011; Gulsen, 2021; Monoghan, 2020; Wang, 2017). Decibel data collection for this EBP was achieved using a Reed Data Logging Sound Level Meter R8070SD. For future reference, this meter will be referred to as the Reed Meter (Appendix G).

The dB meter was placed in the OR by a member of the project team before the patient entered the OR. The Reed Meter was set to record sound every five seconds. The decision was made by the team leader not to have a team member hold the dB meter for concern the movement by the team member could potentially alter the accuracy of recordings The Reed Meter was placed approximately 3 feet from the head of the operating room table at an approximate 45-degree angle to avoid being in the way of the AP. The dB meter was placed on a mayo stand with a gel pad underneath to limit potential vibration or movement of the mayo stand. Written instructions were reviewed and handed to the CRNA team and placed in the carrying case of the dB meter prior to use to ensure proper use of the dB meter.

A Word document (Appendix E) was generated for the sake of logging the case number, date, operating room number, surgical specialty, and total number of people in the OR. The total number of staff members were counted by the same team member responsible for turning on the dB meter. The Word document was reviewed with each team member to ensure understanding and accuracy of documentation.

This scholar met personally with each team member weekly to ensure the NIZ data was accurately recorded on the Word document and to review proper use of the dB meter. The team leader uploaded word data into an Excel spreadsheet and the Reed Meter data was uploaded and coded into an additional Excel spreadsheet. The Excel spreadsheets were reviewed weekly with the statistician to ensure accuracy and proper coding.

Signs (Appendix H) revealing the NIZ initiative start date and process were posted one week prior to PowerPoint presentations to illicit curiosity and evoke questions to this EBP. Baseline data including dB readings and the total number of people for 28 cases were presented to the anesthesia department and the OR staff during staff meetings via a PowerPoint presentation (Appendix D) prior to the NIZ implementation. The PowerPoint presentation was emailed to both groups after the presentation to ensure all providers were informed of the baseline data results and the NIZ process.

Data was personally discussed and emailed to the CMO, chair of the anesthesia department, chief of surgery, and chief of the orthopedics department. The PowerPoint presentation was emailed to all surgical physicians by the department chief of surgery to ensure buy-in of surgical stakeholders and stress its importance. After initiation of the NIZ, it was mentioned weekly at the anesthesia department meetings, during the OR morning huddles, and verbally to the surgical staff. All staff was encouraged to contact this scholar and any team member regarding questions, concerns, and suggestions for the NIZ.

The NIZ began when the patient entered the OR and ended when the anesthesia provider hit the Anesthesia Ready tab in the patient's EMR. Anesthesia Ready deems the patient ready for the surgical team to begin care of the patient. Prior to each patient being brought into the OR, the multidisciplinary team in that OR participates in a presurgical huddle. A presurgical huddle includes the surgeon, OR nurse, scrub technician, and an anesthesia provider. In the huddle, the surgeon states their needs for the procedure to all parties, such as antibiotics to be given by anesthesia, possible blood products, surgical instruments to be obtained by OR personnel and any other pertinent details. The OR nurse, scrub technician, and AP clarify these needs. The AP reiterates these needs and confirms anesthesia type, regional anesthetics that will be performed, blood product confirmation, and any other patient concerns to the team. For the NIZ process, the AP will reiterate this is a NIZ case in this huddle. After the huddle and prior to the AP entering the OR with the patient, the OR nurse places the NIZ sign (Appendix I) on the sterile core door. For clarification, the OR sterile core door is located on the wall opposite of the OR entrance doors. The sterile core door entrance is connected to a sterile area where equipment is maintained, and entrance for all staff during the procedure is through this door to minimize infection. During the procedure, if the OR staff that is scrubbed must leave the room for X-rays, this is the door they go through to wait until X-rays are completed and to maintain sterility. The AP places the NIZ sign on the OR door entrance prior to entering the OR with the patient.

The AP provider leaves the room to retrieve the patient and bring the patient into the OR. The OR nurse ensures music is turned off and the volume on the OR phone is turned down prior to patient entrance. All nonessential personnel are to exit the OR. Prior to patient arrival, the CRNA team member records the OR number and surgical specialty in the predesigned Word document. Upon arrival to the OR, the Reed Meter is turned on by the CRNA team member, and begins recording every 5 seconds until the AP hits the Anesthesia Ready tab in the patient's EMR. The CRNA team member continuously observes the number of people in the room during the NIZ and documents the total number present on the Word document by hand in real time, when the AR tab was hit. Once anesthesia was ready, the dB meter was turned off and the CRNA team member exited the room.

Case inclusion criteria for the NIZ initiative were procedures on Monday through Friday from 6:45am to 7:00pm and included all surgical specialties in the main OR. Cases where a patient was crying, a parent, and/or a child life specialist was present, were excluded as noise had the potential to be much greater, influencing dB readings. COVID positive patients were excluded secondary to the need for additional air circulation machines and personnel protective equipment needed by staff altering the noise and its perception in the OR. Trauma cases due to the additional staff present, potential for multiple entrances and exits, and the need for the surgeon to begin operating emergently before the AP is ready were also excluded. In addition, weekend cases and cases that began after 7pm were excluded due to the limited number of staff present in the OR suite during these time periods. Standard staffing on off shifts consists of only four operating room personnel and two or three anesthesia providers compared to the 50+ staff members during the 7am to 7pm, Monday through Friday shifts. Cases performed out of the main surgical suite, such as MRI and interventional radiology procedures were also excluded as sedation nurses are utilized in these areas and procedures are routinely nonoperative and do not require a general anesthetic.

Study of the Interventions

A pre- and post-intervention design from a sample of convenience is used to assess the impact of a NIZ on dB during the critical time of anesthetic induction. Concrete evidence of decibel readings and the number of people present during the NIZ are chosen to obtain buy-in from stakeholders who may be unaware of variances in task loads of opposing team members during patient care in the OR. Educating the staff to baseline readings in comparison to national guidelines is paramount to obtain support of a

NIZ from this complex interdependent group, to ensure the highest standard of care for our patients.

Measures

The chosen dependent and independent variables were selected based on current literature research. A prospective, observational study by Keller (2018) including 367 hours of observation of 110 abdominal surgeries found noise to be distracting to 95.5% of the anesthetists during periods of high mental workload including AI. Various studies have utilized a dB meter to accurately measure and obtain concrete data pertaining to noise during patient presence in the OR. Their findings echo dB readings well above WHO and EPA guidelines. Alshammari (2017) measured 64 operations in a pediatric hospital in which 813 incidents of noise were documented at >70 dB. Monoghan et al. (2020) documented 735,000 dB readings. The mean during AI = 61.9 dB, whereas Arabaci and Olner's (2020) study noted a mean of 65.1 dB during AI. Gui et al. (2021) referred to the numerous types of distractions that exist and that dB readings were particularly high during critical phases of anesthesia including AI, hindering communication and the ability to multitask during this high task load time.

Noise during this EBP was measured by decibels using the Reed Meter. The Reed Meter was chosen to capture sound as it is used to measure sound at construction sites, public venues and concerts, appliance noise testing, ensuring safe working conditions and recording of acoustic levels for environmental impact studies. Measuring dB range for this meter are from 30-130 dB, well within the range needed for this project. Sampling time is flexible and can be set alternatively between 1 to 60 seconds. For this EBP, sampling was set at every 5 seconds to increase the reliability of the total dB readings.

Frequency weighting, representing what the human ear hears, can be adjusted to A or C weighting. The human ear is less sensitive to very low pitch and very high pitch noises. The weighting of these noises is referred to as A weighting. C weighting is used for peak measurements above 100 dB such as in entertainment noise. For this EBP weighting was set on automatic to enable the device to capture A and C weighting noise. In addition, the meter has the capability to log or automatically transfer data to a secure digital (SD) card that transcribes data into a prefabricated Excel sheet which includes date, time, case number and every 5 second dB readings measured that ensured ease of data analysis. The data was then uploaded to a computer and coded for surgical specialty. To prevent confounding factors in collecting decibel readings, rooms of equal square footage were utilized. The time frame from patient entrance into the OR until the AR tab was touched by the AP was documented to assess the correlation between length of induction, traffic, and dB readings.

To ensure accurate and appropriate use of dB meter, team members were not only instructed on use of the Reed Meter but were additionally monitored during three practice sessions to ensure proper command of the instrument. Decibel data was uploaded to a secured password sensitive computer every three days to verify generation of an accurate excel spread sheet. In addition, team members were encouraged to ask questions regarding use of the Reed Meter and offer suggestions to the team leader.

Presence of an extraneous number of occupants during AI have been identified as increasing disruptions, distractions, and CIC in the OR. In a study by Van Harten et al. (2020), 58 cases were observed. Door movement caused by people entering and exiting the OR, totaling 869 events, was the most frequent distraction with an average of 28.1

door movements noted per hour. However, CIC was deemed by the AP to be the most distracting. Monoghan et al. (2020) mixed method study documented an average of eight people present during AI alone. In Crockett's (2019) survey to 53 AP, 79.2% felt music, extraneous conversations, and loud noises impaired communication during AI. For these reasons, the number of people present was documented during AI. Surgical specialty was also included on the code sheet to assess potential correlation between surgical specialty, traffic, and dB readings.

The team leader and/or a team member, here after are referred to as the counter, directly observed and counted the number of occupants present in the OR during AI. The count included people present during the entire AI, staff entering and leaving during AI, as well as staff entering and remaining in the room during anesthetic induction. No individual was counted more than once. For example, if the circulating nurse left the room to obtain a piece of equipment or a blanket for the patient and then re-entered the OR during AI, he/she was not recounted. The counter was present as an observer and not to perform a clinical role. The counter was conspicuous to the staff present in the OR but was instructed to minimize interaction with staff to prevent changes in staff's behavior and/or illicit further CIC. Of note, students, trainees, visitors, and equipment representatives were included in the count. The number of people was written on a prefabricated Word document that correlated to the case number (Appendix E). The Word document required the counter to write in the case number, OR room number, surgical specialty and number of people present. Data were coded every three days and uploaded to a separate Excel document for ease of statistical analysis. The counter was ultimately responsible for both turning on and off the dB meter and counting the number of people present during the prior mentioned designated AI period. Cases were selected randomly, Monday through Friday from 7am to 7pm to secure reliable, dependable, and valid measurements. Data were collected for six weeks by the team.

Descriptive statistical analysis was used for baseline data. Nominal values were used for the surgical specialty. Two cases included more than one surgical specialty; therefore, the number of values (30) exceeds the number of cases (28). Continuous variables included occupants, duration of AI, and volume (dB). Each variable, dB readings, number of occupants, duration of procedure, and OR number was evaluated by minimum and maximum value, mean, and standard deviation. Outliers were identified. Mean and standard deviation, which assess reliability of the mean, infers the results are replicable and/or dependable. A Shapiro-Wilk normality test, a test of significance, was used to examine whether volume, (dB), was normally distributed. While decibel distribution for all surgical specialties was well above national guidelines, the variation amongst specialties was deemed to have a normal distribution ($W = 0.96$, $p = 28$). The baseline data sample size, 28 cases, asserted the internal validity results of dB readings are a true representation of the data. Pearson's Correlation Coefficient was utilized to examine the possibility of a continuous relationship between the variables number of occupants and the duration of AI. Statistical significance was found ($p < .43$), as the duration of AI increased, so did the number of occupants. Similar statistical analysis was used for the NIZ data.

Analysis

Prior to this EBP, baseline data was analyzed for comparison to data obtained during this NIZ EBP. Initially, the number of occupants and dB readings were analyzed for the entire post- NIZ sample. Data were then extrapolated via univariant statistics for each surgical specialty to depict any correlation between variables of dB readings, occupants, and duration.

Descriptive and inferential statistics are used to evaluate individual variables. Descriptive statistics describe the sample being used. Inferential statistics make inferences from the data collected using the current sample and applies these findings to a general population. Thus, the potential for the results collected from the EBP sample may be correlated to AI in all surgical specialties.

Descriptive statistics are utilized to analyze nominal and continuous variables. Surgical specialty, a nonparametric, nominal variable, is depicted in the data in frequency and percentages. Continuous variables including decibels, occupants, and duration of AI are evaluated according to minimum value, maximum value, and mean. The mean, referred to as central tendency, depicts where most values fall. Standard deviation, the range of data from the central tendency or mean, identifies the dispersion or variability of data whether far away or close to the mean. For ease of organization and interpretation tables and figures are presented representing these findings.

Inferential statistical tests, which can be parametric or nonparametric, are utilized to infer conclusions when utilizing the NIZ amongst the variables of dB, surgical specialty, number of occupants, and length of AI. Correlation coefficient tests of significance assesses whether the relationship between variables is random or not. Analysis of variance (ANOVA), *t*-tests, and parametric Pearson's *r*, a correlation coefficient, are utilized to assess if there is a relationship between two continuous variables, such as number of occupants and dB readings in this EBP. These parameters are used to analyze potential relationships between baseline data and post- NIZ data, as well as individual variables of post- NIZ surgical specialty dB readings, duration, and number of occupants.

ANOVA and *t*-tests assess means of groups and their difference, such that a t-test compares only two groups and ANOVA compares more than two groups. A standard *t*-test attempts to identify an effect in one direction, negative or positive. Whereas a two-tailed *t*-test attempts to identify an effect regardless of positive or negative direction. Strength and direction of potential relationships are interpreted as weak, moderate, or strong using a positive or negative numerical value. Both tests were utilized to compare all variables both pre- and post- NIZ intervention. For example, a *t*-test is used to compare total mean dB readings of baseline data to total mean dB readings of post NIZ data. Whereas ANOVA is used to compare total mean dB readings of baseline data to total mean dB readings post- NIZ and mean orthopedic surgery dB readings post-NIZ. Variables from a distinct category such as dB readings, frequency, and number of occupants are also compared.

The relationship of significance of the effect size, reliability, is assessed by Pearson's *r*, a correlation coefficient, between the continuous variables of duration, occupants and dB readings revealed a value of significance, $p < .43$, between duration and number of occupants in baseline data. For this reason, Pearson's *r* is used to test for significance and effect size between baseline data and post- NIZ data variables. Values of significance for this EBP statistical analysis are set at $p < .05$.

Various tables and figures are utilized to present analysis in an organized format to aid the readers' interpretation of data and provide visual interpretation. Tables represent descriptive and inferential statistics of the entire population and each independent variable according to surgical specialty to assess differences and similarities. Tables of descriptive statistics are used to depict minimum, maximum, mean, and SD for individual variables of dB, number of occupants, and duration of AI for the entire sample and individual surgical specialties. Figures such as histograms, similar to a bell curve, using parametric data, are presented with baseline data and post-NIZ data illustrating the normality of dB findings and any relationship or trend amongst the variables. A Shapiro-Wilk normality test is then further utilized to decipher if dBs are normally distributed. In addition, a boxplot figure is presented which suggests the possibility of an outlier in dB data across quartiles during data collection. The generation of a colored spaghetti diagram provides a visual picture of the variance in each surgical specialty's dB readings over a continuum to further aid analysis interpretation.

Budget

The NIZ quality improvement was relatively inexpensive. The hospital graciously permitted the use of the operating rooms free of charge and the CRNA team volunteered their time to assist with this EBP. The statistician submitted about 30 hours of time and was paid for by the institution's nursing research fund. Costs absorbed by the EBP team leader included the Reed Meter ~~Instrument~~ ($349.00) and the creation of laminated signs and posters ($430.00, Appendix J).

Ethical Considerations

Prior to initiating this quality improvement project, the author completed CITI training (Appendix K) and obtained approval from Wilmington University's Human Subjects Review Committee (Appendix L). Deemed QI in nature, an exemption from the setting's Institutional Review Board (Appendix M) was obtained. Patient data was not collected, therefore no patient breach of privacy occurred and protected health information (PHI) per HIPPA standards was not used or recorded.

No conflict of interest was noted by the team leader nor its members. Volunteer CRNAs that were DNP prepared and familiar with EBP were sought to assist in obtaining data during the NIZ. Staff present during the NIZ were aware of the measurements being obtained as reviewed in the prior PowerPoint presentation, current staff huddles before surgery, and signs placed around the operating room suite. Data collected were either stored in a locked cabinet in a locked office or encoded in Excel files on a password sensitive computer. Per hospital policy, ongoing accurate confidential record keeping was performed, data was secured and only those with permission had access to the data. Data are to be kept for five years.

Concerning to the operating room nursing staff was concerned with the increased workload potentially caused by the responsibility for placement of NIZ signs on sterile core doors before patient entrance into the OR and having to remove sterile core door and patient entrance door signs at end of NIZ if the anesthesia provider was unable to do so. Participants recording data during the NIZ may cause the observed staff to become self-conscious in their duties and stressed in their performance. OR staff was additionally concerned with the presence of senior staff members and the hierarchy that presented itself in the OR limiting their ability to enforce the NIZ. To minimize this concern, OR and surgical staff were encouraged at the patient huddle by an AP to respect the NIZ process and stress the importance of the work of the team when caring for a patient. Volunteers and staff were encouraged to speak with the author or CRNA volunteers with questions or concerns during the QI project. The team leader spoke directly with random OR staff weekly involved in cases that had used the NIZ intervention. Staff was asked about their perception of the NIZ initiative. Questions, concerns, and encouragement of the project were afforded.

Chapter Summary

Chapter three presented the methodology of this EBP in detail. The context was stated, followed by a thorough discussion of the intervention. The study of the intervention was then defined. Measures were examined, subsequently the analysis was identified. The budget was then explored. Finally, ethical considerations were elaborated. Chapter four will provide the results of this evidence-based practice project.

CHAPTER FOUR

RESULTS

Project Modification

Modifications to data collection were made after the first week of instituting the NIZ. After initial review of data collected during week one, it was noted no ENT or neurosurgery cases were captured. To capture neurosurgery and ENT cases, the project was extended to operating rooms three and eleven. These two ORs are designated for neurosurgery and ENT procedures as they contain the necessary equipment specific to these services. Continued surveillance of case specialties obtained ensured adequate capture of these surgical specialties.

The second modification of the NIZ initiative was the sporadic changing of locations of the large purple signs around the operating room to continue to capture interest of the staff. Team members and other anesthesia department staff members suggested this as they felt the purple signs were being ignored, and staff was used to seeing them.

The third modification removed the dental surgical specialty from baseline and post-intervention as no cases were obtained during baseline or NIZ data collection. Additionally, ophthalmology was removed from the post-intervention population as there were no cases obtained during this time.

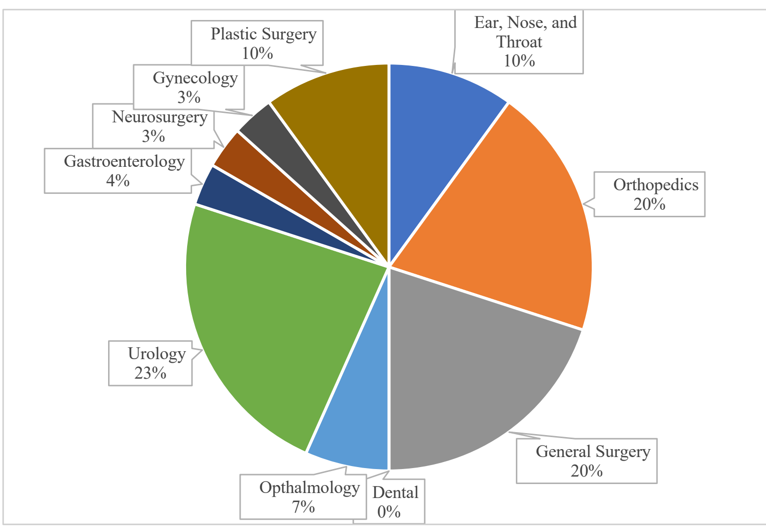
The fourth modification was the addition of pulmonary (PU) as a surgical specialty to post-intervention data.

Sample Characteristics

The period for the NIZ initiative was from February14, 2022 through March 14, 2022. Pre-intervention data included 28 cases with a variety of surgical specialties. However, 30 surgical specialties are noted as two cases had more than one surgical specialty. Percentages of each surgical specialty are depicted in Figure 2. A total of 2,179 decibel readings were recorded.

Figure 2

Surgical Specialty for Pre-Intervention Data



Of the preintervention surgical specialties observed urology measured 23%; both general surgery and orthopedics measured 20% each; both plastic surgery and ENT measured 10% each; gastroenterology measured 4%; ophthalmology measured 7%; both gynecology and neurosurgery measured 3% each; and dental measured 0 percent as there were no dental cases observed.

Post-intervention NIZ data was to include a 60 total cases; however, 63 cases were recorded. Five cases were excluded due to recording error, and four cases were excluded due to the recorder having to assist the Anesthesia Provider (AP) with direct patient care. A total of 54 cases were used for analysis. Percentages for each surgical specialty post-intervention are in Figure 3.

Figure 3

Surgical Specialty for Post-Intervention Data

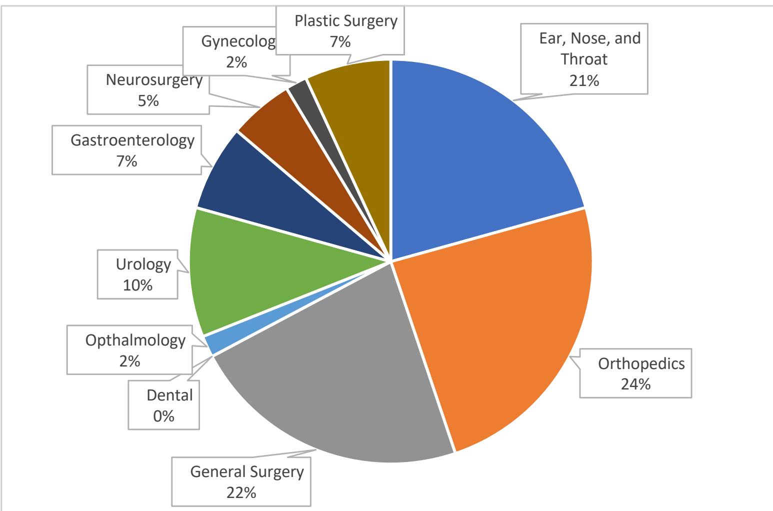


Figure 3 shows breakdown of the post-intervention readings. Orthopedics measured 24%. General surgery measured 22%. ENT measured 21%. Urology measured 10%. Both plastic surgery and gastroenterology measured 7% each. Neurosurgery measured 5%. Both gynecology and ophthalmology measured 2% each. Dental cases were not recorded.

Table 1 depicts descriptive statistics for pre- and post-intervention variables including case numbers and percentages by surgical specialty. Continuous variables including the number of occupants, duration of operation in seconds, and volume (dB) are depicted by minimum (min) value, maximum (max) value, mean, and standard deviation (SD). For ease of reading the tables, patient entrance to anesthesia ready is referred to as duration of operation.

Table 1

Pre- and Post-Intervention Descriptive Statistics of Study Variables

Surgical Specialty	Pre-Intervention	Post-Intervention
Ear, Nose, and Throat	3 (10%)	12 (21%)
Orthopedics	6 (20%)	14 (24%)
General Surgery	6 (20%)	13 (22%)
Dental	0 (0%)	0 (0%)
Ophthalmology	2 (7%)	1 (2%)
Urology	7 (24%)	6 (10%)
Gastroenterology	1 (3%)	4 (7%)
Neurosurgery	1 (3%)	3 (5%)
Gynecology	1 (3%)	1 (2%)
Plastic Surgery	3 (10%)	4 (7%)
Number of Occupants		
Min	6	4
Max	16	13
Mean (SD)	8.11 ±2.13	7.00 ±1.84
Duration of Operation (sec)		
Min	260	50
Max	1690	2014
Mean (SD)	767.96 ±410.61	686.94 ±384.90
Volume (dB)		
Min	62.16	60.28
Max	70.98	69.14
Mean (SD)	65.54 ±2.12	63.41 ±2.03

Note: Because surgical specialties are not mutually exclusive, cases can include more than one surgical specialty, the number of values (30) exceeds the number of cases (28).

RESULTS

A histogram of volume (dB) was used to display the frequency of data distribution. Figure 4 is a histogram representing the normality of volume, dB, the primary outcome variable for preintervention data. The values appear normally distributed as they resemble a bell curve. To further confirm the normality of distribution, a Shapiro-Wilk test was utilized to examine whether volume, the primary outcome variable, was normally distributed. Shapiro-Wilk test is performed when there are 3-50 samples and is used to test for normality. The *p*-value assesses whether random chance was responsible for the results of data collected. When the value of p is < 0.05, results are foreseen as replicable and statistically significant, such that the lower the *p*-value, the greater the statistical significance. With p set at > 0.05, distribution was normal ($p = .14$).

Figure 4

Normality of volume, the primary outcome variable for preintervention data.

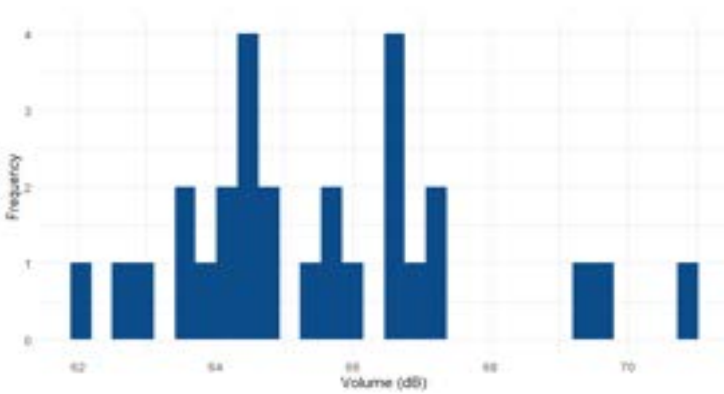


Figure 4 shows normality of volume with the range of dB readings represented on the x-axis. The decibels readings range from 62.16 – 70.98. The frequency of the dBs occurrence is represented on the y-axis, ranging from 0-4. Decibel readings ranging from 63.3 – 67.3 occurred most frequently.

Specific analysis of pre-intervention data for each surgical specialty by number of occupants, duration of operation, and volume (dB) for pre-intervention data is depicted by Table 2.

Table 2

Pre-Intervention (baseline) Descriptive Statistics of Number of Occupants, Duration of Operation, and Volume (dB) by Surgical Specialty

	ENT (N = 2)	ENT, P (N = 1)	GI (N = 1)	GS (N = 6)	GY (N = 1)	N (N = 1)	O (N = 2)	OP (N = 5)	OP, U (N = 1)	P (N = 2)	U (N = 6)
Occupants											
Min	8	9	7	6	9	8	7	7	10	6	6
Max	8	9	7	11	9	8	10	16	10	6	10
Mean (SD)	8.00 ± 0.00	9.00 ± NA	7.00 ± NA	8.00 ± 2.10	9.00 ± NA	8.00 ± NA	8.50 ± 2.12	9.20 ± 3.90	10.00 ± NA	6.00 ± 0.00	7.50 ± 1.52
Duration (sec)											
Min	390	1690	460	430	1170	1370	370	290	840	260	300
Max	960	1690	460	1360	1170	1370	460	1300	840	670	1160
Mean (SD)	675.00 ±403.05	1,690.00 ± NA	460.00 ± NA	983.83 ±350.98	1,170.00 ± NA	1,370.00 ± NA	415.00 ±63.64	712.00 ±415.30	840.00 ± NA	465.00 ±289.91	566.67 ±326.54
Volume (dB)											
Min	66.58	68.52	65.27	65.21	63.97	67.64	65.18	63.69	62.99	62.95	62.27
Max	71.21	68.52	65.27	72.55	63.97	67.64	67.89	67.00	62.99	64.05	66.91
Mean (SD)	68.89 ± 3.27	68.52 ± NA	65.27 ± NA	68.21 ± 2.53	63.97 ± NA	67.64 ± NA	66.53 ± 1.92	65.05 ± 1.34	62.99 ± NA	63.50 ± 0.78	65.48 ± 1.65

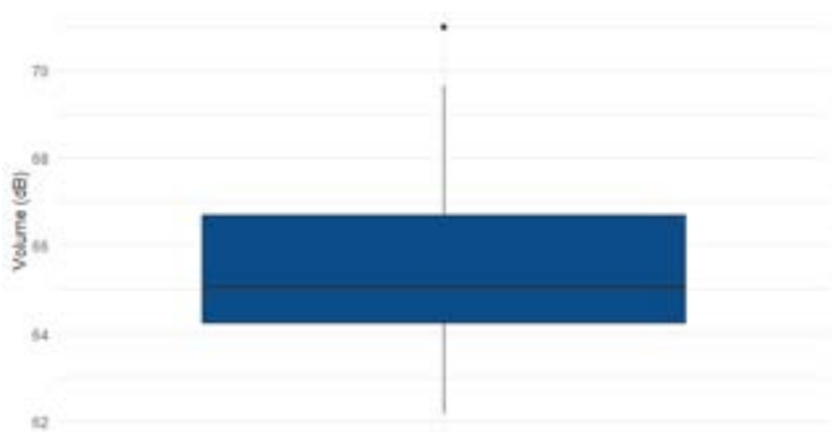
Note. ENT = Ear, Nose, and Throat; P = Plastic Surgery; GI = Gastroenterology; GS = General Surgery; GY = Gynecology; N = Neurosurgery; O = Orthopedics; OP = Ophthalmology; U = Urology.

Table 2 shows each surgical specialty's data. ENT and pulmonary are grouped together in column 2, as are ophthalmology and urology in column 9. Both of these surgical cases included two surgical specialties. In addition, the minimum number, maximum number, and standard deviation of the number of occupants are displayed, as is the duration of time in seconds, and the volume in dBs for each surgical specialty.

A boxplot represents continuous variables (decibel readings), their overall distribution and possible outliers. Preintervention decibel readings are displayed in Figure 5 with a boxplot which examines volume across quartiles.

Figure 5

Volume Across Quartiles Preintervention (baseline)



The blue rectangle in the middle of the diagram represents 50% of the overall decibel readings. The horizontal black line in the middle of the blue rectangle represents the 50th percentile or the exact middle number (Mean) of the dB data, 65.54 decibels. Above the horizontal black line is the 75th percentile, below the horizontal black line is the 25th percentile. The minimum and maximum values are represented by the "whiskers", or vertical lines connected to the boxplot. The upper whiskers are above the third quartile or 75th percentile. The lower "whiskers" are below the first quartile or the 25th percentile.

Note the dot on this figure on the x-axis at 70.98. This value suggests a possible outlier, outside the expected range. The Grubbs test examines only one outlier when data is otherwise normally distributed. An outlier, in this data set = 70.98, is the highest or lowest value in a given sample. The Grubbs test calculates the G value. The G value is the difference between the outlier and the mean divided by SD. The Grubbs test was used to examine whether this reading was statistically different from the overall sample. When the calculated $G_{value} < G_{critical}$ (found on statistically designed standard tables), the point is not an outlier. The value of U is the ratio of sample variances. Results showed the highest volume (70.98) was not an outlier (G = 2.57, U = 0.75, p = .09).

Pearson's Correlation Coefficient measures the relationship between two or more continuous variables. In this instance, the continuous relationship between duration of operation, number of occupants and dB readings were examined using pre-intervention data and are depicted in Table 3.

Table 3

Pearson's Correlation Coefficient Preintervention (baseline)

	Duration (sec)	Occupants (number)	Volume (dB)
Duration (sec)	1	-	-
Occupants (number)	.43*	1	-
Volume (dB)	-0.07	-0.07	1

Note. Values significant at $p < .05$ are indicated using an asterisk (*).

Results showed the number of occupants was positively related to the duration of patient entrance to anesthesia ready time, $p = .43$. Such that the longer the anesthetic induction time, the more occupants were present.

A total of 54 post-NIZ intervention cases' dB readings were statistically analyzed using measures of central tendency including mean, median, and mode. Mean value is the average of all numbers (dB readings). Median value is the middle number of all data points, in such that it is not skewed by outliers The mode value is the most frequently occurring number (dB number). Standard Deviation was utilized to account for probability distributions variability in dB readings. Post-NIZ intervention case results are depicted in Appendix O. Other data noted in Table 4 includes duration of time from patient entrance to AR in seconds, number of occupants, and decibel readings minimum and maximum value.

Table 4

Correlations of Post-Intervention Continuous Study Variables using Pearson's Correlation Coefficient

	Duration (sec)	Occupants (number)	Volume (dB)
Duration (sec)	1	-	-
Occupants (number)	.15	1	-
Volume (dB)	0.01	-0.14	1

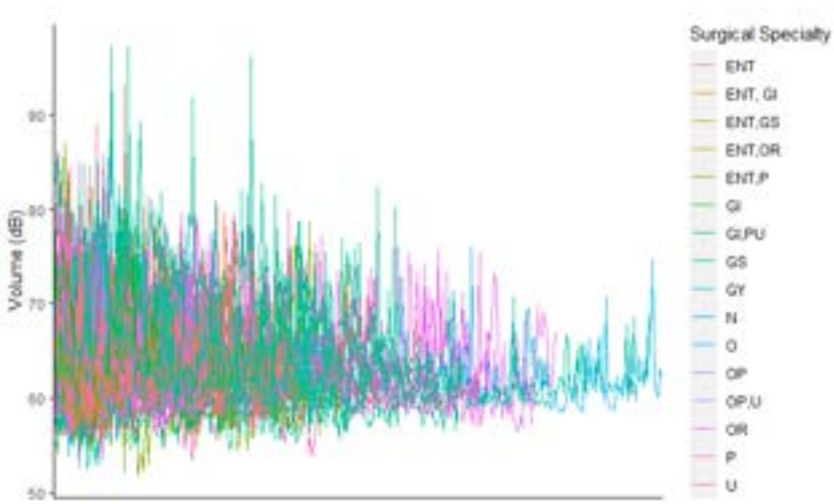
Note. Values significant at $p < .05$ are indicated using an asterisk (no values were significant)

Pearson's Correlation Coefficient was used for post intervention data analysis; however, no significant relationship existed between duration, occupants, and volume (Table 4). Pre-intervention data revealed a statistically significant correlation: as time increased so did the number of occupants in the room. Post-intervention results may be speculated that with education of staff, the number of people entering and exiting the OR regardless of the time of AI, remained unchanged. Despite the increase in time of the AI, the number of people present did not increase.

A spaghetti diagram presents a visual diagram of a variable over time to assess a pattern. Figure 6 represents a spaghetti diagram of volume (dB), over time of each surgical specialty.

Figure 6

Spaghetti Plot Depicting Volume Over Time Per Case Pre- and Post-Intervention



Note. Pre- and post-intervention data together. ENT = Ear, Nose, and Throat; P = Plastic Surgery; GI = Gastroenterology; GS = General Surgery; GY = Gynecology; N = Neurosurgery; O = Orthopedics; OP = Ophthalmology; U = Urology.

Each line represents one case.

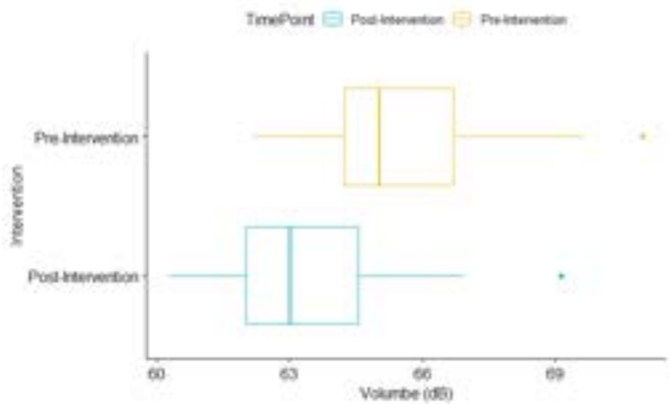
Each surgical specialty is depicted in a different color as specified. Over time, the volume level of each case oscillated between quieter and louder moments for the duration of the operation. The oscillation of louder versus quieter moments may be accounted for when a regional anesthetic performed after the patient's airway is secured. For pediatric patients requiring a regional anesthetic, once the airway is secured the regional anesthetic is performed by the anesthesia provider. This period is included in the AI time. The policy to perform a regional anesthetic requires all present in the OR to be quiet during a time out. A time out is performed before the regional block can be initiated. It included the anesthesia provider proceduralist announcing the patient's name, medical record number, date of birth, type of block being performed, and the local anesthetic to be given Each person present in the room must identify themselves by name and position, for example, "Ruth CRNA". Regional anesthetics are performed during general surgery and orthopedic surgeries routinely. Nonetheless, this variation appears consistent, as there does not appear to be a pattern of higher volume during earlier or later portions of the operations. No surgical specialty appeared louder than the others over time.

It should be noted the frequency in which the Reed Meter was set to collect dB readings differed between pre- and post-intervention. Baseline data was collected every 10 seconds. During baseline data collection, it was noted by direct observation from this EBP scholar, volume could change drastically during AI particularly if alarms sounded or a patient began to cry. Therefore, post-intervention data collection was changed to every 5 seconds diminish confounding circumstances. To ascertain the possibility of there being twice as many data points in post-intervention data when compared to baseline data, averages were created using the total number of data points for each case. For each case, the actual volume of the entire AI was summarized into one number, negating any differences in the number of measurements.

Figure 7 is a boxplot showing both the pre-intervention and post-intervention data. Note there is a visual decrease in the values.

Figure 7

Volume (dB) by Intervention Status

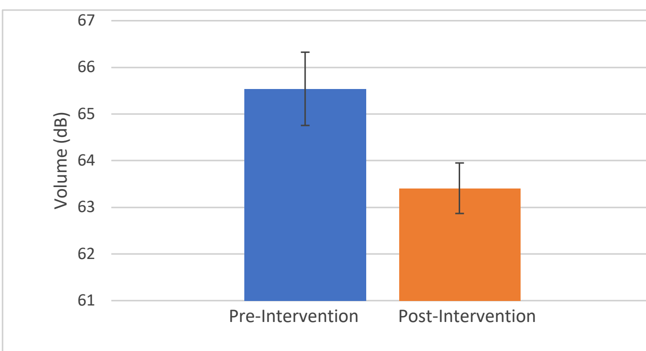


Results revealed the highest volume (70.98) in baseline data was not an outlier (G = 2.57, U = 0.75, p = .09). Results revealed the highest average volume in post-intervention (69.14) was not an outlier (G = 2.82, U = 0.85, p = .09).

Data between pre- and post-intervention were compared to test for distribution and variance. As previous tables have shown values for pre-intervention ($p = .14$) and post-intervention ($p = .05$) were normally distributed. Percentages of each surgical specialty pre- and post-intervention were depicted in Table 1. To compare the populations of these groups, Levene's test was utilized. Levene's test accounts for different sample sizes and ensures the variance within each sample size is similar. Levene's test resulted in equal variance ($p = .77$). Data were deemed comparable according to normalcy and variance. Figure 8 depicts differences with confidence intervals.

Figure 8

Differences in Volume Over Time



A *t*-test is used to determine if the means of two separate sets of data are statistically significant. An independent *t*-test was used to determine whether volume reduced over the course of the NIZ intervention. Specifically, an independent *t*-test does not allow values of preintervention data to be included in post-intervention data. The results were significant, $t = 4.43$ (80), $p < .001$. In other words, pre-intervention volume (mean = 65.54) was significantly reduced (mean = 63.41) following the NIZ intervention. Figure 8 depicts these differences with confidence intervals.

A two-way analysis of variance to determine whether this reduction can be, at least in part, explained by surgical specialty. Although this test likewise found differences in volume by pre- and post-intervention ($p < .001$), there were no significant differences in volume by surgical specialty ($p = .20$), nor were there significant differences in volume by surgical specialty over time ($p = .20$).

There were slightly more occupants' pre-intervention than post-intervention NIZ, mean = 8.11 vs. mean = 7.0. Therefore, independent *t*-tests were conducted to determine whether the number of occupants differed pre-intervention vs post-intervention NIZ. The results were significant ($t = -2.44$, C I= 80, $p = 0.02$). Pearson's correlation was then utilized to determine if the volume generated in each operating room correlated with the number of occupants. Pearson's correlation ($p = 30$) was not significant. The volume generated in each OR did not correlate with its number of occupants.

Chapter Summary

Chapter four presented the results of this EBP. The sample characteristics were conveyed, followed by an in-depth analysis of the data. Chapter five will interpret the outcomes of the intervention and discuss limitations and their effects on the project. Implications for advanced nursing practice, including sustainability and the application of the Doctor of Nursing Practice Essentials to this project will be discussed.

CHAPTER FIVE

DISCUSSION AND IMPLICATIONS

Interpretation

The goal of this per the PICOT used in this QI initiative was to decrease dB readings utilizing a NIZ during anesthetic induction over a period of six weeks. Prior to the collection and analysis of post-NIZ data, a key factor in the results collected was education of baseline data and the impact noise and its deleterious effects can have on patient safety, to OR personnel. It is clear via the statistical analysis utilization of a NIZ was successful in reducing volume (dB) during AI. Behavioral modification mitigating noise, through communication and collaboration amongst the team, was successful. A key component of this change was the use of signs as an educational reminder of the importance of limiting noise during AI. Reminders in the morning huddle before the surgical case started were also key components.

The utilization of Kurt Lewin's theory of change in which behavior is unfrozen, a change is implemented, and the new learned behavior is refrozen was the theoretical basis for this QI. The potential to shift the balancing forces between various departments, (OR, anesthesia, surgery), lessen the hierarchy (director, chair, manager, supervisor, staff) created by educational level or status (MD, CRNA, RN, technician), and altering the relationship between the driving forces and restraining forces has always been available. Due to the increased awareness of the threat to patient safety noise can create during AI through education and concrete evidence, changed was witnessed. Through buy-in of all entities refreezing was inherent.

Baseline data collected noted numerous people in and out of the OR during AI for many reasons: breaks and/or lunches for OR personnel, a nurse liaison checking on patient status to communicate with waiting families, equipment moving in and out of the OR, X-ray technicians in and out of the OR, music playing at various volumes and times, sterile core and main OR doors opening and closing. The longer the AI time the more occupants were noted, this result was not noted in post-NIZ data, such that the length of AI did not increase the number of occupants in post-NIZ data. An explanation for these results may be that after the NIZ initiative began, staff became aware of their entrances and exits and kept them minimal, and non-essential personnel did not enter the room.

The initial thought regarding volume during AI was dB would be greater upon patient entrance to the OR. Multiple people talking to a pediatric patient upon entrance to the OR to engage the child, evoking distractions and diminishing fear to a newfound situation is a frequent occurrence, and the child may be playing on an iPad, or a staff member may be singing to them. While these interventions create noise, they are often unavoidable as all are an effort to soothe the patient. Figure 6 demonstrated the accuracy of this notion for pre- and post-NIZ.

Decibel readings vacillated between highs and lows during AI in both pre and post NIZ intervention data, as shown in Figure 6. Longer AI often included a regional anesthetic, after a patient's airway was secured, that an included a time out in which the room had to be quiet. One cannot dismiss this may have been a result of some of this vacillation (lower dB findings). Surgeons often leave the room during this time resulting in a decrease in dB, AP may be teaching trainees increasing dB, and low task load of ancillary staff eliciting CIC may increase dB readings. Riutort (2020) conferred distractions that occur in the OR due to extraneous conversations and lack of attention contributed to poor outcomes. Regardless of this vacillation in dB readings, volume, was considerably decreased post-NIZ intervention.

Two surgical specialties, ENT and orthopedics, aware of a prior reputation for being loud during AI, acknowledge the need to respect the distractions created during AI prior to this QI initiative. They attributed this to multiple separate conversations occurring simultaneously amongst their team of students, residents, and fellows. They noticed each conversation would become louder to hear their respective surgical colleagues particularly in anticipation of a complex procedure. These surgical specialties stressed the lack of having a designated location to discuss procedures beforehand. While this was beyond the scope of this EBP, it did allow the surgical team to be aware of the noise and the need for another location for their team to discuss patient concerns was brought to the surgical director. These conversations established new communication amongst anesthesia and surgery colleagues, a necessary component of practice change and potential sustainability for a change.

There became an aspiration to extend a variation of the NIZ to other parts of patient care in the OR as expressed by surgeons and OR personnel. During the PowerPoint presentation and conversations with the team leader, OR staff made suggestions when they would like it to be quieter, as did surgeons. Both assessed their need for use of NIZ during their high task load times, such as a critical part of the procedure or surgical counts. Despite their perceived role in care of patient at any given time, both expressed a desire to educate staff. The study of the NIZ concept had extended into nursing and the department of surgery.

Current literature supports orthopedics and neurosurgical specialties are louder than other surgical specialties. In the institution in which this EBP was performed, orthopedics and ENT specialties have a reputation for being nosier and for containing more occupants during AI due to a vast number of trainees for each respective service. Despite this common notion, no one surgical specialty, in baseline data or post-NIZ intervention data, was noted to be statistically louder than another. While ENT accounted for 13%, orthopedics accounted for 16%, and neurosurgery accounted for 2% of post-NIZ data, more accurate depiction of the noise generated by these specialties may have been achieved with larger caseloads for each. Regardless of this evidence, staff continued to express a concern for the noise generated by orthopedics and ENT specifically.

The AORN requires no interruptions during surgical counts and specimen labeling. In 2020, the AORN made a statement conveying distractions increase adverse effects on patient care, cause fatigue, stress, irritability, and anxiety. The AORN recommended education of staff to use of a sterile cockpit or NIZ. The concept of the NIZ when related to these aspects of OR nursing surrounding patient safety heightened awareness of OR staff to the sensitivity to noise during AI as perceived by APs. At times, OR staff were observed asking surgical trainees to leave the room during AI unless they needed to be present.

Post-NIZ intervention data were consistent when compared to baseline data for time of duration of AI. Regardless of the length of AI, there was no difference in noise over time. Times of low task load for surgeon and OR personnel would have thought to illicit an increase in noise during a lengthy AI. It appeared staff was more in tune to the significance of AI. This was not noted in post-NIZ data.

In lieu of the small size of data collected, dB readings were significantly reduced following NIZ intervention. A quiet environment during times of high task load, whether this environment is for OR personnel or the surgical team, is a necessary component for the safety concerns of AP and patient. Utilization of a NIZ or sterile cockpit during AI is a simple, effective tool that can greatly diminish patient safety concerns of AP.

A statistically significant decrease in dB readings during AI was noted post-NIZ intervention validating inexpensive and simple educational measures can illicit change. Keller's (2020) guided recall study noted professionals experience strain during different phases of patient care in the OR. Anesthesia deemed AI as most stressful. The noise generated was related to CIC and entrance and exit to the OR. Weber (2018) reiterated staff entering the OR and CIC as the highest distraction for AP. The use of this project's NIZ kept traffic consistent and decreased noise during AI. Future direction for this QI should include random monitoring of all surgical specialties, continued communication, and education amongst the multidisciplinary team, with one common goal of advocacy for safe patient care.

One of the most significant occurrences of this EBP was the newfound respect for the role each member of the OR team had in the realm of patient safety. Conversations were sparked, communication was enhanced, and staff became empowered to speak. The team leader was approached with statements such as "You should have been in my room, it was so loud today, I could have used the signs today". These conversations were not elicited prior to this intervention. A mutual awareness was noted as not only AP approached this team leader with these concerns, but they also communicated their concerns between each other. The implications of this project had extended well beyond AI and AP.

McMullan (2021) stated there is no criteria for what constitutes unacceptable levels of distractions, interruptions and disturbances for surgeon, AP, or OR staff. Communication is essential to avoid intraoperative complications that are unnecessary and unwarranted.

Limitations

Several limitations were encountered during the NIZ EBP. Normally, 13 operating room sites run Monday through Friday. However, only nine operating rooms were utilized during data collection. Due to the COVID-19 pandemic, one operating room was designated as the COVID-19 room and not monitorable due to the sound generated by the evacuation systems and the required personal protective equipment providers wore making communication much more difficult. Routine and non-emergent surgeries were cancelled when patients tested positive for COVID-19 resulting in an overall low volume of patients. COVID positive nursing and anesthesia personnel resulted in less rooms being open daily. COVID positive surgeons resulted in the occasional cancellation of an entire operating rooms' cases. Operating room nursing shortages resulted in closing of one or two rooms daily during week three and four of data collection. In addition, dental cases were ultimately removed from data collection as no cases were obtained. Despite these limitations, 63 cases were obtained. A larger sample may have elicited different results, particularly with surgical specialties such as neurosurgery and plastic surgery which represented 2% and 3% respectively of the cases captured in post-intervention data.

Initially, only operating rooms of equal size were to be used for data collection. With a limited number of operating rooms running every day due to the pandemic, two additional operating rooms were added to capture certain surgical specialties. The results section of the addition of these two larger operating rooms did not statistically alter outcomes of this EBP.

The initial goal of this EBP was to record 60 anesthetic inductions. A total of 63 cases were recorded, however, four cases were removed secondary to emergencies occurring and team member having to assist with patient care. An additional four cases were deleted during the first week of data collection due to misuse of the Reed Meter. One case was deleted during week three of data collection due to the Reed Meter battery losing its charge. Fifty-four cases were thus utilized for analysis. Strength of the data pertaining to the number of occupants may have been different but the decrease in dB reading proved to be statistically significant despite the small sample size.

The Hawthorne effect was noted to be a frequent concern for team members and the team leader collecting data during pre- and post-NIZ intervention. Operating room and surgical staff asked questions including: “What is that? What are you doing? Why are you here? Are you doing this case?”. At times it was difficult to not engage these questions. The possibility of staff limiting CIC, entering and exiting the room, and moving of instruments may have resulted in lower dB readings during pre-intervention data collection.

Positioning of the Reed Meter was not always consistent. Based on the size of the patient, the acuity of the patient, and equipment needed for the surgical procedure, the recorder may have had to move the Reed Meter further away from the patient during AI. On occasion the team member had to hold the Reed Meter in their hand to continue recording as the mayo stand was an obstruction to providers performing patient care. In addition, the volume and tone of the EKG and pulse oximeter are automatically programmed. Any AP can change the tone and/or volume higher or lower, louder, or softer on any anesthesia equipment with alarms. The preset tone and volume of anesthesia equipment was not accounted for during any case in which data was collected. Readings may have been different if all monitors were ensured to be set at the same tone and volume.

Emergency phones carried by anesthesia providers are not allowed to be silenced. If the AP in the operating room was carrying the emergency phone, it may have alarmed during AI. An attempt was made during post-NIZ data collection to ensure the emergency phone was not being carried by the AP in the room being monitored.

Surgical attendings received the preintervention data PowerPoint from the chair of the department of surgery (see Appendix D). A few emails and verbal communications were made in response to the team leader by surgical attendings. Surgeons stressed concerns of having “no place to go" to discuss their surgical case with fellows, residents, and other students as they often do in the OR before the patient enters the room and during anesthetic induction. This EBP scholar communicated this project was not to mandate surgical staff could not be present during AI, however, to be mindful of the high task load in which AP must perform during AI and how noise can affect the AP ability to safely care for the surgeon's patient. Surgical staff was more receptive to this explanation and encouraged to communicate with the team leader or team members with any concerns, questions, or suggestions.

Education of surgical trainees about the NIZ was inconsistent. While attending surgeons received email communications regarding the NIZ, its purpose, start and end date, this was not consistently conveyed to surgical trainees. Despite the posting of signs in and around the OR, on the operating room doors and sterile core doors, it was noted during the first two weeks of data collection surgical trainees were often unaware of the meaning of the signs and how to interpret them. It was then decided to convey to the surgical trainees during the patient care huddle before the patient entered the OR to educate them to the NIZ anesthetic induction and reiterate its purpose. This communication was inconsistent, as trainees were not always present for the huddle.

Several trainees, medical students, residents, fellows, and SRNAs, were on vacation during post-NIZ data collection weeks of Christmas and New Year. Limited trainees during this time of data collection may have affected the noise generated in procedures where such trainees are normally present and conversation for teaching is essential. When a CRNA and an anesthesiologist are the only AP during AI, tasks are performed simultaneously, allowing AI to be shorter in duration. The shorter AI time may have accounted for the lack of significance in the occupants in the OR during AI post-NIZ intervention.

Implications for Advanced Nursing Practice

Plan for Sustainability

Various surgical attendings approached team members and the team leader before, during, and after dB readings were recorded during their patient's AI. Various surgeons requested information on the Reed Meter, asked to see the meter, questioned how it worked, where was it purchased, what their room readings were, and how they rated compared to other surgical specialties. One surgical specialty suggested they may want to borrow the Reed Meter for incorporation in their own practice. Curiosity had been evoked by major stakeholders, supporting the possibility for sustenance of the NIZ.

A PowerPoint was presented to the anesthesia department, OR staff, and surgical staff included concrete data regarding dB readings, number of occupants, surgical specialty, and any correlations between them, enlisted a newfound respect for the level of noise generated during AI and how it can affect any anesthesia provider. The evidence supports the need for a practice change, as results were statistically significant in decreasing volume after the NIZ intervention. Surgical and OR staff acknowledged this and expressed the need for improvement. A desire to extend the NIZ to other parts of the surgical procedure was suggested by various members of the surgical staff.

Two surgical specialties, aware of their reputation for being loud during AI, acknowledged the need to respect the distractions they create during AI prior to this QI initiative. They attributed this to multiple separate conversation occurring simultaneously amongst their team of students, residents, and fellows. They noticed each conversation would become louder to hear their respective surgical colleagues particularly in anticipation of a complex procedure. These surgical specialties stressed the lack of having a designated location to discuss procedures beforehand. While this was beyond the scope of this EBP, it did allow the surgical team to be aware of the noise and the need for another location for their team to discuss patient concerns was brought to the surgical director. These conversations established new communication amongst anesthesia and surgery colleagues, a necessary component of practice change and potential sustainability for a change.

Presentation of post-intervention data sparked a separate concern for surgical colleagues regarding the number of personnel in and out of rooms prior to surgical incision. Post-operative surgical site infection is a well-documented concern directed related to a high volume of traffic in and out of the operating room. While the concern did not relate to the volume nor distractions these entrances and exits generated, this concern did confer buy-in by surgical staff to limiting traffic during AI, thereby decreasing distractions and disruptions.

Keller's (2020) study on strain experienced in the OR, concluded each team member experienced different times of high task load. No one phase of patient care can be deemed a sterile cockpit. This was reiterated by staff surgeons as they questioned the level of noise during critical parts of the surgical procedure. Use of the NIZ may potentially be spread to other parts of the surgical procedure per surgeon request.

The NIZ initiative was inexpensive with the creation of signs and posters, and the purchase of the Reed Meter (see Appendix J). The signs and posters utilized are reusable and can be copied. Anyone can be taught how to use the Reed Meter at no cost, making the possibility of recording data highly conceivable, and negate the need to hire additional staff. Nursing research employs a statistician that can run new data collected. The statistical programs have already been created; limited billing hours would be needed. Cost to the institution is minimal, practical, and will optimize the function of the team surrounding patient care.

The anesthesia department overall expressed a desire to continue the use of the NIZ signs for critical surgical procedures, especially medically complex patients, which was encouraged by the department. Awareness of noise and its effect on patients and staff members allows for the creation of a process to turn music off during induction, limit CIC, limit entrance and exits to OR, and limit nonessential personnel during AI. OR management will continue to reinforce these concepts at staff meetings and patient care huddles. The desire by the anesthesia department for a policy and/or a mandatory annual competency NIZ for continued education of all OR personnel is still a work in progress. The importance of the use of a NIZ, the same concept being utilized in medication rooms, during surgical counts, and specimen labeling in this institution by nursing staff, needs to be stressed on an ongoing basis. The use of a NIZ advocates for a culture of safety for patients.

The results of this QI initiative were conveyed to the patient safety manager that initially contacted this scholar prior to NIZ implementation. An interest was expressed for continued use of the NIZ in areas of concern for AP and further discussion regarding the use of the NIZ in other areas of the institution, sustenance of this project had gained buy-in from a large stakeholder.

This scholar was encouraged to continue to sporadically monitor readings at the request of multiple anesthesia providers and the approval of the department of surgery chair. In addition, the signs will remain in a designated area for any AP to use as they see fit. Should this scholar leave the institution, a team member, and other members of the department of anesthesia have expressed an interest in continued use of the NIZ signs and the dB meter.

The APSF meeting in 2017 (Van Pelt et al., 2020) identified distractions for APs that pose a threat to patient safety, including self-induced behavior, alarms, patient care related activities by other providers and music. Distractions noted during anesthetic induction have been a significant complain amongst AP in such that the SPA sent a national survey to all anesthesia providers (Appendix A). Data collection continues, and results are pending analysis. Once the survey is completed, the results will be shared with the anesthesia department. In addition, the survey asked for current suggestions or processes institutions currently use to decrease noise during AI and emergence. The need for the mitigation of noise is recognized on a national level.

Communication amongst those with different roles and different educational levels diminishes the hierarchy created in this multidisciplinary team required to care for a patient in the operating room. Van Harten et al. (2020) noted in their mixed method observational study the entire team was unaware of each other's needs. McMullan et al. (2021) meta-analysis identified the gap that exists regarding mechanisms that underlie relationships between noise and their distractions and those that create them. Enhanced trust and respect amongst professionals in a non-retaliative environment, encourages honest, and open communication. A culture of support envisions sustenance.

The DNP degree is the required entry level degree for CRNAs as of 2022, prior to this the degree obtained was a master's level degree. With this change in degree requirements, CRNAs are well-versed in EBP and QI via education and training before practicing as a CRNA. DNP SRNA graduates are educated in securing the best available knowledge for QI initiatives. Years of patient care experience combined with the doctoral degree provide a unique quality with the ability to mold experience and knowledge into a QI that has a greater potential to elicit buy-in form all stakeholders. Many opportunities exist for DNP graduates to present their QI and research findings via posters and podium. Nursing research has become a vital part in education in the forefront of effective and safe patient care.

Application of the AACN DNP Essentials

DNP Essential I: Scientific Underpinnings for Practice

Scientific underpinnings of practice provide the foundation for nursing practice. Knowledge was accumulated in various ways for this EBP. An extensive literature search conducted using multiple data bases established the groundwork. The literature search was used to find the best current evidence supporting the need for a No Interruption Zone to enhance patient safety via reducing noise in the operating room assessed by decibel readings. As a result of this literature search, the concept of a NIZ to promote a practice change came to fruition.

Lewin's theory of change, includes unfreezing the current process, changing to a new process, and refreezing the established process, was used as the theoretical nursing framework for this EBP. There was no established process in the setting of this EBP for noise during anesthetic induction. Noted by many anesthesia providers were the distractions related to noise and the inability to communicate with colleagues and the patient during anesthetic induction, a critical part of patient care. Through education of staff aiding in unfreezing the current behavior, instituting a No Interruption Zone, the desired change, and then presenting post-NIZ intervention data to refreeze the newly established NIZ process, reiterates the use of scientific underpinnings with statistical analysis of concrete findings.

New knowledge regarding the EBP process was gained from a variety of other fields. Ethical knowledge was acquired by obtaining approval of the HRSC from Wilmington University and IRB approval from Nemours Hospital for Children. Historical data was accumulated by collecting baseline db readings and the number occupants during AI. In addition , the response to the analysis of this data by the departments of anesthesia and surgery, as well as the operating room staff prior to the start of the NIZ intervention was evaluated. Organizational knowledge was gained through meetings with multiple department members, separately and in groups. Hierarchies established in the organization lead this scholar to communicate with OR managers and float supervisors, the chair of the department of anesthesia, and the director of surgical staff to ensure buy-in by all participants directly or indirectly involved in the NIZ process. Practice issues were addressed via interactive approaches to ascertain suggestion, answer questions, and explain the how and why of the NIZ. The psychosocial aspects of staff, observing human behavior in the OR environment, were observed during baseline and EBP data collection. The lack of an existing process for noise in the OR was evident. The need for a process was heir apparent by the results of the data obtained.

Evidence was obtained through recording decibel readings, the use of SPSS software, statistical analysis, coding, and recoding data. Frequent communication with the statistician analyzing the data collected was ensured to evaluate data collection processes and changes that needed to be made for coding and Excel spreadsheets. The types of statistical analysis were reviewed and discussed with the statistician to obtain reliable and valid outcomes which enhanced the body of knowledge needed for dissemination.

The impact of the COVID pandemic, its effects on staffing, and patient care resulted in the need for changes in data collection processes, extending the NIZ to additional ORs. Communication with peers and management of the necessary changes fortified this practitioner a process to gather sufficient data.

A concrete knowledge base was necessary to appropriately educate the multidisciplinary team and conjure interest and acceptance.

DNP Essential II: Organizational and System Leadership for Quality Improvement and Systems Thinking

Systems thinking through communication and direct observation in the OR provided this scholar with an understanding of the complexity of the team dynamic encountered during a surgical procedure. This observation afforded this scholar the ability to engage each patient care provider at the provider's level and according to their role in patient care in a nonthreatening way to encourage the need and use of a NIZ.

Systems leadership was demonstrated through the forethought of the need for the creation of a NIZ and a new way to deliver patient care that meets the needs of patient and provider. Creation of signs and posters, presenting PowerPoints to surgical services, and organizing data for ease of interpretation and education of surgical service personnel provided a road map for the team to follow. Continued encouragement to all staff to approach team members with questions or concerns regarding the NIZ afforded further leadership by keeping channels of communication open.

A budget was created and was deemed simple and inexpensive. Volunteers were sought to continue monitoring of noise in the OR to keep cost at a minimum in light of the potential to sustain the NIZ in the future.

This DNP project achieved quality improvement of patient care by decreasing the number of occupants and decibel readings in the operating room during anesthetic induction. Staff was educated about patient safety concerns of anesthetic induction and its effects on anesthesia providers.

Attention was drawn from various stakeholders in patient safety in such that the patient safety director requested the final data and research for this project with the hopes of extending the project to other parts of the hospital and making the NIZ a policy in the OR during various times of patient care. Future applications, including using the NIZ during emergence from anesthesia, was suggested by APs.

Leadership via this EBP was demonstrated throughout the project by educating team members and staff, with particular attention to the current lack of process or system in place, during AI and the need for a process to be established.

DNP Essential III: Clinical Scholarship and Analytical Methods for Evidence-Based Practice

Analytical methods were used to critically appraise the existing literature obtained during a strategic search to substantiate the need for this QI. The NIZ process was designed and used to evaluate changes in noise during AI. The purpose of the NIZ was to improve and promote patient-centered care.

Diverse sources from a variety of disciplines including anesthesia, surgery and nursing were sought to evaluate the current practice and improve it using a more reliable method. The knowledge obtained from these various sources were used to create the NIZ for this EBP.

Informational technology was used to collect appropriate and accurate data to validate the need for a NIZ. The research obtained assisted this author in predicting and analyzing outcomes of the NIZ and how to put it into practice to enhance the safety necessary for patient care.

Patterns of behavior were observed by counting the number of people present during AI and any changes that occurred after the NIZ began. A gap was identified in practice as no process existed regulating noise during AI.

Decibel readings were chosen to be monitored as readings were frequently noted in the literature search. Baseline data demonstrated readings well above WHO and EPA guideless. Post-NIZ intervention data was analyzed.

Secondary to the COVID pandemic and its effects on decreasing the number of staff, the number of operating rooms open every day, and limiting elective procedures at times, adjustments were made to analyze what cases could be included in this project and what would be excluded as certain data collection would be limited. Ophthalmology and dental procedures were ultimately removed from the sample.

Findings were disseminated to the OR and anesthesia departments, as well as the department of surgery.

DNP Essential IV: Information Systems/Technology and Patient Care Technology for the Improvement and Transformation of Health Care

Informational technology was used in designing an Excel spreadsheet code book for dB readings, the budget for this project, and a coded Word document to record surgical specialty, OR room number, and number of occupants. The formulation of data in an organized manner eased interpretation and statistical analysis. Adjustments to the Excel spreadsheets during post-NIZ intervention data collection were made after discussions with the statistician to aid in the evaluation and identify potential outliers that were noted.

Initial utilization of technology to create presentations, posters, and signs that would catch the attention of staff was paramount for visual cues during the time the NIZ was in progress.

This EBP scholar continually monitored and evaluated the process of this EBP. The team leader self-taught in use of the Reed Meter, instructed team members on its function and use. The team leader was frequently available for question regarding its use. The Word document was reviewed with team members and checked for accuracy every week. Data was encoded into the Excel spreadsheets from the Word document on a weekly basis.

The results from the analysis of the data collected required the creation of graphs, diagrams, and tables to illustrate statistical findings.

Extraction of appropriate and relevant research literature was completed to intelligibly communicate the importance of utilizing a NIZ. The conceivable notion of utilization of a NIZ during other high task load periods for any practitioner while a patient is in the operating room was of utmost importance in securing all stakeholders buy-in empowering a practice change.

The possibility of web-based learning via an annual module or creation of a patient safety NIZ process was reviewed with the anesthesia department, the safety director, and OR management.

DNP Essential V: Healthcare Policy for Advocacy in Healthcare

The NIZ was supported by most stake holders and generated a new process during AI. The purpose of the NIZ is to enhance patient safety by diminishing distractions and disturbances that negatively affect anesthesia providers care of a patient during the critical time of anesthetic induction.

Communication with the CMO, patient safety officer, patient safety supervisor, float supervisors, and anesthesia department encouraged this EBP scholar to pursue the NIZ as a formal process. Stakeholders became vested in the project when the realization of the negative effects noise had on AP and the increase ability for patient harm. It was noted silence was expected during the surgical count of instruments, the standard time out, or a critical part of the surgical procedure, such as sudden blood loss, by all members of the multidisciplinary team. It was also noted these policies already in place, may not be consistently adhered to.

Active communication between the team leader, AP, and OR float supervisors assured the continued mention of the NIZ and its sign placement during staff and patient care huddles.