Implementation of a No Interruption Zone to Decrease CRNA Distractions

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Table of Contents

Table of Contents ---------- **2**

Dedication and Acknowledgments ---------- **4**

Abstract ---------- **5**

Background and Significance ---------- **6**

Purpose ---------- **7**

Review of Current Evidence ---------- **7**

Conceptual Framework ---------- **14**

Methods ---------- **15**

Translational Framework ---------- 16

Setting ---------- 17

Instruments ---------- 19

Timeline and critical milestones ---------- 19

IRB approval ---------- 20

Results ---------- **20**

Barriers to success ---------- 26

Discussion ---------- **27**

Conclusion ---------- **30**

References ----------33

Appendix A: Education Plan ----------39

Appendix B: No Interruption Zone Sign----------43

Appendix C: Data Collection Tool ----------44

Dedication and Acknowledgments

Completion of this project could not have been possible without the guidance, support, and encouragement I received from others. I must express my tremendous gratitude to Dr. Kabbe for helping me shape a vision of improving anesthetic patient safety into a meaningful and implementable project, and for helping me to persevere when barriers and challenges arose. I would also like to thank Dr. Epstein, Dr. Kordesmeier, Dr. Lupe, and Dr. Mittal at UNC-Greensboro for their assistance and guidance.

I am appreciative of the support I received from Toni Fortner, MSN and my CRNA and physician coworkers at the project site facility who share my commitment to patient safety and continuous quality improvement. I will always be grateful for the support and encouragement they provided me personally as a colleague and friend.

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Abstract

Background: Vigilance and patient safety are core values in anesthesia practice, particularly during medication preparation, anesthesia machine safety checks, and airway equipment setup. Distractions occur frequently in the clinical setting and are associated with errors, procedural failures, and impaired team communication. Methods to mitigate distractions have demonstrated mixed results.

Methods: A quality improvement project using a quasi-experimental design was conducted in the anesthesia setting of a small community hospital to evaluate the effectiveness of a No Interruption Zone (NIZ). Observed distractions were categorized by timing in relation to CRNA activity, distraction source, and CRNA response.

Results: Thirty pre-NIZ implementation and 31 post-NIZ implementation case observations were conducted. Overall distractions and distractions from staff movement in and out of the room increased following NIZ implementation. Distractions from coworkers initiating conversations, however, decreased. The CRNA was also less likely to halt case preparation to address a distraction following NIZ implementation.

Discussion: The results of this quality improvement project provide information on nurse anesthetist distractions in the clinical setting. NIZ implementation did not decrease overall distractions. Certain distraction types and their impact on the CRNA, however, may benefit from NIZ implementation. Additional PDSA cycles would provide a better understanding of how to best apply the NIZ concept in this setting.

Background and Significance

A "culture of safety" describes an environment that maintains patient safety as an organizational, departmental, and individual clinician priority (Institute of Medicine Committee on Healthcare in America, 2000, p. 166). It requires multidisciplinary integration and collaboration, organizational responsiveness, and ongoing efforts to assure prompt recognition of emerging safety threats as well as opportunities to mitigate them. In the perioperative setting, patient safety is a shared responsibility among anesthesia providers, surgeons, perioperative registered nurses, surgical technicians, and support staff. The complexity of the perioperative work environment and inherent emphasis on efficiency must be balanced with the need to maintain patient safety.

The American Association of Nurse Anesthetists (2015) states that "clinical observation and vigilance are the foundation of safe anesthesia care" (p. 1). Distractions, however, "pose a risk to patient safety" (van Pelt & Weinger, 2017, p. 347), and "distractions and noise that do not serve a clinical function should be minimized" (Association of Perioperative Nursing [AORN] , 2020, p. 675). Any attempts to mitigate distractions, however, will require a comprehensive understanding of their frequency, source, and impact. Campbell et al. (2012) approximate that during a routine anesthetic, distractions occur as frequently as one event every four minutes 23 seconds (p. 709). Coworker conversations and environmental noise have been identified to cause many distractions both specifically to CRNAs (Pape & Dingman, 2011) as well as to registered nurses during routine medication administration (Johnson et al., 2017).

Broom et al. (2011) compared the critical phases of anesthesia induction and emergence to aviation's takeoff and landing but there are numerous critical phases and processes throughout, and even prior to the initiation of anesthesia and surgery that are critical to patient

safety. Anesthesia machine safety checks and preparation of emergency and induction medications are routine processes, but errors in these tasks could have catastrophic consequences. Multiple patient safety initiatives based on strategies used within the aviation industry include the No Interruption Zone (NIZ) which is based on the sterile cockpit concept (Broom et al., 2011; AORN, 2020). The sterile cockpit concept prohibits all conversations unrelated to the safe operation of the airplane during certain critical phases of flight (Federal Aviation Industry, 2014; Karl, 2009). This concept has similar potential in healthcare as a strategy to minimize distractions during critical healthcare processes. Although the specific terminology may vary, the general concept of the NIZ has been utilized by nurses (Anthony et al., 2010; Yoder et al., 2015; Wright, 2016), pharmacists (Raimbault & Guerin, 2013), anesthesia providers (Crockett et al., 2019) and physicians (Behazin et al., 2015) in a variety of clinical settings.

Implementation of the NIZ has been shown to reduce distractions during medication administration (Yoder et al. 2015) and anesthesia (Crockett et al., 2019; Wright, 2016) but it is not routinely implemented, and no studies have applied the concept specifically during pre-procedure anesthesia processes. The NIZ is proposed as a multidisciplinary patient safety strategy to decrease CRNA distractions during routine case preparations.

Purpose

The objective of this quality improvement project is to apply the concept of a NIZ during case preparation processes by the CRNA to decrease distractions and promote patient safety and quality of care.

Review of Current Evidence

Literature Search Strategy

A comprehensive literature review was conducted using CINAHL, PubMed and SCOPUS. Specific terms searched were “no-interruption zone”, “no distraction zone”, and distraction-free zone”. Articles were limited to publication in English only, publication dates of 2015 or later, and subject content related to nursing. This yielded 14 articles from CINAHL, nine articles from SCOPUS and five articles from PubMed. Abstracts of the 28 articles were reviewed for relevance and redundancy, subsequently yielding six usable articles. Additional articles from the reference lists of the above-mentioned original articles were incorporated into the review when the focus was related to the concept of a NIZ to minimize clinician distractions. A total of 14 articles were included in this review of the literature.

The main themes that emerged from this review are that interruptions and distractions are prevalent in clinical practice, are inconsistently defined, and the NIZ concept has been applied as a strategy to decrease distractions in various clinical settings with mixed results.

Interruptions and Distractions

The terms interruption and distraction are sometimes used synonymously (Johnson et al., 2017) to describe activities that interfere with vigilance and task completion. Some authors, however, differentiate the two terms and categorize interruptions from distractions and even potential distractions based on the presence or absence of an observable clinician response (Campbell et al., 2012). Pape & Dingman (2011) differentiate between interruption and distraction further in asserting that an interruption is caused “by a person,” while a distraction is caused by “something” such as noise or conversation (p. 51).

Distractions are frequently further categorized as auditory or physical. Auditory distractions include noise, alarms, music, and conversations; these are most often reported as frequency measures (Anthony et al., 2010; Campbell et al., 2012; Crockett et al., 2019; Gui et al., 2021; Johnson et al., 2017; Pape & Dingman, 2011; Westbrook et al., 2017; Yoder et al., 2015). Other studies report actual measured noise levels in the operating room (Broom et al., 2011; Jenkins et al., 2015; Monaghan et al., 2020; Wright, 2016). Distractions are most often categorized by source. Physical distractions include the movement of staff in and out of a room (Broom et al., 2011; Gui et al., 2021; Jenkins et al., 2015), equipment factors (Campbell et al., 2012; Gui et al., 2021; Johnson et al., 2017; Pape & Dingman, 2011; Sevdalis et al., 2014) and environmental factors (Campbell et al., 2012; Sevdalis et al., 2014). Examples of equipment factors include "inappropriately set alarms" (Campbell et al., 2012, p. 710) and "broken/temperamental equipment" (Campbell et al., 2012, p. 710), while environmental factors might include the extreme temperature variations in the operating room (Sevdalis et al., 2014) or workspace ergonomic issues (Campbell at al., 2012). Behazin et al. (2015) take a different approach and categorize distractions as "low, medium or high" (p. 967) depending on whether they are related to the patient, directly involve the clinician and if there is staff traffic in or out of the room. Distractions can also be self-initiated (Anthony et al., 2010; Campbell et al., 2012; Gui et al., 2021; Yoder et al., 2015) such as "noticing nearby events" and "retrieving patient and medication information" (Anthony et al., 2010, p. 24). Most distractions, however, originate from other staff (Anthony et al., 2010; Campbell et al., 2012; Johnson et al., 2017; Westbrook et al., 2017; Yoder et al., 2015). Patient conversations are included as distractions by some researchers (Behazin et al., 2015) and excluded by others (Pape & Dingman, 2011). Distractions are also categorized by consequence (Campbell et al., 2012; Filer et al., 2017). The lack of

consistent definitions or classification of distractions makes it difficult to compare results between studies, despite the consensus that distractions are a significant problem that needs to be addressed.

Prevalence of Distractions and Interruptions

Multiple observational studies have demonstrated that distractions occur frequently in clinical practice (Anthony et al., 2010; Broom et al., 2011; Jenkins et al., 2015, Johnson et al., 2017; Pape & Dingman, 2011;). Distractions during medication administration procedures are particularly concerning. Anthony et al. (2010) reported that 31.8% of observed medication administration procedures in an adult critical care setting were interrupted. In another study from Australia, 99% of observed medication administration procedures were interrupted in medical-surgical units, a neonatal intensive care unit, and an emergency department (Johnson et al., 2017).

Distractions occur frequently in the anesthesia setting. A small pilot study by Pape & Dingman (2011) reported an average of 7.5 interruptions during each observed anesthesia induction. Another study similarly demonstrated that a distracting event occurred as frequently as one event every 4 min 23 sec of an observed anesthetic from the time the patient entered the operating room until the time they were discharged to the recovery room (Campbell et al., 2012). During the emergence phase of anesthesia, one distracting event was observed every 1 min 59 seconds (Campbell et al., 2012). Staff movement in and out of the room, particularly at the end of a case, can interfere with a smooth emergence phase of anesthesia for the patient. Broom et al. (2011) report that during a single emergence phase in their study, a total of twenty staff entrances and exits were recorded. Distractions are common and occur throughout, and even prior to, the

initiation of the anesthetic process. No studies of distractions during case preparation procedures, however, were identified even though this is a commonly known issue at the project site facility.

Distractions and Safety

Distractions jeopardize patient safety. During routine medication administration by nurses, distractions are associated with clinical errors, procedural failures, and increased workload (Johnson et al., 2017). Anesthesia providers report that auditory distractions during anesthesia induction reduce their vigilance, distract them from noticing alarms, distract their attention during an emergency and impair communication with other staff (Crockett et al., 2019). In another study, "distracting events" (including potential distractions, distractions, and interruptions) were associated with negative patient consequences such as deterioration in physiological variables, prevention of a smooth induction, repeated attempts at procedures, and even brief periods when the patient was unattended (Campbell et al., 2012). Higher distraction rates have also been associated with longer procedure times for screening colonoscopy by endoscopists (Behazin et al., 2015). Decreasing distractions has the potential to improve efficiency and productivity in addition to improving patient safety.

No Interruption Zone

The "no interruption zone" (NIZ) has also been referred to as a "distraction-free zone" (Crockett et al., 2019, p. 795), "safe zone" (Yoder et al., 2015, p. 144), and "healthcare sterile cockpit" (Hohenhaus & Powell, 2008, p. 108). The NIZ is based on the strategy established in aviation to effectively eliminate all unnecessary distractions during critical processes (Federal Aviation Industry, 2014; Karl, 2009). Evaluation of the NIZ in the clinical setting is limited but it has been shown to reduce distractions during medication preparation (Anthony et al., 2010),

anesthesia induction (Crockett et al., 2019; Wright, 2016), anesthesia emergence, surgical time out, specimen collection and instrument counts (Wright, 2016). The NIZ has also been shown to decrease physical distractions to the endoscopist during screening colonoscopy (Behazin et al., 2015).

Specific NIZ implementation varies significantly but typically includes the designation of either an area (Anthony et al., 2010) or process/procedure (Behazin et al., 2015; Crockett et al., 2019; Yoder et al., 2015) or multiple processes/ procedures (Wright, 2016) where the goal is to eliminate all unnecessary distractions. This is accompanied by staff education measures and some visual signage/cues to personnel to serve as a reminder of the NIZ. Anthony et al. (2010) physically marked a designated medication preparation area in a critical care setting using red duct tape while in other studies, staff wore specially designed vests stating, "medication rounds in progress: do not disturb" (Yoder et al., 2015, p. 144). Posted signs were used (Wright, 2016; Yoder et al., 2015; Behazin et al., 2015) in the designated area, and "do not disturb" signs were placed on the procedure room door (Crockett et al., 2019, p. 798; Behazin et al., 2015, p. 967) to limit other staff from entering the room. Some NIZ procedures included a verbal announcement of the no distraction period (Crockett et al., 2019, p. 798; Behazin et al., 2015, p. 967).

The implementation of a NIZ successfully reduced observed distractions during medication administration by 40.9% and eliminated self-interruptions entirely by critical care nurses (Anthony et al., 2010). In anesthesia, the NIZ reduced the frequency of reported noise on induction from 61% to 15% in less than 2 months (Crockett et al., 2019). Measured noise levels during induction also decreased from an average of 61.5 decibels to 53.82 decibels (Wright, 2016). Measured noise levels during emergence were reduced from an average of 63.52 decibels

to 54.84 decibels (Wright, 2016). NIZ may also improve procedure efficiency as Behazin et al. (2015) reported that procedures with higher distractions took longer to complete.

Not all uses of NIZ have been associated with improved outcomes. Raban & Westbrook (2014) conducted a systemic review and expressed caution that outcome evidence is limited due to the lack of controlled trials. Yoder et al. (2015) reported an increase in both the frequency of documented distractions and medication errors on a medical unit following the implementation of a NIZ. They attributed the results to increased awareness of the issue and inquiries from staff and visitors about the orange vests the nurses and student nurses were wearing as part of their NIZ procedures (Yoder et al., 2015, p. 149). The use of these vests as part of a protocol to discourage interruptions may also be negatively received by patients who interpret the "do not disturb" message as directed at them (Palese et al., 2019, p. 30).

It is plausible that the NIZ is more effective in reducing certain types of distractions better than others and that the specific way the NIZ is implemented influences its clinical effectiveness. Behazin et al. (2015) reported an increased number of "low level" distractions but in the setting of reduced "medium" and "high" level distractions. This still represents movement toward fewer distractions. Personnel type and organizational culture also likely influence NIZ effectiveness. Yoder et al (2015) reported that nurses experienced a higher frequency of distractions than student nurses following NIZ implementation.

Although research on the implementation of the NIZ is limited, existing studies show promising potential to decrease distractions and interruptions in clinical practice. Preparation of anesthesia induction medications and anesthesia machine safety checks are routine procedures, but they are often performed while simultaneously preparing other supplies, monitors, and equipment. Furthermore, the medication administration process differs in anesthesia as the usual

checks and balances established between steps of order entry, order reconciliation, pharmacy review, and dispensing of medications before administration are typically all completed by a single anesthesia provider at the bedside. Distractions must be avoided to minimize potentially catastrophic mistakes. Despite the apparently conflicting results on NIZ effectiveness, its potential benefits and ease of implementation warrant continued consideration as a strategy to decrease clinical setting distractions.

Conceptual Framework

Patient care is optimized when surgical teams work collaboratively and effectively together. The Model of Relational Coordination (Gittell, 2000) is a theoretical framework that emphasizes how "shared goals, shared knowledge, and mutual respect" (Gittell, 2000, p. 517) contribute to overall team effectiveness and organizational performance.

Originally described in aviation to improve on-time flight departures (Gittell, 2016, p.5), the framework is defined as the "patterns of communicating and relating through which workers integrate their tasks into a whole" (Gittell, 2016, p. 5) or more simplistically as "communicating and relating for the purpose of task integration" (Gittell et al., 2020, p.13). As in aviation, successful patient outcomes in the surgical setting are dependent on "well-functioning relationships that cut across silos, enabling workers to get things done in a timely way without wasting effort or resources"(Gittell, 2016, p.13). The benefits of relational coordination, however, extend beyond improving organizational outcomes. Clinical settings with higher levels of relational coordination have improved patient satisfaction, improved staff job satisfaction, and staff who are more resilient to the job pressures they experience (Gittell et al., 2020).

Relational coordination requires organizations to "replace traditional bureaucratic structures with more relational structures" (Gittell et al., 2013, p. 210) that prioritize teamwork,

conflict resolution, shared performance measurement rewards, protocols, and information sharing (Gittell, 2013). In the surgical setting, breaking down silos and improving relationships between surgeons, anesthesia providers, registered nurses, surgical technicians, and housekeeping staff would improve overall team performance. Surgical teams share responsibility for maintaining patient safety. Multiple studies, however, have demonstrated that coworkers are a frequent source of clinical distractions and interruptions (Johnson et al., 2017; Pape & Dingman, 2011; Yoder et al., 2015). This should be alarming to all surgical team members, as it jeopardizes the shared goal of a successful surgical outcome. Furthermore, improved relational coordination must include both direct care and support staff (Gittell et al., 2020) especially when their actions may negatively influence another's work performance and quality.

Methods

Distractions unrelated to patient care occur frequently in clinical practice, and No Interruption Zone (NIZ) implementation should be considered as part of a multidisciplinary approach to address them. The purpose of this quality improvement project was to apply the concept of the NIZ during case preparation processes by the CRNA to decrease distractions and promote patient safety and quality of care.

The principal investigator recorded observed distractions during anesthesia case preparation procedures before implementing an educational program to staff and implementing the NIZ in the clinical setting. The evidence-based educational program (Appendix A) included descriptions of types of distractions, their prevalence in the clinical setting, and an explanation of the history and rationale of the NIZ. Evidence-based practice recommendations from professional and quality organizations addressing utilization of the NIZ were included. Post-

education, CRNAs performing case preparation designated a room as a NIZ and posted a sign at the head of the OR table to indicate the NIZ was in progress.

Design

The design of the project was a quantitative, pre-post quasi-experimental design. A distraction was defined as the occurrence of any event not related to patient care or case preparations.

Translational Framework

A quality improvement approach utilizing the PDSA (Plan-Do-Study-Act) model was selected as the foundation for this project. According to Speroff & O'Connor (2004), the "outcomes driven" (p. 30) model "is to assess whether a study intervention imposed to change a process produces an improvement" (p. 17). The model is familiar to many clinicians because of its relative ease of use and straightforward terminology. It consists of four key steps based on the scientific process. These include the formation of a hypothesis (Plan), the implementation of an intervention (Do), an analysis of results (Study), and a subsequent decision to adopt, adapt, or abandon the practice change (Act) before repeating the process (Speroff & O'Connor, 2004). This design facilitates the implementation of specific, small-scale practice changes to determine best practices. The advantages of the PDSA process are the availability of timely feedback on the impact of small practice changes within a particular setting so that decisions can be based on data (Connelly, 2021).

The objective of this quality improvement project (Plan) was to evaluate the effectiveness of the NIZ to decrease distractions experienced by the CRNA during routine case preparations. The interventions (Do) were the delivery of a comprehensive staff educational program followed

by the introduction of the NIZ in the clinical setting. This was followed by an analysis of the frequency, source, and CRNA response to any observed distractions (Study) and a subsequent decision to address encountered barriers before repeating the process (Act). A single PDSA cycle was conducted for the purpose of this project. Additional PDSA cycles would be advantageous to determine the best combination of interventions to reduce distractions and to expand the NIZ to other perioperative processes and settings.

Population

Project participants consisted of a convenience sample of CRNAs employed at the setting organization. An initial target sample size was established of 30 baseline observations of CRNA's performing case preparation and 30 subsequent observations post-implementation of the NIZ. The initial baseline observations were conducted with CRNAs that were blinded to the specific purpose of the observations. Subsequent observations for comparison were conducted on CRNAs that voluntarily agreed to participate. A total of 30 pre-intervention observations and 31 post-intervention observations were conducted.

Setting

The setting was a community hospital in the Southeastern United States. This specific facility has nine general operating rooms, two obstetric operating rooms, and four endoscopy suites. Attempts were made to minimize the investigator becoming a distraction as much as possible before NIZ implementation, by conducting observations in the specific operating rooms with a physical layout that facilitated more discrete observation. Following NIZ implementation, room selection was based on CRNA willingness to participate in the project.

Project Implementation

The objective of this quality improvement project was to promote patient safety by decreasing distractions in the anesthesia setting during case setup and preparation by the CRNA. The principal investigator conducted baseline observations of distractions during CRNA case preparation at the facility site. Distractions that occurred during anesthesia machine safety checks, airway equipment setup, and the preparation of induction medications were recorded and categorized by timing, source, and CRNA response. The CRNA being observed for these baseline data measures was blinded to the specific rationale for these observations.

The principal investigator then developed and conducted an evidence-based educational program (see Appendix A) for all anesthesia and perioperative staff. The educational program described types of distractions and specific literature-based interventions to mitigate them in the clinical setting. This included various strategies to implement the NIZ. Evidence-based practice recommendations from professional and quality organizations addressing utilization of the NIZ were included. This educational program was conducted at 2 previously scheduled departmental meetings. Staff included in the educational program were CRNAs, perioperative registered nurses, and surgical and anesthesia technicians. It was anticipated that case setup processes would be conducted between cases, therefore surgeons were not included in the NIZ education effort.

Following the educational program, CRNAs willing to participate voluntarily implemented the NIZ during their case setup procedures. This included the following routine processes: conducting anesthesia machine safety checks, preparing airway equipment, and/or preparing anesthesia induction medications. For the purposes of this project, an 8” x 10” laminated red sign was used to designate the NIZ period (Appendix B). The sign was placed by the CRNA on an intravenous pole at the head of the table to be visible to other staff in the room.

The purpose of the posted sign was to indicate to other room staff that the CRNA was setting up for a case and requested not to be disturbed unless a matter was urgent, as communicated during the educational program. Data collection was repeated and included the number, classification, source and CRNA response to any observed distractions.

Instruments

Data were recorded using a paper data collection tool that included the number, classification, and source of any observed distractions as well as the observed CRNA response to each distraction (See Appendix C). The data collection tool was adapted from tools utilized previously in other settings or other perioperative processes (Crockett et al., 2019; Filer et al., 2017; Healey et al., 2006; Healey et al., 2007; Sevdalis et al., 2007; Sevdalis et al., 2014).

The data collection tool facilitated the recording of observed distractions in a simple check-off format that included the specific timing of the distraction (during anesthesia machine safety check, airway equipment setup, or induction medication preparation), the source of the distraction (person, traffic in/out of the room, music, monitor, equipment, phone, other), the personnel causing the distraction (RN circulator, scrub tech or endoscopy tech, housekeeping staff, anesthesia tech, surgeon, anesthesiologist, other CRNA or self-initiated by the CRNA) and the response of the CRNA to the distraction (ignores, acknowledges and defers until after task completion or halts current task to address distraction). The data collection form was designed to allow for the recording of multiple distractions during any single case preparation period.

Timeline and critical milestones

Multiple preliminary meetings were held with department directors in October and November 2020 to determine project feasibility and available facility support. Subsequent

meetings were held to coordinate project objectives, process, timing, and methods through April 2021. The project was submitted to the UNC Greensboro Institutional Review Board (IRB) in April 2021 and was subsequently deemed to not be research. Facility IRB submission was delayed multiple times due to other organizational priorities including issues related to a global pandemic. Facility project approval was ultimately granted in August 2021. Baseline data collection was conducted in September and early October 2021 prior to the educational programming that was conducted in late October. Repeat data collection following NIZ implementation was initiated immediately following the educational programming and was completed in November 2021.

IRB approval

Data collection was initiated following designation of the project as not research by the UNCG institutional review board and approval to proceed by the project site institutional review board. No patient identifiable information was collected. Operating room personnel were identified solely by their professional role; no identifying information was collected about staff. All collected data were secured in a locked cabinet at the study facility that was only accessible by the principal investigator.

Data Analysis

Descriptive statistics were used to compare pre-intervention and post-intervention data to evaluate whether the provided educational program and NIZ implementation successfully mitigated distractions.

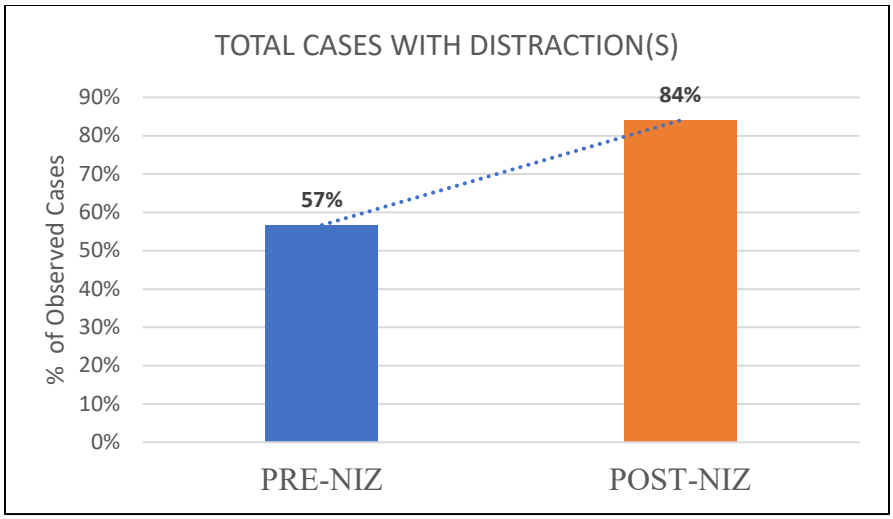
Results

Baseline data observations were made in September and early October of 2021. Staff were blinded as to the specific rationale for the initial observations, except that they were related to a quality improvement project. Of these baseline observations, 57% of case preparation processes were characterized as having one or more distractions, with a mean of 1.23 distractions per case. Multiple distractions were present in 70.6% of cases that had distractions. One single case observation was marked by four distracting events.

Observations of case preparations were conducted again during late October and November 2021 following an educational program that reviewed current literature findings on clinical practice distractions and implementation of a No Interruption Zone (NIZ). Following implementation of the NIZ, cases with distractions increased (see Figure 1). Following implementation of the NIZ, 84% of case preparation processes were characterized as having one or more distractions, with a mean of 1.84 distractions per case. Multiple distractions were present in 69% of cases that had distractions. Three cases were marked by four or more distracting events each.

Figure 1

Observed Case Distractions



Note. NIZ= No Interruption Zone

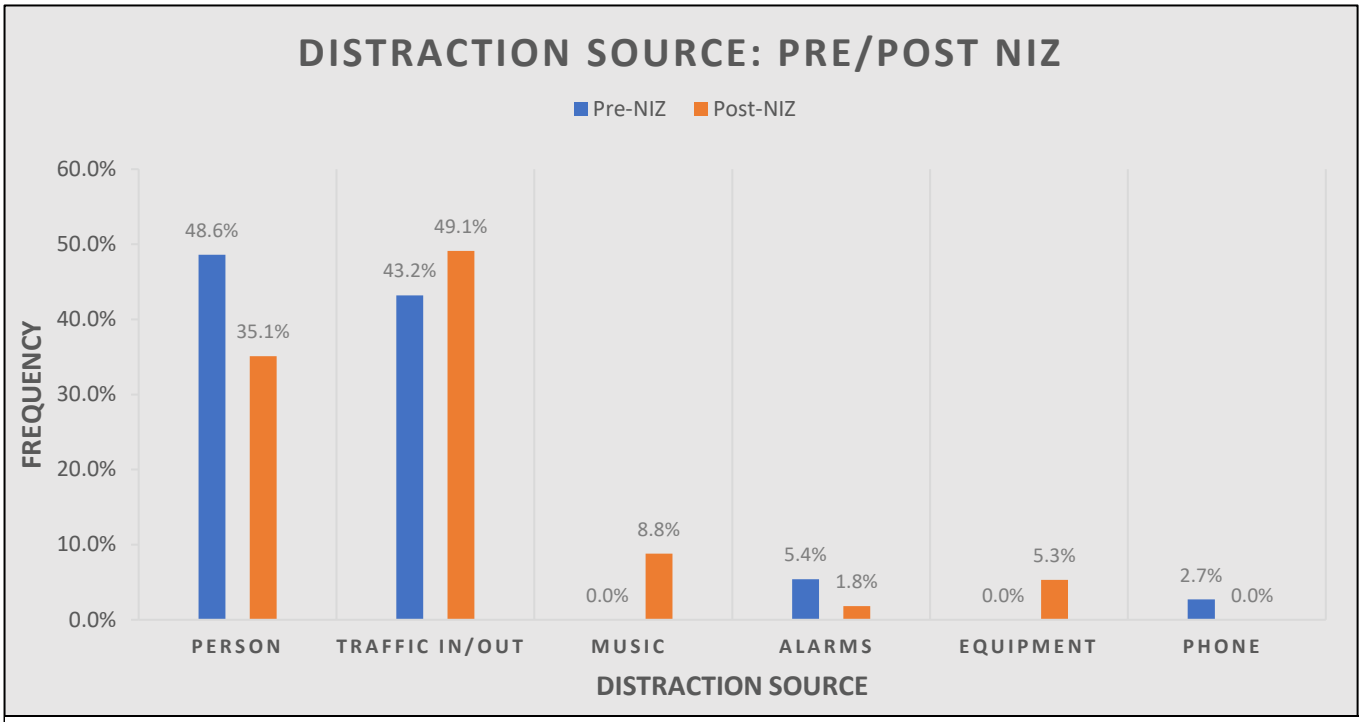
Distractions were further categorized by their timing in relation to the specific case preparation activity being performed by the CRNA. Distractions were observed most frequently during medication administration processes. Distractions during medication preparation were observed in 53.3% of all cases prior to NIZ implementation, and 64.5% of all cases following NIZ implementation. Prior to NIZ implementation, 94.1% of cases with distractions had a distraction during medication preparation. Following implementation of the NIZ, 76.9% of distracted cases had a distraction occur during medication preparation. Although not statistically significant due to limited sample size, implementation of the NIZ was associated with a decrease in distractions during medication preparation processes by 17.2%. Similarly, implementation of the NIZ was associated with a reduction in distractions during the anesthesia machine check by 38.2% and a reduction in distractions during airway equipment setup procedures by the CRNA by 53.6%. These reductions, however, were not statistically significant.

Observed distractions were further categorized by their source. Distractions caused by other staff initiating conversation with the CRNA decreased by 13.5%. Distractions caused by

personnel movement in and out of the room, however, increased by 5.9% following NIZ implementation. Cumulatively, distractions caused by coworkers (either by conversation or movement in and out of the room), decreased by 7.6% following NIZ implementation. Any engagement of the CRNA by staff, either in conversation or by physically entering the immediate CRNA workspace, was recorded as a distraction whether clinically relevant or not. Staff were observed entering the immediate CRNA workspace and distracting the CRNA for multiple reasons, such as to retrieve supplies or equipment for other operating rooms, to document on the shared computer, to offer assistance, and to provide staff breaks. Distractions caused by music, alarms, equipment, and phones were observed far less frequently (see Figure 2).

Figure 2

Sources of Observed Distractions

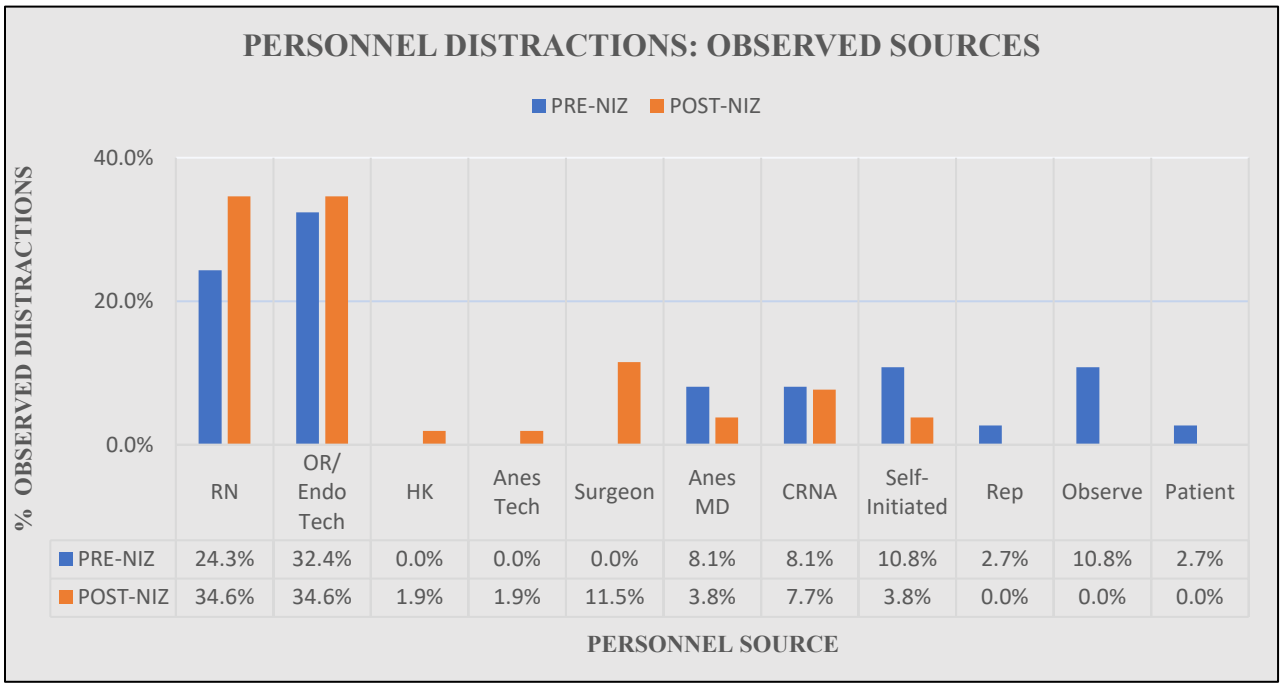


Note. NIZ= No Interruption Zone

To better understand the source of personnel-related distractions to the CRNA, these distractions were further categorized by personnel type (see Figure 3). Prior to NIZ implementation, perioperative nurses, and perioperative technicians (including operating room technicians, endoscopy technicians, and anesthesia technicians) accounted for 24.3% and 32.4% of distractions, respectively. Following implementation of the NIZ, perioperative nurses accounted for 34.6% and perioperative technicians accounted for 36.5% of observed distractions. Other CRNAs accounted for 8.1% of distractions in the pre-intervention and 7.7% in the post-intervention groups. Distractions were considered self-initiated by the CRNA if he/she commenced a conversation with other staff during the observation period, including with the investigator. Self-initiated CRNA distractions decreased following implementation of the NIZ by 7%. Distractions from anesthesiologists decreased following NIZ implementation by 4.3%. Distractions from surgeons, however, increased by 11.5%.

Figure 3

Personnel Distractions by Role

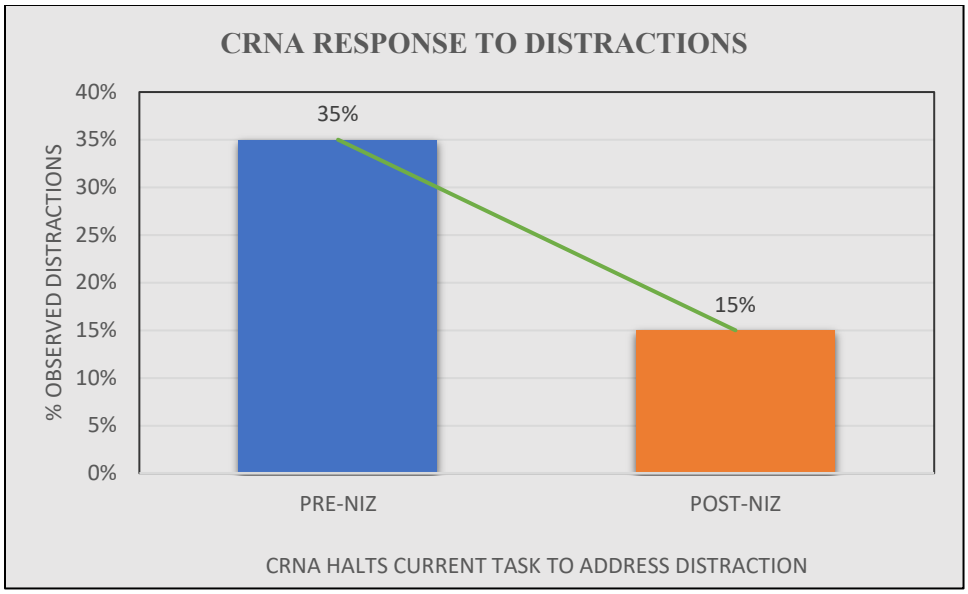


Note. NIZ= No Interruption Zone; RN= Registered Nurse; OR/Endo Tech= Operating Room or Endoscopy Technician; HK= Housekeeping staff; Anes MD= Anesthesiologist; CRNA= Other CRNA; Rep= Sales or Equipment Representative

The impact of the distraction on the CRNA provides a suggestion of its impact on patient care and safety. Following implementation of the NIZ, the CRNA halted the task being performed in 20% fewer of observed distractions (see Figure 4).

Figure 4

Observed Response of CRNA to Distractions



Note. NIZ= No Interruption Zone

Barriers to success

The small sample size, single observation setting, and potential bias in data collection are limitations to this quality improvement project. These findings may not be applicable to other clinical environments, including other surgical settings. This project also took place during a global pandemic with impacts on day-to-day staffing, staff turnover, case schedule variability, and employee morale. These factors present additional potential distractions that were neither considered nor addressed.

Case observations also revealed that clinical processes for the CRNA are not necessarily linear; tasks of anesthesia machine check, airway equipment setup, and medication preparation were frequently observed to be performed simultaneously. Whether this presents a distraction, and how this might impact the CRNA's ability to manage simultaneous extraneous distractions is not known. The post-implementation group also included three emergency add-on cases that were characterized by more complex anesthesia setup requirements and, more notably, other

CRNAs offering to help. These interactions were recorded as distractions, however, how they were perceived by the primary CRNA is not known. It is also possible that distractions are perceived differently by the CRNA in emergent situations as compared to routine cases.

The failure to include surgeons in the educational programming intervention was a limitation that precluded their opportunity to collaborate in the initiative. It also increased distractions because surgeons inquired as to the purpose of the posted NIZ signage during the time the CRNA was conducting case setup processes. Coordination of work, communication, and shared goals are key components of the Model of Relational Coordination (Gittell, 2020), and this limitation clearly hindered successful coordination between all key players.

Discussion

The purpose of this quality improvement project was to apply the concept of the NIZ to routine case setup procedures by the CRNA to mitigate distractions. Baseline data findings were consistent with the literature review in that distractions occur frequently in the clinical setting and come from a variety of sources. In this study, however, implementation of the NIZ was not associated with a reduction in observed distractions. Surprisingly, the mean average of distractions per case increased from 1.23 to 1.84 and the percentage of cases with distractions increased by 27%. These findings, although unexpected, are consistent with those of some prior researchers who have also demonstrated conflicting results. Yoder et al. (2015), for example, reported an increase in both overall distractions and medication error rate following implementation of the NIZ concept. Similarly, Behazin et al. (2015) reported a 12.7% increase in low-level distractions following NIZ implementation in the setting of decreased medium-level and high-level distractions.

It is also likely that successful implementation of the NIZ requires multiple coordinated strategies and longer periods of time to provide any significant clinical impact. Crockett et al. (2019) reported an overall reduction in distractions during pediatric anesthesia inductions in over 700 case observations using six sequential interventions implemented over a period of one year. The run chart (p. 800) provided in their publication, however, demonstrates an increase in observed distractions of nearly 20% immediately following initial project implementation with a single NIZ intervention. Ongoing PDSA cycles may have yielded more favorable results.

Cases with multiple distractions were observed in both pre-and post-NIZ implementation groups. The number of cases with four or more distractions, however, increased from a single case in the baseline group to three cases in the post-NIZ group. In the post-intervention observations, three of these cases were emergency add-on cases and multiple distractions were observed when other CRNAs and providers were interrupting the CRNA to help prepare for the cases. It is possible that the frequency and source of distractions in emergency cases differ from those of routine cases and warrant further future evaluation.

Distractions during medication preparation by the CRNA are concerning in terms of patient safety and potential risk, and the frequency in which these distractions were observed is truly alarming. Nanji et al. (2016) estimate that one in 20 perioperative medication administrations involves a medication error and/or an adverse drug reaction. Anthony, et. al (2010) and Johnson et. al (2017) identified medication preparation as opposed to medication administration as more frequently impacted by interruptions and distractions. Furthermore, the medication administration process in the anesthesia setting differs from other clinical settings because a single provider is responsible for all steps of the process including requesting, administering, documenting, and monitoring the patient. Thus, routine safety checks inherent in

the medication administration process of other settings are absent during anesthesia medication preparation. Grigg and Roesler (2018) have proposed the need for innovative solutions to address the "lack of redundancy and accountability enjoyed by our nursing colleagues" (p. 348) when "medications are not prescribed, pharmacy is not involved, and medications come from generic vials in a drawer" (p. 348). NIZ implementation for this project was associated with an overall increase in the frequency of observed distractions during medication preparation by 11.2%. When looking specifically at distracted cases only, however, NIZ implementation was associated with a 17.2% reduction in cases having one or more observed distractions. This decrease was not statistically significant due to the limited sample size. Additional studies are needed to determine whether the NIZ is an effective strategy in reducing medication errors.

Similarly, additional studies are needed to determine if the NIZ is an effective strategy to mitigate distractions during anesthesia machine safety checks and airway equipment setup procedures. In my observations, cases with one or more distractions during anesthesia machine checks decreased by 38.2%, and cases with one or more distractions during airway equipment setup decreased by 53.6% following NIZ implementation. These reductions, however, were also not statistically significant due to the limited sample size.

The sources of observed distractions were similar pre-and post-NIZ implementation. Distractions were caused most frequently by other perioperative staff. This finding is consistent with previous literature findings that coworkers are a frequent source of distractions in the clinical setting (Pape & Dingman, 2011; Johnson et al., 2017). Although the NIZ was not associated with any significant improvement in the frequency of these distractions, this clearly represents an area where focused interventions would have a profound impact. Distractions caused by surgeons increased following NIZ implementation and this represents the failure to

include them in the staff education program. Surgeons unaware of the purpose and intent of the NIZ signage questioned the CRNA regarding the project and these interactions were recorded as personnel distractions.

The response of the CRNA to observed distractions suggests the potential severity of the impact of the distraction on task completion. Following NIZ implementation, the CRNA was 20% less likely to halt their current task to address the distraction. In other words, although post NIZ distractions increased overall, the impact on task completion by the CRNA appears to have been reduced. This suggests that the NIZ and the education program after a single PDSA cycle may have affected CRNA response to distractions, even if the NIZ did not demonstrate effectiveness in decreasing the overall occurrence of distractions. Crockett et al. (2019) sequentially implemented a multi-step educational and interventional process to reduce distractions during anesthesia induction over a period of over ten months. Their initial primarily educational interventions were associated with a dramatic reduction in distractions by 46% in the initial eight months (Crockett et al., 2019). Multiple clinical interventions over the subsequent two months successfully reduced distractions only an additional 5% (Crockett et al., 2019).

Conclusion

CRNA distractions occurred frequently during all case preparation processes and although the findings did not demonstrate NIZ effectiveness in mitigating them, iterative PDSA cycles may reveal positive results. Preliminary findings were shared with the facility department director and will be disseminated to the anesthesia and perioperative staff at upcoming scheduled staff meetings. This project successfully raised baseline awareness of clinical distractions as a problem, but ongoing efforts will require patient safety champions, practice and policy changes, and ongoing efforts.

It was difficult to critically analyze the source of distractions and demonstrate statistical significance due to the small number of observed distractions. Larger sample sizes of distracted cases would facilitate a more critical evaluation of distraction sources. Further evaluation of the NIZ using different procedural techniques might also be more effective. For example, traffic in and out of the room was identified as a frequent distraction, and posting a sign designating NIZ implementation inside the operating room was not visible to staff until they had entered the room. Implementation of the NIZ for emergent vs. routine cases would also further contribute to our overall understanding of NIZ effectiveness. Lastly, inquiry as to how observed distractions are perceived by the CRNA (instead of observed by another individual) could focus mitigation efforts where they might be most impactful. Revision of the data collection tool to better capture the source and CRNA response of each distraction could also help guide better-targeted solutions. Future interventions should continue to be data-driven and evidence-based.

The complexity of the perioperative environment necessitates cohesive team performance to consistently achieve quality outcomes. Even though each perioperative team member has their unique role and responsibilities, every member shares responsibility for maintaining patient safety. Clinical distractions can jeopardize patient safety and thus, all perioperative personnel must consistently work together to implement strategies to mitigate them. We can no longer merely accept that "distractions are an integral part of anesthetic practice and dealing with them is a key professional skill" (Campbell et al. 2012, p. 714) without working together to develop effective solutions.

Multidisciplinary initiatives to educate all surgical personnel on the adverse impact of perioperative clinical distractions are reasonable first steps to raising awareness of the issue. Successfully decreasing distractions, however, will require addressing deeply embedded

communication and organizational norms that can prevent optimal team cohesion, synergy, and performance. Each perioperative team member must remain aware of the potential for their actions to adversely impact the performance of other team members. Decreasing clinical distractions will also require a paradigm organizational shift that consistently prioritizes patient safety over organizational efficiency.

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Appendix A: Education Plan

CRNA Distractions in the Operating Room: Education Plan

Learning Objectives:

1. Identify the most common distractions routinely experienced in the perioperative setting and effective strategies to mitigate them as demonstrated in the current literature.
2. Verbalize understanding of position statements on distractions from professional organizations
3. Explain the history, current literature findings and implementation strategies of the "No Interruption Zone" concept in clinical practice.

Introduction:

Distractions to patient care in clinical practice are exceedingly common and present a growing safety issue. Multiple studies over the past several years have addressed them and have found that they reduce vigilance, distract providers from noticing alarms, distract attention during an emergency and impair communication with other staff (Crockett et al., 2019).

The primary responsibility of the CRNA is to keep our patients safe. Certain tasks we perform on a regular basis such as medication preparation and administration, anesthesia machine safety checks, induction, and emergence of anesthesia, as well as attending to critical patient situations mandate our full attention. Our objectives today will be to review various types of distractions, frequent sources of distractions, implications for practice and a strategy called the 'no interruption zone'.

Appendix A: Education Plan

Distractions are activities that interfere with vigilance and task completion. They can be auditory (such as noise, alarms, music, or conversations) or they can be physical such as the number of staff present in the room, movement of staff in and out of a room, equipment factors and environmental factors. Distractions can also be self-initiated.

DISTRACTIONS: HOW COMMON ARE THEY?

CITATION	PERIOD MONITORED	FINDINGS
Crockett, C.J. et al. (2019)	INDUCTION	86% of staff reported distractions >50% of the time during induction.
Campbell et al. (2012)	ENTIRE ANESTHETIC	1 distraction every 4 minutes, 23 seconds
	EMERGENCE:	1 event every 1 min 59 seconds
Pape & Dingman (2011)	INDUCTION	7.5 interruptions occurred per 9 min period, mostly in form of conversations. CRNAs were often the ones initiating the conversations.
Broom et al. (2011)	INDUCTION MAINTENANCE & EMERGENCE	Measured noise in the OR using a calibrated meter. Sudden loud noises (> 70dB) was 34x more frequent during emergence.

Appendix A: Education Plan

Jenkins et al. (2015)	C-SECTION PATIENTS	Measured noise levels using Calibrated meter Noise & distracting events are more common in OB than in the main OR. Mostly due to baby crying, measured at >80 dB on 18 occasions (out of 30 cases)

No Interruption Zone (NIZ)

The NIZ is based on a strategy established in aviation to eliminate all unnecessary distractions during critical phases in flight. It has also been referred to as a "*distraction-free zone*" (Crockett et al., 2019), "*safe zone*" (Yoder et al., 2015), and "*healthcare sterile cockpit*" (Pape, 2003). In healthcare, the NIZ has been shown to reduce distractions during medication preparation (Anthony et al., 2010). In anesthesia, the NIZ reduces distractions during induction (Crockett et al., 2019 & Wright, 2016), emergence, surgical time out, specimen collection, and instrument counts (Wright, 2016). NIZ implementation has also been shown to reduce the frequency of reported noise on induction from 61% to 15% in less than 2 months (Crockett et al., 2019) and measured noise levels during induction also from an average of 61.5 decibels to 53.82 decibels (Wright, 2016). Measured noise levels during emergence were also reduced from an average of 63.52 decibels to 54.84 decibels (Wright, 2016). Specific NIZ implementation varies significantly but typically includes one or more of the following: Posted sign, physically marked designated area, staff wear vest or sash, A staff member makes an announcement of NIZ

Appendix A: Education Plan

Trial of NIZ

Preparation of anesthesia induction medications, anesthesia machine safety checks, and setup of airway equipment are routine anesthesia procedures, but they are critical tasks to maintain patient safety. Furthermore, the medication administration process differs in anesthesia as the usual checks and balances established between steps of order entry, order reconciliation, pharmacy review and dispensing of medications before administration are typically all completed by a single anesthesia provider at the bedside. I would like to trial the NIZ here at this hospital during the case setup processes.

Case setup will include the completion of the following routine tasks:

1. Anesthesia machine safety checks
2. Verification of emergency airway equipment.
3. Preparation of anesthesia induction medications.

The process:

CRNAs willing to participate will post the provided laminated 8" x 10" red sign before initiating case setup procedures outlined above. The sign will alert other staff that the NIZ is in process and all unrelated staff conversations and distractions are to be minimized. Case observations will record the observed distractions.

*References available upon request

Appendix B: No Interruption Zone Sign

Appendix C: Data Collection Tool

OR #:_________	___ Person	___RN Circulator	___Ignores
CRNA: _________	___ Traffic In/Out of ro	___Scrub Tech/Endo Tech	___Acknowledges and defers
	___ Music	___Housekeeping	___Halts current task to address distraction
TIMING OF DISTRACTION	___ Monitor/Alarms	___Anesthesia Tech	
___Medication Prep	___ Equipment	___Surgeon	
___Anesthesia Machine Chec	___ Phone	___Anesthesiologist	
___Airway Equipment Setup	__ Other: _________	___Other CRNA	
		___Self (CRNA)	
		___Other: _________	

Date: _________	**SOURCE**	**PERSON**	**CRNA RESPONSE**
OR #:_________	___ Person	___RN Circulator	___Ignores
CRNA: _________	___ Traffic In/Out of ro	___Scrub Tech/Endo Tech	___Acknowledges and defers
	___ Music	___Housekeeping	___Halts current task to address distraction
TIMING OF DISTRACTION	___ Monitor/Alarms	___Anesthesia Tech	
___Medication Prep	___ Equipment	___Surgeon	
___Anesthesia Machine Chec	___ Phone	___Anesthesiologist	
___Airway Equipment Setup	__ Other: _________	___Other CRNA	
		___Self (CRNA)	
		___Other: _________	

Date: _________	**SOURCE**	**PERSON**	**CRNA RESPONSE**
OR #:_________	___ Person	___RN Circulator	___Ignores
CRNA: _________	___ Traffic In/Out of ro	___Scrub Tech/Endo Tech	___Acknowledges and defers
	___ Music	___Housekeeping	___Halts current task to address distraction
TIMING OF DISTRACTION	___ Monitor/Alarms	___Anesthesia Tech	
___Medication Prep	___ Equipment	___Surgeon	
___Anesthesia Machine Chec	___ Phone	___Anesthesiologist	
___Airway Equipment Setup	__ Other: _________	___Other CRNA	
		___Self (CRNA)	
		___Other: _________	

Date: _________	**SOURCE**	**PERSON**	**CRNA RESPONSE**
OR #:_________	___ Person	___RN Circulator	___Ignores
CRNA: _________	___ Traffic In/Out of ro	___Scrub Tech/Endo Tech	___Acknowledges and defers
	___ Music	___Housekeeping	___Halts current task to address distraction
TIMING OF DISTRACTION	___ Monitor/Alarms	___Anesthesia Tech	
___Medication Prep	___ Equipment	___Surgeon	
___Anesthesia Machine Chec	___ Phone	___Anesthesiologist	
___Airway Equipment Setup	__ Other: _________	___Other CRNA	
		___Self (CRNA)	
		___Other: _________	