ANESTHESIA PROVIDERS' PERCEIVED DISTRACTIONS IN THE OPERATING ROOM DURING INDUCTION OF ANESTHESIA AT A MID-SIZED SUBURBAN HOSPITAL

by

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A Doctoral Scholarly Project submitted to the faculty of
The University of North Carolina at Charlotte
in partial fulfillment of the requirements
for the degree of Doctor of Nursing Practice

Charlotte

2023

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ABSTRACT

CHANTEL GLASSER CIRANNI. Anesthesia Providers' Perceived Distractions in the Operating Room During Induction of Anesthesia at a Mid-Sized Suburban Hospital. (Under the direction of DR. DAVID LANGFORD)

There are a variety of distractions that can occur in the operating room during the induction of anesthesia. A review of the literature revealed that common distractions include noise, music, cell phones and pagers, production pressure, and unnecessary conversations. This project is part of a larger quality improvement project investigating anesthesia providers' perceptions of the types and severity of distractions occurring during induction of anesthesia at three different surgery sites: a mid-sized suburban hospital, a level one trauma center, and an ambulatory surgery center. This project reports on identifying distraction severity and frequency in a mid-sized suburban hospital. An anonymous, electronic survey was distributed to physician anesthesiologists, certified registered nurse anesthetists (CRNAs), and student registered nurse anesthetists (SRNAs), at these three different clinical locations within a single health system asking providers to rate perceived frequency and severity of selected distractions using a modified Likert scale. At the mid-sized suburban hospital, participants ranked conversations as the most distracting item, with over 80% saying it was at least somewhat distracting. Staff exiting and enter the room and music were reported as the least distracting factors. There was no significant difference across the three different sites.

ACKNOWLEDGEMENTS

With sincere thanks I would like to recognize the invaluable contributions of my group members Bailey Christin Coggins and Elisa Hillman. Their unwavering efforts over these past three years included many long discussions at our anesthesia program, video calls to edit papers, and coffee shop meet ups. Bailey and Elisa- you are such kind and patient human beings; I could not have done it without you!

Great recognition is owed to Dr. Zhou Job Chen, who completed the data analysis and interpretation. Job was a pleasure to work with and ensured that results were transparent and concise.

I would also like to extend my sincere gratitude to Dr. David Langford and Dr. Dianne Earnhardt, who gave invaluable feedback and edits throughout the entire process. Thank you for guiding our anesthesia program through its first set of doctoral projects, easily navigating the many challenges we faced along the way.

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Introduction/Background

The American Society of Anesthesiologists' seal depicts a lighthouse shining brightly over a ship at sea. The ship sailing in rocky seas represents the patient, and the captain of the ship is the anesthesia provider guiding the patient through their journey of fear and uncertainty. The lighthouse portrays the firm foundation of safety and provider knowledge of the science and art of anesthesia (American Society of Anesthesiologists, 2021). Anesthesia providers hold the responsibility of safely guiding patients through their anesthetic experience during surgery; however, a variety of distractions in the operating arena can create barriers for the provider in delivering safe and efficient anesthetic care. Harten et al. (2020) performed an observational study over 148 hours in the operating room (OR) and found a total of 4,594 distracting events occurred. These distractions can lead to serious safety issues, with 5% of human errors in the operating room being attributed to distracting events (Riutort, 2020). Induction is a critical point in the anesthesia process where the anesthesia provider is securing an airway and administering a variety of drugs to prepare the patient for the surgical procedure. It is essential that distractions in the operating room during the induction of anesthesia be mitigated in order to facilitate focus for the anesthesia provider as they safely get the patient anesthetized.

Problem Statement

Operating rooms are known for being loud work environments. However, studies have found that before and after surgery and during critical moments like intubation for anesthesia, noise levels are consistently even *higher* (Ginsberg et al., 2013, p.528). A systematic review of 38 articles found the two most common distractions to anesthesia providers to be small talk and staff entering and exiting the room. Additional significant distractions included music and equipment alarms (Gui et al., 2021). Studies have found that these distractions and noise levels

decrease anesthesia providers' clinical reasoning, performance, and lead to poorer patient outcomes (Gui et al., 2021; Enser et al., 2017, p. 466). Evidence has clearly shown that distractions in the operating room during intubation may yield serious consequences that lead to patient harm and need to be addressed.

Stakeholders affected by this issue include anesthesia providers (nurse anesthetist and anesthesiologist), the surgical team, hospital administrators, the patients, and their families. The surgical team has many tasks to accomplish during the induction period as well, and their collaboration is necessary to decrease distractors. Hospital administrators are also stakeholders, as they are interested in decreasing adverse events, increasing cost efficiency, and shortening operating room times. In addition, they can implement policies to help decrease the distractions. Lastly, the potential adverse events from distractions can have lifelong impacts on patients and their family members. The top priority of each stakeholder and ultimate goal of distraction reduction is to provide the safest patient care.

PICO Question

This quality improvement project is part of a larger project addressing distractions in the OR during induction. The PICO question for the larger project is "How do anesthesia staff members (P) perceptions of distractions during induction (I) at three different clinical sites (C) vary (O)?" The three sites are a mid-sized suburban hospital, a level one trauma center, and an ambulatory surgery center. These three locations each have unique characteristics and can yield insight to location-based characteristics that can ultimately improve the quality of care patients receive in the perioperative environment.

The PICO question specific to this project is "At a mid-sized suburban hospital (P) how do opinions on distractions during induction (I) amongst anesthesia providers (C) vary (O)?" The

project assessed the frequency and types of distractions during induction that occur at a mid-sized local suburban hospital in the Southeastern United States. During the COVID pandemic, this hospital was used to concentrate admission of COVID-19 patients from a larger urban health system. Surveying this location provides insight on the challenges anesthesia providers are facing during induction and intubation of high-risk airways. The staff at this site operate within a very community-centered culture.

Conceptual Framework

This project uses the Plan-Do-Study-Act (PDSA) model which is a four-step framework used to improve a process or to carry out a change (Agency for Healthcare Research and Quality, 2020). For this project, the planning component of the model begins with identifying known induction distractions in the literature, followed by the development of a survey to elicit the top induction distractions at each of the three clinical sites. Next, the "do" component encompasses the implementation of the survey. After the results were collected, the "study" phase required thorough review of data and analysis. To finalize, each group member "acts" by drawing conclusions and making recommendations for distraction mitigation. One main strength of the PDSA model is that it was formulated to be cyclical in nature; promoting the idea of continual quality improvement. Future implications beyond this project may include creation and implementation of policy, educational tools, and further evaluation of outcomes.

Literature Review

It is important to evaluate the presence and impact of distractions in the operating room, as anesthesia providers seek to improve the quality and safety for patients. The first step in mitigating distractions is to identify the problem so that the appropriate solutions can be implemented. This doctoral quality improvement project aims to achieve this by assessing

anesthesia providers' perceptions and attitudes towards distractions in the O.R., specifically during *induction*- one of the most critical periods of anesthetic care.

Key Topics in Reviewing the Literature

In this literature review, research surrounding the different types of distractions present during the induction of anesthesia in the O.R. will be discussed along with their implications. These distractions can be divided into the following major categories: noise, music, cell phones/pagers, production pressure and conversations/movement. Because these activities have been identified as distractions in the literature, they were included in the project survey. Discussing distractions by type highlights the variety and intensity of interruptions that the anesthesia provider must navigate to safely deliver care. The first step to changing the operating room environment into a safer space for patients is recognizing that distractions stem from a variety of sources and assessing what is the most distracting for providers.

Noise

Operating rooms are notoriously loud work environments before, during, and after surgery. Noise of any kind can be detrimental to the anesthesia provider's concentration and communication. A prospective study found that during critical moments for anesthesia, including induction, the noise levels are consistently at their *highest* (Ginsberg et al., 2013, p.528). Shapiro & Berland (1972) found that noise in the operating room can be as loud as a traffic highway. This is significant because noise can cause serious negative consequences that include communication breakdown, decreased mental effectiveness, short-term memory reductions, inability to hear important monitors such as the pulse oximeter, and creates physiologic stress in the anesthesia provider (Hodge & Thompson, 1990; Murthy et al., 1995; Stevenson et al., 2013; Kam et al., 1994).

Broom et. al (2011) likens the distractions that occur in the operating room to those that occur in aviation. The article refers to the sterile cockpit rule that prohibits non-essential conversation during crucial time periods of the flight to prevent any distraction that could lead to a potential accident. Take-off and landing of a flight mirror the induction and emergence phases of anesthesia. Interestingly, this study found the emergence phase, the time period when the patient gradually regains consciousness after anesthesia, to be far noisier than the induction phase of anesthesia (Broom et al., 2011). One limitation of this study was the placement of each data recorder in proximity to the anesthetist which could have contributed to variability in decibel recordings. Another limitation is that the researchers recorded data throughout all three phases of anesthesia: induction, maintenance, and emergence. By focusing on only one phase, the researchers could have looked at unique contributors to noise pollution based on what phase of anesthesia was being examined. While this study found emergence to be the noisiest, another study found the preparation of the room and patient for surgery to be the noisiest (Hodge & Thompson, 1990). However, each of these studies correlates increased noise to decreased effectiveness in communication (Broom et al., 2011; Hodge & Thompson, 1990). When the anesthetist cannot communicate effectively during the induction of anesthesia, this creates the opportunity for potential harm to the patient. Induction during anesthesia is a team effort, and a quiet environment allows for better communication.

The impact of noise on the mental effectiveness and short-term memory capabilities of the anesthesia provider was examined using a case-control study of anesthesia providers (Murthy et al., 1995). Anesthesia providers were taken to an audiology lab and listened to recordings from an operating room while tests were administered to measure the noise level effects on their mental ability and short-term memory retention. The results demonstrated a statistically

significant reduction in the mental efficiency and short-term memory abilities when exposed to the operating room noise recordings compared to no noise at all (Murthy et al., 1995). Similar to the Hodge and Thompson (1990) study, this study also found the highest decibel readings occurred during the preparation phase of the surgery. One limitation of this study is that it measured mental and short-term memory effectiveness in the audiology lab (Murthy et al., 1995). If these tests had been performed in the operating room, they may have shown an even greater reduction in mental and short-term memory effectiveness related to specific anesthesia tasks. The delivery of anesthetic care requires extreme vigilance and high levels of critical thinking. This study supports that high levels of noise can impede the mental functioning of the anesthesia provider and that noise reduction can likely facilitate a more vigilant anesthesia provider and safer patient care.

Patient monitoring of vital signs and cardiopulmonary status in the OR is a critical component of safe anesthetic care. Without the ability to monitor the patient's vital signs, the surgery would not be allowed to proceed. A group of researchers studied anesthesia providers in a lab setting and measured their ability to hear pulse oximeter changes when background noise (previously recorded operating room sounds) was applied. The anesthesia providers had to complete certain tasks with the background noise on and were asked to press a button once they recognized a change in pulse oximeter tone. The study did find that the background noise significantly decreased providers' response times in noticing the drop in oxygen saturation (Stevenson et al., 2013). This study again highlights the extreme importance of reducing unnecessary noise.

Noise levels in the operating room are above recommended levels (Kam et al., 1994). A study observing 403 general surgeries found noise in the OR to be consistently above 35 decibels

and averaged 63 dB during the induction phase of anesthesia (Arabaci & Onler, 2021). Kam et al. (1994) explain the physiologic implications that noise can have on a provider. High levels of noise above 90 decibels can increase stress hormone levels such as epinephrine and norepinephrine and additionally increase cardiovascular stress by raising blood pressure and heart rate. The physiologic effects caused by noise can lead the anesthesia provider to feel irritable or annoyed. Irritability and annoyance can produce side effects such as fatigue and headache. The operating room environment produces noise that frequently is above 90 decibels. This level is considerably above what the US Occupational Safety and Health regulations recommend (Kam et al., 1994; Arabaci & Onler, 2021). Noise volume creates a clear hazard for the anesthesia provider and patients.

Music

Similar to noise, music is an audible factor that can divert the attention of anesthesia providers. Weldon et al. (2015) suggests that music is played in 53-72% of surgeries. This high frequency and lack of clinical policy guiding the use of music have raised questions about the impact of music on provider performance and focus. An ethnographic study done at a London teaching hospital observed over 33 hours of surgery with 5303 observations of interactions requesting or responding to others in the room. Results showed that when music was played, requests had to be repeated five times more than if no music was played. Moreover, tensions between staff heightened after these repeated requests, surgical task times increased, and the music was often not turned down during crucial times (Weldon et al., 2015). A limitation to this study was the study did not include a variety of surgical specialties, nor did it include different types of surgical facilities.

In contrast to the previous study, Faraj et al. (2014) sought to understand the opinions of music use from both medical and nursing staff in the O.R. Sampling was taken from a hospital with five-operating rooms in which they received 52 respondents. Overall, the majority (66%) of both medical and nursing staff responded that they enjoyed their workday more when music was playing. Some survey responses did indicate that music should be regulated, as it becomes distracting during times like instrument counting or critical surgical moments (Faraj et al., 2014). Anesthesia professionals were included in the study, but no comments were included about the impacts of music specific to critical moments in anesthesia care. This suggests that anesthesia tasks like induction and airway management are often overlooked by the surgical team. Music continues to be played during pivotal anesthesia tasks and more research needs to be done to highlight its impact on anesthetists focus and patient safety.

A survey in 1997 by Hawksworth et al. surveyed anesthesia providers on music prevalence and their opinions on it being played. The study of 104 respondents said music was played 72% of the time. Issues of safety were apparent as, “26% of the sample felt that music reduced their vigilance and impaired their communication with other staff while 11.5% felt that music might distract their attention from alarms” (Hawksworth et al., 1997, p. 80). Many of today’s operating rooms are routinely equipped with upgraded stereo systems compared to what was present in 1997. This upgraded technology likely has louder audio capabilities, access to a larger variety of music genres, and complex control consoles which can be distracting when changing music type, volume, or stopping the music.

A final study published in 2021 by Fu et al. studied medical students performing simulated laparoscopy. Two groups were selected, one listened to the music of their choice, while the other listened to standard pre-recorded O.R. noise. The group listening to music scored

lower on a standardized mental workload questionnaire (SURG-TLX) after the experience and heart rate variability was statistically significantly lower. Surgical task performance showed no differences between the two groups. While this suggests that music in the O.R. can have some positive effects, there are shortcomings in the experiment. No interruptions or alarms were levied on the medical students, which would likely be present in a non-simulated situation. While the applicability of these findings to anesthesia tasks is small, the results suggest that more work is needed on the impacts of music, during certain times of surgery.

Cell Phones and Pagers

With cell phones becoming a common part of everyday life, it is no surprise that they have found their way into the workplace. When working in the operating room, a communication tool is needed to call for help or update others on the progress of the procedure. These tasks can be done with a hospital-issued device or are often done using a personal cell phone. Observations of 52 surgeries recorded 205 phone calls during the surgeries. Anesthetists were responsible for 11.7% of the incoming calls and 50% of the outgoing calls (Avidan et al., 2019). While the majority of these conversations were work-related, none of the conversations were related to the patient in the room. Unfortunately, some of the incoming calls adversely diverted the attention of staff in the room. These findings were limited in that they were measured by the observer and the content and necessity of the calls were not assessed. Overall, the study suggested turning phones off or leaving them outside of the O.R. This is not always feasible in cases where the hospital requires non-scrubbed O.R. staff to use their personal phones as a work-related communication tool.

It has also been suggested to activate the “do not disturb mode” on cellphones when in the operating room (Gui et al., 2021). This intervention offers a layer of safety, as vital

notifications can be seen at appropriate times and quick communication can be made during emergencies, but non-essential communication is reduced. The unexpected or repeated beep of a pager during critical moments like intubation can not only be distracting but can jeopardize patient safety. The actual frequency of pager and cell phone distractions are reported as uncommon but when they do occur, they create a "high level of disturbance in terms of consequences and duration" (Savoldelli et al., 2010, p. 686). It is clear that patient safety can be impaired in the operating room because of these devices. As communication technologies continue to change further investigation should look at smart watches, text messaging and social media applications used by anesthesia providers during surgery.

Production Pressure

The Agency for Healthcare Research and Quality (AHRQ) describes production pressure as an unspoken pressure placed on healthcare workers by their organization to prioritize the amount of work they complete over safety and quality (Carayon, 2007). Production pressure is certainly prevalent in the OR and distracts anesthesia providers by focusing them on keeping to a schedule and the next surgery. From a survey completed by 279 anesthesiologists, 49% reported witnessing production pressure causing an unsafe action by the anesthesia provider (Gaba et al., 1994). A similar study surveyed 422 hospital employees, the majority being nurses, to investigate whether production pressure decreased safety behaviors. The survey included five questions on how production pressure distracted providers from their work, with the items having a Cronbach alpha of 0.91. The survey results concluded that production pressure had statistically significant negative effects on safe behavior (Amponsah-Tawaih & Adu, 2016).

Conversations and Movement

While communication amongst healthcare staff is crucial in ensuring safe patient care, conversations can be distracting during the induction phase of anesthesia. In Broom et al.'s (2011) observational study, side conversations were being conducted 40% of time during the induction phases, with 3% having more than two simultaneous conversations. In a systematic review by Gui et al. (2021), conversation was found to be the most frequently reported distracting event, with irrelevant small-talk present in over 70.3% of the induction time period. Side conversations that overpower the interactions of the anesthetists during induction could create delays in care or communication misunderstandings.

Even relevant conversations about the patient in the room can reduce provider attentiveness, especially if they are teaching or guiding another anesthetist. Gui et al. (2021) included a study where vigilance was measured by a provider's response time to a flashing light. Talking with a student and providing intraoperative teaching significantly reduced the provider's responsiveness- especially during the phases of induction and emergence (Gui et al., 2021). Interactions with and supervising students is a common practice but warrants additional inquiry.

Staff entering and exiting the room is also common, and this movement can be highly distracting to the anesthesia provider. Staff movement in and out of the O.R. was reported during 37% of inductions (Broom et al, 2011). Harten et al. (2020) found that door movements were the most frequent distraction during the induction phase of anesthesia, with staff entering or exiting the O.R. on average 28 times per hour at the beginning of the case. Conversation and movement of staff in the O.R. are consistently found in the literature to be some of the most persistent distractions during the induction phase. A limitation of each of these studies is that although they observed the frequency of the distractions, they did not assess whether the providers found the interruptions to be a barrier to the safety of their workflow and practice.

Multifactorial Issue

While lone factors have often been highlighted and studied, these distractions frequently happen in combination creating a unique challenge for the anesthesia providers to mitigate. An observational study during induction of general anesthesia found the median number of five distractions during a single induction and 39.5% of the time, at least one distracting event spanned the entire duration of the induction process (Savoldelli et al., 2009). A negative impact on the patient was identified to occur 21.5% of the time, including poor preoxygenation, accidental volatile agent administration, and increased duration of tourniquet needed for intravenous catheter placement (Savoldelli et al., 2009).

A study by Slagle et al. (2018) observed 319 nurse anesthetists and anesthesiology residents during all phases of anesthesia. They concluded that self-initiated distractions, such as social conversations, reading, and personal email were concentrated during periods of patient stability. This suggests that anesthesia providers distract themselves during non-critical times of a surgery. The researchers did propose that distraction management should be included during anesthesia provider training. With few guidelines existing to lessen potential distractions, provider focus and patient safety continue to be suboptimal.

Crockett et al. (2018) studied the implementation of a distraction reduction tool during the induction phase of anesthesia in a pediatric otolaryngology operating room. The team investigated the impact of noise, conversation, and music on increasing levels of distraction to the anesthesia provider during induction and correlated that increased noise level to decreased patient safety. A process was created to mitigate distractions during induction using specific interventions. First, education was provided to the entire perioperative staff on the negative impact of induction distractions on patient safety. Second, the circulating nurse was given the

responsibility of turning any music off just before the patient entered the O.R. And third, the anesthesiologist took the role of announcing induction time and addressing the room if any disrupting noise occurred during the induction phase. Over the span of nine weeks implementing this quality improvement measure, the team saw a 10% reduction in induction distractions to in pediatric otolaryngology operating rooms (Crockett et al., 2018). This project demonstrated that mitigating distractions can be done with the collaboration and dedication of the entire perioperative team.

Conclusion

A review of the literature demonstrates that distractions are a significant problem for anesthesia providers. Not only does the literature reveal how common distractions are, but it has also shown how these distractions can impede the provider's focus, potentially making induction of anesthesia less safe for patients. Furthermore, this literature illustrates the *complexity* of these distractions. There is not just one single distraction causing problems during induction; there are a multitude of noises, technologies, and even other clinicians, that compete for the anesthesia provider's attention.

Project Design

Methodology

This project aims to assess the presence and types of distractions in a busy suburban hospital and is part of a larger project assessing distractions in three operating room settings, a suburban hospital, a large urban trauma center, and same day surgery center. This quality improvement project uses a descriptive survey assessing anesthesia providers perceptions of distractions in the operating room. Surveys were administered to CRNAs, SRNAs, and physician

anesthesiologists over a three-week period. A total of 70 anesthesia providers received an invitation to participate.

Setting

The setting was a mid-sized suburban hospital that is part of a larger health care system and serves a fast-growing suburban population of residents in both North and South Carolina. The hospital has 307 beds and 12 standard operating rooms, excluding endoscopy rooms. A majority of the surgeries performed fall under the gynecological, orthopedic, general and cardiovascular surgical specialties. Typical daily case counts for the OR range from 35-45 procedures. Staffing challenges are an ongoing issue at the hospital. In February 2022, FEMA deployed a medical team to relieve the emergency department.

Sample

The sample for this project consists of CRNAs, SRNAs, and physician anesthesiologists. The CRNA population has either a doctoral degree, master's degree, or in some cases a certificate. The SRNA population for this project were students enrolled in a Doctor of Nursing Practice (DNP) nurse anesthesia program. Anesthesiologists complete four years of medical school, four years of anesthesia residency, and many complete a fellowship in an anesthesia specialty.

The clinical site operates under the anesthesia care team (ACT) model which consists of one physician anesthesiologist supervising typically three O.R.s, each with a CRNA providing anesthesia for that O.R. The physician anesthesiologist performs a documented preoperative interview for each patient, is typically responsible for procedures such as peripheral nerve blocks, central line insertions, transesophageal echocardiograms etc., and is present on induction and emergence of anesthesia which is facilitated by CRNAs. The CRNA is assigned to one operating room and patient and may be teaching a nurse anesthesia student.

Inclusion criteria for participation in the survey required that the participant be an anesthesia provider, either a CRNA, SRNA, or anesthesiologist within one of the identified hospitals. Anesthesia providers received the survey through their healthcare system email or via QR code on posted fliers. Those excluded from participating were SRNAs who were not currently active at any of the targeted clinical sites. Emails sent to SRNAs instructed them to respond based on their current placement; if they were at a site other than the three listed, they were excluded. This method prevented participation from students who were rotating throughout different sites at the healthcare system.

Tools/Measures/Methods

This project used a survey developed by the project team. Distractions identified during the literature review guided question development for the survey. The survey used a modified Likert scale; a validated tool for data collection with ordinal measurement (Davino & Fabbris, 2013). The five-point Likert scale response selections included ‘not distracting’ to ‘highly distracting’ as the extreme anchor points on each end of the scale (Appendix A). The survey was distributed to all CRNAs, SRNAs, and physician anesthesiologists at the clinical sites using Microsoft Forms. The survey software did not allow users to skip sections of the survey.

The electronic survey was securely distributed to CRNAs, SRNAs, and anesthesiologists at the suburban hospital using secure Enterprise Microsoft Outlook email and on a QR code in breakrooms. The introduction page stated the survey inclusion criteria and a statement regarding confidentiality and anonymity before providers began. The first portion of the survey asked participants for demographic information: job title, age, gender, and clinical site. Anonymity was maintained by having participants select demographics such as age within a numerical range

The second portion of the survey was designed to present providers with a list of potential distractions. The survey includes questions about the following events: music, conversations, equipment alarms, vocera/work phone, staff entering/exiting the OR, and personal cell phone use. The participant was asked to rank each event on the modified Likert scale based on their last administered general anesthetic. The question read 'Please rate each event based on the last general anesthetic you provided at your primary work site'. The provider then selected an option, indicating whether the event was not distracting, somewhat distracting, undecided, distracting, or highly distracting. The survey concluded with a text box where the participant could comment on any other distracting events they experience that were not listed. Cronbach's Alpha was used to ensure internal reliability of the scale. Appendix A displays the complete survey template.

Data Collection and Timeline

The survey was created and distributed using a link to Microsoft Forms. A current email list was provided for the CRNAs and anesthesiologists by the Director of Anesthesia Services. SRNA emails were obtained from the nurse anesthesia program. Fliers were placed in lounges and break rooms advertising the survey and providing a QR code for quick access. The project team also advertised the survey dates via word of mouth. These steps were important to yield higher participation rates. The survey could only be completed *one time* by a provider. Reminders were emailed to providers supplying the link midway through the survey period. Contact information for the project directors was included in the email so participants could reach out with concerns. An anonymity disclosure was listed before the participant began the survey. The project was reviewed by the health system IRB and determined to be a quality improvement project which required no further action (Appendix C).

Analysis Description

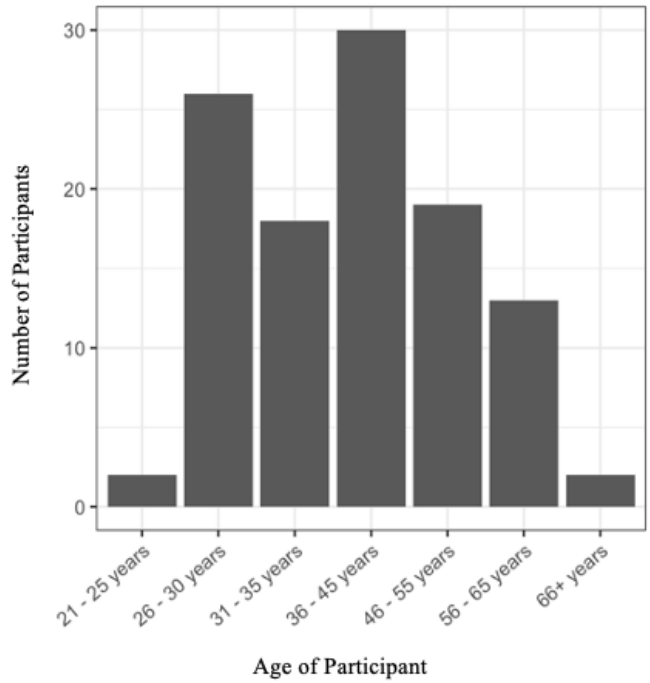
The survey software collected the survey response data. Survey results were password protected and access was restricted to the project team and committee members. Microsoft Forms provided basic data collection tools. The data was exported to Microsoft Excel for more advanced computations. Initial steps included dividing responses by practice location. Perception of distractions from Likert-scale ratings were measured on a 1 thru 5 scale, with greater values indicating the event as more distracting. Means and the standard deviations were calculated for distractions versus demographics and site. Analysis of variance (ANOVA) compared group differences across gender, age, and site for the six distractions, respectively. The p-values based on the ANOVA for gender, age groups, and site were included in the findings. This determines if gender, age, or site affected the perceived level of distraction. Tukey HSD post hoc tests examined pairwise group mean differences. Open-ended qualitative responses were compiled and assessed for content themes. A word cloud visually represents this text data (Appendix B).

Project Findings

Total participants were 110 individuals (80 female and 30 male) working in three sites: 75 (68.2%) at a level one trauma center, 13 (11.8%) at an ambulatory surgery center, and 22 (20.0%) at a mid-sized suburban hospital. Figure 1 displays the age distribution at all three sites as a bar graph. Most participants were 26-30 years old or 36-35 years old.

Figure 1

Age Distribution

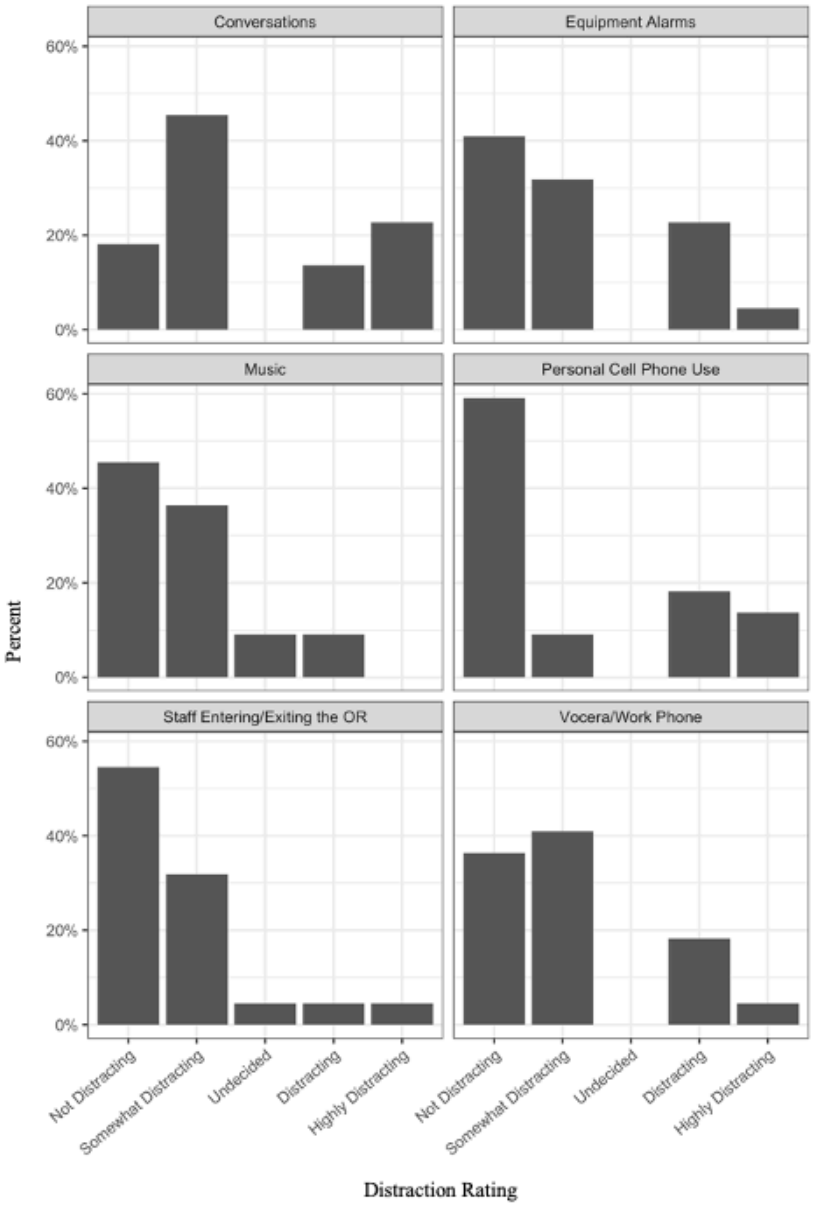


Note. Age distribution of participants at all three sites is displayed. The majority of the sample is aged between 26 to 65 years old.

Distraction frequency at a mid-sized suburban hospital is displayed in Figure 2. Participants ranked conversations as the most distracting item, with over 80% saying it was at least somewhat distracting. Staff exiting and enter the room and music were reported as the least distracting factors. 75% of all responses rated the factors as ‘Not Distracting’ or ‘Somewhat Distracting’ (99 out of 132 total rankings).

Figure 2

Distraction Distribution- Mid-Sized Suburban Hospital



Note. Distraction ratings of each factor is displayed in the bar graphs. Most of the responses favored 'Not Distracting' or 'Somewhat Distracting'.

Table 1 displays the mean ratings of distraction level for the 6 distractions across gender, age group, and site. Analysis of variance (ANOVA) compared the means across groups. Tukey HSD post hoc tests examined pairwise group mean differences.

Compared to males, females rated conversations more distracting ($F = 8.74$, $p = .004$), music more distracting ($F = 8.09$, $p = .005$), and personal cell phone use more distracting ($F = 7.12$, $p = .009$). There was an age difference in perceiving distractions of equipment alarms, $F = 9.31$, $p < .001$. Younger providers (21-30 years old) perceived equipment alarms as significantly more distracting than the mid-career peers ($p < .001$), and more distracting than the 46 years old or above ($p < .001$). There was no significant difference across the three different sites.

Table 1

Perceptions of Six Factors of Distraction Across Gender, Age Group, and Site

	Perceptions of Distraction M ± SD, p-values					
	Conversations	Music	Equipment Alarms	Vocera/Work Phone	Staff Entering/ Exiting the OR	Personal Cell Phone Use
Gender	.004	.005	.393	.216	.080	.009
Male	2.40 ± 1.25	1.67 ± 1.09	2.43 ± 1.48	2.27 ± 1.23	1.70 ± 1.06	1.73 ± 1.05
Female	3.31 ± 1.51	2.46 ± 1.38	2.70 ± 1.44	2.64 ± 1.46	2.20 ± 1.41	2.56 ± 1.57
Age groups	.891	.371	< .001	.307	.280	.610
21-30 years	2.96 ± 1.35	1.96 ± 1.04	3.57 ± 1.26	2.68 ± 1.42	2.29 ± 1.30	2.25 ± 1.43
31-45 years	3.15 ± 1.54	2.38 ± 1.41	2.38 ± 1.39	2.60 ± 1.45	2.04 ± 1.35	2.56 ± 1.57
46 or above	3.03 ± 1.57	2.29 ± 1.49	2.21 ± 1.37	2.31 ± 1.33	1.91 ± 1.36	2.09 ± 1.42
Site	.416	.116	.107	.324	.219	.790
Level One Trauma Center	3.08 ± 1.50	2.43 ± 1.43	2.83 ± 1.46	2.63 ± 1.42	2.08 ± 1.35	2.35 ± 1.47
Ambulatory Care Center	3.46 ± 1.45	1.92 ± 1.26	2.23 ± 1.48	2.69 ± 1.55	2.54 ± 1.56	2.54 ± 1.45
Mid-Sized Suburban Hospital	2.77 ± 1.51	1.82 ± 0.96	2.18 ± 1.33	2.14 ± 1.25	1.73 ± 1.08	2.18 ± 1.62

Note. In the cells are mean ± standard deviations. Analysis of variance (ANOVA) compared group differences across gender, age, and site for the six distractions, respectively. The p-values based on the ANOVA are included in the entry for gender, age groups, and site. A p-value < .05 would indicate a statistically significant difference across the groups being compared.

When comparing overall distraction score, the mid-sized suburban hospital's average score was the lowest at 2.14 versus 2.56 and 2.57 at the ambulatory care center and level one

trauma center, respectively. Every single distraction was rated lower at this site compared to the other two. Although there were no statistically significant differences by site for any individual distractions.

Open-ended response items described additional distractors such as surgical counts, setting up equipment, the noise of case carts, applying sequential compression devices, inserting foley catheters, and patient positioning. One response stated that certain factors such as music and conversations were not distracting unless they reached a certain threshold; for example, once those factors were louder than their own alarms. Another response stressed that a quiet period needs to be initiated for both the induction and emergence of anesthesia stating, “As a patient I remember hearing all the loud clashes and bangs upon emergence and it was terrifying.”

Discussion

Implications for Practice

Gender should be further investigated as a determinant of perceived distraction as there were significant differences between female and males for conversations, music, and personal cell phone use. Similarly, a study on open-office floor plans found that women were more disturbed by noise than their male counterparts (Kaarlela-Tuomaala et al., 2009, p. 1436). They concluded that quiet and private office environments could be superior for productivity, mental math performance, and recall/memory (Kaarlela-Tuomaala et al., 2009, p. 1439). These are all measures that anesthetists also navigate, and noise is a clear disruptor. The top distraction was reported as ‘conversations’ at all three sites, aligning with other findings on distractions in the O.R. (Pape & Dingman, 2011, p. 55; Gui et al., 2021, p. 9).

Alarms in the O.R. come from the anesthesia machine, medication pumps, hemodynamic monitors, and other equipment. The ratings of alarm distraction resulted with significant

differences between age groups. Twenty-one- to thirty-year-old anesthetists rated alarms as most distracting, followed by thirty-one- to forty-five-year-olds, with the lowest distraction rating from the forty-six years or above group. It is possible that providers may become less sensitized to these alarms as they age or gain experience. Interestingly, alarms can be both a source of distraction and a source of needed attention. Alarms exist to alert providers of unacceptable parameters; seeing these warnings as a distraction may indicate the machines are too sensitive. Overtime, this creates alarm fatigue, where providers become less sensitive and responsive to the noises. This provides another possible explanation as to why the older providers did not rank them as severely.

The goal of this project was to identify important distractions and compare distractions between the three survey locations and provider demographics. There were no significant differences in distraction level detected between sites; however, providers at all sites reported feeling distracted by all six factors. This indicates there may not be much difference in the environment of anesthesia delivery but rather in the providers themselves.

Strengths and Limitations

Strengths of this project included survey response rate. Out of 70 eligible providers at the mid-sized regional hospital, 22 responded (31.4%). Support from the anesthesia department was crucial for the success of this project. The survey was a simple medium for data collection and only took providers an average of a couple of minutes to complete. There was a wide distribution of participants by age, site, and gender.

Because the survey was self-reported, the actual frequency of distracting events was not measured. An observational study would give more robust insight to this kind of analysis and may identify other distractions that were not listed on the survey. Another limitation is that

distractions were reported based on a typical workday and did not distinguish characteristics unique to specific service-based (e.g., obstetrics, cardiac, orthopedics, neurology, etc.) trends. Specialty cases consist of vastly unique processes and techniques which could provide additional perspectives.

Better participation from the anesthesiologist subgroup would have enabled stronger comparison between distraction level based on provider role; only 5 out of 110 responses came from anesthesiologists. However, based on the care team model of practice, the CRNA is present with the patient throughout entire procedure and may be more sensitive to impact of distractions. Production pressure was cited in the literature as a distraction but was not included in the survey. Some responses did allude to multitude of tasks that need completed at the beginning of the case, which often impact anesthesia induction.

Recommendations

Distractions of multiple sources were reported at all three sites investigated; however, there are no standard measures initiated at the start of induction to mitigate these interruptions. A study at a mid-sized hospital by Pape & Dingman (2011) quantified the number of distractions and interruptions an anesthesia provider encountered to be 7.5 per 9 minutes, which was derived from observation. Anesthesia providers are doing critical tasks like dosing anesthetics, narcotics, and paralytics, as well as managing patient airways during the induction period. Creating a quiet and controlled environment for induction of anesthesia must become a priority in the O.R. because it decreases the mental focus of providers (Murthy et al., 1995; Hodge & Thompson, 1990). Adopting the aviation industry process which prohibits non-essential conversation during critical moments is one way to decrease the impact conversations have during induction of anesthesia (Broom et al., 2011). Designating a time to pause, get quiet, turn music down or off,

and place personal devices on ‘do not disturb’ will eliminate unnecessary noise, movement, and actions. At the current time there is not such a policy within the operating rooms involved in this project. Next steps may be to implement “quiet time” pilot programs to assess if anesthesia providers report fewer distractions. Anesthetists are committed to providing their patients with the best care and decreasing distractions during induction will greatly enhance the safety and quality of care they provide.

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APPENDIX A: SURVEY

Distractions During Induction of Anesthesia

You are invited to participate in this anonymous survey assessing anesthesia providers' opinions on distractions during the induction of anesthesia. The survey will take about 3 minutes to complete. Your participation in this survey implies your consent. All electronic data is anonymous and will remain secure within the Microsoft Forms encrypted software on a password-protected account. No identifying information will be collected. The investigators Bailey Coggins, Chantel Glasser, and Elisa Hillman will be the only persons to access the data. The UNCC Stats department will assist with statistical analysis. You are free to discontinue participation at any time during the survey. The results of this project may be published.

For questions, please contact the following investigator for your primary work site:
Contact information provided

1. Select your primary worksite.
- o Level One Trauma Center
- o Mid-Sized Regional Hospital
- o Ambulatory Surgery Center

2. Select your role.
- o Anesthesiologist
- o Certified Registered Nurse Anesthetist (CRNA)
- o Student Registered Nurse Anesthetist (SRNA)

3. Select your age range.
- o 21 - 25 years
- o 26 - 30 years
- o 31 - 35 years
- o 36 - 45 years
- o 46 - 55 years
- o 56 - 65 years
- o 66+ years

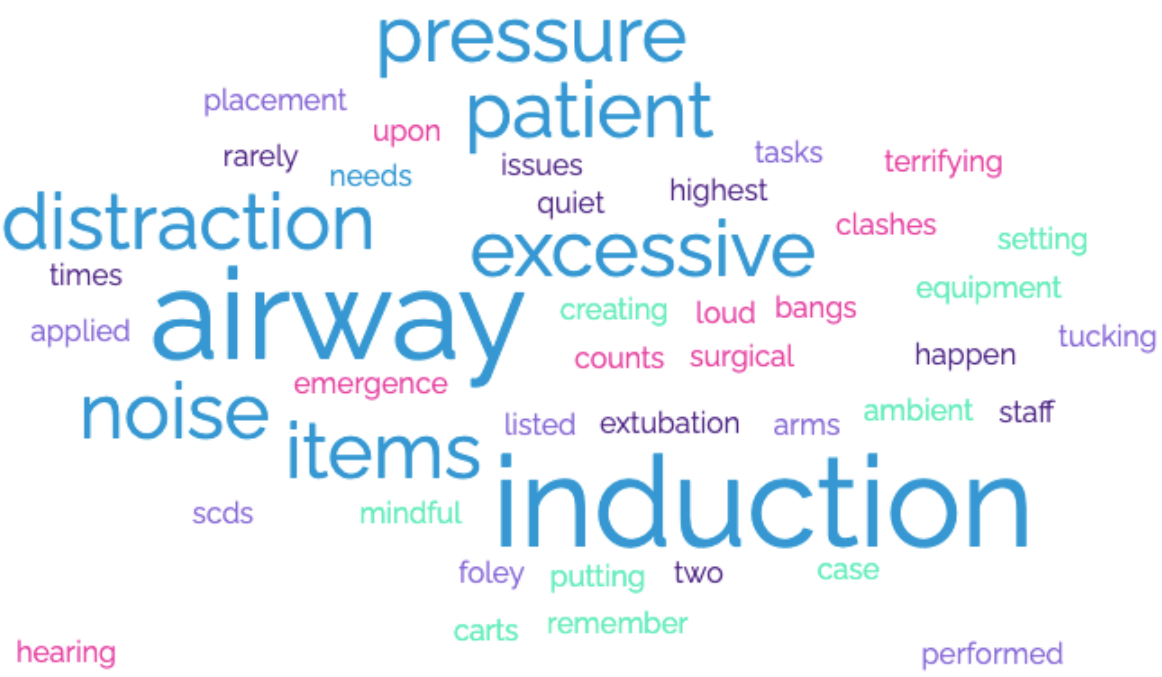
4. Select your gender.
- o Female
- o Male
- o Non-binary
- o Other

5. The following list includes events that may be distracting during the induction of anesthesia.
Please rate each event based on the last general anesthetic you provided at your primary work site.

	Not Distracting	Somewhat Distracting	Undecided	Distracting	Highly Distracting
Music	o	o	o	o	o
Conversations	o	o	o	o	o
Equipment Alarms	o	o	o	o	o
Vocera/Work Phone	o	o	o	o	o
Staff Entering/Exiting the OR	o	o	o	o	o
Personal Cell Phone Use	o	o	o	o	o

6. If there is a distraction you find to be significant, but was not listed, please add your thoughts here.

APPENDIX B: WORD CLOUD



APPENDIX C: IRB EXEMPTION LETTER

MEMORANDUM

To: Exie Earnhardt
Atrium/Carolinas Healthcare System

From: Jeannie Sekits, Senior Protocol Analyst
Institutional Review Board

Date: 7/7/2022

Subject: Not Human Subjects Research: IRB00086377
Surveying Anesthesia Providers on Perceived Distractions in the Operating Room During Induction of Anesthesia

The Wake Forest University School of Medicine Institutional Review Board has reviewed your protocol and determined that it does not meet the federal definition of research involving human subject research as outlined in the federal regulations 45 CFR 46. 45 CFR 46.102(f) defines human subjects as "a living individual about whom an investigator (whether professional or student) conducting research obtains (1) data through intervention or interaction with the individual, or (2) identifiable private information."

The information you are receiving is not individually identifiable. In recent guidance published by the Office of Human Research Protections (OHRP) on the Guidance on Research Involving Coded Private Information or Biological Specimens, OHRP emphasizes the importance on what is being obtained by the investigator and states "if investigators are not obtaining either data through intervention or interaction with living individuals, or identifiable private information, then the research activity does not involve human subjects."

Note that only the Wake Forest University School of Medicine IRB can make the determination for its investigators that a research study does not meet the federal definition of human subject research. Investigators do not have the authority to make an independent determination that a study does not meet the federal requirements for human subject research. Each project requires a separate review and determination by the Board. The Board must be informed of any changes to this project, so that the Board can determine whether it continues to not meet the federal requirements for human subject research. If you have any questions or concerns about this information, please feel free to contact our office at 716-4542.