Music Therapy Effects on Pain and Anxiety Throughout the Perioperative Period

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Abstract

Alternative therapies for pain and anxiety are in high demand due to a multitude of problems including a lack of effective treatment modalities, nationwide drug shortages, and the implications from the opioid epidemic. A review of the current literature was performed to determine the effects of music therapy (MT) on pain and anxiety throughout the perioperative period. The results of the literature review found that MT is effective in treating both pain and anxiety. Furthermore, its use as an anesthesia adjunct can decrease narcotic and anxiolytic medication usage during the perioperative period. Additionally, MT can provide a better anesthetic, stabilize vital signs, and increase patient satisfaction. After the literature review, an educational PowerPoint was presented to the 2019 class of student registered nurse anesthetists (SRNAs) at AdventHealth University (AHU). The objective of the presentation was to enhance SRNA knowledge base regarding the effects of MT on perioperative anxiety and pain. The efficacy of the educational presentation in increasing knowledge base was determined using a pre/post-test administered before and after the presentation. A paired samples t test was conducted to analyze the data from the pre/post-tests. The obtained t value of -9.165 is associated with a p value of $< .001$ which is statistically significant. Therefore, it can be concluded that the average scores between pre-test and post-test increased significantly. These results suggest that SRNAs' knowledge base increased after the PowerPoint presentation regarding the effects of MT on perioperative anxiety and pain.

Keywords: music therapy, pain, anxiety, anesthesia, surgery, perioperative

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Introduction

According to the World Health Organization, over 300 million surgeries were performed worldwide in 2012 (Weiser et al., 2016), with more than 50 million surgeries performed annually in the United States alone (Hole, Hirsch, Ball, & Meads, 2015). As the number of surgeries performed increases every year, pain associated with surgery remains a clinically significant problem that continues to grow despite increased awareness and clinical advancements in pain management (Pogatzki-Zahn, Segelcke, & Schug, 2017; Weiser et al., 2016). Inadequate perioperative pain control is multifaceted, involving several factors that contribute to the issue.

Pogatzki-Zahn et al. (2017) attribute undertreated pain in the perioperative period to the limited translation and implementation of scientific findings into clinical practice and the lack of analgesics and techniques that benefit specific aspects of pain management with minimal adverse effects. Additionally, the lack of effective surgical pain modalities is currently exacerbated by the national narcotic shortage (Ross, 2018), in which the ramifications of the drug shortages are being felt in today's clinical setting. Furthermore, the National Institute on Drug Abuse (NIDA) (2017) estimates that over 30 million people worldwide are addicted to opioids and benzodiazepines, which has led to tolerance and worse treatment outcomes for patients (Morris & Mir, 2015).

The adverse implications of undertreated surgical pain involve the association between anxiety and pain (Liu & Petrini, 2015). Surgical intervention often causes anxiety, and patients mainly develop preoperative anxiety over their uncertainty of surgical outcomes and fears of anesthesia (Ali et al., 2014). In turn, untreated preoperative anxiety potentiates postoperative pain which adversely affects recovery from anesthesia (Ali et al., 2014). Additionally, ineffective postoperative analgesia caused by anxiety can lead to the development of chronic pain after

surgery (Pogatzki-Zahn et al., 2017). Anxiety also increases morbidity and leads to the development of surgical complications (Ali et al., 2014).

Recently, surgical strategies aimed at optimizing pain control, such as Enhanced Recovery After Surgery (ERAS), have been employed into clinical practice to improve patient outcomes (Tan, M., Law, L.S., & Gan, T. J., 2014). However, further research is needed to determine the efficacy of ERAS protocols (Tan et al., 2014). In addition to the drug shortages and opioid epidemic, the concurrent rise of pay-for-performance incentives and the utilization of quality of care as a measure for which hospitals are paid has further prompted anesthesia providers in finding alternative methods of providing effective anxiolysis and analgesia in the perioperative period (Lu, Vinocur, Burrows, & Rosen, 2017). Additionally, the negative side effects of dose-related narcotic use in the postoperative period, such as respiratory depression, nausea and vomiting, urinary retention, and ileus adversely impact patient outcomes, which in turn affects patient satisfaction (Tan et al., 2014). Therefore, it is imperative to find alternative methods in reducing perioperative anxiety and pain to improve patient outcomes.

Problem Statement

MT has a long history of being used as an adjunct to anesthesia and was first described being used to help patients undergoing surgery in 1914 (Hole et al., 2015). MT is defined as clinical and evidence-based interventions that are used to achieve individualized goals within a therapeutic relationship by a credentialed professional (Matsota et al., 2013). MT has been demonstrated to be effective in reducing anxiety and postoperative pain (Matsota et al., 2013; Bradt, Dileo, & Shim, 2013). Despite the evidence of MT's positive effects, it has not been routinely used in the perioperative period (Hole et al., 2013). Therefore, this project reviewed the literature to determine if MT is effective in reducing anxiety and pain in the perioperative period.

Project Questions

A systematic review of the literature was guided by the first research question, which addressed the clinical problem: In adult patients undergoing surgery (P), how does MT (I) affect anxiety and pain (O) throughout the perioperative period (T)? The second question addressed the proposed project intervention: In the 2019 Student Registered Nurse Anesthetist (SRNA) cohort at AdventHealth University (AHU) (P), will a PowerPoint presentation regarding MT and its effects on anxiety and pain (I) increase the SRNAs' knowledge base (O) during one class period (T)?

Literature Review and Synthesis

Inadequate pain control in the perioperative period remains a growing problem. Chou et al. (2016) report that more than 80% of patients undergoing surgery experience acute postoperative pain, and approximately 75% of those patients rank their pain from moderate to extreme. Inadequate surgical-related pain control has profound adverse outcomes, exerting detrimental psychological effects and negatively impacting multi-organ bodily systems (Prabhakar et al., 2014). Additionally, ineffective anxiolysis correlates with increased perioperative pain, which leads to increased morbidity and mortality (Ali et al., 2014). If left untreated, acute perioperative pain can lead to the development of chronic pain, which is estimated to cost between $565 and $635 billion per year in healthcare and reduced productivity (Cahana et al., 2013).

Inadequate perioperative pain control has resulted from a multitude of issues including lack of existing effective treatment modalities, drug shortages, and the implications of the opioid epidemic (Pogatzki-Zhan et al., 2017; Morris & Mir, 2015; Ross, 2018). The effects of the nationwide narcotic shortage have particularly been experienced by anesthesia providers,

including AHU SRNAs in their clinical rotations at various AdventHealth affiliations. It was reported that several healthcare facilities in Florida have run out of opioid products and are struggling to replenish supplies needed to care for their patients (Ross, 2018). Anesthesia providers, including SRNAs, are faced with finding alternative therapies for pain control daily in their clinical practice, as Pfizer Inc., the primary manufacturer of injectable opioids reportedly will not be able to resume full production until the beginning of 2019 at the earliest (Ross, 2018).

In addition to adverse outcomes, drug shortages, opioid epidemic implications, and exorbitant healthcare costs that undermanaged perioperative pain incurs, the rise in hospital reimbursement incentives have advocated for alternative therapies for anxiolysis and analgesia to be developed and implemented (Lu, Vinocur, Burrows, & Rosen, 2017). Given the current state of patient care in the surgical setting, it is imperative to explore new effective strategies for managing anxiety and pain in the perioperative period. Based on the current literature, MT has been shown to have positive effects in attenuating perioperative anxiety and pain (Matsota et al., 2013; Bradt, Dileo, & Shim, 2013). Thus, educating and increasing SRNA knowledge base regarding MT as an alternative or adjunct therapy to perioperative pain control may lead to its implementation in clinical practice, which ultimately could improve patient outcomes.

Effects on Pain

In 2001, the Joint Commission created a new standard, which made pain the fifth vital sign. MT may prove to be a helpful tool in decreasing pain and the use of narcotics perioperatively. Even while under general anesthesia, Matsota et al. (2013) found that listening to music preoperatively led to decreased postoperative pain as evidenced by less narcotic usage. Additionally, MT was shown to decrease the need for narcotics intraoperatively (Matsota et al., 2013). Another study found that patients had less pain postoperatively when they listened to their

own selection of music intraoperatively; this was evidenced by lower Visual Analog Scale (VAS) pain scores (Kahloul et al., 2016). Other studies have shown the benefits of intraoperative MT as well. For example, patients who listened to calming and relaxing music while under general anesthesia had less pain postoperatively than those who did not (Jayaraman et al., 2006). Intraoperative MT is not limited to general anesthesia. It also has useful applications for regional anesthesia and procedures under monitored anesthesia.

Surgical procedures performed under regional anesthesia often require both sedatives and narcotics. MT has been shown to decrease narcotic requirements during regional anesthesia (Matsota et al., 2013). In addition to general and regional anesthesia, MT can be helpful for procedural and diagnostic testing. Many procedures and diagnostic tests are painful. Reducing narcotic usage could be helpful in most cases. In a study involving patients undergoing cystoscopy, those who listened to music had significantly less pain than those who did not (Yeo et al., 2013). Per that same study, MT works on the perception of discomfort by activating the cingulo-frontal cortex, the part of the brain responsible for shifting attention and modulating pain (Yeo et al., 2013). However, not all the results show that MT is helpful for treating pain. For patients undergoing extracorporeal shockwave lithotripsy, MT was found to be ineffective for moderate to severe pain (Cepeda et al., 1998).

The most compelling use for MT may be during the postoperative period. Multiple studies have shown its effectiveness in decreasing pain both alone and in conjunction with more traditional interventions. The positive effects of listening to music intraoperatively often extend into the postoperative period. When comparing intraoperative MT and postoperative MT to no MT, both music groups reported significantly lower pain than the control group without any music (Nilsson et al., 2003). While intraoperative MT can be helpful, it may be even more so

postoperatively. This is because while listening to music in both stages reduced pain, those in the postoperative MT group used less morphine than the intraoperative MT group (Nilsson et al., 2003). However, the pain reducing effects of MT were found to last for only a couple of hours into the postoperative period (Nilsson et al., 2003).

MT has also been used to treat postoperative pain after cesarean sections. In these cases, the patients who listened to music for thirty minutes while in recovery required less pain medication than those who did not (Ebneshahidi & Mohseni, 2008). An additional point of interest is that by reducing narcotic usage, mothers had earlier and more meaningful contact with their newborns (Ebneshahidi & Mohseni, 2008). Despite pharmacological interventions, pain is still reported by multiple surgical populations. One of these is gynecological patients. In these patients, postoperative MT was found to reduce the intensity of pain and use of pharmacologic analgesics (Sin et al., 2015).

MT has also been used in combination with patient-controlled Sufentanil after lung cancer surgery. In patients who underwent resection surgery for lung cancer, MT provided in the postoperative period was helpful in postoperative pain control (Wang et al., 2015). Patients were found to have less pain as evidenced by lower VAS and self-reported pain scores (Wang et al., 2015). Additionally, patients in the MT group used significantly less PCA Sufentanil (Wang et. al, 2015). Another group that benefited from MT are those who had spinal surgery. Patients who underwent spinal surgery were found to have significantly lower pain scores when they listened to music postoperatively (Bradt et al., 2013). This was evidenced by lower VAS pain scores as reported by the patients (Bradt et al., 2013). While MT has positive effects on pain, it may have positive effects on anxiety as well.

Effects on Anxiety

MT can be a useful tool in decreasing anxiety in surgical patients. Multiple studies support that it is effective in treating perioperative anxiety (Bradt et al., 2013, Bringman et al., 2009; Jimenez-Jimenez et al., 2013, Lepage et al., 2001; Matsota et al., 2013; Sin et al., 2015; Yeo et al., 2013). Based on the results of their systematic review and three other Cochrane systematic reviews, Bradt et al. (2013) found that simply listening to music could help decrease anxiety during the preoperative period. Moreover, Bringman et al., (2009) discovered that listening to music controlled anxiety in the preoperative setting better than oral versed. A literature review by Matsota et al. (2013) revealed even more support for preoperative MT. Per their review, listening to music preoperatively had positive effects on responses to surgical stress. These positive effects included lower stress scores on postoperative questionnaires and decreased anxiety postoperatively (Matsota et al., 2013).

In addition to preoperative anxiolysis, MT has also been shown to be effective intraoperatively. Surgical procedures performed under regional anesthesia often require sedation to attenuate the effects of anxiety. MT has been shown to decrease anxiety levels and sedative requirements during regional anesthesia (Matsota et al., 2013). Additionally, MT has been successful in decreasing anxiety for patients undergoing surgical procedures with spinal anesthesia. In a study performed by Lepage et al. (2001), all participants were given patient-controlled IV versed while only half were allowed to listen to music. The music listeners used less versed but had the same levels of relaxation as those who did not listen to music (Lepage et al., 2001). In addition to regional anesthesia, MT can be helpful for diagnostic procedures.

Many procedures and diagnostic tests may cause anxiety. In a study involving patients undergoing cystoscopy, those who listened to music had significantly lower anxiety levels (Yeo

et al., 2013). MT can be helpful for patients dealing with anxiety related to interventional procedures or diagnostic tests, especially when those procedures or tests are painful. For example, MT was found to be just as effective as 2mg of versed in patients undergoing extracorporeal shockwave lithotripsy (Matsota et al., 2013). Another procedure during which MT was found to be helpful is varicose vein stripping. For this study, the test group listened to soothing MT while the control group was treated with only routine interventions. Afterward, the test group was found to have significantly lower anxiety as evidenced by lower plasma adrenaline levels (Jimenez-Jimenez et al., 2013).

While MT has been found to be effective during both the pre and intraoperative periods, it can also be helpful postoperatively. In postoperative gynecological patients, MT was found to decrease both fatigue and anxiety (Sin et al., 2015). Another group that can benefit from MT are those who have had spinal surgery. In patients who underwent spinal surgery, MT was found to have positive effects on postoperative anxiety and stress (Bradt et al., 2013). Those results were drawn from patients' reports, blood cortisol levels, and blood glucose levels. Increases in plasma glucose levels are a normal finding with the stress of surgery. For those patients who listened to music preoperatively, a decrease in plasma glucose levels of almost seven percent was noted compared to their baseline pre stress levels (Bradt et al., 2013). Those who did not listen to music showed an increase of greater than ten percent in their plasma glucose levels compared to baseline (Bradt et al., 2013).

While MT has been shown to effectively treat perioperative anxiety, data regarding the postoperative period is somewhat controversial. Although many studies support its effectiveness, there are some that found little to no effect on anxiety postoperatively. For example, patients recovering from cesarean sections who listened to music had little difference in anxiety levels as

compared to those who did not (Ebneshahidi & Mohseni, 2008). Another study of spinal surgical patients found that MT made no difference between the therapy and control groups as far as anxiety and depression postoperatively (Mondanaro et al., 2017). However, most studies support its effectiveness in treating perioperative anxiety. While the evidence suggests that MT can be helpful in treating pain and anxiety, it may have additional benefits as well.

Additional Benefits

In addition to pain and anxiety, MT can help provide a better anesthetic, stabilize vital signs, and even increase patient satisfaction scores (Jimenez-Jimenez et al., 2013; Kahloul et al., 2016; Matsota et al., 2013; Wang et al., 2015; Yeo et al., 2013). In their literature review, Matsota et al. (2013), found that listening to music preoperatively led to lower Bispectral Index Scores (BIS) intraoperatively without increased anesthetic medications. Patients who listened to soothing music while undergoing varicose vein stripping had significantly lower heart rates and blood pressures than the control group (Jimenez-Jimenez et al., 2013). Those who chose their own intraoperative music were noted to have more stable systolic blood pressures during surgery and experienced calmer emergences from anesthesia (Kahloul et al., 2016). In lung resection surgical patients, combining MT with a postoperative Sufentanil PCA led to lower heart rates and blood pressures than those who received only the Sufentanil PCA (Wang et al., 2015). However, not all studies found that MT made a difference as far as heart rates and blood pressures. In fact, for patients recovering from cesarean section surgery, no difference in heart rate and blood pressure was noted between the therapy and control groups (Ebneshahidi & Mohseni, 2008).

An additional point of interest is the effect of MT on patient satisfaction scores. Patients who could choose the music they would listen to during surgery reported higher satisfaction

scores (Kahloul et al., 2016). Other studies have also shown that MT can boost patient satisfaction scores. For example, during diagnostic tests, patients who listened to music had higher satisfaction scores than those who did not (Yeo et al., 2013).

While the data may be somewhat contradictory, there are clear indications that MT has a place during the perioperative period. MT has been proven to reduce anxiety preoperatively. Its preoperative benefits can extend into the intraoperative setting and aid in creating a better anesthetic. MT has also been noted to help decrease both pain and anxiety intraoperatively. This is especially true for procedures under regional anesthesia. Lastly, listening to music postoperatively has been shown to be beneficial in a wide assortment of surgical patients. Those benefits range from decreased pain and anxiety to facilitating earlier bonding with newborns. Other benefits of MT are lower heart rates and blood pressures and increased patient satisfaction in the perioperative period. Furthermore, while some of the data did not show any statistically clear benefits to MT, none showed that MT caused harm. Therefore, in a medical culture where reimbursement is driven by patient satisfaction, MT is an inexpensive, risk-free method that can greatly improve a patient's surgical experience.

Contribution and Dissemination/Justification

Considering the recent drug shortages, anesthesia providers in today's clinical setting are using other pain modalities in which their efficacy is not well known to the provider, potentially leading to adverse outcomes. The AHU SRNA knowledge base of alternative pain adjuncts and modalities for the perioperative period is limited to what is currently being used in today's clinical setting. Additionally, AHU SRNAs do not always follow-up and assess their patients in the post-operative period due to time constraints, thus making it difficult to gauge the effectiveness of their anesthetic regimens.

This scholarly project contributed to the awareness of the problem by conducting a review and synthesis of current literature pertaining to MT's efficacy as an alternative adjunct to anesthesia. The project group members presented their findings in Fall 2018 through an educational PowerPoint presentation to the 2019 SRNA cohort, discussing the effects of MT and its potential implications for the perioperative period. A pre/post-test (See Appendix B) was employed to assess subject knowledge base and understanding of the presentation.

Project Aims

The goal of this project was to enhance the 2019 AHU SRNA cohort's knowledge base regarding MT's effects on perioperative anxiety and pain via an educational PowerPoint presented in Fall 2018. SRNA knowledge base was measured by pre/post-test scores, and statistically significant improvements in post-test scores compared to baseline demonstrated an increase in their knowledge base.

Project Methods

The proposed scholarly project used a pre/post-test design that was implemented following Scientific Review Committee (SRC) and Institutional Review Board (IRB) approval. The project was conducted with SRNAs during class at AHU in Orlando, Florida. The pre/post-test design is favorable for this project due to the logistics of the data collection. Mandatory SRNA class attendance made implementation of the project feasible as the pre/post-tests that were utilized for data collection were distributed to the same subjects at one time.

The project's target population consisted of a convenience sample size of 21 SRNAs in the 2019 cohort at AHU. Inclusion criteria for the subjects included enrollment at AHU, completion of trimester four of the Master of Science in Nurse Anesthesia (MSNA) program, on-time class attendance, and signed informed consent (See Appendix A). Exclusion criteria

included students enrolled in an institution or program other than the AHU MSNA, class absence or tardiness, and failure to provide informed consent.

The project's implementation strategy consisted of giving an educational PowerPoint presentation regarding the effects of MT on perioperative anxiety and pain to SRNAs in a classroom setting. The participants were instructed to complete and return the pre-test before the start of the presentation and to complete and return the post-test after the conclusion of the presentation.

Participation in the project remained anonymous. The participants were de-identified with the use of a number system; a number was assigned and written on the top right-hand corner of each test and each pre-test was paired to the post-test with the same corresponding number. To further ensure the participants' anonymity was protected, the pre/post-tests were concealed and distributed randomly in identical white envelopes. The participants were also instructed to place their tests in the envelopes upon completion before returning them to the researchers. Additionally, the participants were instructed to refrain from writing their names or any other identifiable markers on their tests. Furthermore, the data collected from the project was stored securely in a password protected computer hard drive in an undisclosed location in the residence of one of the researchers. The data will be permanently deleted one year after the completion of the project by erasing it from the hard drive. Additionally, any paper documents containing data from the project were destroyed via a paper shredder.

Timeline

The timeline for the Scholarly Project will span three trimesters, which began in May 2018 and will be completed in April 2019. Data collection of the project was initiated during the Fall trimester in MSNA 504. The project implementation phase occurred during the presentation

of the project which occurred on October 11, 2018. Post-implementation data was collected immediately after the conclusion of the presentation. Data analysis occurred during the Fall trimester after the presentation and post-implementation data collection.

Data Collection Plan

Data collection occurred during class on the scheduled presentation day of the project. After informed consent was obtained from each prospective participant, the researchers presented the PowerPoint presentation. Any members of the cohort who did not complete and submit the consent forms or arrived after the start of the project presentation were excluded from participating in the project's data collection.

Assessment of the participants' knowledge base regarding the subject matter was obtained from the pre/post-tests. The pre-test and post-test consisted of ten identical multiple-choice questions regarding the presentation's subject matter. The pre-test was distributed to the subjects by a member of the research team before the start of the presentation, and completed pre-tests were collected by the researchers prior to the presentation. Upon conclusion of the presentation, the post-test was distributed and collected in the same manner as the pre-test. There was one encounter with the participants, which included a total of six exchanges of papers including the distribution and return of the consent forms, pre-tests, and post-tests.

Evaluation Plan

The quantitative data collected from the pre/post-test scores was transcribed into a Microsoft Excel spreadsheet (See Appendix D), which was submitted to Dr. Roy Lukman in the AHU Research Department to obtain assistance with statistical analysis. Statistical measures used a paired t-test with a significance level of $P < 0.05$ to compare the two data sets collected from the pre/post-tests (See Appendix D). The computer program that was used for data analysis

is the Statistical Package for Social Sciences (SPSS). Upon completion of the statistical analysis, the researchers determined the project's effectiveness regarding enhancing SRNA knowledge base as evidenced by statistically significant improvements in post-test scores compared to baseline pre-test scores.

Results

Data for the results was collected in the form of paired pre-tests and post-tests administered to a sample of 21 participants from the AHU 2019 SRNA cohort. The SRNAs were instructed to take the pre-test and then return it prior to the start of the educational PowerPoint presentation. After the presentation, the paired post-tests were administered to the SRNAs. The pre-tests revealed a mean score of 3.9 out of 10 or 39% with a standard deviation of 1.84 and a standard error mean of 0.4. The results of the post-tests showed a mean score of 8.1 out of 10 or 81% with a standard deviation of 1.01 and a standard error mean of 0.22. The paired samples tests revealed a mean of -4.238, a standard deviation of 2.119, a standard error mean of 0.462, and a t value of -9.165 which is associated with a $p < 0.001$. Mean percentage scores increased significantly by 42%.

Conclusion and Limitations

The pre-test and post-test questionnaires were disseminated to the 2019 SRNA cohort at AHU with a total of 21 responses that were evaluated. The pre-test, with a mean score of 3.9048 out of 10 and a standard deviation of 1.84132 and a standard error mean of 0.40181, demonstrated that the SRNA knowledge base regarding MT effects on pain and anxiety in the perioperative period was deficient. In comparison, the post-test mean score of 8.1429 out of 10 with a standard deviation of 1.01419 and a standard error mean of 0.22131 demonstrated a 42.381% increase in the mean score. This increase in the mean score is statistically significant as

the paired samples t test conducted to analyze the data obtained a t value of -9.165, which is associated with a p value of < .001. Therefore, it can be concluded that the average scores between the pre-test and post-test increased significantly after the PowerPoint presentation to the SRNA 2019 cohort, which educated them about MT's effects on pain and anxiety in the perioperative period. The statistical analysis of the data demonstrated that the scholarly project aim to increase SRNA knowledge base regarding MT's effects on perioperative pain and anxiety was successful.

Despite the success of the scholarly project, there were several known limitations of the study. There is a risk of bias since the project's sample size was small (N=21). Additionally, the small sample consisted of a homogenous convenience sample of SRNAs belonging to the same cohort at one location, which further incurs bias to the study. Consequently, the sample may not be representative of SRNAs in other settings and cannot be generalized outside of the sample group. Including SRNAs from the 2021 AHU cohort or from other schools would have provided a larger and more heterogeneous sample, which in turn would incur potentially less bias.

Another limitation of the study includes the time constraints to present the PowerPoint and disseminate the pre/post-tests. The short amount of time elapsed between the pre- and post-test incurs doubt on the reliability and validity of the data, as retention and increased knowledge base of the subject matter cannot be truly assessed in one class period. Taking the post-test within an hour of taking the pre-test carries the potential for the SRNAs to remember the pre-test questions and answer them based on simple recall rather than true understanding. Preferably, the post-test would be administered several days to a month after the pre-test was given as retention of knowledge can be more reliably assessed in this manner, as this would make simple recall of the pre-test questions more difficult.

Furthermore, the pre/post-test is a self-constructed evaluation tool that was not tested prior to implementation, which further decreases the reliability and validity of the data. Lastly, using identical pre/post-tests further questions the validity of the data, as the SRNAs may gain knowledge just from taking the pre-test.

The ongoing problem of inadequate pain control and the multitude of issues that continues to contribute to it (Pogatzki-Zhan et al., 2017; Morris & Mir, 2015; Ross, 2018) warrant the continued exploration of other effective anxiolysis and analgesia treatment modalities such as MT. The results of this scholarly project support the need to further educate SRNAs regarding the subject matter. Ultimately, this scholarly project has the potential benefit of serving as an invaluable education tool regarding MT as an effective adjunct for reducing perioperative pain and anxiety for SRNAs and licensed anesthesia providers.

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Appendix A

ADU NAP CAPSTONE PROJECT – INFORMED CONSENT

We are MSNA students in the Nurse Anesthesia Program (NAP) at Adventist University of Health Sciences (ADU). We are doing a Capstone Project called *Music Therapy Effects on Pain and Anxiety Throughout the Perioperative Period*. We would like to invite you to participate in this project. The project is being supervised by our department chair. The main purpose of this form is to provide information about the project so you can make a decision about whether you want to participate.

WHAT IS THE PROJECT ABOUT?

The purpose of this project is to enhance the 2019 ADU SRNA cohort's knowledge base regarding Music Therapy's effects on perioperative anxiety and pain via an educational PowerPoint presentation.

WHAT DOES PARTICIPATION IN THIS PROJECT INVOLVE?

If you decide to participate in this project, you will be asked to complete an anonymous pre-assessment, attend a classroom presentation, and then complete an anonymous post-assessment. The assessment will address your knowledge base regarding the effects of Music Therapy on perioperative pain and anxiety. Your participation by attendance at the presentation and completion of the survey is anticipated to take approximately one hour

WHY ARE YOU BEING ASKED TO PARTICIPATE?

Your participation in this study is voluntary. You may choose to not to participate. The decision to participate or not participate in this research study is completely up to you. If you choose not to participate your refusal to participate in this research study will involve no penalty or loss of benefits to you. If you choose to participate, you can change your mind later and withdraw your consent and discontinue participation from this study at any time. If you chose to withdraw informed the PI of your wishes.

You do not have to participate in this research study and choosing not to participate in this study will not involve any penalty or loss of benefit to you. The decision to participate or not participate in this research study is completely up to you. If you choose to participate, you can change your mind later and withdraw your consent and discontinue participation from this study at any time. If you chose to withdraw from the study informed the PI of your wishes.

WHAT ARE THE RISKS INVOLVED IN THIS PROJECT?

Although no project is completely risk-free, we don't anticipate that you will be harmed or distressed by participating in this project.

ARE THERE ANY BENEFITS TO PARTICIPATION?

We don't expect any direct benefits to you from participation in this project. The possible indirect benefit of participation in the project is the opportunity to gain additional knowledge about the effects of Music Therapy on perioperative pain and anxiety.

HOW WILL THE INVESTIGATORS PROTECT PARTICIPANTS' CONFIDENTIALITY?

The results of the project will be published, but your name or identity will not be revealed. To maintain confidentiality of assessments, the investigators will conduct this project in such a way to ensure that information is submitted without participants' identification. The participants will be de-identified with the use of a number system; a number will be assigned and written on the top right-hand corner of each

test and each pre-test will be paired to the post-test with the same corresponding number. To further ensure the participants' anonymity will be protected, the pre/post-tests will be concealed and distributed randomly in identical white colored envelopes. The participants will also be instructed to place their tests in the envelopes upon completion before returning them to the researchers. Additionally, the participants will be instructed to refrain from writing their names or any other identifiable markers on their tests. Furthermore, the data collected from the project will be stored securely in a password protected computer hard drive in an undisclosed location in the residence of one of the researchers. The data will then be permanently deleted after the completion of the project by erasing it from the hard drive. Additionally, any paper documents containing data from the project will be destroyed via a paper shredder.

Thus, the investigators will not have access to any participants' identities.

WILL IT COST ANYTHING OR WILL I GET PAID TO PARTICIPATE IN THE PROJECT?

Your participation will cost approximately one hour of your time, but will require no monetary cost on your part. You will not be paid to participate.

VOLUNTARY CONSENT

By signing this form, you are saying that you have read this form, you understand the risks and benefits of this project, and you know what you are being asked to do. The investigators will be happy to answer any questions you have about the project. If you have any questions or concerns about the project process or the investigators, please contact the Nurse Anesthesia Program at (407) 303-9331.

_____ Date _____

Participant Signature/ Participant Name (PRINTED LEGIBLY)

_____ Participant Name (PRINTED LEGIBLY)

Appendix B

Pre/Post Test

1.) Music therapy's effectiveness on reducing anxiety has been demonstrated by all of the following, except?

a.) Patients undergoing cesarean section
b.) Decreased plasma adrenaline levels
c.) Lower postoperative questionnaire stress scores
d.) Patients undergoing gynecological surgery

2.) How much did plasma glucose levels change with music therapy?
a.) decreased 3%
b.) increased 5%
c.) decreased 7%
d.) increased 10%

3.) Which one of the following is not a reason to use music therapy as a method of pain control?

a.) Narcotic shortages
b.) Inadequacy of traditional narcotic based pain control methods
c.) Adverse effects of narcotics
d.) Poor patient outcomes related to music therapy

4.) Music therapy has been demonstrated to be an effective adjunct to reduce pain and anxiety in all of the following anesthetic techniques, except?

a) Conscious sedation
b) General anesthesia
c) Regional anesthesia
d) Monitored anesthesia care

5.) Additional benefits to music therapy implemented in the perioperative period to reduce pain and anxiety include all of the following, except?

a) Music therapy increases heart rate and blood pressure leading to improved perfusion and decreased risk of ischemia
b) Music therapy is a cost-effective pain-control treatment modality
c) Music therapy does not have any known adverse side effects
d) Music therapy increases patient satisfaction

6.) About how long does pain control provided by music therapy last?

a.) Less than one hour
b.) Two hours
c.) Three hours

d.) Five hours

7.) Music Therapy works by activating what part of the brain?

a.) Temporal lobe
b.) Cingulo-frontal cortex
c.) Thalamus
d.) Marginal Sulcus

8.) Which is a benefit of perioperative music therapy?

a.) Anxiety reducing effects equal to that of 2mg IV Versed
b.) Lower anesthetic requirements intraoperatively
c.) Lower rates of infection
d.) Increased patient satisfaction

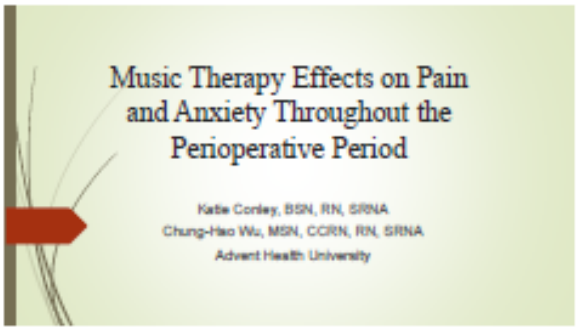
9.) Which is not a benefit of Pre and intraoperative music therapy?

a.) Increased anesthetic medications
b.) Lower BIS scores
c.) Decreased preoperative anxiety
d.) Decreased postoperative pain

10.) What percent of surgical patients report acute postoperative pain?

a.) 30%
b.) 50%
c.) 80%
d.) 90%

Appendix C



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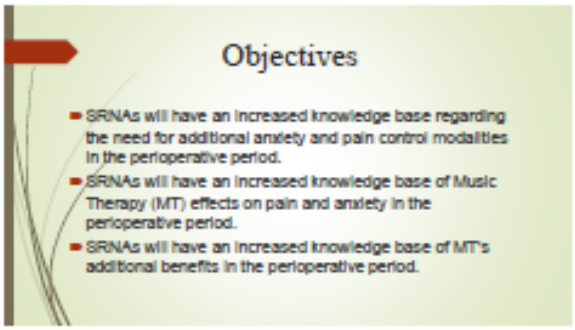

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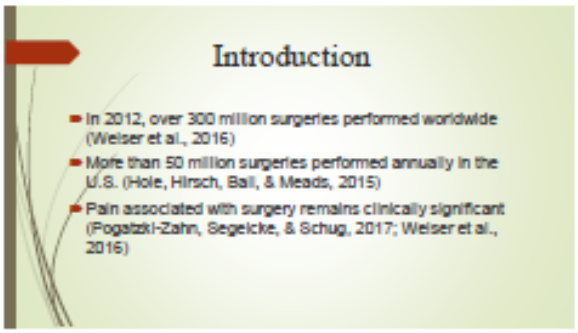

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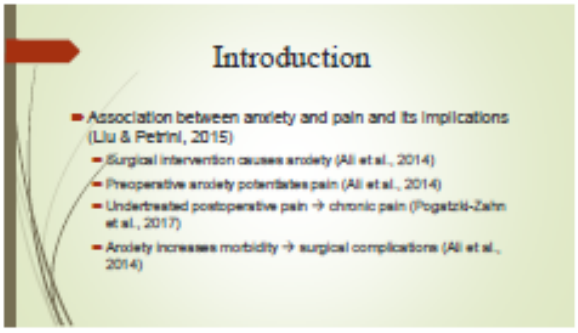

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6


Motivation
Significance in the clinical setting
Enhanced Recovery After Surgery (ERAS) (Tan, M., Law, L.S., & Gan, T. J., 2014)
Adverse narcotic side effects (Tan et al., 2014)
Reimbursement incentives (Liu, Vinocur, Burrows, & Rosen, 2017)
Narcotic shortage effects
Alternative therapies

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Music Therapy
Music Therapy (MT) definition - Clinically and evidence-based interventions that are used to achieve individualized goals within a therapeutic relationship by a credentialed professional (Malsota et al., 2013).
MT History
First described in 1914 (Hole et al., 2015)
Effective anxiolysis and analgesic (Malsota et al., 2013)
Not routinely used in the perioperative period (Hole et al., 2015)

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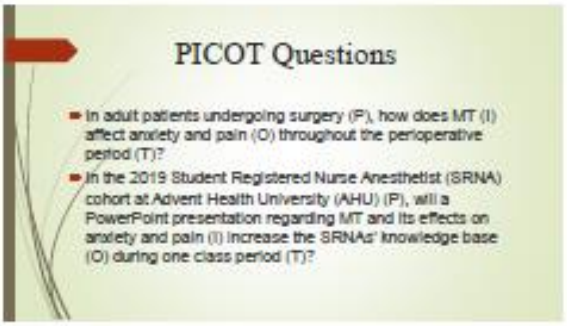
PICOT Questions
In adult patients undergoing surgery (P), how does MT (I) affect anxiety and pain (O) throughout the perioperative period (T)?
In the 2019 Student Registered Nurse Anesthetist (SRNA) cohort at Advent Health University (AHU) (P), will a PowerPoint presentation regarding MT and its effects on anxiety and pain (I) increase the SRNAs' knowledge base (O) during one class period (T)?

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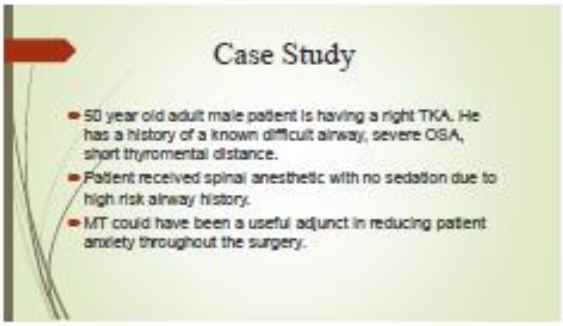
Case Study
50 year old adult male patient is having a right TKA. He has a history of a known difficult airway, severe OSA, short thyromental distance.
Patient received spinal anesthetic with no sedation due to high risk airway history.
MT could have been a useful adjunct in reducing patient anxiety throughout the surgery.

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Literature Review & Synthesis: MT Effects on Pain
MT has proven to be helpful in decreasing pain and narcotics usage perioperatively.
Listening to music preoperatively led to decreased narcotics usage intra and postoperatively (Malsota et al., 2013; Jayaraman et al., 2006)
Patients who listened to music intraoperatively had lower Visual Analog Scale (VAS) pain scores postoperatively (Kahlout et al., 2018)

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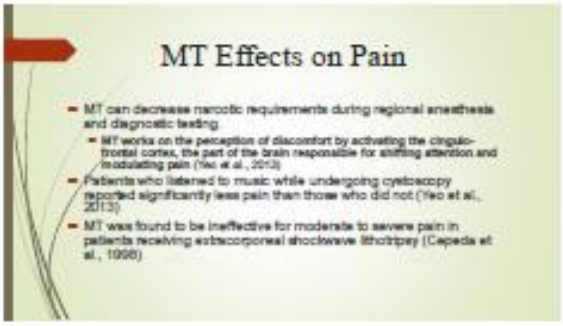
MT Effects on Pain
MT can decrease narcotic requirements during regional anesthesia and diagnostic testing
MT works on the perception of discomfort by activating the cingulo-frontal cortex, the part of the brain responsible for shifting attention and modulating pain (Yeo et al., 2013)
Patients who listened to music while undergoing cystoscopy reported significantly less pain than those who did not (Yeo et al., 2013)
MT was found to be ineffective for moderate to severe pain in patients receiving extracorporeal shockwave lithotripsy (Cepeda et al., 1998)

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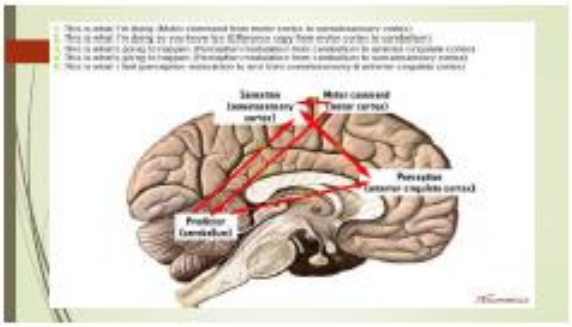

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MT Effects on Pain

- Those who listened to music postoperatively used less morphine than those who listened to music intraoperatively or not at all (Nilsson et al., 2003)
  - Listening to music postoperatively was found to reduce pain for about two hours into the postoperative period (Nilsson et al., 2003)
- Patients who listening to music for 30 minutes after a cesarean section required less pain medications than those who did not listen to music (Ebneshahidi & Mohseni, 2008)
  - Reducing narcotics usage post C-section allowed mothers to have earlier and more meaningful contact with their newborns (Ebneshahidi & Mohseni, 2008)

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MT Effects on Pain

- In gynecological patients, postoperative MT reduced the intensity of pain and use of pharmacologic analgesics (Sin et al., 2015)
- After surgery for lung cancer, patients who listened to music had lower VAS scores and used significantly less PCA Sufentanil (Wang et al., 2015)
- Patients with MT after spinal surgery also reported lower VAS scores than those who did not have MT (Brandt et al., 2013)

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MT Effects on Anxiety

- Multiple studies support the effectiveness of MT in treating perioperative anxiety (Bradt et al., 2013, Bringman et al., 2009; Jimenez-Jimenez et al., 2013, Lepage et al., 2001; Matsota et al., 2013; Sin et al., 2015; Yeo et al., 2013).
- **Listening to music controls preoperative anxiety better than oral versed** (Bringman et al., 2009)
- MT has been shown to decrease anxiety levels and sedative requirements during regional anesthesia as evidenced by lower stress scores on postoperative questionnaires and deceased anxiety postoperatively (Matsota et al., 2013)

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MT Effects on Anxiety

- MT has been shown to decrease anxiety levels and sedative requirements during **regional anesthesia** (Matsota et al., 2013)
- In a study of patients undergoing surgical procedures with spinal anesthesia, all participants were given patient controlled IV versed while only half were allowed to listen to music. The music listeners used less versed while reporting the same levels of relaxation as those who did not listen to music (Lepage et al., 2001)

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MT Effects on Anxiety

- Patients undergoing cystoscopy with MT reported significantly lower anxiety levels than those without MT (Yeo et al., 2013)
- **MT was found to be just as effective as 2mg of oral versed in patients undergoing extracorporeal shockwave lithotripsy** (Matsota et al., 2013)
- Patients undergoing varicose vein stripping with MT were found to have significantly lower anxiety than those without MT as evidenced by lower plasma adrenaline levels (Jimenez-Jimenez et al., 2013)

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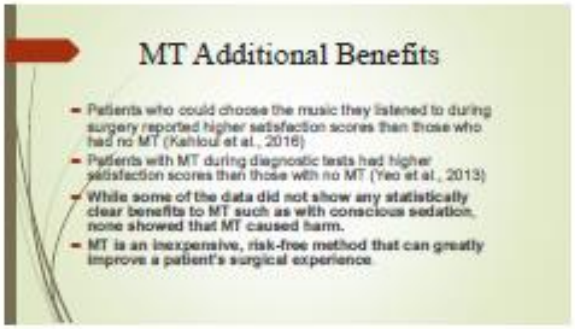

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Appendix D

Test Number	Pre-Test Score	Post-Test Score
1	3	7
2	3	8
3	4	8
4	8	8
5	7	8
6	6	10
7	6	10
8	4	7
9	3	9
10	2	7
11	6	7
12	4	8
13	4	8
14	3	7
15	5	7
16	2	8
17	2	9
18	2	10
19	4	8
20	1	9
21	3	8

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	PreTest	3.9048	21	1.84132	.40181
	PostTest	8.1429	21	1.01419	.22131

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	PreTest - PostTest	-4.23810	2.11907	.46242	-5.20269	-3.27350	-9.165	20	.000