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Effects of Music Intervention on the Patient's Perception of Pain  
After Knee Replacement Surgery

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A thesis  
presented to  
the faculty of the Department of Allied Health Sciences  
East Tennessee State University

In partial fulfillment  
of the requirements for the degree  
Master of Science in Allied Health

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by  
Heather E. Hooks  
May 2014

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Dr. Susan Epps, Chair  
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Keywords: earbud, music intervention, music therapy, pain and opioids

## ABSTRACT

Effects of Music Intervention on the Patient's Perception of Pain

After Knee Replacement Surgery

by

Heather E. Hooks

The purpose of this study was to determine whether therapeutic music affects the patient's perception of pain, postoperative day 1 after knee replacement surgery in an inpatient hospital. In addition to the patient's pain levels, the study was an analysis of the quantity of opioids the patient was requested, the length of stay, and the physiological parameters, which included blood pressure, heart rate, respiratory rate, and oxygen saturation. Sixty knee replacement patients were randomly placed in the music group or the quiet group. The Faces Pain Scale Revised with Numeric Rating Scale was used to measure pain levels. Statistical analysis between the music group and the quiet group indicated a significant difference in patient's pain levels ( $F = .298$ ;  $p = .037$ ). Study results support music decreasing patient's perception of pain. Nurses can suggest music intervention to decrease pain with this patient population knowing evidence based practice supports the efficiency of music.

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## CHAPTER 1

### INTRODUCTION

Nurses spend more time providing care for patients in pain than any other health care professional (Dunn, 2004) and yet, surgical patients often experience inadequate pain management often (Apfelbaum, Chen, Mehta, & Gan, 2003). Pain can be provoked by “medical conditions including ischemia, infections, inflammation, edema, and distention” (Stanik-Hutt, 2003, p. 99). Wounds, incisions, and invasive medical devices as well as nursing procedures like suctioning, turning, inserting, and removing catheters can also initiate pain (Stanik-Hutt, 2003).

When taken as prescribed, opioids can effectively and safely manage pain; however, addiction and abuse of these medications are a growing concern for all health care professionals. Long term use of opioids can result in physical dependency or addiction. As Fishbain, Rosomoff, and Rosomoff (1992) stated, studies have shown “opioid abuse rates in patients with chronic pain vary from 3% to 17%” (as cited in Jewell, Thomlinson, & Weaver, 2011, p.32). In addition, Sehgal, Manchikanti, and Smith (2012) asserted that “the increasing use of opioid analgesics for treating chronic non-cancer pain, and the introduction of high-dose, extended release oral tablet formulations of opioids has increased opportunities for the illicit use of prescription opioids” (p. ES68). Patients who are regularly treated or receive opioid prescriptions in a hospital setting for chronic pain may abuse opioids or violate the prescriptions by ingesting excessive dosages in shorter time frames than directed (Jewell et al. 2011). The Monitoring the Future research study revealed that “in 2000, retail pharmacies dispensed 174 million prescriptions for opioids; by 2009, 257 million prescriptions were dispensed, an increase of 48 percent” (The White House, 2011, para. 5). According to estimates from the Centers for Disease Control and Prevention,



“14,800 Americans died from overdoses involving opioid pain relievers in 2008. In 2009, there were 15,597 deaths involving opioid medication” (USFDA, 2012, para. 4). Because of the detrimental effects of opioids, the health care providers for many years searched for alternate pain treatments.

Music has been shown to be effective in reducing pain associated with a variety of procedures “including burn debridement, laceration repair, lumbar punctures, insertion of intravenous lines, immunizations and dental procedures” (Kemper & Danhauer, 2005, p. 285). Kemper and Danhauer (2005) suggest “carefully selected music can reduce stress, enhance a sense of comfort and relaxation, offer distraction from pain, and enhance clinical performance.” (p. 286).

One of the more common theories regarding the efficacy of music therapy in alleviating pain is that music acts as a distraction. If the patient is experiencing negative stimulation, the music may create a more positive and encouraging atmosphere in the patient's mind (Nilsson, 2008). Researchers at the Joanna Briggs Institute (2011) conducted a literature review on music as an intervention in hospitals, and found “that the patients who listened to music experienced a 70% greater probability of having at least 50% pain relief, compared with the patients who had not listened to music.” (p. 101).

Nilsson's (2008) literature review of 22 studies examining anxiety and pain reducing effects of music interventions revealed that the majority of music therapy efforts occurred in postoperative health care settings. The type of music selected for each patient to listen to was soothing. The tempo of the music selected for the patients were 60 to 80 beats per minute. In the majority of studies patients selected the music they wanted to listen to. According to Nilsson (2008) researchers evaluating the effects of music on patients who were experiencing pain

generally used the visual analog scale (VAS) to measure pain experienced by patients. In fact, “in 59% of the studies, music intervention was shown to have significant pain reducing effect, reflected by decreased pain scores” (Nilsson, 2008, p. 802). In 47% of the studies music therapy also had a significant decrease in the use of opioids.

Nilsson (2008) noted that future researchers should evaluate specifically composed music designed for each individual patient, as well as “the differences in the effect of music interventions related to patient gender, age and ethnicity” (p. 803).

While narcotics help relieve the patient’s pain, they also can lead to addiction and other harmful side effects that may be prevented with a more holistic approach to pain relief. In addition to addiction, the pain-relieving opioids can cause other side effects including constipation, nausea, somnolence, itching, dizziness, and vomiting--all of which that can impede patient progress. A patient may be unaware of alternative methods available to potentially decrease his or her perceived pain levels. Similarly, health care professionals may not provide the patient with information about more holistic approaches to nursing because these are more time consuming and opioids do an effective job of managing the patient’s pain.

#### *Purpose of the Study*

The purpose of this study was to determine whether therapeutic music affects the patient’s perception of pain following knee replacement surgery in an inpatient hospital located in the southeastern region of the United States.

#### *Significance of the Study*

This research may provide allied health professionals with a nonpharmacological method that could contribute to pain management (Vaajoki, Pietila, Kankkunen, & Vehvilainen-

Julkunen, 2011). If music therapy is a viable option for pain management, patients could improve pain relief with little to no side effects at minimal costs.

### *Research Questions*

The study is guided by the following questions:

1. Does listening to therapeutic music decrease the patient's perception of pain?
2. Does listening to therapeutic music alter the patient's physiologic parameters (blood pressure, heart rate, respiratory rate, and oxygen saturation)?
3. Does listening to therapeutic music decrease the amount of opioids taken after the initial dosing of medications?
4. Does listening to therapeutic music change the patient's length of stay?

### *Delimitations and Limitations*

The geographic location of the research was gathered in an orthopedic unit in an inpatient hospital in the southeastern region of the United States. The study was limited to adults over the age of 18. Pregnant women, emergent patients, hearing impaired patients, and mentally impaired patients were excluded from the study. In addition, patients were required to be alert, oriented, and able to communicate to verbally participate in the study. The data were collected from September 2013 through November 2013.

### *Assumptions*

It was assumed that all patients who participated in the pain perception survey provided cooperation and answered study questions honestly.

### *Operational Definitions*

The following definitions are included for clarification:

*Earbud*: a type of headphone device that fits inside the ear.

*Music intervention*: “defined as music played for a patient during a single episode of care to produce outcomes that were achievable during that session of music” (Evans, 2001, p.9).

*Music Therapy*: “a discipline whose professionals make use of clinical and evidence-based music interventions to accomplish individualized goals within a therapeutic relationship by a credentialed professional who has completed an approved music therapy program” (American Music Therapy Association, 2010, para. 1).

*Pain*: “an unpleasant sensory and emotional experience associated with actual or potential tissue damage” (Koestler & Myers, 2002, p. 8). Pain is subjective and is dependent upon each individual and their experiences.

*Opioids*: classification of pain medications used to relieve pain (National Institute of Health, 2011).

## CHAPTER 2

### REVIEW OF LITERATURE

For the literature review I used the following databases: CINAHL, ScienceDirect, PubMed, Conchrane Database of Systematic Reviews, and Wiley Online Library as well as Google Scholar. Key words used were chronic pain, Numeric Pain Scale, Visual Analog Scale, Faces Pain Scale, opioids, music therapy, music intervention, postoperative pain, holistic therapies in nursing, opioid addiction, knee replacement, patient involvement in patient care decisions, aromatherapy, guided imagery, and massage.

#### *Pain*

According to the International Association for the Study of Pain (IASP) (2005), “pain is an unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage” (para.5). Perception of pain is always subjective and differs by individual. Pain is a common problem that does not discriminate, affecting people of all ages, socioeconomic status, and ethnicities (Godfrey, 2005). Moreover, “understanding and effectively managing pain requires accurate evaluation, not only of any organic pathology that may be responsible for the discomfort, but of any behavioral, psychosocial, demographic, or other factors that may contribute to the person’s reported experience” (American Association of Critical Care Nurses, 2010, p. 12). Kuehn (2007) elaborated that

Pain is a serious, undertreated public health problem in the United States, with 19% of US adults reporting chronic pain and 34% reporting recurrent pain, according to a 2005 telephone survey of a random sample of 1204 adults sponsored by news organizations and Stanford University Medical Center ( p. 249).

However, the occurrence of pain is not a straightforward response to an unpleasant sensation (Godfrey, 2005) and both the patient's perception and response to pain can be factored by the "individual's emotional state, memories, genetic makeup, personality, and by the cultural, environmental, and socioeconomic context" (Holdcraft & Power, 2003, p. 635).

Godfrey (2005) explained that,

The processing of pain information is complex, but follows a similar neural pathway as other types of sensory information: the incoming stimuli are changed into nerve impulses which are relayed along nerve fibres to the spinal cord and then to brain centres. Pain results from activation of specialized pain receptors, or nociceptors, in somatic or visceral tissues and the transmission of the nerve impulses; this is called nociceptive pain (p. 847).

#### *Pathophysiology of Pain*

There are three components within the nervous system that contribute to the feeling sensation and perception of pain. These entities include afferent pathways, efferent pathways, and the central nervous system (McCaffrey, Frock, & Garguilo, 2003). The afferent pathways are composed of nociceptors, with the majority of the specialty receptors being found on the skin (McCaffrey et al., 2003). The nerve endings found on the skin detect sensations of pain, pressure, and itch.

Moreover, McCaffrey et al. (2003) stated, "free nerve endings are sensitive to mechanical, thermal, electrical or chemical stimuli; they are responsible for transmitting sensory pain information" (p. 282). In addition, "the nociceptor stimulation flows through the afferent pathways to the spinal cord where they ascend through a series of relay neurons to the brain" (McCaffrey et al., 2003, p. 282). McCaffrey et al. (2003) further explained that

Once the pain signal reaches the central nervous system the pain stimulus is evaluated and interpreted by the limbic system, reticular formation, thalamus, hypothalamus, medulla, and cerebral cortex. The brain's interpretation of pain is based on the physical pain stimulus and psychological aspects, such as prior experiences with pain, cultural aspects of pain perception and pain expression, and personal attitudes toward pain. The interpretation of pain is then relayed back through the efferent pathways. Pain modulation takes place in the efferent neural pathways from the brain, and may involve chemical factors, such as neuropeptides, that can increase sensitivity of the afferent pain receptors to particular noxious stimuli. (p. 282-283).

These pathways result in feeling and sensing pain.

### *Types of Pain*

Patients who have had a surgical procedure, or any incision for that matter, may experience postoperative pain and discomfort. The pain may be acute, lasting a few days to a few weeks or it may be chronic, lasting longer than 6 months.

Nociceptive pain occurs when nerves in an injured area sense a problem and respond by stimulating the production of pain receptors. The stimulation travels up the spinal cord to the brain triggering the pain sensation. Nociceptive pain includes somatic pain that results from injury to the arteries, ligaments, bone, skin, tendons, and muscle as well as visceral pain that results from the stimulation of pain receptors in internal organs like infection, inflammation, distention, and obstruction (McCaffrey et al., 2003). Neuropathic pain arises from damage to the peripheral nerves and is expressed by a specific pain receptor. Neuropathic pain is often described as burning, tingling, or shock-like and is often untouched by traditional opioid pain medications (McCaffrey et al., 2003).

### *Traditional Treatment for Pain*

Pain management is an essential component in nursing care in which the patient receives education on the treatment options then chooses the pain management treatment. While opioids are considered the most common traditional treatment for pain, nontraditional treatment methods including complementary therapies have also been used to lower patient pain levels.

For a thousand years opium has been the element used to relieve pain and other health illnesses (Back, Payne, Simpson, & Brady, 2010). Opioids are derived from opium and used to alleviate pain and keep the patient comfortable. According to Snidvongs and Mehta (2012), “opioids are pharmacological agents that are agonists at endogenous opioid receptors, with effects on the peripheral and central nervous system, and have been shown to be effective in the treatment for many chronic pain conditions” (p. 66). The most commonly prescribed opioids in the United States are “codeine, fentanyl, hydrocodone, hydromorphone, levorphanol, meperidine, methadone, morphine and oxycodone” (Noble, Tregear, Treadwell, & Schoelles, 2008, p. 215).

Increasing opioid tolerance occurs in individuals prescribed opioids for long-term management of either chronic noncancer pain (CNCP) or cancer pain (Huxtable, Robers, Somogyi, & Macintyre, 2011, p. 804). As Huxtable et al. (2011) explained, “the United States Food and Drug Administration (USDA) had responded to the ‘societal crisis’ of prescription opioid abuse by increasing regulatory controls and developing risk evaluation and mitigation strategies for long-acting opioids as part of approval process” (p. 806). In the United States both opioid prescription rates and opioid-related fatalities have increased causing a rise of concerns (Huxtable et al., 2011). Evidence among those prescribed opioids for CNCP suggests the higher the dose prescribed, the greater the risk of opioid-related fatality (Huxtable et al., 2011). Patients on long-term opioid treatment may experience symptoms that include “constipation, nausea,



somnolence, itching, dizziness, and vomiting” (Snidvongs & Mehta, 2012, p. 68). While opioids can be effective in managing pain, complementary therapies for pain could be used as an alternative without the harsh side effects or complications.

### *Nontraditional Treatments for Pain*

Keegan (2003) stated “one of the primary appeals of using complementary therapies to manage the stress and anxiety of critically ill patients is that the therapies generally are considered ‘low-tech’ and noninvasive” (p. 322). There are several common intervention methods for the critical care environment to help reduce pain including aromatherapy, imagery, massage, and music (Keegan, 2003).

#### *Aromatherapy*

According to Potts (2009), “aromatherapy is the use of distilled essential oils, highly concentrated, fragrant extracts from plants that vaporize easily” (p. 55). There are numerous benefits for critically ill patients in using essential oils such as inhaled peppermint oil and lavender essential oil that could be helpful in relaxation and anxiety as well as the control of wound odor (Rosenbaum, 2012). Moreover, “aromatherapy is thought to encourage the release of neurotransmitters, such as encephalines and endorphins that have an analgesic effect and produce a feeling of wellbeing” (Potts, 2009, p. 55). Furthermore, Potts (2009) reiterated the effects of the essential oils could be used in addition to chronic pain medications or as alternative holistic approaches. Kim et al. (2006) compared the analgesic efficacy of postoperative lavender oil aromatherapy in 50 patients undergoing breast biopsy surgery. Twenty-five patients received supplemental oxygen through a facemask with two drops of 2% lavender oil postoperatively. The remaining patients were placed in the control group that received supplemental oxygen through a facemask with no lavender oil. The outcome variables of the study included the 0-10 numeric

rating scale (NRS) that was measured at 5, 30, and 60 minutes postoperatively; opioid requirements in the postanesthesia care unit (PACU); patient satisfaction with pain control; as well as the discharge time from the PACU (Kim et al., 2006). There was no significant differential in the opioid requirements or the discharge times between the lavender group and the control group. The pain scores were not significantly affected by the postoperative lavender oil aromatherapy. “The patients in the lavender group did however report a higher satisfaction rate with pain control than patients in the control group ( $P = 0.0001$ )” (Kim et al., 2006, p. 276).

### *Guided Imagery*

Imagery is a nonverbal, noninvasive modality that is accomplished by the patient along with the health care providers and family members. Kwekkeboom, Hau, and Bumpus (2008) defined guided imagery as “the use of one’s imagination to create mental images that distract attention away from pain or that alter the pain sensation itself” (p. 186). Imagery provided an opportunity for someone with stress and pain to focus directly on positive thoughts and images, thus allowing a temporary mental escape from the mental content that causes the feeling of ‘overload’ or the inability to cope with immediate problems (Keegan, 2003). Kwekkeboom (2001) conducted a study to determine if the history of imagery used and the outcome expectancy of guided imagery had any correlation. Seventy-five women ranging in age from 28 to 79 years undergoing surgery for gynecologic or breast cancers participated in the study. The author noted a “significant relationship correlation between participants with previous history of using imagery and outcome expectancy ( $r = 0.47, p < 0.01$ ) and between perceived credibility of the imagery provider and outcome expectancy ( $r = 0.45, p < 0.05$ )” (Kwekkbeoom, 2001, p. 1126). In addition, Kwekkeboom et al. (2008) conducted another study to determine the effectiveness of guided imagery and progressive muscle relaxation interventions in 26 patients

with cancer. “Sixteen participants reported that the guided imagery intervention worked to relieve pain” (Kwekkeboom et al., 2008, p. 189). The researchers concluded that guided imagery is suitable in treating cancer pain for some participants. The researchers also found that patient variables including physical capacity, energy level, intensity of pain and preferences for intervention should be investigated in each patient before selecting participants for the study (Kwekkeboom et al., 2008).

### *Massage*

Massage is a touch intervention designed to reduce stress, alleviate anxiety, decrease pain, promote circulation, and generally stimulate a state of wellbeing (Keegan, 2003). More specifically, Keegan (2003) “suggested that rubbing, pressing, massaging, and holding are natural manifestations of the desire to heal and care for one another” (p. 324). With massage therapy, the practitioner touches, pushes, kneads, or rubs the patient’s skin and underlying tissue using the four primary back care massage strokes (Keegan, 2003). Chang, Wang, and Chen (2002) conducted a randomized controlled trial in Taiwan to determine the effects of massage on pain and anxiety during labor and reported the “experimental group had significantly lower pain reactions in the latent, active and transitional phases of labor” (p. 68). As a result, Chang et al. (2002) concluded that massage was a cost effective intervention that could decrease pain and anxiety during labor. In a similar study Mortazavi, Khaki, Moradi, Heidari, and Rahimparvar (2012) found the women of the massage group in the active and transitional phases of labor had significantly lower pain levels ( $p < 0.05$ ). The massage group had lower pain and anxiety states in three phases in comparison with the control group ( $p < 0.05$ ) (Mortazavi et al., 2012).

### *Music Intervention for Pain*

In addition to massage therapy, music intervention is another nontraditional alternative to opioids pain relievers. Chlan described music (2000) as a complex web of expressively organized sounds composed of four key elements: pitch, rhythm, harmony, and tempo. “Music is a pleasant, noninvasive intervention, which is useful and a safe non-pharmacological method for patients to consider” (Li et al., 2011, p. 416). Other researchers asserted that listening to music is a safe and inexpensive way to facilitate healing and enhance wellness (McCaffery, 2008; McCaffrey & Locsin, 2002). Patient responses have indicated that experiencing music aided symptom relief as well as other aspects of living with illness (Abrams, 2001).

### *History of Music Therapy in Nursing Practice*

Music intervention dates back into the time of the Ancient Greeks. Ancient Greeks worshiped Apollo as the god of both medicine and music because they understood the influence of music on healing (McCaffrey & Locsin, 2002). According to Abrams (2001), “through the ages, humankind has used the healing potential of music to address a vast range of physical, emotional, social and spiritual concerns for people of all ages and cultures” (p. 222).

In the early history of nursing Florence Nightingale used music as an intervention for treating patients. Nightingale presented music as part of the healing process for injured soldiers and described how music used in healing could benefit the injured soldiers’ health (as cited in McCaffrey & Locsin, 2002). Nightingale stated that it was the duty of the nursing staff to control the environment to optimize healing of the soldiers to occur (as cited in McCaffrey & Locsin, 2002). One of the most important roles in nursing is to promote the patients wellbeing and create an environment where the patient is able to heal comfortably (McCaffrey, 2008).

### *Gate Control Theory*

One explanation of how the mind plays a role in pain perception is known as the gate control theory. McCaffrey et al. (2003) described the gate control theory of pain as “a ‘gating system’ in the central nervous system that opened and closed pain pathways” (p. 283). To further elaborate, Li et al. (2011) stated:

Pain impulses are transmitted from the site of an injury via the spinal cord to the brain, where the actual pain perception is generated. Neural gates in the spinal cord may be opened or closed to varying degrees, thus allowing more or fewer of those pain impulses to transmit through to the brain. If control gates are blocked due to outlying factors, then the perception of the pain may be reduced. One of these factors in blocking gates could be messages descending from the brain from the efferent pathways in the spinal cord.

Music could be these descending messages, resulting in fewer pain impulses reaching our conscious awareness. (p. 416).

The gate control theory describes why and how it is possible for pain to be relieved when the brain is experiencing distractions like music intervention (McCaffrey et al., 2003).

### *Studies Using Music Intervention*

Music intervention has been shown to have several advantages over analgesics by improving anxiety and depression, increasing a sense of power, and adding virtually no side effects for the patient (Li et al., 2011). As McCaffrey (2008) noted in recent nursing studies, “music listening has been shown to affect health and well-being, physiologically, psychologically, and cognitively” (p. 40). According to Chan (2007), “physiological changes that occur when individuals listen to music include reductions in blood pressure, pulse, and heart rates, as well as an increase in oxygen saturation” (p. 432).

Positive results of music having a significant reduction on patients' pain levels were reported in other studies (Allred, Byers, & Sole, 2010; Vaajoki et al., 2011). On the other hand, one study that found the music group and quiet group had no significant differences (Phipps, Carroll, & Tsiantoulas, 2009). Doran et al. (2006) did not find significant differences between systolic blood pressure, diastolic blood pressure, and heart rate among the patients in the music group and quiet group. Allred et al. (2010), reported no significant difference in patients' heart rate, respiratory rate, and oxygen saturation levels between the music group and the quiet group. Contrary to the results of the physiological parameters for the Allred et al. study, there are studies that support significant differences in physiological parameters for patients who were in the music group (Chen, Wang, Shih, & Wu, 2012; Vaajoki et al., 2011). The Doran et al. (2006) research study results also showed no significant difference with the amount of opioids between the groups. There is a study however that had a statistical difference that showed music intervention to be effective in decreasing the amount of opioids taken over the length of stay in the hospital (McCaffrey & Locsin, 2006).

Huang, Good, and Zauszniewski (2010) explored the effectiveness of music in relieving pain for 126 patients with cancer. The experimental group listened to music for 30 minutes while the control group rested. The patients in the music group had significantly less posttest pain than the control group. In fact, Huang et al. (2010) found that "the music added one-third more comfort than rest alone" (p. 1360).

Another study used the effects of music therapy on pain and anxiety in 100 patients undergoing bone marrow biopsy and aspiration (Shabanloei, Golchin, Esfahani, Dolatkah, & Rasoulia, 2010). Patients completed the Spielberger Stat-Trait Anxiety Inventory (STAI) 5 minutes before the procedure began. During the 10 to 20 minute bone marrow biopsy and

aspiration procedure, patients in the music group listened to the three preselected songs while the control group did not listen to music. One minute after the procedure, both groups completed the STAI and visual analogue scale to compare the pain intensity. The researchers found that listening to music reduced pain and anxiety (Shabanloei et al., 2010).

Music intervention consists of a researcher or allied health professional using recorded music for patients to hear. McCaffrey (2008) went on to describe music as “a fundamental form of personal and cultural expression that can create responses to capture the unique and elusive essence of each individual” (p. 40). Additionally, “music listening is a passive activity that does not require the person’s attentiveness but rather facilitates a nonthreatening atmosphere and provides an environment for healing” (McCaffrey, 2008, p. 43).

Cooke et al. (2010) conducted a study to determine the effect of music on discomfort experienced by 17 intensive care unit patients during turning. Nurses turn patients who are immobile in order to prevent pressure sores by using the turning standard of moving the patient every 2 hours. Some patients may need to be turned more frequently if sores are already present. The turning occurs by rotating the patient on his or her left side, back, or right side. For immobile patients turning can be very painful and exhausting. Discomfort and anxiety were measured 15 minutes before and immediately after two turning procedures. The music participants were able to listen to the music of their choice 15 minutes prior to turning as well as during the turn procedure. The control group in this study wore earphones attached to a portable CD player like the music group; however, no music was played. The findings from the study showed the music had no statistically significant effect on the subjects. The researchers explained that a possible limitation of the study was that the participants were postoperative prior to the initiation of the study. The patients partaking in the study could have had residual

anesthetics that could have played a factor in the turning procedure, whereas patients normally would experience moderate to severe pain (Cooke et al., 2010).

Chlan (1998) conducted a quasi-experimental pretest-posttest study of patients receiving ventilatory assistance. The music group patients listened to music for 30 minutes while the rest group only had an altered environment of closed blinds, dim lights, and a “Do Not Disturb” sign on the door (Chlan, 1998). The music group reported significantly less anxiety than the rest group (Chlan, 1998). Additionally, Chlan (1998) found that heart rates and blood pressure had a greater reduction with ventilated patients in a music group than compared to those in the control group with no music.

In a similar study, Han et al. (2010) examined the effects of music intervention on physiological stress response and anxiety level of 137 mechanically ventilated patients in China by randomly assigning patients to an interventional group (music listening through headphone), placebo group (putting on headphones without music), and control group (quiet rest without music). Each music participant listened to his or her choice of music from the investigator’s collection for 30 minutes. The placebo group wore headphones for 30 minutes with no music playing, while the control group was asked to rest for 30 minutes. The patient’s heart rate, respiratory rate, blood pressure, and oxygen saturation parameters were measured. Although they noted no significant change in the physiological parameters of the patients in any group, Han et al. (2010), however, suggested that listening to music had beneficial effect in regards to relaxation and anxiety in mechanically ventilated patients. “Music listening may be an intervention of choice in high-tech critical care settings where noisy and stressful environment may generate nervous tension” (Han et al., 2010, p. 986).



### *Instruments Used to Measure Pain*

Cravero, Fanciullo, McHugo, and Baird (2012) specified self-reporting to be the preferable method for quantifying pain because pain is subjective. It is essential that the appropriate tools be chosen according to the patient's literacy level and the ability to comprehend the pain scale instruments. The information gathered from the pain scale instruments provides a pain assessment from the patient in order to control the patient's pain levels. Instruments used to measure pain include the Visual Analog Scale (VAS), the Numeric Rating Scale (NRS), and the Faces Pain Scale (FPS).

#### VAS

According to the American Association of Critical Care Nurses (2010), "any patient who is experiencing considerable discomfort, especially for a prolonged period, will appreciate the nurse's assistance in characterizing the nature of the extent of his/her pain in a manner that facilitates expeditious and effective amelioration" (p. 13). The VAS is a pain rating scale that is commonly used when evaluating a patient's pain intensity levels (Gallagher, Liebman, & Bijur, 2001). As cited by Jamison et al. (2002), the "VAS has been used in many studies to measure a number of constructs including pain (Badley & Papegeorgiou, 1989), asthma (Dhand et al., 1988), dyspepsia (Nyren et al., 1987), mood (Monk, 1989), appetite (Stubbs et al., 2000), ambulation (Welsh et al., 1993), and vitality (Wood et al., 1990)" (p. 341). The VAS scale is easy to use, users do not need much training, it can be administrated quickly, and it can be adapted for use in many different contexts (Gallagher et al., 2001; Taddio et al., 2009). The VAS is a horizontal line, 10 cm in length, with the end points of the line displaying "no pain" and "extreme pain" (Chanques et al., 2010; Kahl & Cleland, 2005). The patient is asked to mark his or her pain intensity by marking a perpendicular line at the appropriate location between the "no pain" and

“extreme pain.” The distance measured from the “no pain” endpoint of the line to the patient’s mark indicates the amount of pain the patient is experiencing.

Bijur, Silver, and Gallagher (2001) evaluated the reliability of the VAS for measurement of acute pain in 96 Emergency Department (ED) patients ranging from 19 to 71 years of age. The patients were asked to mark pain intensity on the scale and then a minute later the patient was asked to mark the pain again on a new sheet. The procedure was repeated every 30 minutes for 2 hours or until the patient left the department (Bijur et al., 2001). “The findings from this study indicated that the VAS is a highly reliable instrument for measurement of acute pain” (Bijur et al., 2001, p. 1156).

#### *NRS*

The NRS is a variation of the VAS in that it adds vertical lines on the horizontal line, creating a scale of 0 – 10 in which the patient identifies his or her degree of pain (Freeman et al., 2001). In addition, “the patient is required to choose a number from 0 to 10 which best represents their pain if 0 is equivalent of no pain and 10 is the equivalent of the worst imaginable pain” (Chanques et al., 2010, p. 712). As stated in Kim and Buschmann (2006), “since Dalton and McNaul (1998) recommended the universal adoption for the 0-10 NRS for clinical assessment of pain intensity and since its use is so common (American Pain Society (APS) Clinical Practice Guideline, 2002; McCaffery & Pasero, 1999), it has become the gold standard in clinical practice” (p. 448).

On the Verbal Numeric Rating Scale (VNRS), the patient verbally rates his or her pain level using the numeric scale indicating no pain as zero to the worst imaginable pain being a 10. The VNRS has advantages of being used in fast paced environments and requires no equipment or supplies. “The VNRS was strongly correlated with the VAS for both the patients’ and the

physicians' pain ratings ( $r = 0.94$  and  $0.99$  at arrival,  $r = 0.96$  and  $0.99$  at exit)" (Marquié et al., 2008, p. 35). The authors confirmed the VNRS is easier and quicker to administer, and more patients are able to use it because it does not depend on intact motor skills (Marquié et al., 2008). The study reinforces the suggested use of the VNRS instead of VAS in ED patients who have acute pain.

### *FPS*

The Wong-Baker Faces Scale is a popular facial expression scale useful in multiple pediatric and older adult settings and has been validated as a measure of pain (Cravero et al., 2012; Kim & Buschmann, 2006). The Faces Pain Scale (FPS) has several versions that include those with 6 faces, 7 faces, 9 faces, or 11 faces (Kim & Buschmann, 2006). While there are many types of face pains scales, the Faces Pain Scale-Revised (FPS-R) is unlike any of the other face pain scales in that it does not show smiling faces or tears to indicate pain intensity levels (Miró & Huguet, 2004). The revised scale also only shows 6 faces while other scales can show as many as 11. "The FPS-R was easy to use at the bedside, and consequently it can easily be integrated into practice" (Miró & Huguet, 2004, p. 63).

### *Summary*

While opioids are the traditional method for treating pain, nontraditional methods of pain management are less costly and have no side effects or risk of addiction. Historically, music intervention has been used in nursing as a nontraditional treatment and is the subject of this study.

## CHAPTER 3

### DESIGN AND METHODOLOGY

#### *Overview*

Opioid pain medications help alleviate postoperative pain and promote patient comfort. Negative side effects and the risk of addiction to the opioids are two key reasons for investigating music intervention as an alternative to traditional pain management. Interventional music may serve as a distraction for patients by taking their minds off the pain and provides an alternate focus on words, rhythm, and beat of the music.

#### *Research Questions*

The study was guided by the following questions:

1. Does listening to therapeutic music decrease the patient's perception of pain?
2. Does listening to therapeutic music alter physiologic parameters (blood pressure, heart rate, respiratory rate, and oxygen saturation)?
3. Does listening to therapeutic music decrease the amount of opioids taken after the initial dosing of medications?
4. Does listening to therapeutic music change the patient's length of stay?

#### *Population*

The population for this study included patients from an inpatient hospital in the southeastern region of the United States. The patients in the inpatient hospital's orthopedic unit who were 18 years of age and older were selected based upon meeting the criterion of experiencing continuous pain. Pregnant women, hearing impaired patients, and emergent patients who show signs of dyspnea, palpitations, seizures, significant hemorrhages, syncope, trauma, or significant burns, and mentally unstable or incoherent patients who were unable to make

decisions for themselves, were excluded from the study. Sixty patients participated in the study, 30 patients in the music group and 30 in the control group.

### *Orthopedic Unit*

The 30-bed orthopedic unit was arranged in the shape of a square with two nurses stations located in the center of the orthopedic unit [Appendix E]. Both nursing stations were open on three sides allowing personnel to have easy access to the patients. The patient rooms were in close proximity to the central location of the nursing stations. Talking, intercom communication, monitor alerts, paging, phone calls, and printing occurred on a consistent daily basis and had the potential to create disturbances for patients. In addition, patients had many encounters with healthcare professionals including physical therapists, nurse aids, nurses, home health care companies, lab technicians, physician assistants, respiratory therapist, and surgeons, among others, throughout the day.

### *Research Design*

This study was a modified version of a study conducted by Allred et al. (2010). While Allred et al. evaluated pain and anxiety, I used a pretest-posttest design to determine if therapeutic music had any effect on the patient's perception of pain following knee replacement surgery specifically regarding patients' physiologic factors of heart rate, respiratory rate, blood pressure, and oxygen saturation. Unlike Allred et al.'s study, the patients had the opportunity to choose the genre of music from the selected list. The control group in this study received ear buds to wear for 30 minutes three times in 1 day in an attempt to prevent any differential in treatment by the nurses in the unit.

### *Informed Consent Approval Process*

Prior approval from East Tennessee State University's (ETSU) Institutional Review Board (IRB) (IRB # 8013.1s) [Appendix A] and the hospital's IRB were obtained. The hospital IRB consent was required first. In order to obtain hospital approval, I read, reviewed, and signed the hospital research agreement and confidentiality agreement. I completed the CITI training for the hospital as well as the nonemployee worker packet. I turned in the ETSU self-insurance statement, my resume, immunization records, drug test results, and background check.

Permission to perform the study in the hospital was given by the nursing education coordinator once all documentation was received [Appendix B]. The first three chapters of my thesis were submitted to the hospital IRB and the Nursing Research Council for approval. I presented the research proposal to the Nursing Research Council for approval to proceed in the facility. Once I obtained approval from the Nursing Research Council, I submitted the IRB application to the hospital facility. The hospital IRB notified me after the review was complete that the study was approved.

Upon approval of the hospital IRB, I proceeded to obtain approval from ETSU's IRB. To gain school IRB approval, I filled out the ETSU IRB online application. The uploaded documents consisted of potential conflict of interest forms for my chair and me, informed consent form, the school CITI completion form, the external site approval and hospital IRB approval form, my resume, references, and the Faces Pain Scale Revised. Once ETSU approval was declared, I sent a copy of the informed consent form to the hospital IRB for stamp of approval. Once the informed consent was received, I was approved for research to begin.

### *Informed Consent Consideration*

I obtained a list of room numbers for all patients having knee replacement surgery who were day 1 postsurgery from the nurse manager or scheduler in the orthopedic unit. Once the room numbers had been identified, I reviewed each patient with the nurse to make sure the patient was coherent and able to give consent. Once the patient was confirmed for consent, I approached each patient in the privacy of his or her hospital room. I explained the purpose of the study to see if the patient would be interested in participating. If the patient agreed to participate in the study, I went over the informed consent in further detail. Each patient was provided with the informed consent that described the purpose of the study, any risks associated with participation of the study, and contact information for the researcher as well as the advisory committee chair should the patient have any questions after the initial consult. The patient was informed that at any point he or she could leave the study with no repercussions or differential in patient care treatment. Patients were able to review the letter. If the patient could not read, I provided assistance by reading the letter to him or her. Each patient was provided the opportunity to ask any questions before declination or providing a signature for confirmation to participate. Once the patient signed the consent, I randomly assigned the individual patient to the music or control group. The randomization after the patient signed the informed consent decreased bias and ensured adequate recruitment for the patients in the control group. After placement in either group, a number identifier was assigned to the patient. The patient number identifiers were developed in order to compile data and ensure each patient's confidentiality. The patient number identifier was the primary patient identifier for the study.

### *Data Collection Procedure*

Each patient received a set of ear buds to keep. I provided an iPad mini tablet as the device that supplied different genres of music for the music group patients from which to choose. Pandora One, a paid satellite radio subscription that offers unlimited music commercial free, was used to obtain the various types of music. I provided the music group patients with a list of different genres of music to choose from that included soft rock, easy listening, jazz, classical, bluegrass, country, R&B, gospel, nature sounds, and pop. The patients were asked not to change music genres after selecting a genre. The patients were asked not to alter the music player at any time. Before each session with the patients, I checked with the nurse and physical therapist to make sure the 30-minute session would not interfere with the patient's care plan. Once an open time frame was established, a sign was placed on the closed door that read, "Study in progress. Study will be complete at \_\_\_\_\_. Please see the nursing station for questions". I wrote on the sign the end time for each session and taped the sign on the door. I obtained the patient's pain level by showing the patient the FPS-R with NRS [Appendix C], which indicated a zero for no pain at all and 10 being the most excruciating pain, prior to the 30 minute session. I read the instructions located below the pain scale to the patient on each pain assessment. The pain scale print was enlarged and printed on yellow paper for easier viewing for patients' as well as laminated for easy cleaning between patients. The nurse, nurse's aide, or I obtained the physiological parameters prior to the 30- minute session. After obtaining the data, I set up the music according to the genre the patient selected. I left the room once the music was set up and returned at the end of the session. At the end of the 30-minute period, I obtained the pain level for the postsession recording as well as the physiological parameters just as they had been obtained in the prior session. I obtained demographic data including that included marital status, ethnicity, gender, zip



code, insured or noninsured, as well as the reason for being admitted into the hospital from the patient's medical chart. In addition to the medical record information, because of not having access to the patient's medicine list, I asked the patient's nurse directly about the daily schedule and specific information regarding opioid dosage, route of administration, and time administered for the duration of the day. The patients were monitored in the morning between the times of 10:00 AM to 12:00 PM, early afternoon between 2:00 PM to 5:00 PM and evening between 7:30 PM to 9:30 PM.

The patients in the control group experienced no changes in their environment other than wearing the ear buds for 30 minutes without music and having the individual patient room door closed. As with the music group, before each session with the patients, I checked with the nurse and physical therapist to make sure the 30-minute session would not interfere with the patient's care plan. Once an open time frame was established, a sign was placed on the closed door that read, "Study in progress. Study will be complete at \_\_\_\_\_. Please see the nursing station for questions". I wrote on the sign the end time for each session and taped the sign on the door. The patients were monitored three times in 1 day just like the music group, during the morning between 10:00 AM to 12:00 PM, early afternoon between 2:00 PM to 5:00 PM, and evening between 7:30 PM to 9:30 PM time frames. During the designated times I acquired the pain scale measurement as well as the physiological parameters before and after each 30-minute session. As with the music group, I also recorded the type of pain opioids being administered, time of administration, and the dosage of the medication from the patient's nurse directly. I left the room during the quiet time just like with the music group and returned at the end of the 30-minute time frame to record the postsession data.

### *Reliability and Validity*

Reliability is the extent to which an instrument will produce the same results each time it is used (Cottrell & McKenzie, 2011). The instruments used in this study were the FPS-R with the NRS included and the GE Dinamap ProCare Monitor. Other studies have used the FPS-R, which verify the validity and reliability of the instrument (Huang et al., 2012; Li, Herr, & Chan, 2009; Miró & Huguet, 2004). The GE Dinamap ProCare monitor was validated and found reliable by other researchers who used the instrument during research (De Greeff, Ghosh, Anthony, & Shennan, 2010; De Greeff, Reggiori, & Shennan (2007); Gupta et al., 2009; Reinders, Reggiori, & Shennan, 2006). Reliability is based upon the quality of a measurement and it shows the consistency of each measure. Reliability is measured on a scale of 0 and 1. Test-retest reliability is used in this study. This means the same instrument was used on the same group of people at different points in time (Cottrell & McKenzie, 2011). The established FPS-R with the NRS included was the instrument used on all patients throughout the three different times of evaluation. The pain assessment was taken the same way for each patient, with the researcher reading the instructions located on the pain scale document. The patient's heart rate, blood pressure, respiratory rate, and oxygen saturation were acquired by using the GE Dinamap ProCare monitor.

According to Green and Lewis (as cited in Cottrell & McKenzie, 2011), “validity in measurement addresses the degree to which the concept or concepts under study are accurately represented by the particular items on your questionnaire, test, self-report form, or other measuring device” (p.149). The study should contain validity and accuracy. According to Bijur et al. (2001), “without valid and reliable instruments, any true effect of treatment can be obscured by measurement error, or ineffective treatments may be erroneously considered

therapeutic” (p. 1153). Concurrent criterion-related validity was used in the study. The FPS-R integrated with the NRS, which was the technique used in this study, provided a better understanding and communication for older adult’s pain intensity levels (Kim & Buschmann, 2006).

The GE Dinamap ProCare Monitor used advanced technology that displayed and retrieved crucial data more efficiently (General Electric Company, 2004). The engineering department at the hospital facility required that quality control be completed according to the manufacturer’s instruction manual to insure the equipment maintained validity and reliability.

#### *Data Analysis*

A pretest-posttest design compared the music group to the control group was used to determine if therapeutic music had any effect on the patient’s perception of pain after knee replacement surgery. The independent variable was the music. The dependent variable was the patient’s perception of pain as well as the physiologic parameters of blood pressure, heart rate, respiratory rate, and oxygen saturation. The groups compared were the music and control groups. The effect of music on blood pressure, heart rate, oxygen saturation and respiratory rate were all numeric values that were evaluated by using sample independent *t*-tests. The independent *t*-test was used to determine if there were any differences present between the music group and control group prior to the project. The confidence level for the study was set at 95% ( $\alpha=.05$ ).

The data collected were analyzed using the Statistical Package for Social Sciences (SPSS) Version 21 (SPSS Inc., Chicago, IL, USA).

## CHAPTER 4

### ANALYSIS OF DATA

The purpose of this study was to determine whether therapeutic music decreases the patient's perception of pain following knee replacement surgery. The research outcomes of this study may provide nursing and allied health professionals with a nonpharmacological option in addition to opioids to assist with pain management. The hypothesis was with music intervention, patients would experience a decrease in perception of pain, decrease in the amount of opioids taken, and improvement in the physiological parameters of blood pressure, heart rate, respiratory rate, and oxygen saturation after knee replacement surgery. The null hypothesis was music intervention would have no effect on the patient's perception of pain, amount of opioids taken, or the patient's physiological parameters of blood pressure, heart rate, respiratory rate, and oxygen saturation after knee replacement surgery.

#### *Participants*

Participants in this research study were patients who underwent elective knee replacement in an institution in the southeastern region of the United States. Sixty patients participated in the study with 30 patients in the music group and 30 patients in the control group. Forty-one of the participants were female, 19 were male. The participants ranged from 43 to 83 years of age, with a mean age of 66 years and mode of 64 years. Forty-eight patients were white, 11 were African American, and one was Asian. Fifty-eight participants had insurance while two were noninsured. Six participants were single, 41 participants were married, 10 participants were widowed, and 3 participants were divorced. The body mass index (BMI) for the patients ranged from 18.6 to 46.23. The mean BMI was 33, the median was 32.17, and the mode was 28.10. The demographics are summarized in Table 1.

Table 1.  
*Knee Replacement Surgery Patients Demographic Data*

Age	Range 43-83	Mean 66.48	Median 66	Mode 64
Insurance	Insured 58 (96.7 %)	Non Insured 2 (3.3%)		
Gender	Females 41 (68.3%)	Males 19 (31.7 %)		
Ethnicity	White 48 (80%)	African American 11 (18.3%)	Asian 1 (1.7 %)	
Marital Status	Single 6 (10 %)	Married 41 (68.3 %)	Widowed 10 (16.7 %)	Divorced 3 (5 %)
BMI	Mean 33	Median 32.17	Mode 28.10	Range 18.60-46.23

### *Results*

The research questions were:

1. Does listening to therapeutic music decrease the patient's perception of pain?
2. Does listening to therapeutic music alter physiologic parameters (blood pressure, heart rate, respiratory rate, and oxygen saturation)?
3. Does listening to therapeutic music decrease the amount of opioids taken after the initial dosing of medications?
4. Does listening to therapeutic music change the patient's length of stay?

#### *Patient Perception of Pain*

An independent-samples *t*-test was conducted to evaluate the patients' perception of pain after the 30-minute session of music intervention as compared to the patients' perception of pain after the 30-minute session of quiet time. A 95% confidence level ( $\alpha=.05$ ) was selected for this study. Levine's test for equal variances demonstrated that equal variances could be assumed and the test was significant,  $t(58) = -2.137$ ,  $p = .03$ . Patients in the music intervention group ( $M = 3.97$ ,  $SD = 2.27$ ) on average reported less pain after the 30-minute session than patients in the quiet group ( $M = 5.18$ ,  $SD = 2.12$ ). The 95% confidence interval for the difference in means

ranged from -.08 to -2.35. The null hypothesis was rejected, validating that the therapeutic music was effective at the alpha level of .05. The results are summarized in Table 2.

Table 2.  
*Output of t-Test for Independent Samples*  
*Patient Pain Levels*

Group Statistics					
	Group	N	Mean	Std. Deviation	Std. Error Mean
Baseline	Music Group	30	5.4333	2.40553	.43919
	Control Group	30	5.4333	2.04011	.37247
After Intervention	Music Group	30	3.9667	2.26983	.41441
	Control Group	30	5.1778	2.11677	.38647

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Baseline	Equal variances assumed	.298	.587	-2.137	58	.037	-1.21111	.56665	-2.34539	-.07683
	Equal variances not assumed			-2.137	57.720	.037	-1.21111	.56665	-2.34550	-.07672
After Intervention	Equal variances assumed	1.898	.174	.000	58	1.000	.00000	.57587	-1.15272	1.15272
	Equal variances not assumed			.000	56.494	1.000	.00000	.57587	-1.15338	1.15338

### Physiological Parameters

*Pretest.* For this study, the multiple variables of blood pressure (diastolic and systolic), heart rate, respiratory rate, and oxygen saturation were analyzed to determine if the parameters were different in the music group compared with the quiet group. The independent samples *t*-test was used for all of the physiological variables. At the 95% confidence level (alpha=.05), the *p*

for the independent variable *t*-test for each variable was greater than alpha (ranging from 0.358 to 0.826). The research hypothesis was rejected, and the null hypothesis supported indicating that there was not a significant difference between the music group and the quiet group for any of these variables prior to the intervention. The baseline pretest results are found in Table 3.

Table 3.

*Output of t-Test for Independent Samples Test  
Patient Physiological Parameters Pretest Baseline Results*

	Music Group (N = 30): mean (SD)	Quiet Group (N = 30): mean (SD)	df	t	p
Systolic BP	129.30 (17.69)	130.37 (19.71)	58	-0.221	0.826
Diastolic BP	66.72 (6.75)	68.28 (10.73)	58	-0.672	0.504
Heart Rate	74.02 (12.07)	76.88 (11.80)	58	-0.927	0.358
Respiration	16.53 (.92)	16.38 (1.18)	58	0.57	0.571
Oxygen Sat.	96.23 (1.79)	96.54 (2.13)	58	-0.614	0.542

BP, blood pressure; SD, standard deviation; df, degrees of freedom; sat, saturation.

*Posttest.* The independent samples *t*-test was used for all of the physiological variables. At the 95% confidence level (alpha=.05), the p for the independent variable *t*-test for each variable was greater than alpha (ranging from 0.239 to 0.660). The research hypothesis was rejected, and the null hypothesis was supported indicating that there was not a significant difference between the music group and the quiet group for any of these variables after the music intervention. The results of the posttest results after the therapeutic music and quiet time are found in Table 4.

Table 4.

*Output of t-Test for Independent Samples Test  
Patient Physiological Parameters Posttest After Therapeutic Music Results*

	Music Group (N = 30): mean (SD)	Quiet Group (N = 30): mean (SD)	df	t	p
Systolic BP	129.88 (13.96)	133.58 (19.58)	58	-0.843	0.403
Diastolic BP	67.64 (5.54)	69.80 (9.66)	58	-1.06	0.293
Heart Rate	74.63 (11.25)	78.16 (11.67)	58	-1.19	0.239
Respiration	16.60 (.94)	16.48 (1.19)	58	0.442	0.660
Oxygen Sat.	96.62 (2.39)	96.98 (2.05)	58	-0.619	0.538

BP, blood pressure; SD, standard deviation; df, degrees of freedom; sat, saturation.

*Amount of Opioids Administered*

In order to effectively run the independent samples t-test, I calculated the time interval between the opioids administered in session 1 with the opioids administered in session 2. I also calculated the time interval between opioids administered in session 2 with the opioids administered in session 3. The independent samples *t*-test was used to determine if listening to therapeutic music decreased the amount of opioids taken after the initial dosing of medications. A 95% confidence level ( $\alpha=.05$ ) was selected for this study. Levine's test for equal variances demonstrated that equal variances could be assumed and the test was not significant for time interval 1,  $t(58) = .138$ ,  $p = .665$ , nor was the test significant for time interval 2,  $t(58) = -.318$ ,  $p = .587$ . There was no difference in opioid administration between the control and intervention group. Table 5 demonstrates the results.



Table 5.

*Output of t-Test for Independent Samples Test  
Amount of Opioids Administered to the Patient*

Group Statistics					
	Group	N	Mean	Std. Deviation	Std. Error Mean
Interval	Music Group	30	3.7007	1.79177	.32713
One	Control Group	30	3.6387	1.69123	.30878
Interval	Music Group	30	2.8807	2.12022	.38710
Two	Control Group	30	3.0483	1.95747	.35738

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Time Interval	Equal variances assumed	.189	.665	.138	58	.891	.06200	.44984	-.83845	.96245
	Equal variances not assumed			.138	57.808	.891	.06200	.44984	-.83852	.96252
Time Interval Two	Equal variances assumed	.299	.587	-.318	58	.751	-.16767	.52685	-1.22226	.88693
	Equal variances not assumed			-.318	57.634	.751	-.16767	.52685	-1.22241	.88707

*Length of Stay*

The length of stay for the music group and the quiet group was analyzed using the independent samples *t*-test. At the facility where the research was conducted, the average stay in general for each patient was 3 days. A 95% confidence level ( $\alpha=.05$ ) was selected for this study. Levine's test for equal variances demonstrated that equal variances could be assumed and

the test was not significant,  $t(58) = -0.873$ ,  $p = .386$ . There was no difference in the length of stay between the music group and the quiet group. Table 6 demonstrates the results.

Table 6.

*Output of t-Test for Independent Samples Test  
Length of Stay*

Group Statistics					
	Group	N	Mean	Std. Deviation	Std. Error Mean
Length of Stay in days	Music Group	30	2.90	.885	.162
	Control Group	30	3.13	1.167	.213

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Length of Stay in days	Equal variances assumed	.431	.514	-.873	58	.386	-.233	.267	-.768	.302
	Equal variances not assumed			-.873	54.067	.387	-.233	.267	-.769	.303

*Discussion*

The purpose of this study was to determine whether therapeutic music affects the patient's perception of pain after knee replacement surgery. The independent samples *t*-tests showed that the music group patients' perception of pain reflected a significant difference from that of the control group, while the amount of opioids administered, length of stay, and physiological parameters remained unchanged with either group at the alpha level of .05. The perceived pain levels were 23% lower for the music group than the control group, which

suggests therapeutic music correlates with the administration of opioids in lowering the patient's pain levels. There were no significant differences between the music group and control group on any of the physiological parameters, amount of opioids taken, and length of stay, rejecting the research hypothesis because all the p variables were larger than the alpha level. This study has shown that music intervention has a positive effect on patients' perceptions of reducing pain levels after knee replacement surgery.

## CHAPTER 5

### CONCLUSIONS, DISCUSSIONS AND RECOMMENDATIONS

Music intervention is a safe, low cost, easy, and effective type of therapy that nurses can offer to patients who are experiencing pain (McCaffrey, 2008). This evidence based intervention works because the music acts as a distraction to the patient, allowing the patient to focus on the lyrics, sounds, and rhythm of the music instead of thinking about how much pain the patient is experiencing. The purpose of this study was to determine whether therapeutic music positively affects the patient's perception of pain after knee replacement surgery. The results of this study could provide health care professionals with an evidence-based practice that uses nonpharmacological method in addition to opioids in dealing with pain management. Patients and allied health professionals may be unaware that there are other alternatives that can be used instead of solely relying on the use of opioids.

#### *Conclusions*

Data from this research study suggests that when music intervention was used in conjunction with the administration of opioids, the patients' perceived pain levels were lower than the control group. While the patients' perceived pain levels were lower, it cannot be said the therapeutic music alone contributed to the lower pain levels because opioids were administered to each patient between the music intervals. In order to determine if the therapeutic music has a single contribution to decreasing pain levels, the researcher would have to find a patient population that is willing to have no pain medication after surgery. If the patient population was changed from surgical patients to patients who were having a painful but simple procedure, the probability of being able to use therapeutic music instead of opioids to decrease pain levels

would be more realistic. Childbirth labor could be a possible painful procedure in which therapeutic music could be a viable option.

Based on the results of this study, therapeutic music did not have any effect on the patient's length of stay, physiological parameters, or the amount of opioids taken during the first postoperative day. These results could vary depending on the type of procedure or particular surgery the patient experiences. The pain levels could also vary with different physicians and if the physicians use different techniques while performing the surgery. Because of the different techniques, one could further investigate if the pain levels differ at all between laser surgery, robotics surgery, and traditional instrument surgery. This study selected a group of physicians within the same practice. The length of stay in the orthopedic unit was determined by the physicians for a standard 3-day hospital stay. The patients who were discharged at 2 days either had knee replacement surgery before or only had a partial knee replacement. Each patient had to complete a series of tasks with physical therapy before being considered for early discharge by the physician. The amount of opioids taken by the patient was determined by the nurse by implementing the nursing assessment he or she used in managing the patient's pain levels. While each nurse managed pain for each patient, some nurses on the floor administered the opioids on a fixed time schedule, whereas other nurses waited until the patient asked for the opioids. The orthopedic units protocol in this inpatient hospital did not use patient controlled analgesia as a method of pain management in patients. While patients who had knee replacement surgery had no changes in length of stay, physiological parameters, or amount of opioids taken, patients who experienced other elective surgeries or procedures might have a different experience with music intervention.

## *Discussion*

In addition to the music intervention data, additional data were obtained during the research stages including the patients' sex, age, body mass index, ethnicity, and marital status. The demographic information obtained for this study creates the opportunity for other questions to be addressed in future research. Larger studies could investigate whether a particular demographic where music intervention makes a difference. Is there a difference in the pain levels between males and females with music intervention? Is there a particular age group that experiences a difference in pain levels after music intervention versus another age group? Do patients with larger body mass index report higher or lower pain levels than those with lower body mass index after listening to therapeutic music?

The quantitative approach was used for this study; however, one could consider approaching the topic in a qualitative approach for future research. The quantitative approach involved data collection, statistical analysis, and interpretation of the data in the form of statistics and numbers, whereas qualitative data is in the form of words, pictures, or objects. The qualitative approach could be used by completing an in-depth interview with the patients asking questions related to how they experience pain levels, therapeutic music, and their experiences postsurgery.

With the quantitative approach to research, the environment for the research is highly controlled. As a researcher I tried to maintain a consistent experience for each patient but realistically in a hospital setting that is a difficult task to achieve. After completing the research for this study, I found a few inconsistencies that could have affected the results of the study.

### *Disruptions*

Despite the efforts of keeping the patient undisturbed by placing a sign on the door, there were times individuals would go into the patient's room during the intervention or quiet time. The types of interruptions included but were not limited to patients needing assistance to the restroom, the nurse or aid moving the patient from the bed to the chair, the nurse or lab technician needing a sample, physicians making rounds, home healthcare trying to obtain information needed, or family members entering the room. If the patient moved, for example to use the bathroom or to move from the bed to the chair, the movement caused the patient to experience higher pain volumes than when assessed prior to the start of the music intervention or the controlled setting. If patients who were moved reported higher pain levels, it is reasonable to assume it was the result of the movement of the intervention or quiet time. Patients who were interrupted during the music intervention or quiet time by lab technicians needing a sample or by physicians making rounds would have been unable to focus on the music or the quiet during the time the patient was interacting with the technician or physician.

### *Pain Medication Distribution Schedule*

While the results of this study showed no significant difference between the music group and the control group, it was noted that some nurses would distribute the opioids to patients in anticipation of the pain, whereas other nurses would wait to administer the opioids when the patient's pain level would reach a certain level. In order to address this issue in future research possibilities, I would suggest doing a questionnaire with the nurses prior to starting the research process. Once the researcher knows how the nurses operate, the researcher can group together the nurses who are similar in assessments and follow one of the methods. By keeping the nursing assessment for pain medication distribution the same, the researcher is able to get more accurate

data on the amount of opioids being administered as well as the manner in which the opioids are administered with each patient.

### *Recommendations*

The first recommendation for future researchers would be to increase the sample size of the population for research. One of the weaknesses in this research was the small size of the unit, which in turn created a small sample size. In order to strengthen the study, the future researcher could broaden the sample size of the study to multiple orthopedic units in several different hospitals. The population of patients would have a better representation than this small sample size in one location. The researcher could also branch out into different population areas that could include other surgeries or painful procedures. This particular study focused on the elective knee replacement surgery; however, the results could vary depending on the type of surgery or procedure performed.

In addition to sample sizes, another suggestion would be to play therapeutic music with longer extended sessions than the session times included in this study. This study only permitted music for 30 minutes three times a day; however, allowing the patient to listen to the music throughout the length of the patient's stay would allow the patient to have more music time. In addition to lengthening the music time, the music intervention could also be spread out into a variety of different settings within the facilities.

Obtaining feedback from the nursing staff would also be valuable information for further study. Although it might be more limiting in some ways because it would depend on the work load of the nursing staff, gathering data on their experiences with the patients, such as whether they observed changes in the patients' behavior or in their level of cooperation with the staff



after listening to therapeutic music, could provide an opportunity to expose the nurses more directly to the potential benefits of therapeutic music.

This study reported data on a small number of patients during a short period of time. While the music showed significant differences in the patient's perception of pain, this study is just a starting point for further research. The results of the study were promising but preliminary. This research study was not intended to be replicated; however, it may be expanded for future projects. It is the hope that this research will be able to shed light to nursing staff and other allied health areas to recognize nonpharmacological methods, therapeutic music in particular, for treating pain levels in addition to opioids.

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# APPENDICES

## Appendix A

### ETSU IRB Approval Letter



East Tennessee State University

Office for the Protection of Human Research Subjects • Box 70565 • Johnson City, Tennessee 37614-1707  
Phone: (423) 439-6053 Fax: (423) 439-6060

#### IRB APPROVAL – Initial Expedited Review

September 9, 2013

Heather Hooks

**Re:** Effects of Music Intervention on the Patient's Perception of Pain After Knee Replacement Surgery  
**IRB#:** 0813.1s  
**ORSPA #:**

The following items were reviewed and approved by an expedited process:

- New Protocol submission, Letter of support from Novant Health, References, CV, \*ICD with HIPAA no version date, Data collection sheet, Faces pain scale

The item(s) with an asterisk(\*) above noted changes requested by the expedited reviewers.

On **September 6, 2013**, a final approval was granted for a period not to exceed 12 months and will expire on **September 5, 2014**. The expedited approval of the study *and* requested changes will be reported to the convened board on the next agenda.

The following **enclosed stamped, approved Informed Consent Documents** have been stamped with the approval and expiration date and these documents must be copied and provided to each participant prior to participant enrollment:

- Informed Consent Document (ICD (no version date) stamped 9/6/2013)

Study has been granted a Waiver or Alteration of Informed Consent, **for recruitment list only**, by George Youngberg, M.D, Chair, ETSU/VA IRB, under category:

45 CFR 46.116(d)

The research involves no more than minimal risk to the participants as the waiver applies only to the recruitment list and the study has an appropriate protocol. . The waiver or alteration will not adversely affect the rights and welfare of the subjects as the waiver applies only to the recruitment list and the study has an appropriate protocol. The research could not practically be carried out without the waiver or alteration as the



Accredited Since December 2005

waiver is necessary to identify potential participants who could be contacted for the possibility of participation (through an ICD). Providing participants additional pertinent information after participation is not appropriate as it is a recruitment list only.

The Chair also granted a HIPAA waiver per recruitment list only required to identify potential participants.

Federal regulations require that the original copy of the participant's consent be maintained in the principal investigator's files and that a copy is given to the subject at the time of consent.

**Projects involving Mountain States Health Alliance must also be approved by MSHA following IRB approval prior to initiating the study.**

Unanticipated Problems Involving Risks to Subjects or Others must be reported to the IRB (and VA R&D if applicable) within 10 working days.

Proposed changes in approved research cannot be initiated without IRB review and approval. The only exception to this rule is that a change can be made prior to IRB approval when necessary to eliminate apparent immediate hazards to the research subjects [21 CFR 56.108 (a)(4)]. In such a case, the IRB must be promptly informed of the change following its implementation (within 10 working days) on Form 109 ([www.etsu.edu/irb](http://www.etsu.edu/irb)). The IRB will review the change to determine that it is consistent with ensuring the subject's continued welfare.

Sincerely,  
George Youngberg, M.D., Chair  
ETSU/VA Medical IRB

Appendix B

Forsyth Medical Center Facility Consent



Forsyth Medical Center  
3333 Siles Creek Parkway  
Winston-Salem, NC 27103

April 5, 2013

To: Dr. Susan Bramlett Epps

Assistant Professor, Allied Health Services,

Director, ETSU 1000 Program

This serves as notification that Heather Hooks has been cleared for a clinical rotation at Novant Health effective April 5, 2013.

Glenda Livengood, RN, MHA, MBA, CNOR

Director of Novant Health Student Programs

## Appendix C

### IASP Faces Pain Scale and Instructions

#### Faces Pain Scale – Revised (FPS-R)

In the following instructions, say "hurt" or "pain," whichever seems right for a particular child.

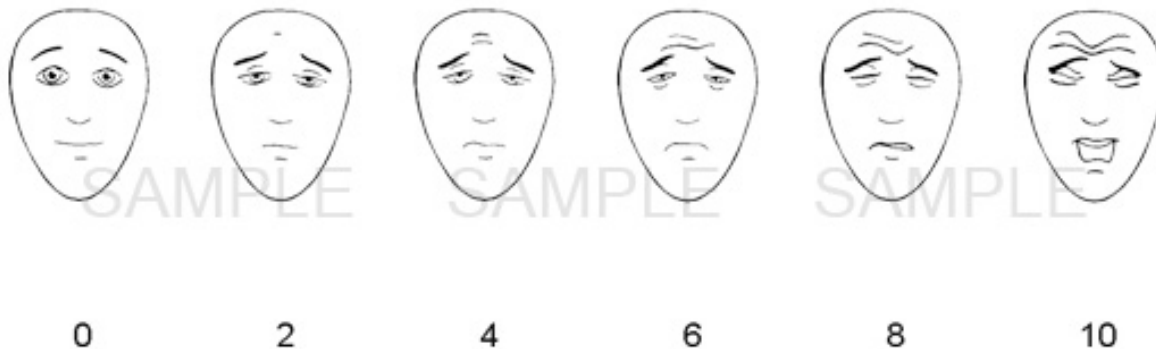
"These faces show how much something can hurt. This face [point to left-most face] shows no pain.

The faces show more and more pain [point to each from left to right] up to this one [point to right-most face] - it shows very much pain. Point to the face that shows how much you hurt [right now]."

Score the chosen face 0, 2, 4, 6, 8, or 10, counting left to right, so '0' = 'no pain' and '10' = 'very much pain.' Do not use words like 'happy' and 'sad'. This scale is intended to measure how adults feel inside, not how their face looks.

Permission for Use. Copyright of the FPS-R is held by the International Association for the Study of Pain (IASP) ©2001. This material may be photocopied for non-commercial clinical, educational, and research use. For reproduction of the FPS-R in a journal, book, or web page, or for any commercial use of the scale, request permission from IASP online at [www.iasp-pain.org/FPS-R](http://www.iasp-pain.org/FPS-R).

Sources. Hicks CL, von Baeyer CL, Spafford P, van Korlaar I, Goodenough B. The Faces Pain Scale – Revised: Toward a common metric in pediatric pain measurement. *Pain* 2001;93:173-183. Bieri D, Reeve R, Champion GD, Addicoat L, Ziegler J. The Faces Pain Scale for the self-assessment of the severity of pain experienced by children: Development, initial validation and preliminary investigation for ratio scale properties. *Pain* 1990;41:139-150.  
(fold along dotted line)





# Appendix D

## IASP Consent

East Tennessee State University Mail - FPS-R Permission Request



Heather Scott <[scotthe@goldmail.etsu.edu](mailto:scotthe@goldmail.etsu.edu)>

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### FPS-R Permission Request

2 messages

---

**dominica.myers@iasp-pain.org** <[dominica.myers@iasp-pain.org](mailto:dominica.myers@iasp-pain.org)>  
To: [dominica.myers@iasp-pain.org](mailto:dominica.myers@iasp-pain.org)  
Cc: [scotthe@goldmail.etsu.edu](mailto:scotthe@goldmail.etsu.edu)

Wed, Nov 28, 2012 at 3:02 PM

FNAME: Heather  
LNAME: Hooks  
EMAIL: [scotthe@goldmail.etsu.edu](mailto:scotthe@goldmail.etsu.edu)  
PHONE: 336-749-9087  
ADDRESS: 228 Mallard View Lane  
ADDRESS\_2:  
CITY: Winston-Salem  
STATEPROVINCE: NC  
POSTALCODE: 27127  
COUNTRY: United States  
REQUESTER\_ROLE: Author  
OTHERROLE:  
INTENDEDUSE: I am a graduate student working on my thesis. I would like to use the tool to collect the pain intensity of my patients before and after music intervention.  
INTENDEDAUDIENCE: Intensive care patients in step down units as well as the allied health field.  
PUBLICATION\_TITLE: Thesis for graduate school  
PIECE\_TITLE: Effects of music intervention on intensive care step down unit patient's perception of pain  
PUBLISHER: Heather Hooks  
DISTRIBUTION: Handout,Other  
DISTRIBUTION: Handout,Other  
OTHERDISTRIBUTION: also displayed in my thesis  
USES: I hope to have 60 to 80 patients  
CHARGE: No  
FUNDING: No  
FUNDINGINFO:  
PUBDATE: I hope Summer of 2013  
TRANSLATE\_MODIFY: No  
TRANSLATION\_MODIFICATION:  
COMMENT: I am a graduate student at East Tennessee State University. I am looking for an assessment tool that will evaluate the pain intensity of my patients before and after they listen to music.  
EXAMPLEFPSR:  
CAPTCHA: AK874

---

**Dominica Myers** <[Dominica.Myers@iasp-pain.org](mailto:Dominica.Myers@iasp-pain.org)>  
To: "[scotthe@goldmail.etsu.edu](mailto:scotthe@goldmail.etsu.edu)" <[scotthe@goldmail.etsu.edu](mailto:scotthe@goldmail.etsu.edu)>

Wed, Nov 28, 2012 at 4:02 PM

Hi Heather,

Since this is for a graduate thesis, you are free to use the Faces Pain Scale – Revised (for a PhD thesis, you will need a permission letter from us). Here are some things to keep in mind when you use the scale:

1. Please be sure to follow the FPS-R Instructions closely. Instructions are available on the IASP website.

[https://mail.google.com/mail/u/0/?ui=2&ik=051838b3b9&view=pt&search=inbox&th=13b489d2a2b80647\[1/2/2013 12:26:48 PM\]](https://mail.google.com/mail/u/0/?ui=2&ik=051838b3b9&view=pt&search=inbox&th=13b489d2a2b80647[1/2/2013 12:26:48 PM])

East Tennessee State University Mail - FPS-R Permission Request

2. If you reprint the scale in your paper, please be sure to properly cite it (citation is available in the instructions).
3. The faces should not be modified or redrawn in any way.

Best of luck with your thesis, and please let us know if you have any further questions or concerns.

Kind Regards,

**Dominica Myers**

*Executive Assistant*

*SIG and Chapters Liaison*

[Dominica.Myers@iasp-pain.org](mailto:Dominica.Myers@iasp-pain.org)

*International Association for the Study of Pain*

*111 Queen Anne Ave N, Suite 501*

*Seattle, WA USA 98109*

*1.206.283.0311 X238 (office)*

*Global Year Against Visceral Pain October 2012 – October 2013*

*Save the Date for the 15th World Congress on Pain in Buenos Aires: October 7-11, 2014*

**From:** [dominica.myers@iasp-pain.org](mailto:dominica.myers@iasp-pain.org) [mailto:[dominica.myers@iasp-pain.org](mailto:dominica.myers@iasp-pain.org)]

**Sent:** Wednesday, November 28, 2012 12:03 PM

**To:** Dominica Myers

**Cc:** [scotthe@goldmail.etsu.edu](mailto:scotthe@goldmail.etsu.edu)

**Subject:** FPS-R Permission Request

[Quoted text hidden]

[https://mail.google.com/mail/u/0/?ui=2&ik=051838b3b9&view=pt&search=inbox&th=13b489d2a2b80647\[1/2/2013 12:26:48 PM\]](https://mail.google.com/mail/u/0/?ui=2&ik=051838b3b9&view=pt&search=inbox&th=13b489d2a2b80647[1/2/2013 12:26:48 PM])

# Appendix E

## Informed Consent for Participant

### Informed Consent for Participant

**Title of Project:** Effects of Music Intervention on the Patient's Perception of Pain After Knee Replacement Surgery

**Principle Investigator:** Heather E. Hooks, CNMT, BS  
Novant Health Forsyth Medical Center  
3333 Silas Creek Parkway  
Winston-Salem, NC 27103  
(336) 749-9087  
[scotthe@goldmail.etsu.edu](mailto:scotthe@goldmail.etsu.edu)

#### Introduction:

Dear potential participant: You are invited to participate in a research study to see if music intervention has the potential to assist pain medications in relieving pain. With the results of this study it may be helpful in educating allied health professionals of alternative methods of treating pain.

This Informed Consent will give an explanation of being a participant in this research study. It is important that you read the material carefully and then decide if would like to volunteer.

- 1. Purpose of this study:** The purpose of this study is to determine if intervention music has an effect on adult patient's perception of pain after knee replacement surgery.
- 2. Procedures to be followed:** If you consent to participate in this study, your blood pressure, breathing rate, and heart rate will be collected each time within the three sessions. The amount of pain medications and how often the pain medications are taken will also be recorded from the patient medical chart. In addition to the data collected, you may be selected to be part of a non music group or a music group. The ear buds will be provided for each participant to keep. The music group will have a choice of preselected genres of music whereas the non music group will hear nothing for 30 minutes. There will be three music or non-music sessions throughout the period of the day. After each 30 minute period the pain scale will be administered. The pain scale is a self-rating scale where participants will point to the face that is describing his or her pain level. There will be no restrictions or changes to the current medical care provided. You will receive pain medications and medical care as the doctors have prescribed.
- 3. Duration of this study:** Participants will be engaged in either a music or non-music group, with three sessions scheduled throughout the period of one day. The sessions will be 30 minutes long during the morning, early afternoon, and evening times according to each patient's schedule.



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SEP 05 2014

ETSU/VA IRB

APPROVED  
By the ETSU/VA IRB

SEP 06 2013

By *HE*  
Chae IRB Coordinator

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4. **Alternative procedures:** There is no alternative procedures/treatment. If you decide to decline from the study, you will continue to receive medical care as the doctor prescribed.
5. **Foreseeable risks:** There are no foreseeable risks for you as a participant in this study. However, unforeseeable risks are possible.
6. **Costs:** There will be no expense for anyone participating in this study.
7. **Confidentiality:** All the information gathered for this study will be kept confidential for each individual. Your participation in this research process is confidential. Only group information will be reported. Each participant will receive a random identification number that will be used for each person throughout the duration of the study. All data acquired will be kept in a secure password protected location, which will be kept for at least 5 years after completion of the research study. Your rights and privacy will be maintained, the Secretary of the Department of Health and Human Services, ETSU IRB and personnel particular to this research have access to the study records. Your records will be kept completely confidential according to current legal requirements. They will not be revealed unless required by law, or as noted above.
8. **Voluntary Participation:** Your participation in this research is voluntary. You do not have to participate and can discontinue your involvement in the study at any time. If you decided to quit or refuse to participate, the health care treatment will remain as the physician ordered. If you choose to discontinue your involvement with this research study, please contact Heather Hooks at (336) 749-9087.
9. **The benefits for you to participate in this study:** By being a participant in this study, if selected for the music group you will be able to listen to the music of your choice from a preselected list or if you are selected to the non music group you can wear the ear buds with no music. The results of this study may provide us with knowledge to help educate health care professionals to be able to keep patients comfortable without having as many of the negative side effects from pain medications.
10. **Contact for questions:** At any time during the study process or after the music intervention has been administered; please contact Heather Hooks at 3336-749-9087. You may also contact Dr. Susan Epps at 423-547-4911 or by email using epps@etsu.edu. You may also call the Chairman of the Institutional Review Board at 423-439-6054 for any questions you may have as your rights as a research subject. If you have questions or concerns about the research and want to talk to someone outside of the investigator, you may call an IRB Coordinator at 423-439-6055 or 423-439-6002.



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SEP 05 2014

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By the ETSU/VA IRB

SEP 06 2013

By   
Chair IRB Coordinator

**11. Authorization to Use and Disclose Protected Health Information for Research Purposes:**

The privacy law, Health Insurance Portability & Accountability Act (HIPAA), protects my individually identifiable health information (protected health information). The privacy law requires me to sign an authorization (or agreement) in order for researchers to be able to use or disclose my protected health information for research purposes in the study entitled: Effects of Music Intervention on the Patient's Perception of Pain after knee replacement surgery.

I authorize Heather Hooks CNMT, BS to use and disclose my protected health information for the purposes described below. I also permit my doctors and other health care providers to disclose my protected health information for the purposes described below.

**My protected health information that may be used and disclosed includes:**

- Demographic information, pain medications (administration, dosage, and time given), blood pressure, heart rate, breathing rate, pain level, body mass index, patients room number, medical record number, initial diagnoses, insurance/non-insured.

**The Investigator, Heather Hooks CNMT, BS may use and share my health information with:**

- The East Tennessee State University Human Research Protections Program (HRPP) Institutional Review Board Administration when the researcher or the research site is undergoing *Quality Improvement Program (QIP)* auditing.
- The James H. Quillen Veterans Affairs Medical Center Office of Research & Development when the researcher or the research site is undergoing *Quality Improvement Program (QIP)* auditing.
- Government representatives, when required by law
- Novant Health Forsyth Medical Center

Once my health information has been disclosed to anyone outside of this study, the information may no longer be protected under this authorization. The investigator, Heather Hooks CNMT, BS and Novant Health Forsyth Medical Center agree to protect my health information by using and disclosing it only as permitted by me in this Authorization and as directed by state and federal law.

**I do not have to sign this Authorization. If I decide not to sign the Authorization:**

- It will not affect my treatment, payment or enrollment in any health plans nor affect my eligibility for benefits.
- I cannot be allowed to participate in this research study.



**After signing the Authorization, I can change my mind and:**

- Not let the researcher disclose or use my protected health information (revoke the Authorization).
- If I revoke the Authorization, I will send a written letter to: Heather Hooks CNMT, BS to inform him/her of my decision.
- If I revoke this Authorization, researchers may only use and disclose the protected health information already collected for this research study.
- If I revoke this Authorization my protected health information may still be used and disclosed should I have an adverse event (a bad effect, or experience something unanticipated).
- If I change my mind and withdraw the authorization, I may not be allowed to continue to participate in the study.

This Authorization does not have an expiration date.

If I have not already received a copy of the Privacy Notice, I may request one by contacting the Privacy Officer. If I have any questions or concerns about my privacy rights, I should contact East Tennessee State University, James H. Quillen College of Medicine Privacy Officer, Paula Wright, at 423-433-6074.

**Results of the study:**

Results of this study will be included in a thesis submitted to East Tennessee State University and may be published. Your name will not appear on any documentation.

**Consent to participate:**

I have read the information provided to me and have had all my questions answered. I understand that I do not have to participate in this study and can discontinue my voluntary involvement at any time. I understand that by not participating in the study, my care will not be altered in any way. I do consent to participating in this research study. In addition, I am authorizing the use and disclosure of my protected health information for research purposes as described above. I have received a copy of this information for my own use.

If you agree to take part in this research study and the information outlined above, please sign your name and indicate the date below.

\_\_\_\_\_  
Participant's Signature Date \_\_\_\_\_

\_\_\_\_\_  
Participant's Printed Name Date \_\_\_\_\_

\_\_\_\_\_  
Investigator's Signature Date \_\_\_\_\_

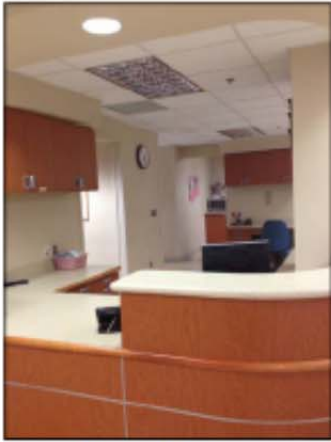


APPROVED  
By the ETSU/VA IRB  
SEP 05 2014  
ETSU/VA IRB  
SEP 06 2013  
By [Signature]  
Chair IRB Coordinator

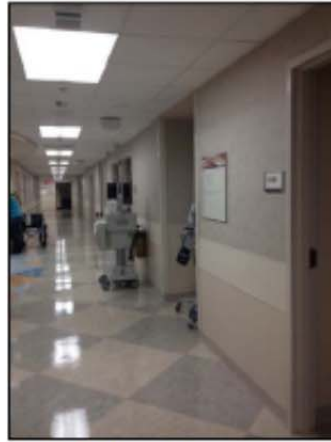
Appendix F

Orthopedic Floor Plan and Photographs

# Orthopedic Floor Plan and Photographs



Nurses Station



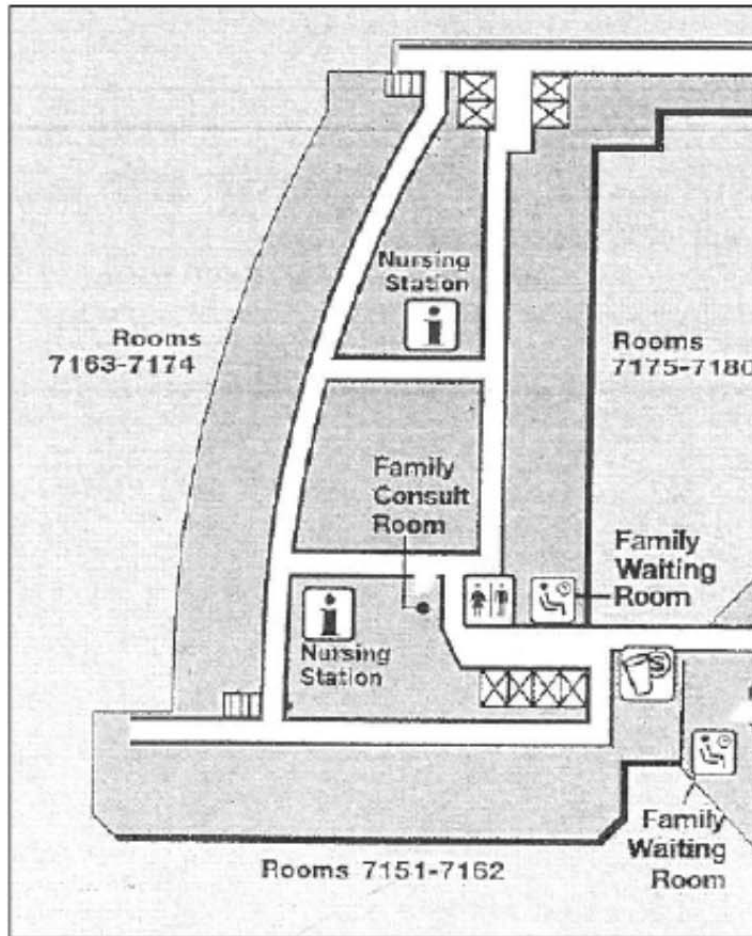
Hallway View



Hallway View



Hallway View



Unit Floor Plan

## VITA

### HEATHER E. HOOKS

- Education: Public Schools, Winston-Salem, North Carolina
- A.S. Business Administration, Forsyth Technical Community College, Winston-Salem, North Carolina 2009  
Graduated High Honors
- A.S. Nuclear Medicine Technology, Forsyth Technical Community College, Winston-Salem, North Carolina 2009  
Graduated High Honors
- B.S. Allied Health, East Tennessee State University, Johnson City, Tennessee 2011  
Graduated Cum Laude
- M.S. Allied Health, East Tennessee State University Johnson City, Tennessee 2014
- Professional Experience: Nuclear Medicine Technologist, Forsyth Medical Center Winston-Salem, North Carolina 2011
- Office/Financial Manager, Loftis Companies Winston-Salem, North Carolina 2005 –Present
- Professional Certifications: Certified Nuclear Medicine Technologist 2009-Present  
Certificate Number 032970
- Certified in Cardiopulmonary Resuscitation
- Honors and Awards: Graduate School Thesis Scholarship Summer, 2013  
East Tennessee State University
- Member, Association of Interprofessional Healthcare Students (AIHS), East Tennessee State University
- Member, Allied Health Student Association (AHSA)  
East Tennessee State University



Member, Sigma Alpha Lambda  
East Tennessee State University