EFFECT OF MUSIC LISTENING THERAPY ON ANXIETY AND INTUBATION TIMES

FOLLOWING CARDIOVASCULAR SURGERY

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Introduction

Introduction

Coronary heart disease is the leading cause of death for men and women in the United States, affecting 1 in 4 Americans (American Heart Association, 2012a; Franciscan St. Francis Health, 2011). In 2006, the World Health Association estimated that 2.5 million deaths will be due to cardiovascular disease worldwide by the year 2020 (Mandel, Hanser, Secic, & Davis, 2007). Coronary artery bypass graft (CABG) and valvular replacement surgeries are two of the most common procedures currently utilized to treat patients with coronary heart disease (American Heart Association, 2012b).

Cardiovascular diseases are costly, not only in medical expenses, but also in morbidity, mortality, and personal stress, accounting for 22% of total cost of all illness, injuries or death for 2007 (National Institutes of Health, 2010). Under the new proposed HealthCare Plan, people with pre-existing conditions may have to pay higher premiums for health care coverage. Some states will only provide coverage through the state, and not federal programs (Healthcare.gov, 2012), resulting in more out of pocket expenses. Surgical procedures to treat cardiovascular diseases require inpatient hospitalization, including mechanical ventilation, creating astronomical health care costs.

Having heart disease is stressful (Major Hospital, 2000-2012). Patients diagnosed with heart disease may have a high likelihood for anxiety due to personal stress,

regardless of whether or not previously predisposed to anxiety (Horne-Thompson & Grocke, 2008). Major metabolic, physical, and psychological stress are associated with CABG surgery (Nilsson, 2009a). Anxiety may begin for patients when the decision is made to undergo surgery, and may continue for up to 3 months after surgery (Nilsson, 2009a; Twiss et al., 2006). High levels of stress after surgery may worsen long-term psychologic outcomes (Nilsson, 2009a). Postoperative anxiety increases sensitivity to noise, resulting in sleep deprivation that can increase the duration of hospital stay. Patients with high levels of anxiety preoperatively may experience higher levels of postoperative pain and analgesic requirements (Nilsson, 2009b).

Stress caused by mechanical ventilation increases anxiety, increases heart rate (HR), blood pressure (BP), and respiratory rate (RR), and increases neurohumoral responses with potential for destructive anxiety syndrome (Hunter et al., 2010; Lee, Chung, Chan, & Chan, 2005). Stress and anxiety may prevent ventilator weaning, and may lead to difficulty in communication, and delirium (Hunter et al., 2010). Standard treatment for anxiety and distress associated with mechanical ventilation is administration of various sedative agents intravenously (Hunter at al.; Lee et al.). Utilization of sedatives to treat anxiety during weaning of mechanical ventilation may cause side effects, such as respiratory depression, which can prolong weaning and rehabilitation (Hunter et al.). Patient and nurse satisfaction was high with use of music therapy in combination with other therapies, to effectively treat anxiety for patients who are being weaned from mechanical ventilation (Hunter et al., 2010).

In Twiss et al.'s (2006) study, music listening perioperatively and postoperatively reduced anxiety in patients undergoing CABG or valve replacement surgery. Music therapy demonstrated significant decreases in anxiety for terminally ill

patients after a single session. Patients required a shorter period of mechanical ventilatory support in the music listening group compared with the control group after cardiovascular surgery (Twiss et al., 2006). Self-report demonstrated that a single music therapy session can reduce anxiety and improve quality of life for terminally ill patients (Horne-Thompson & Grocke, 2008). Relaxing music in combination with pharmacologic agents reduces stress after cardiovascular surgery (Nilsson, 2009a). Music therapy research needs to be continued to provide additional findings to establish and support the validity of its use, especially with cardiac surgery.

Background and Significance

Music therapy has been recorded for several centuries as being an effective adjunct to soothe and provide comfort. Flute-like instruments disinterred from Cro-Magnum and Neanderthal remains suggest that music has been around since Prehistoric times (Conrad, 2010). Scholars, such as Robert Dunbar, believed that drums beating, voices chanting, and bodies swaying may have indicated religious musical rituals existed to invoke deindividuation. The oldest form of music utilized for healing has been depicted by harp-playing priests and musicians in frescos from 4000 BCE. Performance of *Codex haburami* (hallelujah to the healer) was given as reimbursement for medicinal services. Music was utilized to dispel evil spirits in 2000 BCE by the Assyrians. David played the harp for King Saul in I Samuel 16:33 in the Bible, and "Saul was refreshed, and was well,…" (Thomas Nelson, Inc., 1976, p. 474).

In ancient Greece, one of the first applications of music therapy was utilized to conquer passion. Plato believed music to be sovereign because of the effects rhythm and harmony have on the soul, "imparting grace, if one is rightly trained" (Conrad, 2010, p. 1980). The Pythagoreans examined the relationship between various rhythms and the

effects on humans, and Plato took this information to assist in development of western music. Aristotle focused on cathartic properties of music, believing music could help overcome certain feelings, with mystic music allowing healing and purifying of the soul. Plato and Aristotle held different views of music, but both believed that music could heal (Conrad, 2010).

During the Middle Ages, music was highly regarded for sustaining wellness, and was believed to heal the psyche, and thus heal the body. Specific musical applications were used for defined diseases, for example, using the flute and harp as the remedy for gout. Into the late 19th century, beliefs slowly changed from the magical to a growing interest in the physiology of acoustics, pioneered by Herman von Helmholtz. The research results of von Helmholtz were utilized to apply music in a defined clinical setting (Conrad, 2010).

Nightingale (1969) realized that music could be beneficial if provided by human voices, wind instruments, or stringed instruments, providing continuous sound (Nightingale, 1969). One of the early documented uses of music in the 20th century was recorded by Evan O'Neill Kane in *JAMA*. Kane used music from a phonograph in 1914 in the operating room during surgery after seeing its effects in the recovery wards. W P Burdick published Kane's account in the *American Yearbook of Anesthesia and Analgesia* the following year, stating that music reduced anxiety prior to surgery, and patients were better able to tolerate induction of anesthesia. Music therapy has been used for more than 100 years for promotion of sleep, decreasing anxiety associated with surgery, and facilitating the effects of local anesthesia (Chan, 2007).

Veterans have been entertained by music as early as World Wars I and II, as amateur and professional musicians traveled to play music for patients in Veterans

hospitals who had suffered from both physical and emotional trauma during the wars (American Music Therapy Association, 1998-2011). Women's military bands welcomed injured men home in hospital ships, performed for soldiers at hospitals, and provided formal concerts in hospital theatres and dances. Womens' bands were an integral part of the Army Reconditioning Program for the injured during World War II, forming a bond between the musicians and the medical community (Sullivan, 2007).

Research has suggested music intervention during medical procedures has positive results: decreased postoperative pain, reductions in hemodynamic variability, decreased need for sedatives and analgesics, and overall improvement in the postoperative recovery period (Chan, 2007; Chang, Luo, & Yeh, 2004; Conrad, 2010; Horne-Thompson & Grocke, 2008; Hunter et al., 2010; Mandel et al., 2007; Lee et al., 2005; Metzger, 2004; Nilsson, 2009a; Nilsson, 2009b; Sendelbach, Halm, Doran, Miller & Gaillard, 2006; Sullivan, 2007; Twiss et al., 2006; Voss et al., 2004). Music therapy is an effective method to enhance motivation for rehabilitation following cardiac events. Music therapy may serve as an adjunct to medical treatment for cardiovascular disease, and can also be effective in stress management during cardiovascular rehabilitation (Metzger, 2004).

Cardiac rehabilitation can reduce mortality by 25% for patients after myocardial infarction (Mandel et al., 2007). Mandel et al. (2007) compared the effects of music as an adjunct in reducing stress for patients in cardiac rehabilitation, with cardiac rehabilitation without music. The results of Mandel et al.'s research showed reduction of stress through utilization of music, and blood pressure improved as stress was reduced. Listening to music has been beneficial in promoting relaxation and reducing anxiety for patients following surgery.

Today, in the 21ˢᵗ century, patients in cardiac rehabilitation programs focus on total well-being, including change of diet, smoking cessation, weight management, exercise, and stress management. Music can be beneficial in stress management, and can enhance motivational and behavioral management needs for patients in cardiac rehabilitation (Metzger, 2004). Music has a calming effect, altering physiologic parameters as well as reducing discomfort and pain, and may lead to lower doses of analgesics postoperatively (Chan, 2007). Music creates a distraction or diversion away from pain and anxiety, simulating the relaxation response (Voss et al., 2004).

Soothing music can be a welcome addition to providing a healing environment for patients undergoing CABG or other cardiovascular surgeries, and can decrease anxiety, decrease intubation time, and decrease serum cortisol levels (Nilsson, 2009a). Music is also being used to decrease pain perception, enhance the effect of pharmacological sedation, decrease anxiety and depression, reduce stress-related cardiovascular and endocrinologic reactions, improve mood, increase relaxation, and reduce delirium. Use of multidisciplinary, patient-centered, holistic, non-pulmonary interventions may be able to shorten the weaning process for patients mechanically ventilated (Hunter et al., 2010).

Music is not harmful, is easy to engage in, and inexpensive. Music can be utilized by nurses without contraindications, and can reduce pharmacological therapy and maximize promotion of comfort to patients (Chan, 2007; Lee et al., 2005). Soothing music can also be used to decrease pain and anxiety by increasing oxytocin levels in open-heart surgery patients. Music listening during bedrest after open-heart surgery increases oxytocin secretion, with a causal relation from psychological (music makes patients feel good and relaxed) to the physical (oxytocin release) (Nilsson, 2009b).

According to Twiss et al. (2006) music listening is the attendance to eloquent arrangements of sound and silence, and is the intervention utilized in the current study. Music has several effects, including improvement of motivation and mood, promoting feelings of relaxation, releasing endorphins to facilitate pain relief and lower vital signs, and decreasing oxygen requirements and serum lactic acid levels (Twiss et al.). Twiss et al. conducted a study of two groups of patients over the age of 65 undergoing cardiovascular surgery, with one group listening to music and the other group receiving care as usual. The results of Twiss et al.'s study supported other studies. Anxiety was reduced, and intubation time was decreased following CABG and valvular surgery in older adults listening to music compared with older adults who did not listen to music. The authors concluded that strong evidence exists for utilizing music listening as an independent nursing intervention for providing a healing environment for patients during and after uncomplicated CABG and valvular surgery, decreasing anxiety and improving recovery (Twiss et al.). This study will validate the findings of Twiss et al.'s study.

Statement of Problem

Music therapy in the acute clinical care setting has not been utilized on a wide spread basis for patients undergoing cardiovascular surgery. Patients receiving mechanical ventilation need to be supported and weaned as quickly and safely as possible. Cardiac surgery is stressful, and treatment regimens should include ways to reduce anxiety and pain for patients. Patients receiving pharmacological agents continue to experience pain and anxiety postoperatively, leading to poor outcomes not conducive to healing. Music therapy can reduce anxiety, pain, intubation times, hospitalization, and prolonged recovery (Twiss et al., 2006).

Purpose of the Study

The purpose of this study is to examine the effects of music listening therapy on postoperative anxiety and intubation times for two groups of patients following cardiovascular surgery: one group listening to music, and the other group not listening to music (Twiss et al., 2006).

Research Questions

1. What is the difference in postoperative anxiety test scores after CABG or valve replacement surgery in older adult patients who listen to music compared with a control group of older patients who do not listen to music?

2. What is the difference in intubation time after CABG or valve replacement surgery in patients who listen to music compared with a control group that does not listen to music?

Definition of Terms

Postoperative Anxiety: Conceptual.

State anxiety is defined as the temporary emotional response to a stressful situation, not necessarily an anxiety trait present as part of the patient's psychological makeup (Spielberger, 1990). State anxiety was chosen, with the premise that state anxiety would best be reflected by the change in anxiety level after music intervention without burdening participants by answering numerous trait anxiety questions (Twiss et al., 2006).

Postoperative Anxiety: Operational.

Postoperative anxiety will be measured by the Spielberger State Trait Anxiety Inventory (STAI). The state anxiety portion of the test consists of 20 phrases that the participants will answer using a 4-point Likert scale (Spielberger, 1983).

Intubation Time: Conceptual.

Intubation is defined as insertion of endotracheal tube, beginning at the time the patient leaves the operating room and ending when the patient is extubated in the Intensive Care Unit (ICU) (Twiss et al., 2006).

Intubation Time: Operational.

Differences between the two groups in minutes of intubation time will be measured (Twiss et al., 2006).

Music Listening: Conceptual.

Music listening is defined as "attending to the eloquent arrangement of sound and silence" (Twiss et al., 2006, p. 225).

Music Listening: Operational.

Music was purchased from Prescriptive Music Inc. for the study, consisting of six compact discs (CDs) with different types of music that have been known to precipitate relaxation and calming effects for hospitalized patients. Participants chose one of the six CDs for music listening based on preference.

Older Adults: Conceptual.

Older adults are defined as greater than 65 years of age admitted to an acute care setting for CABG or valve replacement surgery (Twiss et al., 2006).

Older Adults: Operational.

Older adults are defined as greater than 65 years of age.

Organizing Framework

The organizing framework for this study is based on the writings of Florence Nightingale (1992), proposing that nurses provide a therapeutic environment as one providing an integrative network of spiritual, physical, and psychological factors having

an additive effect on creation of a healing or healthy place. Music as a therapeutic intervention will be investigated for the current study to assist in altering the environment to reduce anxiety and shorten intubation times for patients following CABG or valvular surgery.

Limitations

This study is limited to a small convenience sample of patients admitted to the Cardiovascular ICU following cardiovascular surgery, and may not represent all patients in all hospitals or over an extended period of time. Results could be limited due to unforeseen complications during or following surgery, and could interfere with internal validity. Unforeseen complications could extend intubation time, and would interfere with weaning and completion of the STAI on the third posteroperative day.

Assumptions

1. Patients undergoing surgical treatment for coronary artery disease (CAD) and/or valvular heart disease (VHD) experience anxiety before surgery and up to 3 months following surgery.

2. Anxiety can increase postoperative pain, lengthen hospital stay, and lengthen recovery time.

3. Nursing interventions of music listening targeted at reducing psychological and physical stress associated with surgery and intubation may reduce postoperative sedation and allow for early extubation.

Summary

Anxiety is experienced by patients as soon as the decision is made to proceed with cardiovascular surgery, and can last for up to 3 months postoperatively. Current treatment modalities for anxiety consist of pharmacological sedative and anxiolytic agents to treat

pain and decrease anxiety, resulting in increased length of intubation, lengthened hospitalization, and poor outcomes. The current study is a replication of Twiss et al.'s (2006) study. The purpose of the study is to determine differences in postoperative anxiety and intubation times in patients following cardiovascular surgeries in two groups of patients, with one group receiving care as usual and the second group receiving care as usual along with music listening.

The framework for the study is Nightingale's (1969) philosophy to provide a therapeutic environment for patients in order to promote healing. Music listening is one treatment modality readily available to nurses, and can be implemented with minimal time and no expense to patients.

Findings for the study will provide information for nurses for improving care of patients following cardiovascular surgery by providing a therapeutic environment conducive to healing through music listening. Patients will be given the option to choose music based on preference.

Chapter II

Review of Literature

Introduction

Music listening therapy used as an adjunct to traditional medicine has been an effective anxiolytic for patients undergoing cardiovascular surgery (Twiss et al., 2006). Current research supports utilization of this treatment modality as a safe and inexpensive intervention for nurses to employ during normal routine postoperative care (O'Regan & Wills, 2009). Music listening decreases sedative and anxiolytic use, reduces intubation time, and creates an environment conducive to healing (Twiss et al., 2006).

The purpose of this study is to examine the effects of music listening therapy on postoperative anxiety and intubation times for two groups of patients following cardiovascular surgery: one group listening to music, and the other group not listening to music (Twiss et al., 2006).

Organizing Framework

The organizing framework for the study is based on Florence Nightingale's (1992) philosophy of a therapeutic environment, one that is conducive to rest and recovery (Twiss et al., 2006). A therapeutic environment provides a network of physical, spiritual, and psychological factors having an additive effect on creating a healing or a healthy place (Cmiel, Karr, Gasser, Oliphant, & Neveau, 2004; Felgen, 2004, as cited in Twiss et al., 2006).

Nightingale (1969) recognized the importance of music in the canon of noise, stating the effect of music on ill patients being "scarcely at all noticed" (p. 57). Nightingale recognized the beneficent effect of the human voice and wind instruments capable of producing continuous sound. In Nightingale's opinion, strong piano selections with no continuous sound should not be utilized, stating the effect "will damage the sick" (Nightingale, 1969, p. 58).

Music has been broadly defined as attending to eloquent arrangements of sound and silence. Music improves mood and motivation, along with promotion of relaxation. Music decreases pain, blood pressure, heart rate, respiratory rate, oxygen consumption, and serum lactic acid levels. In a study by Yung, Chui-Kam, & Chan (2002), music significantly reduced anxiety in an experimental group of 30 Chinese men undergoing transurethral resection of the prostate.

Williams (1998) recognized the importance of adding therapeutic applications to environments of patients in acute care hospitals. Therapeutic landscapes were described as places, settings, situations, locales, or milieus encompassing both physical and psychologic environments. Therapeutic environments are associated with treatment or healing, as well as maintenance of health and well-being (Williams, 1998).

Twiss et al.'s study (2006) utilized music selections purchased from Prescriptive Music Inc. (Prescriptive Music, Woodland Hills, CA; Prescriptive Music, 2004), comprised of six CD's with different types of music. The musical selections have been shown to precipitate relaxation and to calm hospitalized patients.

The music selections were based on the characteristics of clarity (familiar melodies from classical motion pictures), timeless (inspired by letters from individuals testifying of qualities inherent in music), towards (tender, spontaneous piano

improvisation prompted by real-life experiences), universe (synthesized compositions blending thought and sense into an ambient space), and essence (original and traditional compositions unveiling therapeutic bonds of cello and piano). Nineteen out of 30 times patients chose selections based on clarity, defined as "a host of familiar melodies selected from classical motion pictures" (Twiss et al., 2006, p. 227).

Clinical studies have shown a decrease in anxiety at the time of surgery while patients listened to music. Twiss et al.'s (2006) study was the only known study investigating the effect of music for patients over the age of 65 undergoing CABG and valvular replacement surgeries. Music will be utilized in this study as a therapeutic intervention to reduce anxiety for patients over the age of 65 undergoing cardiovascular surgery. This framework is appropriate for this study because music does provide an environment conducive to rest and healing.

Music Therapy: Cardiac Rehabilitation

Formal cardiac rehabilitation programs provide marked benefits for recovery from cardiac events, but unfortunately only a small percentage of patients participate. Music therapy is an effective method utilized in alleviating risks, and can enhance motivation for rehabilitation following cardiac events. Music therapy may serve as an adjunct to medical treatment for cardiovascular disease, and can also be effective in stress management during cardiovascular rehabilitation (Metzger, 2004). The purpose of Metzger's study was to discover needs and uses of music by patients participating in a cardiac rehabilitation program. The framework was based on Fowler's (1988) work. Fowler suggested that it is necessary to assess current needs and uses of music by patients in order to evaluate the effectiveness of music therapy in achieving a higher rate of

medically acceptable progress for patients participating in cardiovascular rehabilitation (Metzger, 2004).

The study took place in the large cardiovascular rehabilitation facility at St. Joseph Health Center in Kansas City, Missouri. Thirty-three patients currently enrolled in the cardiac rehabilitation program completed the survey on site, and returned it to the researcher. Of the 33 patients enrolled, 25 were male (76%), 26 were Caucasian (79%), and 26 were married (79%). Most patients (27) were of Christian faith (82%), with a mean age of 67 (50-83 years old). Most of the patients (88%) had been in cardiac rehabilitation for a few weeks due to recent heart surgery (Metzger, 2004).

The music played during exercise did not follow any particular pattern or beats per minute. Music was chosen by nursing staff preference and individual patient preference. Patients rarely or never synchronized movements to the music, and did not have earphones, but listened in a large exercise room as a group. Heart rate was monitored continuously, and blood pressure was taken before, during, and after exercise sessions (Metzger, 2004).

The questionnaire developed by Fowler (1988) contained 12 questions, with patients responding on a 5-point Likert scale with 5 = always, 4 = a lot, 3 = sometimes, 2 = rarely, and 1 = never. The survey results were collated into the respective research questions, measuring how patients use music for exercise, relaxation, stress reduction, or enjoyment (Metzger, 2004). The informed consent letter and survey were reviewed by two music therapy professors and approximately 15 graduate students in music research. Feedback contributed to helpful revisions for clarity and ease of use (Metzger, 2004).

Research question 1a was: "Do patients in cardiovascular rehabilitation programs use music as a distraction while exercising?" (p.61). Twenty-one percent answered 5,

and 3% answered 1 (never) (Metzger, 2004). Research question 1b was: "Do patients in cardiovascular rehabilitation programs use music as a motivator to energize their exercise routine?" (p. 61). Seven percent answered 5 (always), 39% answered 4 (a lot), 32% answered 3 (sometimes), 17% answered 2 (rarely), and 5% answered 1 (never (Metzger, 2004).

Research question 1c was: "Do patients in cardiovascular rehabilitation programs use music to reduce stress symptoms that may be related to heart disease?" (p. 61). Seven percent answered 5 (always), 39% answered 4 (a lot), 34% answered 3 (sometimes), 19% answered 2 (rarely), and 1% answered 1 (never) (Metzger, 2004). Research question 1d was: "Do patients in cardiovascular rehabilitation programs use music in their daily life for recreation or enjoyment?" (p. 61). Thirty-three percent answered 5 (always), 42% answered 4 (a lot), 24% answered 3 (sometimes), 0% answered 2 (rarely), and 1% answered 1 (never) (Metzger, 2004).

Research question 2 was: "Would patients in cardiovascular rehabilitation programs be interested in learning more about how to use music to reach their rehabilitation goals?" (p. 61). Twenty-one percent answered 5 (always), 28% answered 4 (a lot), 43 answered 3 (sometimes), 7% answered 2 (rarely), and 1% answered 1 (never) (Metzger, 2004).

Research question 3 was: "What are the demographics of those answering Questions 1 and 2?" (p. 61). Twenty-five of the participants were male, and 6 were female (2 were left blank); 26 were married, 2 divorced, 2 were single, and 1 was widowed (2 were left blank). Twenty-seven marked Christian as the predominant spiritual orientation, and Jewish, Buddhist and Other were mentioned once (3 were left blank). Twenty-six were white (Non-Hispanic); Native American and Asian American

were 4 each; African American was 2, and 2 were left blank. Ages of participants were 50 to 83 with $M = 67$ and $SD = 9.59$ (Metzger, 2004).

The range in number of weeks in rehabilitation was 1.5 to 18, with $M = 9$ and $SD = 4.73$. Of the 31 answering the questions about music experience, 9 stated having no previous or current experience (2 did not answer), and 22 had a total of 45 musical experiences in either music groups or in study about music. Average mean rating differences for music experiences on the five research questions was 0.44, interpreted as minimal (Metzger, 2004).

The conclusions support the fact that most patients recovering from serious heart events related to cardiovascular disease are white males over the age of 65. Patients in Metzger's study valued music as pleasurable, and may consider using it to enhance exercise, having no strong opposition to music therapy as part of cardiovascular rehabilitation (Metzger, 2004). Health care providers can utilize this cost-effective method of music therapy as an adjuvant in cardiac rehabilitation programs. It is important to assess music preferences, and to design music programs that are individualized to patients' needs and requests. Music is a very practical and safe treatment to utilize for patients undergoing cardiovascular rehabilitation.

Cardiovascular index factors have not been explored quantitatively due to the qualitative nature of music stimulation and its use in clinical practice (Chang et al., 2004). The purpose of this study was to quantify and analyze the relationship between music stimuli and cardiovascular responses in humans through continuous monitoring of noninvasive cardiovascular signals.

Twenty undergraduate students in the Department of Psychiatry at the National Cheng Kung University Medical Centre participated in the study to test system

performance. Fourteen males and six females between 19 and 22 years participated. Four sequential periods were in each test: an 8-minute rested period, a 3-minute music stimulus period, a 5-minute rest period, and a 3-minute music stimulus period. The first music stimulation period had the following parameters: Shubert's 'Lullaby' (melody), Piano (timbre), Tempo 60 (tempo), and Level +0 (pitch). The second music stimulation period had the same parameters, except the tempo was changed to tempo 40 (Chang et al., 2004).

The testing system was composed of two units: one unit for generating and monitoring quantitative acoustic stimuli, and a second portable autonomic nervous system (ANS) analysis unit for recording and analyzing cardiovascular responses (Chang et al., 2004). The hardware consisted of two major automated components built into an integrated system: a quantitative sound stimulating unit, and a quantitative sound monitoring unit. The sound stimulating unit served as a quantitative sound stimulating source and performing device; the sound monitoring unit measured and monitored the sound waveform generated from the stimulating unit. Sound signals were routinely calibrated quantitatively prior to each test session by the dynamic signal analyzer (HP35670A).

Heart rate variability (HRV) is a widely used non-invasive quantitative parameter for sympathetic and parasympathetic nervous activities, and has the potential for providing valuable insight into the physiological responses of music. The four music components in the music database operating panel were melody timbre, tempo, and pitch (Chang et al., 2004). The four short-term components of HRV analyzed were the mean respiratory rate (RR) cycle length (NN); the standard deviation of the RR intervals (SDNN); the percent of successive RR intervals with a difference more than 50 ms

(pNN50); and the geometric method of Poincare plot (Chang et al., 2004). Statistical analyses were made by utilizing the SPSS Statistical Package Base System for Windows (Version 9.0).

Electrocardiology rate (ECG) and pNN50 decreased gradually after the four test periods. Three TBP (systolic, diastolic, and mean blood pressure) values increased during the period of music stimulation. The findings suggested that music stimulation decreases heart rate (Chang et al., 2004).

The longitudinal axis (*L*) and the transverse axis (*T*) were the two components of RR calculated from the Poincare plot (Chang et al., 2004). Time-domain HRV analyses showed decreasing the *L* and *T* during music stimulation decreased variability during heart contractions. Toichi et al. determined that calculation of $\log_{10} (L \text{ x } T)$ was found to be a sensitive index of cardiac vagal function not affected by sympathetic nerve activity, and this was decreased, suggesting cardiac vagal function is affected by music stimulation.

Frequency-domain HRV analyses revealed the L/H ratio (sympathetic tone indicator) increased during music stimulation, and that total power (TP) and very low frequency (VLF) also showed decreasing tendencies. High frequency (HF), parasympathetic tone indicator, decreased during the second period of music stimulation, but not during the first period (Chang et al., 2004).

Conclusions were that the proposed system of experimentation can exactly achieve the goal of full control and measurement for music stimuli, as well as effectively supporting quantitative indices of cardiovascular response in humans (Chang et al., 2004). The analysis tools can provide clinicians with accurate experiment and investigation on the topic of ANS. The authors concluded that different stimuli to balance

sympathetic and parasympathetic nerves may be discussed and predicted in further clinical research (Chang et al., 2004).

Music Therapy: Anxiety and Stress

Mechanical ventilation increases anxiety of patients in the intensive care unit (ICU) as manifested by increased heart rate (HR), blood pressure (BP), respiratory rate (RR), and neurohumoral responses (Lee et al., 2005), Sedatives and anxiolytic agents have been used to control distress caused by mechanical ventilation, but may prolong the duration. Music therapy is a nursing intervention that can act to relieve both pain and anxiety (Lee et al., 2005). The purpose of this study was to examine the effect of music on physiological responses and anxiety levels of patients receiving mechanical ventilation in the ICU (Lee et al., 2005). Nightingale noted the healing effect of music on patients in the early 1800s, and this philosophy is the framework utilized for this study (Lee et al., 2005).

Sixty-four ventilator-dependent patients (32 in the music group, and 32 in the control group), in an ICU in Hong Kong agreed to participate, with patients randomly assigned to either an experimental or control group. This sample size has an 80% power to detect an effect size of 0.625, with a 0.05 one-side significance level (Lee et al., 2005). Patients were alert, had no psychiatric illness, able to obey commands, able to hear, hemodynamically stable, and undergoing mechanical ventilation with self-triggering modes. Patients were excluded if hemodynamically unstable (Lee et al., 2005).

Patients' characteristics consisted of 46 males and 18 females, with a mean age of 69.4 years, and 89% were above the age of 50. Patients (83%) received a primary level of education or less. Some patients (12.5%) had experience in music relaxation (Lee et al., 2005). Comparison of demographic data and clinical characteristics for the two groups

revealed no significant differences between the groups, which gave more homogeneity to the groups (Lee et al., 2005).

The control group rested with eyes closed and headphones switched on, connected to a CD player with no CD playing. The experimental group listened to music selected from the researcher's collection through headphones via a portable CD player for 30 minutes, with the volume adjusted according to facial expressions of participants (Lee et al., 2005).

The physiological responses of RR, HR, systolic BP, and diastolic BP were measured before and after the 30-minute intervention period for both groups. Anxiety level of seriously ill patients was measured by a six-item version of the Chinese State Trait Anxiety Intervention (C-STAI), used to measure state and trait anxiety. The C-STAI had a high internal consistency, and correlated significantly with other measures of psychological well-being, establishing concurrent validity (Lee et al., 2005). Internal reliability between the short and long form of the STAI was established, and test-retest reliability for a patient receiving mechanical ventilation in Hong Kong had an alpha coefficient of 0.72. Researchers read the six items to the patients, who held up the corresponding number of fingers from one to four to match the 4-point Likert scale from "not at all" to "very much," or by choosing from four answers that had been printed on large signs (Lee et al., 2005).

A checklist was developed by researchers to match the four common types of resting behaviors (restlessness, facial distortion, restfulness and sleep) in response to music therapy. Patient satisfaction was measured by asking patients in the music group to rate the music after the intervention (Lee et al., 2005). The five outcome measures of RR, HR, systolic BP, diastolic BP, and C-STAI were compared between the groups.

Research question 1 was: "Will music reduce the HR, RR, systolic blood pressure (SBP) and diastolic blood pressure (DBP) of patients receiving mechanical ventilation?" (p. 612). Significant decreases were found in the post-test period for the experimental group, with RR ($P < 0.001$), HR ($P = 0.003$), SBP ($P = 0.001$), and DBP ($P = 0.002$) (Lee et al., 2005). No significant reduction was found in the control group in the post-test period.

Research question 2 was: "Will music reduce the Chinese State Trait Anxiety Intervention (C-STAI) anxiety levels of patients receiving mechanical ventilation?" (p. 612). No significant decrease was found in the post-test period for the experimental group for C-STAI ($P = 0.048$) (Lee et al., 2005).

Research question 3 was: "Are there any differences between a music intervention group and a control group in mean HR, RR, SBP and DBP of patients receiving mechanical ventilation?" (p. 612). Significant differences were found on RR and HR, with patients in the music group (RR mean = -3.6, SD = 4.9; HR mean = -3.8, SD = 70) having a higher decreasing rate than in the control group (RR mean = -0.1, SD = 3.4, $P < 0.001$; HR mean = -0.3, SD = 4.4, $P = 0.009$) (Lee at al., 2005). No significant differences were found in SBP and DBP (Lee et al., 2005).

Research question 4 was: "Is there any difference between a music intervention group and a control group in the post-test Chinese STAI anxiety level of patients receiving mechanical ventilation?" (p. 612). There was no significant difference found for the music group in the post-test C-STAI anxiety level of patients receiving mechanical ventilation ($P = 0.048$) (Lee et al., 2005).

The findings supported the beneficial effect of music for ICU patients who received mechanical ventilation by reduction of the physiological responses to anxiety

(HR, RR, SBP and DBP). A greater increase in the proportion of "comfortable behavior" was also demonstrated in the music group than the control group. However, no statistical difference was found for the post-test C-STAI anxiety level for the music intervention group (Lee et al., 2005). The authors thought the post-test C-STAI could have been affected by the ability of patients to answer the questionnaire due to feeling tired and unable to concentrate well enough to answer the questions (Lee et al., 2005).

The authors concluded that music therapy can reduce anxiety and promote comfort for patients receiving mechanical ventilation. The authors pointed out that music should be selected by the patient based on preference, and instructions need to be clearly understood by patients receiving music therapy (Lee et al., 2005). Music therapy can provide a simple, cost-effective, and safe method of effectively reducing potentially harmful physiological responses arising from anxiety for patients who receive mechanical ventilation. Music can promote feelings of peace in patients under stress.

Patients undergoing cardiovascular surgeries, such as coronary artery bypass grafting (CABG) or valve replacement, begin to experience anxiety as soon as the decision is made to undergo surgery, and may last for up to 3 months after surgery (Twiss et al., 2006). Anxiety after surgery can also increase intubation time. Music listening has been shown to decrease anxiety at the time of surgery, but little evidence exists for patients over the age of 65 undergoing CABG and valvular surgery. The purpose of Twiss et al.'s (2006) study was to investigate the effects of music on postoperative anxiety for patients undergoing CABG or valvular surgery, and to examine the length of time patients are intubated following surgery. The organizing framework for Twiss et al.'s study is Nightingale's philosophy that nurses need to provide a therapeutic environment for patients.

A convenience sample of 86 patients who were admitted to an acute care setting for CABG or valve replacement surgery, at Delray Medical Center at Florida Atlantic University, participated in the study. Inclusion criteria were: oriented to person, place and time on admission; not using music therapy intervention at the current time; able to listen to music from a compact disc (CD) player; and available the night before surgery to give consent and meet with the study coordinator. Patients were divided into two groups, with 42 in the experimental group, and 44 in the control group. Patients were over the age of 65, and matched for gender with 67% female and 33% male. Chi-square tests showed no significant difference in the following areas: age, previous surgery, previous CABG surgery, level of education, prior treatment for anxiety, and currently taking medication for anxiety. The *t*-test results showed no significant differences in the groups in preoperative anxiety scores. Each groups had patients who dropped out postoperatively due to complications, but others were recruited with a final sample of 60 participants (Twiss et al., 2006).

Data collection was completed with the state portion of the Spielberger STAI, which has been shown to be a widely used and psychometrically sound measure of anxiety, specific to preoperative anxiety (Twiss et al., 2006). The state portion of the STAI is a 20 phrase questionnaire utilizing a 4-point Likert scale. Stability and reliability of the STAI were shown to have coefficients ranging from -65 to -86, with sample intervals ranging from 1 hours to 104 days (Twiss et al., 2006). Validity of the STAI was measured against the Taylor Manifest Anxiety Scale and Multiple Adjective Check List, with correlations of -80 and -75, respectively. Patients completed the state portion of the STAI preoperatively and on the third day postoperatively.

The first major finding of Twiss et al.'s (2006) study was that music listening perioperatively and postoperatively reduced anxiety in patients who had undergone CABG or valve replacement surgery. Patients from the experimental group awoke from surgery while listening to familiar music prior to surgery, and during surgery. Familiar music provided soothing, pleasing, and preferred stimuli as opposed to strange ICU noises (Twiss et al., 2006). Allowing the patient the option of choosing music from a selection, or bringing music from home, was a cost-effective way of helping patients manage anxiety postoperatively. A one-way analysis of variance (ANOVA) was used for comparing samples, and avoiding the error inherent in using multiple t-tests (Twiss et al., 2006). The experimental group had significantly less anxiety than the control group ($F = 5.570$, $p = .022$, and SD = 1.98).

The second major finding of Twiss et al.'s (2006) study was that patients who listened to music during and after CABG and valvular surgery required a shorter period of mechanical ventilatory support compared with the control group. Length of ventilation time was measured in minutes from the time the patient left the operating room until extubation occurred in the ICU. One-way ANOVA measured the differences between groups, with statistically significant differences found ($F = 4.88$, SF = 14, $p = 0.48$) (Twiss et al., 2006). Music listening decreased the time patients were intubated following CABG and valvular surgery in the experimental group compared with the patients in the control group.

The authors concluded that music listening is a non-invasive and inexpensive therapy that can be safely utilized by nurses in the perioperative and postoperative areas to provide a healing environment and reduce anxiety. Reducing anxiety and intubation

times may improve patient satisfaction and promote overall recovery for patients following CABG and valvular surgery (Twiss et al., 2006).

Stress management is essential in lowering risk factors for coronary heart disease (CHD). Programs that implement education, counseling, and psychosocial interventions, help improve quality of life and overall well-being for patients who have experienced a myocardial infarction (Mandel et al., 2007). The purpose of this study was to investigate the changes in health-related outcomes of cardiac rehabilitation patients through utilization of music therapy and cardiac or traditional cardiac rehabilitation. The biopsychosocial model proposed by Medich, Stuart, Deckro, and Friedman (1991) (as cited in Mandel et al., 2007) addresses the many factors determining health and disease, particularly with patients who have CHD. This model links stress to hypertension, with hypertension being a strong risk factor for CHD.

Five hundred ninety-six patients were enrolled in an outpatient monitored exercise program during the education phase of cardiac rehabilitation (Phase II) from two hospital sites of a community hospital system in Ohio. One hundred and three (17%) patients were recruited, and consented to participate in the program. Thirty-five patients (34%) dropped out prior to completing posttest measures due to: noncompliance, illness, death, control patients' enrollment in music therapy, or an interruption of the study due to medical leave of the music therapist. Final sample size was 68 patients (66% of 103) who were included in post-treatment analyses. Inclusion criteria were: acute myocardial infarction, stable angina, valve replacement, coronary artery bypass graft, angioplasty, stent placement, congestive heart failure, and cardiomyopathy within the year preceding admission to cardiac rehabilitation. Patients were excluded for mental or medical status that precluded meaningful participation, or had severe hearing loss (Mandel et al., 2007).

Patients were assessed for: age, gender, education, eligibility for Medicaid, blood pressure, co-morbid medical conditions, medication, usage, exercise capacity, weight, diet, and smoking behavior. Patients were randomly assigned to cardiac rehabilitation plus music therapy or traditional cardiac rehabilitation (Mandel et al., 2007). Patients were between the ages of 30 and 80, with a median age of 64 for the control group, and 65 for the music therapy group ($p = 0.27$). All were currently participating in the first 3 weeks of Phase II. The majority, 48% of the control group, and 51% of the music therapy group, were female ($p = 0.81$). No significant differences were found between the control and music groups at baseline for all demographic variables (Mandel et al., 2007).

Initial power analysis suggested 150 subjects were required for the study to detect significant results on physiological and psychological measures. Results were statistically significant if $p <$ or $= 0.05$, and calculation of effect size (ES) determined clinical significance. A drop out rate of 34% (35 patients) occurred prior to completing posttest measures for various reasons (Mandel et al., 2007).

Music therapy sessions had a duration of 1.5 hours, and were offered during alternating weeks at one of two outpatient hospital sites. Sessions concluded with a 20-minute Music-Assisted Relaxation and Imagery (MARI) experience. MARI tapes were recorded on Maxell XLII-S 60-minute audio cassettes using a Denon Personal Audio System (D-C35) and a handheld microphone (Mandel et al., 2007).

Physiological and psychological changes were outcome measures assessed over time, with measurements obtained pre-treatment, and at 1, 4, and 10 months following post-treatment. Physiological changes were measured by taking systolic and diastolic blood pressure, utilizing the Welch Allen adult large and regular blood pressure cuffs. Data were recorded by a cardiac rehabilitation staff member with a Tyco/Welch Allen

manual sphygmomanometer, displayed on a large screen on a portable pole with wheels (Mandel et al., 2007).

Psychological measures were obtained through self-reported questionnaires for: anxiety with the trait scale of the State-Trait Anxiety Inventory (STAI-T); depression with the Center for Epidemiologic Studies Depression Scale (CES-D); overall distress with the chronic form of the Brief Symptom Inventory (BSI); and health-related quality of life with the Medical Outcomes Study 36-Item Short-Form Survey (SF-36) (Mandel et al., 2007). The State-Trait Anxiety Inventory (STAI) has adequate internal consistency and convergent validity. The CES-D has reasonable test-retest reliability, excellent internal consistency, and impressive concurrent and construct validity. The BSI uses a 5-point scale to assess nine dimensions of psychological status, and shows high levels of internal consistency with strong test-retest reliability, convergent and discriminant validity, as well as internal structure and construct validity. The SF-36 has been tested in medical, psychiatric, and general populations, and has excellent psychometric properties. Patients responded to the question "How stressed are you at this time?" at the beginning and ending of each music session, with $0 =$ no stress at all and $10 =$ the most stress (Mandel et al., 2007).

Significant differences were found in systolic blood pressure measurements between the music therapy group and the control group ($p = 0.03$). The music therapy group showed a decrease in systolic blood pressure from pre- to post-treatment, and the control group had an increase in systolic blood pressure. No significant differences were found between groups on diastolic blood pressure after treatment ($p = 0.20$) (Mandel et al., 2007).

No significant differences were found between experimental conditions on post-treatment psychological measures. However, statistical differences were found for the music therapy group at 4 months: a larger decrease in STAI-T post-treatment ($p = 0.03$); a greater improvement in general health post-treatment ($p = 0.01$); and a greater improvement in social functioning post-treatment ($p = 0.04$) (Mandel et al., 2007). Clinically significant group differences were found pre-treatment to 1-month post-treatment changes in general health via SF-36, and at 4-months post-treatment ESs were found in SF-36 factors: physical functioning, body pain, general health, social functioning, and mental health. Also, CES-D, STAI-T, and BSI showed significant 4 month post-treatment ESs (Mandel et al., 2007).

No significant difference was found between control patients and music therapy patients for session attendance ($p = 0.07$). No significant difference was found between control patients and music therapy patients for lecture attendance ($p = 0.86$) (Mandel et al., 2007).

Significant improvements were found in stress and anxiety levels in the pre- to post-session data for music therapy patients in both the STAI-S and stress analog scales ($p < 0.001$). Patients responding to the 10-month follow up questionnaire showed a median stress scale of 3 on a scale of 0 to 10, with 0 indicating no stress at all. Median ratings for interaction with the music therapist and continued benefit of MARI were 9 on a scale of 0 to 10, with 10 indicating the most benefit (Mandel et al., 2007). No significant difference was found in depression between the two groups.

In conclusion, music therapy is beneficial in reducing stress and anxiety for patients attending cardiac rehabilitation programs, as evidenced by lower systolic blood pressure. Health care personnel have a safe and effective adjunct to current cardiac

rehabilitation, with positive effects of use, not only immediately after treatment, but also several months in the future (Mandel et al., 2007).

Anxiety for patients diagnosed with a terminal illness is common, even if having no predisposition to anxiety. Anxiety greatly increases as patients endure procedures and treatments, eventually leading to palliative care, and may become extremely debilitating (Horne-Thompson & Grocke, 2008). Music therapy has been effective in managing anxiety for patients with terminal illness. The purpose of this study was to examine the effectiveness of a single music therapy session in reducing anxiety for terminally ill patients (Horne-Thompson & Grocke, 2008).

The study was conducted at Calvary Health Care Bethlehem, Melbourne, Australia. The population was patients receiving palliative care services due to a diagnosis of terminal illness. Power analysis to predict sample size was 60 patients, with 30 in each group, based on 80% power. Recruitment for the study was lower than expected, with only 25 patients in the final sample. Patients were randomly assigned to one of two groups, with 13 in the experimental group, and 12 in the control group. The patients were between the ages of 18 and 90, with the overall mean age of participants being 73.9 years. Patients met inclusion criteria for referral to music therapy, with anxiety given as the reason for referral. Exclusion criteria were: a Blessed Orientation, Memory and Cognition (BOMC) score greater than 10, indicating cognitive impairment and inability to give informed consent; unable to speak English; or a major hearing impairment (Horne-Thompson & Grocke, 2008).

The Edmonton Symptom Assessment System (ESAS) was used to measure severity of symptoms on a scale of 1-10. Nine common areas experienced by patients in palliative care were listed in the ESAS, with 0 = no symptom and 10 = worst

possible symptom. Patients were offered another scale to add symptoms experienced. Each patient completed the ESAS immediately before and after the music therapy session. Patients also wore a pulse oximeter during the study to record heart rate (Horne-Thompson & Grocke, 2008).

Findings supported hypothesis 1: there will be a significant difference between the experimental and control groups on anxiety levels as demonstrated by anxiety measurement of the ESAS. Anxiety was significantly reduced for the experimental group ($p = 0.005$), with no demonstrated change over the same period of time for the control group. This result was of particular importance, since patient self-report is considered the gold standard (Horne-Thompson & Grocke, 2008).

Hypothesis 2 was not supported: there will be a significant difference between the experimental and control groups on anxiety levels as demonstrated by a decrease in heart rate. No significant difference was found between the control group and experimental group in heart rate ($p = 0.8$). However, patients in the experimental group reported significantly less tiredness and drowsiness after music therapy, suggesting that increased energy levels may be reflected in increased heart rate (Horne-Thompson & Grocke, 2008).

The authors concluded that music therapy demonstrated significant decreases in anxiety for terminally ill patients after a single session. Self-report demonstrated that a single music therapy session can reduce anxiety and improve quality of life for terminally ill patients. In addition, music therapy was found to decrease tiredness, drowsiness, and pain in terminally ill patients (Horne-Thompson & Grocke, 2008). This study showed the benefit of a single music therapy session in reducing anxiety for patients diagnosed with a terminal illness.

Patients who have had cardiovascular surgery experience major metabolic, physical, and psychological stress. High levels of stress may lead to worse long-term psychological outcomes. Cortisol has been found to be an important indicator of stress response, with degree of surgical trauma being correlated with concentration of cortisol (Nilsson, 2009a). The purpose of this study was to test the effectiveness of a music intervention on cortisol levels in patients who had undergone coronary artery bypass grafting (CABG) or aortic valve replacement (AVR) surgeries while resting in bed on the first postoperative day (POD) (Nilsson, 2009a).

The population for Nilsson's (2009a) study was 264 patients undergoing open heart surgery in Uppsala, Sweden. Calculation of sample size was based on a one way analysis for serum cortisol (s-cortisol): significant level of 5%, power of 80%, and estimated medium effect size of .30, suggesting a sample size of 42 patients. A final sample size of 30 patients in each group was the result, covering for attrition. A sample size of 58 had been considered, but 60 patients fulfilled inclusion criteria. Two patients were excluded from the study due to chest pain and a drainage procedure, leaving 28 patients in the music group and 30 patients in the control group. The two groups had no significant differences in age, gender, type of surgery, duration of surgery, aortic occlusion ($A_{AO}O$), and extracorporeal circulation (ECC) time, O2, and intra- and postoperative analgesia. No significant differences were noted between the two groups in pre-values of s-cortisol, MAP, HR, RR, $P_{AO}2$ and $S_{AO}2$, subjective pain, and anxiety levels (Nilsson, 2009a).

The sample for Nilsson's (2009a) study included 58 patients from the American Society of Anesthesiologists on the first POD after CABG or AVR surgeries under general anesthesia. Exclusion criteria were: emergency operation, surgery starting after

12:00 noon, need for an intra-aortic balloon pump or temporary pacemaker, participation in other studies, any hearing impairment, or difficulties cooperating during measurements (Nilsson, 2009a).

Patients had all been scheduled for bedrest at 12 noon on the first POD. Prior to bedrest, all patients received chest physiotherapy while sitting in a chair along with oxygen support. Patients were then placed in bed in a supine position with head of bed elevated 20-30 degrees. Patients had been randomly placed into a music group or control group. In addition to the above, the music group listened to music from a music pillow connected to an MP3 player while resting. The music was soft and relaxing, 60-80 bpm, and included different melodies in new-age style at a volume of 50 to 60 dB for 30 minutes. Health care professionals closed the door and posted signage to facilitate rest (Nilsson, 2009a).

To obtain data, a radial artery cannula was used for blood samples, a GE Carescape Datex-Ohmeda monitor for vital signs, and a numeric rating scale (NRS) from 0 to 10 to score pain and anxiety. Arterial blood samples for blood gas measurements ($P_{AO}2$ and $S_{AO}2$) and s-cortisol were drawn on the day of surgery for both groups. Post values were drawn at 12:30 pm (30 minutes after initiation of rest and/or music) and at 1:00 pm for s-cortisol, but blood gas measurements were only obtained at 1:00 pm. MAP, HR, and RR were obtained at 12:00 pm, 12:30 pm, and 1:00 pm, as was the NRS scale of 0 (no pain/anxiety) to 10 (maximal pain/anxiety) (Nilsson, 2009a).

Findings were that the stress marker, s-cortisol, changed over time, with significant decreases at both post value marks for both groups ($P < .001$). Thirty minutes after bedrest (12:30 pm), a significant difference in s-cortisol levels was noted between the music and control group ($P < .02$). No differences were found after 1 hour of bedrest

(1:00 pm). MAP ($P < .002$) and RR ($P < .005$) were also significantly decreased over time for the music group compared with the control group. Pain and anxiety both decreased over time in both groups: music group $P < .001$ for pain and $P < .004$ for anxiety, and $P < .011$ for control group for pain and $P < .037$ for anxiety. No significant changes were noted over time in HR, $P_{AO}2$, and $S_{AO}2$. No significant differences were noted at any time between the two groups for HR, RR, MAP, $P_{AO}2$, $S_{AO}2$, or subjective pain and anxiety levels (Nilsson, 2009a).

The findings suggested the biggest benefit for effect on stress response for the music group was seen at 30 minutes after intervention was initiated (12:30 pm). Bed rest with or without music intervention resulted in decreased pain and anxiety for both groups. Music may have had a greater effect on results if patients had been allowed to choose music per preference, although music had a positive effect, regardless if selected by patients or not. The author stressed the importance of utilizing equipment of good quality that was user friendly and hygienic. The author concluded that relaxing music in combination with pharmacologic agents reduces stress after cardiovascular surgery, and that listening to music while taking bedrest after open heart surgery be put into clinical use (Nilsson, 2009a).

High levels of preoperative and postoperative anxiety and depression result in higher postoperative pain and analgesic requirements (Nilsson, 2009b). The purpose of this study was to compare the effect of bedrest with and without music intervention on relaxation after coronary artery bypass grafting (CABG) and/or aortic valve replacement (AVR) surgery on postoperative day one (POD 1).

One hundred and sixty-eight patients in an intensive care unit undergoing open heart surgery (CABG and/or AVR) under general anesthesia were considered for the

study, with only 40 meeting inclusion criteria. Calculation of sample size was based on a significance level of 5%, power at 80%, and an estimated medium effect size of 0.14, with a suggested sample size of 31. However, 20 patients in each group were utilized to cover sample attrition (Nilsson, 2009b). Patients included were scored as ASA III (American Society of Anesthesiologists) on a physical status classification system, indicating severe systemic disease. Exclusion criteria were: undergoing emergency operations, start of surgery after 12:00 noon, previous cardiac surgery, current treatment with corticosteroids, need for an intra-aortic balloon pump or temporary pacemaker, not extubated in the evening of the day of surgery, participation in other studies, any hearing impairment, or difficulties cooperating during measurements (Nilsson, 2009b). Patients had an average age of 65.5, were male, and had CABG surgery. Patients in the music group had more CABG surgeries than the control group.

Patients were randomly assigned to either the music group ($n = 20$) or the control group ($n = 20$), with all patients scheduled on bed rest at 12:00 noon on POD I, and all receiving oxygen support (Nilsson, 2009b). Patients in the music group listened to music distributed through a music pillow connected to a MP3 player (Wellness Musicpillow) during the rest period, with soft and relaxing music for 30 minutes.

Arterial blood gases and serum oxytocin (s-oxytocin) analysis were obtained from a radial artery cannula in each patient's left arm at 12:00 pm and at 1:00 pm, and s-oxytocin was also measured at 12:30 pm. The blood gas measurements of arterial oxygen tension (PaO2), and arterial oxygen saturation (SaO2), were analyzed with Radiometer ABL 505; s-oxytocin measurements were determined by using an enzyme immunoassay kit from Assay Designs. Mean arterial oxygen saturation (MAP) and heart rate (HR) were measured at 12:00 pm, 12:30 pm, and 1:00 pm by GE Carescape Datex-Ohmeda monitor.

Patients rated relaxation levels on a numeric rating scale (NRS) of 0 to 10, with 0 = no

relaxation and 10 = complete relaxation. NRS for relaxation has not been validated, but

NRS for pain has been validated and tested for reliability (Nilsson, 2009b). A *p*-value <

0.05 was considered statistically significant.

Findings revealed no significant differences in the two groups in respect to age,

gender, duration of aortic occlusion ($A_O O$) and extra-corporeal circulation (ECC) time,

O2, and intra- and postoperative analgesia. Pre-value of s-oxytocin was significantly

lower in the music group than the control group, and no differences in post values at

12:30 pm and 1:00 pm were found between the groups. Changes in oxytocin levels were

statistically different between the two groups, but not over time within subjects in each

group. Patients in the music group had an increase in oxytocin at both 12:30 pm and 1:00

pm, compared with the 12:00 pm levels. Patients in the control group had a decreased

level of oxytocin at 12:30 pm with a further decrease noted at 1:00 pm from the 12:00 pm

level (Nilsson, 2009b).

No differences were found in pre and post values of MAP and HR between the

groups. However, MAP over time showed decreases in MAP in the music group (*p* <

0.002) when compared with baseline levels: pre values vs. values at 12:30 pm were *p* =

0.01, and pre values vs. values at 1:00 pm were *p* = 0.002. Decrease of MAP over time

was not found in the control group. No significant changes over time were found within

subjects in HR (Nilsson, 2009b).

No significant differences were found in pre and post values at 12:30 pm between

the groups in oxygen saturation. Significantly higher PaO2 levels were found in the

music group compared with the control group at 1:00 pm, with *p* = 0.036. Comparison of

pre and post values within subjects for the music group found PaO2 levels had

significantly increased, with $p = 0.039$. Higher SaO2 trends were found in the music group when compared with the control group, with $p = 0.058$. No increase was seen in the control group for PaO2 or SaO2 values within subjects (Nilsson, 2009b).

Significant differences were found in changes over time between the groups in subjective relaxation levels. In the music group, subjective relaxation levels increased significantly over time ($p < 0.001$): pre levels vs. values at 12:30 pm ($p = 0.001$), and pre values vs. values at 1:00 pm ($p = 0.003$). Pre levels of relaxation were significantly lower in the music group, and no differences were found in post values at 12:30 pm and 1:00 pm between groups. No significant changes over time were found within subjects in the control group. The major finding of the study was increased oxytocin levels and relaxation in patients undergoing CABG or AVR surgery who listened to music (Nilsson, 2009b).

In conclusion, music listening during bedrest after open-heart surgery increases oxytocin secretion, with a causal relation of psychological (music makes patients feel good and relaxed) with the physical (oxytocin release) (Nilsson, 2009b). Music intervention is an effective and safe adjunct to add to current treatment regimens for patients who undergo cardiovascular surgery, aiding in increasing relaxation for this patient population.

Administration of sedatives to treat anxiety for patients undergoing weaning from mechanical ventilation can create symptoms that cause the weaning process to be interrupted. Interruption of weaning can result in prolongation, and can lead to complications and lengthened hospital stays (Hunter et al., 2010). The purpose of the study was to evaluate the feasibility and efficacy of incorporating music therapy (MT)

into the weaning process based on levels of anxiety, Days to Wean (DTW), and both nurse and patient satisfaction (Hunter et al., 2010).

A convenience sample was used for the pilot research study to test a music therapy application that was previously untested. Any patient at least 18 years old admitted to the pulmonary step-down unit for weaning from mechanical ventilation, and had completed 8 hours or less on a tracheostomy collar (TC) prior to enrollment, was eligible to participate. Patients were excluded if deemed inappropriate for participation by a unit nurse practitioner (Hunter et al., 2010). Patients were matched with historical controls for age (+/- 3 years), gender, and Diagnosis Related Group (DRG) to patients previously treated on the pulmonary step-down unit within 2 years of the study.

The MT sessions were 45 to 60 minutes in length, and were offered three times per week during weaning trials. Anxiety was found to be highest during periods of 4 hour weaning trials. To assist with anxiety during the shorter weaning trials, the MT therapist would begin sessions 20 minutes before switching from ventilator to TC, and would continue for another 40 minutes into the weaning trial. For weaning trials longer than 4 hours, the MT therapist would begin sessions halfway through the trial. If patients became anxious before the scheduled MT time, the therapist was notified and would arrive as soon as possible to begin MT sessions to aid in reduction of anxiety for patients. All MT interventions were designed to facilitate with reduction of anxiety to aid in weaning, consisting of live music including guitar, voice, keyboard and/or rhythm instruments, based on patients' music preferences (Hunter et al., 2010).

Music therapy was divided into four sections: introduction, assessment, and session goal setting (5 minutes); playing and improvisation (15-20 minutes); music-assisted relaxation, guided imagery (20-30 minutes); and conclusion (5 minutes). Music

preference was identified by patients, family members, and/or visitors during the first session (Hunter et al., 2010).

The first aim of the study was to evaluate the feasibility of incorporating MT into the weaning process (Hunter et al., 2010). Feasibility was measured by successful enrollment of patients in the study along with nurses' survey responses. Efficacy was measured by heart rate (HR), respiratory rate (RR), patient survey, nurse survey, DTW, and patient/nurse satisfaction (Hunter et al., 2010). Ninety-three patients were approached, and 61 (66%) agreed to participate. Males and females were almost evenly matched, at 32 and 29, respectively. Average age of patient was 66.9, and 10 patients withdrew from the study for various reasons, with a total of 51 (84%) completing the study (Hunter et al., 2010). Only 126 (52%) of the 243 nurse surveys were completed. Assimilation of the intervention was determined by the third question "Music was incorporated unobtrusively during this session (i.e., did not interfere with my job duties)" (p. 209). Results were a mean of 4.66 out of 5.0, indicating nursing staff strongly agreed (Hunter et al., 2010).

The second aim of the study was to evaluate the efficacy of the MT intervention based on levels of anxiety, measured by physiologic signs (HR and RR), and the patient/nurse survey, DTW (number of days until the patient was liberated from the ventilator for at least 72 consecutive hours), and patient and nurse satisfaction with the MT intervention (Hunter et al., 2010). A within-subject analysis revealed that HR decreased from beginning to end of MT sessions ($t = -1.945$, $p = .0267$), and RR also significantly decreased ($t = -5.650$, $p = .0001$). Reduction of the two physiologic measures of anxiety indicated a more relaxed state at the end of MT sessions (Hunter et al., 2010).

Nurse surveys were administered after each MT session, and consisted of six items ranked from 1 = strongly disagree to 5 = strongly agree. HR and RR were obtained before and after each MT session by the music therapist or research assistant. HR was measured by an external monitor used in standard care, and RR obtained by therapist or research assistant, counting inhalations and exhalations for 15 seconds, and multiplying by four (Hunter et al., 2010).The patient assessment survey for level of anxiety revealed a mean of at least 4.20 (agree to strongly agree), indicating the patients appeared less anxious when observed by nurses.

Patient surveys were obtained after the initial session, and then every third subsequent session to assess ongoing patient perceptions of the MT intervention. Patients not receiving the survey were asleep or delirious at the end of the session. Patient surveys had four yes/no questions, with a fifth question for suggestions or comments about patient experiences with music therapy that would be helpful for future program implementation (Hunter et al., 2010). Forty-two patients (82%) completed the patient survey, with 11 completing more than one survey, for a total of 54 patient surveys being completed. Ten surveys were not completed because the patient was sleeping at the end of the MT session, and 13 surveys were not given due to patient delirium. After 98% of sessions surveyed, patients felt less anxious, and after 80% of sessions surveyed, patients felt less stress than expected (Hunter et al., 2010).

Forty-one (80%) patients were weaned from mechanical ventilation. Seven patients were unable to be matched to historical controls. Three patients were excluded due to DTW being greater than two SDs above the group mean. Efficacy for DTW was not supported by this study, with statistically significant t-value ($p < .05$), and historical controls having a lower mean DTW (Hunter et al., 2010).

Patient satisfaction scores were high, with patients reporting that 96% of the time

MT was helpful, and that 100% would participate in MT again. Nurse satisfaction scores

were also high, with a reduction in nursing personnel stress mean score of 4.19, and a

perceived value of MT for patients mean score of 4.59 (Hunter et al., 2010).

The authors suggested that MT can be effectively incorporated into a program for

weaning difficult-to-wean patients in a pulmonary step-down unit, and can complement

the process of actively weaning patients from mechanical ventilation. Also, survey results

for both patients and nurses indicated highly positive responses, finding that MT is

beneficial to the weaning process. The physiologic signs of anxiety as manifested by HR

and RR were also reduced with MT. In conclusion, patient and nurse satisfaction was

high for MT. MT can be used successfully, in combination with other therapies, to

effectively treat anxiety for patients who are being weaned from mechanical ventilation

(Hunter et al., 2010).

Music Therapy: Pain

Patients who have had open-heart surgery continue to experience moderate to

severe anxiety and pain with chair rest despite opioid analgesic use (Voss et al., 2004).

The purpose of this study was to examine the effects of sedative music, along with

scheduled rest, on self-reported anxiety, pain sensation, and pain distress (Voss et al.).

Sedative music was expected to decrease pain and anxiety by creating distraction or

diversion, and by stimulating the relaxation response. Scheduled rest was expected to

reduce pain and anxiety by eliminating interruptions, and by reducing physical and

 mental work.

A convenience sample included 96 patients from a surgical intensive care unit at a

rural midwestern hospital. The number 96 was based on power analysis that showed an

estimated medium effect size of 0.33 (Cohen's *f*), power 0.80, and alpha = 0.05.
However, after enrolling 62 patients, data collection was concluded due to significant
group differences, and large effect sizes for anxiety, pain distress, and pain sensation
(Voss et al., 2004). One patient in the music group was identified as an outlier for
extreme pain and mild respiratory distress and was dropped from the analyses. The final
sample was 61 patients.

Eligibility criteria were first postoperative day following open-heart surgery,
morning chair rest ordered, stable condition, alert, oriented, able to follow commands,
able to read, write and understand English, at least 18 years old, and no major hearing
deficit. Exclusion criteria included femoral arterial sheath remaining in place after
surgery (Voss et al., 2004).

Three groups were randomly assigned: 19 patients in the sedative music group, 21
patients in the rest group, and 21 patients in the treatment as usual group during 30
minutes of chair rest. The final sample was mostly male (64%), with a mean age of 63,
87% were white, and 80% had undergone coronary artery bypass grafting (CABG)
procedures. No significant differences were found between the three groups for the
following: age, gender, race, surgical procedures, previous use of music for relaxation,
morphine equivalents administered, baseline anxiety, pain sensation, or pain distress
(Voss et al., 2004).

Anxiety was measured with a visual analogue scale (VAS) with a 100-mm
horizontal line anchored at either end by descriptive words of "not anxious about chair
rest" to "most anxiety imaginable." Patients marked the line at the point that represented
the degree of anxiety about chair rest, with a minimum of 0 mm and a maximum of 100
mm. Construct validity of the VAS was compared with scores on the State Anxiety

Inventory (SAI), with a strong positive correlation found between the SAI and the VAS in 56 critical care patients with acute myocardial infarction or unstable angina pectoris (r = 0.70) (Voss et al., 2004). A pilot study of 10 postoperative cardiac patients had a moderate correlation between the SAI and VAS (r = 0.41) (Voss et al., 2004).

Pain sensation and pain distress were measured using dual VAS scales. The scales were marked from 0 to 100 mm with anchors of "no sensation of pain," "most pain sensation imaginable," "no pain distress," or "most pain distress imaginable." Construct validity for pain sensation and pain distress were compared with Johnson's numeric rating scales (NRS), which had high correlations: r = 0.85 and 0.92 for pain sensation, and r = 0.91 and 0.92 for pain distress at five time points. Test-retest reliability of VAS measures of pain sensation and pain distress with 10 postoperative cardiac patients was established at two time points during chair rest: r = 0.66 and 0.84, respectively (Voss et al., 2004).

Hypothesis 1 was: "The sedative music group would report significantly less anxiety, pain sensation and pain distress after 30 minutes of chair rest than the scheduled rest group" (p. 198). Repeated measures MANOVA showed a significant interaction effect (group by time) on anxiety, pain sensation, and pain distress, with Wilks' Lambda observed power 1.0. Univariate repeated measures ANOVA also indicated interaction effects for the three dependent variables of anxiety, pain sensation, and pain distress, with observed power 1.0. The music group reported significantly less anxiety, pain sensation, and pain distress after 30 minutes of chair rest than the scheduled rest group (P < 0.017). Hypothesis 1 was supported (Voss et al., 2004).

Hypothesis 2 was: "The sedative music group would report significantly less anxiety, pain sensation, and pain distress after 30 minutes of chair rest than the control

(treatment as usual) group" (p. 198). Bonferroni's adjustment for multiple comparisons to test posttest group differences with independent *t*-tests and separate variance estimates also showed that the music group reported significantly less anxiety, pain sensation, and pain distress after 30 minutes of chair rest than the control group ($P < 0.017$). Hypothesis 2 was supported (Voss et al., 2004).

Hypothesis 3 was: "The scheduled rest group would report significantly less anxiety, pain sensation, and pain distress after 30 minutes of chair rest than the control (treatment as usual) group" (p. 198). Through utilization of Bonferroni's adjustment for multiple comparisons, the scheduled rest group did not report significantly less anxiety, pain sensation, or pain distress than the control group. Hypothesis 3 was not supported (Voss et al., 2004).

Findings were that almost half (47%) of the music group used sedative music to relax and distract while sitting in the chair, with about half using it just to relax, and only 6% using it for distraction alone. No adverse events, such as fatigue or psychological discomfort, were encountered by patients from either the interventions or completion of VAS scales. Sedative music had a large effect when compared to both scheduled rest (Cohens $d > 0.90$) and usual chair rest (Cohen's $d > 1.0$). However, scheduled rest alone did have a small to medium effect on anxiety, pain sensation and pain distress (Cohens' $d = 0.20$-0.45) (Voss et al., 2004).

The authors concluded that sedative music, being a cognitive-behavioral intervention, can provide patients with a more adaptive way of responding to anxiety and pain (Voss et al., 2004). The findings strongly support using the cost-effective intervention of sedative music in combination with pharmacological agents to treat

anxiety and pain during early activities immediately following open-heart surgery, such as chair rest, and should be offered as a choice to patients as an adjunct to treatment.

Health care providers recognize that coronary artery bypass (CAB) and valvular replacement surgeries are accompanied by pain and anxiety (Sendelbach et al., 2006). Music therapy has been shown to decrease pain, anxiety and physiological parameters for patients undergoing surgical procedures. The purpose of this randomized controlled study was to compare the effects of music therapy versus a quiet, uninterrupted rest period on anxiety, pain intensity, physiological parameters of heart rate (HR) and blood pressure (BP), along with opioid consumption after CAB and/or valvular replacement surgery (Sendelbach et al.). The study was based on the Gate Control Theory, which advocates that pain impulses are transmitted from nerve receptors to synapses in the gray matter of the dorsal horns of the spinal cord.

The study took place in one healthcare system in the Midwest. Data were collected from cardiovascular units in three hospitals, with approximately 1,500 patients undergoing cardiac surgery yearly (Sendelbach et al., 2006). Inclusion criteria was patients scheduled for non-emergent CAB, and/or valve replacement surgeries. Patients were excluded if non-English speaking, physician-documented psychiatric disorder, or intubated. Patients were assigned to one of two groups by a flip of a coin, either music/relaxation, or rest in bed. Both groups had similar demographic characteristics, except for type of surgical procedure. The typical patient was male (69.8%), 63 years old, had CAB surgery (69.8%), and had seldom used music therapy (81.2%) (Sendelbach et al.). A total of 50 patients received 20 minutes of music therapy, and 36 patients received 20 minutes of uninterrupted bedrest. A repeated-measures analysis of variance was used to examine differences between groups. Due to a substantial amount of missing

data, only the first three time points were used to calculate outcome variables (POD 1: AM and PM sessions, and POD 2: AM session only).

Pain was measured by having patients rate pain intensity on a scale of 0 to 10, with 0 being "no pain" and 10 being "worse pain possible." Strong concurrent validity for the numeric rating scale of 0 to 10 has been documented, with a correlation coefficient of 0.92 for a vertical visual analog scale, and 0.91 for a verbal descriptor scale (Sendelbach et al., 2006).

Anxiety was measured by an abbreviated 10-item State Personality Inventory to reduce subject time and burden, with 3 subscales substantiated by factor analysis (state anxiety, state anger, and state curiosity). The responses were rated from 1 (not at all) to 4 (very much), with higher scores reflecting higher anxiety (Sendelbach et al., 2006). The scale had an internal consistency reliability of coefficients ranging from 0.93 to 0.97 with the parent anxiety scale of the State Trait Inventory. Only the current state of anxiety was measured during this study, to determine the effect of music therapy on the patients' state anxiety at that moment. Physiological parameter of HR was recorded by a bedside monitor, with the noninvasive BP being measured by the monitor or via a BP cuff. Bedside monitors are tested and calibrated annually by the bioengineering departments, and research assistants were trained in BP measurements before data were collected (Sendelbach et al.).

The research question for the study was: "Does music therapy delivered on postoperative day(s) (POD) 1 to 3 decrease anxiety, pain levels, HR and BP, and amount of parenteral opioid equivalents consumed by patients undergoing cardiac surgery, compared with patients who receive standard therapy (rest in bed)?" (Sendelbach et al., 2006, p. 195). Findings were that anxiety was significantly lower in the music group

than in the control group for the 3 time points (P < .001), and in pain (P = .009) in the music group. No differences were found between groups in regards to systolic BP (P = .17), diastolic BP (P = .11), or HR (P = .76). Differences in opioid use between the two groups were calculated using *t* tests. One patient outlier with migraine headaches was excluded from analysis, with no differences found between the two groups on any of the days. Therefore, music therapy did not decrease the amount of pain medication use.

In conclusion, music is an inexpensive intervention that can be utilized as an adjuvant for postoperative pain in the cardiac surgery population, and should be encouraged as there are no known side effects. Unrelieved pain may lead to other issues, such as a generalized sympathetic response (increased HR, peripheral resistance, BP, cardiac output, and depth and respiratory rate), as well as interference with sleep and appetite. Pain could also contribute to urinary tract and gastrointestinal complications (Sendelbach et al., 2006). Using music to decrease anxiety is also an independent nursing function, and was shown in this study to significantly decrease anxiety among cardiac surgery patients. Music therapy did not decrease in opioid use after cardiac surgery, but research on pain management suggested that early treatment to relieve or minimize acute pain may help prevent long-term pain (Sendelbach et al., 2006). This can be accomplished through the independent nursing intervention of music therapy.

The application of the C-clamp device to provide compression and immobilization is often uncomfortable and painful for patients following percutaneous coronary interventions (PCI) (Chan, 2007). Music therapy may reduce pain. The purpose of Chan's study was to examine the effect of music on physiologic parameters (heart rate, respiratory rate, and oxygen saturation), as well as the psychological parameter of pain and discomfort in patients undergoing C-clamp application following

PCI. The framework was based on Hass et al. and Watkins' theories that music exerts an effect through entrainment of body systems, bringing harmony, and closely relating musical rhythm with the listener's breathing or respiratory patterns (Chan, 2007).

A randomized controlled trial was conducted in three intensive care units (ICUs) of three acute care hospitals in Hong Kong. The target sample was drawn from 400 hospital beds in each facility, for a total of 1,200 patients. There were 600 staff members in each facility providing specialist inpatient and outpatient hospital services. Eight-two patients were eligible based on the following inclusion criteria: a diagnosis of myocardial infarction, acute coronary syndrome, and/or coronary artery disease. Patients were conscious and alert according to the Glasgow Coma Scale from 3 (worst condition) to 15 (best condition), with conscious and alert score being designated as 4 = best eye response, 5 = best verbal response, and 6 = best motor response. Patients were able to communicate, write, and read, and able to speak Cantonese. Exclusion criteria were: hearing deficits, history of psychiatric illness, neurologic disorders, dying, or unable to give informed consent (Chan, 2007).

Seventy patients were randomly assigned to the experimental or control group, after 12 patients refused due to lack of interest. Four patients in the experimental group refused to continue, resulting in a final sample of 66, with 31 patients in the experimental group and 35 patients in the control group. Patients in the control group were 66% male and 34% female, with 81% male and 19% female in the experimental group. A chi-square test showed no statistically significant differences between the control group and experimental groups for all demographic and health history variables. No statistically significant differences were noted among the three hospitals for all variables (Chan, 2007). Patients chose music based on preference of either Chinese classical music,

religious music, or Western classical music. Music selections had soft, slow beats without lyrics, and patients listened to selections via an MP3 player with headphones, adjusting the volume as desired. The power of the study was based on the primary outcome measure of heart rate (HR). The required sample size of 35 for each group, for a total of 70, was required to achieve 80% power at a significance level of 5% (Chan, 2007).

The instrumentation had three parts. Part 1 was demographic variables: gender, age, religion, marital status, educational level, previous experience with application of C-clamp, previous experience of listening to music during application of C-clamp, along with medical history. Part 2 was physiologic parameters: systolic blood pressure (SBP), diastolic blood pressure (DBP), heart rate (HR), oxygen saturation ($S_{PO}2$), and respiratory rate (RR). Collection of physiologic data was obtained by a bedside monitor, with baseline readings (before C-clamp use), 15 minutes after placement, 30 minutes, and 45 minutes (before removal of C-clamp) readings. Part 3 was the psychological parameter of pain. Pain scores were determined by use of the University of California at Los Angeles (UCLA) universal pain assessment tool. This tool consists of an 11-point scale that ranges from 0 (no pain) to 10 (worst possible pain) (Chan, 2007).

The same nurse researcher collected all the data, as well as administration of the intervention. Data were collected at baseline (before application of the C-clamp), and 45 minutes later (before removal of the C-clamp). Content validity index (CVI) for the UCLA tool was conducted by a panel of experts (senior medical officer, a nursing officer working in the ICU, and a clinical psychologist). In order for the instrument to be valid, the CVI needed to be equal to or greater than .85. The panel determined the CVI of the UCLA tool to be 1.00. Test-retest reliability was also conducted, with the reliability coefficient for this trial using the UCLA tool being .89 (Chan, 2007).

Null hypothesis 1 was that there would be no statistically significant difference in the reduction in physiologic measures (e.g. HR, SBP, DBP, RR, and $S_{PO}2$) between a music intervention group and a control group of patients undergoing the application of C-clamp after PCI. A Mann-Whitney U test was used to determine whether there were statistically significant differences in physiologic variables between the experimental and control groups at each time point (baseline, 15 minutes, 30 minutes, and 45 minutes). The results showed significant differences for HR, RR, and $S_{PO}2$ at 30 minutes and 45 minutes. For each group, the Friedman test was used to determine statistically significant changes among the four time points for each physiologic variable. The results showed no statistically significant differences for the control group for DBP, but statistically significant increases were found for SBP, HR, RR, and $S_{PO}2$. For the experimental group, statistically significant reductions were noted in SBP, HR, RR, and $S_{PO}2$ (Chan, 2007).

Null hypothesis 2 was that there would be no statistically significant difference in the reduction of a psychologic parameter (pain level) between a music intervention group and a control group of patients undergoing the application of C-clamp after PCI. A Mann-Whitney U test showed that at baseline, no differences were found between the two groups, but at 45 minutes statistically significant differences were found between the experimental and control group. The Wilcoxon signed-rank test showed a statistically significant increase at 45 minutes in the control group compared with baseline, and a significant decrease at 45 minutes in the experimental group compared with baseline (Chan, 2007).

Both null hypotheses were rejected in Chan's (2007) study. The author concluded that music therapy can and does lower physiologic and psychologic parameters in

patients undergoing C-clamp procedure following PCI. Allowing patients opportunity to choose music, and adjust volume to satisfactory levels, was very effective in enhancing relaxation for patients. Music therapy is not harmful to the patient, and is a cost-effective means to promote healing and to enhance entrainment of body rhythms (Chan, 2007).

Summary

Music was found to be an effective intervention for cardiac rehabilitation. Metzger (2004) found the typical patient recovering from serious heart events related to cardiovascular disease to be white, male, and over the age of 65. Patients in the study valued music as pleasurable, may consider using it to enhance exercise, and had no strong opposition to using music therapy as part of cardiac rehabilitation (Metzger, 2004).

Cardiovascular indices for music stimulation and its use in clinical practice were explored quantitatively in a study by Chang et al. (2004). The proposed two-fold testing system of one unit for generating and monitoring quantitative acoustic stimuli, and a second portable autonomic nervous system (ANS) for recording and analyzing cardiovascular responses, measured the effect of music stimuli on cardiovascular responses for humans. The analysis tools can provide clinicians with accurate experiment and investigation on the topic of ANS. Balancing sympathetic and parasympathetic nerve responses may be discussed and predicted in further clinical research (Chang et al., 2004).

Music was found to be effective in reducing anxiety for patients receiving mechanical ventilation (Lee et al., 2005). Physiologic responses to anxiety (HR, RR, SBP and DBP) were reduced, and an increase in comfortable behavior was found in the experimental group. Music was most effective when selected by patients. It is a simple,

cost-effective, and safe method of effectively reducing potentially harmful physiological responses, and can promote feelings of peace in patients under stress (Lee et al., 2005).

The first major finding of Twiss et al.'s (2006) study was that music listening perioperatively and postoperatively reduced anxiety in patients who had undergone CABG or valve replacement surgery. The second major finding of Twiss et al.'s (2006) study was that patients who listened to music during and after CABG and valvular surgery required a shorter period of mechanical ventilatory support compared with the control group. The authors concluded that music listening is a non-invasive and inexpensive therapy that can be safely utilized by nurses in the perioperative and postoperative areas to provide a healing environment and reduce anxiety (Twiss et al., 2006).

Mandel et al. (2007) found that music therapy is beneficial in reducing stress and anxiety for patients attending cardiac rehabilitation programs, as evidenced by lower systolic blood pressure. Clinically significant group differences were found pre-treatment to 1 month post-treatment changes in general health via SF-36, and at 4 months post-treatment ESs were found in SF-36 factors: physical functioning, body pain, general health, social functioning, and mental health. Health care personnel have a safe and effective adjunct to current cardiac rehabilitation, with positive effects of use, not only immediately after treatment, but also several months in the future (Mandel et al., 2007).

Music therapy demonstrated significant decreases in anxiety for terminally ill patients after a single session. Self-reporting demonstrated a single music therapy session can reduce anxiety and improve quality of life for terminally ill patients. In addition, music therapy was found to decrease tiredness, drowsiness, and pain in terminally ill patients (Horne-Thompson & Grocke, 2008).

In Nilsson's (2009a) study, music may have had a greater effect on results if patients had been allowed to choose music per preference, although music had a positive effect, regardless if selected by patients or not. Relaxing music in combination with pharmacologic agents reduced stress after cardiovascular surgery. Listening to music while taking bedrest after open heart surgery should be put into clinical use (Nilsson, 2009a).

Music listening during bedrest after open-heart surgery increased oxytocin secretion, with a causal relation from psychological (music makes patients feel good and relaxed) to the physical (oxytocin release) (Nilsson, 2009b). Music intervention is an effective and safe adjunct to add to current treatment regimens for patients undergoing cardiovascular surgery, aiding in increasing relaxation for this patient population.

Music Therapy (MT) can be effectively incorporated into a program for weaning difficult-to-wean patients in a pulmonary step-down unit, and can complement the process of actively weaning patients from mechanical ventilation. Survey results for both patients and nurses indicated highly positive responses, finding that MT is beneficial to the weaning process. The physiologic signs of anxiety, manifested by HR and RR, were also reduced with MT. Patient and nurse satisfaction was found to be high for MT. MT can be used successfully, in combination with other therapies, to effectively treat anxiety for patients who are being weaned from mechanical ventilation (Hunter et al., 2010).

Sedative music, a cognitive-behavioral intervention, can provide patients with a more adaptive way of responding to anxiety and pain. The findings strongly support using the cost-effective intervention of sedative music in combination with

pharmacological agents to treat anxiety and pain during early activities immediately following open-heart surgery, such as chair rest, and should be offered as a choice to patients as an adjunct to treatment (Voss et al., 2004).

Music is an inexpensive intervention that nurses can independently employ at the bedside as an adjuvant for postoperative pain in the cardiac surgery population. Music should be encouraged for patients, as there are no known side effects. Unrelieved pain may elicit a sympathetic response, affecting vital signs, and can lead to other issues, such as interference with sleep and appetite. Unrelieved pain may also contribute to urinary tract and gastrointestinal complications (Sendelbach et al., 2006). Music can be effectively utilized to significantly decrease anxiety among cardiac surgery patients. Music therapy may also be utilized in combination with other therapies, such as opioid and/or anxiolytic use, and can be instituted prior to, during, and/or after cardiac surgery (Sendelbach et al., 2006).

Music therapy lowered physiologic measures of HR, RR, SBP and $S_{PO}2$ for patients undergoing C-clamp procedure following PCI. Music therapy also lowered the psychologic parameter of pain in patients undergoing C-clamp procedure following PCI. Allowing patients opportunity to choose music and adjust volume to satisfactory levels was very effective in enhancing relaxation for patients. Music therapy is not harmful to the patient and is very cost-effective. Music therapy can be utilized to promote healing, and to enhance entrainment of body rhythms to match musical rhythms (Chan, 2007).

The above studies have demonstrated the effectiveness of music listening on patients following cardiac surgery and in cardiac rehabilitation, decreasing anxiety, stress, and pain, as well as shortening mechanical ventilation time. Nurses have several modalities of initiating music as an adjunct to patient care, including patients bringing

equipment and music selections from home. Music is an independent nursing intervention that can be utilized for every patient population during and after surgery, and can be easily incorporated into a plan of care for patients. Music selections need to be soothing, soft, and have a rhythm in synchronization with patients' own heart rates to provide the ultimate benefit. Music intervention provides a safe and therapeutic environment for patients, assisting with comfort and healing.

Chapter III

Methods and Procedures

Introduction

Patients begin to experience anxiety as soon as the decision is made to have

surgery, and anxiety can persist for up for 3 months after surgery (Twiss et al., 2006).

Anxiety has been associated with poor outcomes in patients undergoing cardiovascular

surgery. Patients who have had CABG or VHD surgeries are intubated for a period

of time following surgery. Extended intubation time can lead to prolonged recovery and

possible increase in morbidity and hospitalization (Twiss et al., 2006).

The purpose of this study is to examine the effects of music listening therapy on

postoperative anxiety and intubation times for two groups of patients following

cardiovascular surgery: one group listening to music, and the other group not listening to

music (Twiss et al., 2006).

Problem

Patients experience anxiety at some level prior to surgery, and high levels of

anxiety are commonly treated with sedatives and anxiolytic medications to help ease

symptoms of anxiety, such as increase in vital signs (HR, RR, BP) and inability to relax.

Untreated anxiety increases patients' susceptibility to external stimuli and environmental

stressors such as cold, noise, lighting, pain, and discomfort (Kemper & Danhauer, as

cited in Twiss et al., 2006). High levels of anxiety after surgery are associated with

increased postoperative pain and prolonged recovery from surgery, interfering with

the body's ability to heal appropriately (Twiss et al., 2006). Patients receiving sedatives and anxiolytic agents after surgery to treat anxiety may also have prolonged intubation times and lengthened hospital stays in the ICU. Increased hospital stays, especially in the ICU, lead to increased health care costs, and can lead to increased morbidity (Twiss et al.).

Research Questions

1. What is the difference in postoperative anxiety test scores after CABG or valve replacement surgery in older adult patients who listen to music compared with a control group of older adult patients who do not listen to music?

2. What is the difference in intubation time after CABG or valve replacement surgery in older adult patients who listen to music compared with a control group of older adult patients who do not listen to music?

Population, Sample, and Setting

The study will take place at St. Francis Hospital in Indianapolis, Indiana, which is part of St. Francis Health Franciscan Alliance, Inc. The Cardiovascular Critical Care Unit at St. Francis is a 16-bed unit dedicated to acutely ill cardiac and vascular patients, staffed entirely by registered nurses (RN's) (St. Francis Health, Cardiovascular Critical Care, 2012).

A sample of patients will be selected from patients admitted to St. Francis for CABG or VHD surgeries over a period of 1 year from January 2013 to January 2014, with an anticipated sample of 100 patients. Inclusion criteria are: over the age of 65; scheduled for CABG or VHD surgery; oriented to person, place and time on admission; not currently participating in a music program; able to listen to music from a CD player and wear headphones; available the night before surgery to complete the State Trait

Anxiety Inventory (STAI); and able to read and write English. Exclusion criteria are: patients having emergency surgery; hard of hearing; currently participating in music therapy; deemed unstable by nursing personnel; and unable to read and/or write English.

Patients in the experimental group ($n = 50$) and control group ($n = 50$) will be matched for the following demographics: age, gender, education, previous surgery, co-morbidities, prior treatment for anxiety and/or taking medication currently for anxiety.

Protection of Human Rights

The study will be submitted to the Institutional Review Boards (IRB) of Ball State University. After obtaining approval from the IRB, researchers will meet with the Director of Nursing (DON) in the Cardiovascular Critical Care Unit (CCU) at St. Francis. The purpose of the study will be explained to the DON and approval to complete the study will be received from St. Francis. Researchers will meet individually with each patient the night before surgery. Researchers will give patients a cover letter with a detailed explanation of the music intervention procedure, answer questions, and have patients sign a letter of consent. Patients will be assured that anonymity will be maintained using patient identifiers instead of names to protect privacy. Confidentiality and privacy will be maintained throughout the study. Patients will be assured that choosing not to be involved in the study at any point will not affect medical care. Questionnaires will be structured without patient identifiers and researchers will use numbers to identify participants. Patients will randomly choose slips of paper to select participation in either the experimental or control group. No risks have been identified with the study. Benefits of the study include providing a therapeutic environment that is conducive to healing, and providing nurses with more information about non-

pharmacologic agents effective in reducing anxiety and decreasing intubation times after cardiac surgery.

Procedures

After meeting with the DON of CCU, the nurse researchers will schedule an appointment to meet with the nurse managers. The nurse managers will assist the nurse researchers to determine patients meeting inclusion criteria for the study. Patients will complete the 20 question State Trait Anxiety Inventory (STAI) to determine current state of anxiety prior to surgery. Patients will select a number and the number will be placed randomly into one of two groups: a control group receiving care as usual and an experimental group receiving care as usual along with music listening. The researchers will compile demographic information from the patients' charts to match patients in the control and experimental groups for: age, gender, co-morbidities, previous cardiovascular surgery, level of education, medications, and current or prior treatment for anxiety.

Headphones and CD players will be provided by the St. Francis Audiology Department. Patients will try on the headphones and headphones will be adjusted for comfort and fit. After signing informed consent, patients will complete the 20 question STAI. Patients will be given the option of either bringing CD's from home for music listening, or may choose from various musical selections provided by the nurse researcher including: classical, soft rock, contemporary Christian, and country and western. Patients will leave the unit, returning to St. Francis Cardiovascular CCU the following morning for scheduled cardiovascular surgery.

Patients in the experimental group will be admitted to the hospital, music will be turned to "continuous play," and headphones will be secured. Patients will be taken to surgery and will listen to music during surgery and while in the CCU. Once awake,

patients will have the option to change music selections, or to discontinue music. In addition to music listening, patients in the experimental group will receive routine care, including narcotic and sedative agents, for 3 days after surgery, the same as patients in the control group. Control group patients will receive care as usual, per routine postoperative care protocols in the St. Francis Cardiovascular CCU.

Three days after surgery, patients in both groups will be visited by the nurse researcher, and will complete the same 20 question STAI state anxiety questionnaire completed prior to surgery. Patients too weak to complete the questionnaire at that time can respond to questionnaires given verbally by the nurse researcher, with patients holding up fingers or pointing to cards with answers from 1 through 4 on the Likert scale printed on the cards. Headphones will be sanitized with Cavi Wipes and placed in the patient's closet with the CD player when the patient decides to discontinue music listening.

Instrumentation

The instrument utilized for the study will be the state portion of the Spielberger State Trait Anxiety Inventory (STAI, 1983). The STAI has been widely used and is a psychometrically sound measure of anxiety (Spielberger, 1983). State anxiety is defined as the temporary emotional response to a stressful situation, not necessarily anxiety that is part of the person's psychological makeup. The STAI consists of 20 questions using a 4-point Likert scale, with 1 = not anxious to 4 = very anxious. Validity for the STAI was compared with the measures of the Taylor Manifest Anxiety Scale and Multiple Adjective Check List, with correlations of .80 and .75, respectively (Spielberger, Gorsuch, & Lushene, 1970). Test-retest reliability was measured with a small sample of

Cardiovascular CCU nurses, and found to be at .95, considered to be a sound measure of reliability (Wong, Lopez-Nahas, & Molassiotis, 2001).

Design

The design for the study will be quasi-Experimental repeated measures. Repeated measures is most commonly used in nursing to show comparison of groups following treatment. This type of design is a classic means for comparison of a treatment group with a non-treatment group, and is utilized to decrease the risk of bias in selection of groups (Burns & Grove, 2009).

Data Analysis

Data analysis of pretest scores will be conducted through a one-way analysis of variance (ANOVA) to compare anxiety levels of subjects in the control group with the experimental group. ANOVA has been selected for analysis to compare variance within each group with the variance between groups, and clearly determines the location of a significant difference, since only two groups will be studied. The result of the analysis is the *F* statistic, used to determine whether the two groups are statistically significant prior to testing (Burns & Grove, 2009).

A one-way ANOVA will also be used to determine differences in state anxiety test scores after surgery between the two groups. A one-way ANOVA has been chosen for statistical analysis for this measurement because it compares the means of three or more samples, and avoids the error inherent in performing multiple *t*-tests (Burns & Grove, 2009).

Length of intubation time will be measured in minutes, and will be calculated from the time the patient leaves the operating room until the time extubation occurs in the CCU. The difference in minutes of intubation time between the two groups will be

measured utilizing a one-way ANOVA to determine statistical significance. Descriptive statistics will be used for demographic data with mean and standard deviation (SD) (Burns & Grove, 2009).

Summary

This chapter describes the type of research study, the design, and methods for statistical analysis. The anticipated sample will consist of 100 patients who will be admitted to St. Francis Hospital in Indianapolis between January 2013 and January 2014 for cardiac surgery. The treatment will be music listening with a CD player and headphones. The dependent variables will be anxiety and intubation time. Data will be measured with the state portion of the STAI. The proposed study is a replication of Twiss et al.'s (2006) study to add to the current knowledge of the effects of music as a nursing intervention for patients following cardiovascular surgery.

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