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THE EFFECT OF MUSIC ON REDUCING ANXIETY IN SURGICAL PROCEDURES: A META-ANALYSIS

By

Sang Eun Lee

A THESIS

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

MASTER OF MUSIC

Music Therapy

2009

ABSTRACT

THE EFFECT OF MUSIC ON REDUCING ANXIETY IN SURGICAL PROCEDURES: A META-ANALYSIS

By

Sang Eun Lee

The purpose of the present meta-analysis is to examine the overall efficacy of music for anxiety reduction in patients undergoing surgery. This study compiled the results of 29 research reports with a total of 1781 subjects, analyzing eight categorical variables as moderator variables: year of study, publication source, type of measurement, age, gender, intervention period, music preference and type of control group. Results showed the overall average effect size (ES) of $d. = .39$ ($p = .00$) which cannot explain all studies because effect sizes across the 29 studies were not consistent, as the test of homogeneity was statistically significant ($p = .00$). In the analysis of categorical variables, two variables - music preference and type of control group - significantly affected the magnitude of the effect of each sub-categorical variable. This research supports that music as a therapeutic intervention is effective in anxiety reduction in surgical procedures, and suggests that in order to maximize the effect of music, music therapists should be involved in the medical treatment and research.

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This thesis is dedicated

to my God for making all this possible.

ACKNOWLEDGMENTS

I would like to express my appreciation to those who supported me while I was finishing my thesis.

Firstly, I want to thank members of my thesis committee, Roger Smeltekop, Frederick Tims, and Chae Young Lim for their constant encouragement and intellectual support. I especially acknowledge the invaluable support I received from my thesis committee chair, Professor Roger Smeltekop. He believed in my process from the start and that helped me complete my work successfully. Dr. Tims also strongly encouraged me while I was writing my thesis, and Dr. Lim supported me whenever I had statistical difficulties. I would like to express my gratitude to them again.

I am grateful to my friends in the prayer meetings, "Sisters of Lydia," who always shared the moments of sadness and happiness with me: Eunsil Lee, Miran Kim, Sunhee Moon, Hyunjoo Ha, Mikyung Kim and Hyegyu Lee. They have been my family for the last three years. In particular, I would like to express my heart-felt gratitude to my friend, Jeonghee Noh who always helped me overcome any difficulties during the master's period.

I really want to thank my family. I could have not completed my master's study without support and love from my family. I would like to express my gratitude to my husband, Sangho Lee, and to my daughter, Hyerim Hailey Lee, for being a constant source of my strength and endurance all these years. My special thanks also go to my mother Soonkyu Lee for her unconditional love and support.

Finally, my greatest gratitude goes to my Heavenly Father who has blessed me with these amazing people. He is always with me at every moment. It has been a remarkable

period of growth for me during which I began to learn walking in the Lord. I thank Him for showing me His grace, and for providing me with wisdom and courage to go through this journey.

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CHAPTER 1

INTRODUCTION

In modern society, the quality of life has been increasingly emphasized. This is especially so in medical settings. The more medical techniques develop, the more importance is given to the quality of medical services and their affects on the patients, physically as well as emotionally and psychologically. The word *hospital* itself often generates anxiety. Patients undergoing surgery are often more anxious than they would be during other treatment procedures, and this negatively impacts not only the treatment procedures but also the recovery time. To offset and/or reduce these negative symptoms, many efforts have been made to increase the quality of intervention services in medical settings. One such intervention is music.

Music has been used for human health since antiquity, including its use as an effective therapeutic tool in non-pharmacological interventions. Accordingly, many researchers have investigated the effect of music therapy on reducing negative symptoms, such as anxiety, in medical settings. In the music therapy field, as well as in other professional health fields, researchers have studied the effect of the clinical use of music on reducing anxiety, especially during surgical procedures. Since 1990, studies about such effects have increased, some actually done by music therapists, others by medical professionals. Despite this, however, music therapy is not actively applied in the surgical procedures.

To remedy such a circumstance and to expand and improve music therapy's efficacy in medical settings, evidence-based research is required. Thus, some researchers have tried to synthesize results from sets of studies to examine the generalization of music's effects in a medical setting. Meta-analysis is one of the methods for the synthesis of previous quantitative research, and statistically has more power than other methods. Therefore, using meta-analysis as evidence-based research, the present study demonstrates the effect of music therapy on reducing anxiety in surgical procedures.

Purpose of the Study

This study's purpose is to identify music therapy's effect on reducing anxiety in surgical procedures by statistically synthesizing individual findings which have been both published and unpublished through the year 2008 and collected according to the criteria for meta-analysis. Such meta-analysis seeks to establish (or help establish) a standardized clinical protocol for the effective use of music for reducing anxiety in surgical procedures.

Organization of the Thesis

The present study is organized into five chapters. Chapter One illustrates the general background, purpose and importance of this study. Chapter Two reviews relevant literature according to related topics. In Chapter Three, the research design and methodology are described, including the search and selection of research studies, study description, literature coding, statistical analyses and procedure. Chapter Four presents statistical outcomes. Chapter Five summarizes findings, implications, limitations and directions for further study.

CHAPTER 2

LITERATURE REVIEW

Previous research was reviewed to find support for the present research idea that music is an effective therapeutic tool to reduce anxiety in surgical procedures. This chapter is comprised of three sections. The first reviews previous research related to anxiety in surgical procedures, explaining anxiety factors in hospitals, especially in surgical procedures. The second reviews previous research on the effective use of music as a therapeutic intervention, explaining background, application according to specific type of surgery, population and period. The third reviews previous meta-analysis research related to music therapy, explaining the efficacy of meta-analysis.

Anxiety in Surgical Procedures

Many words can describe patients' feelings while in the hospital. One is anxiety. In general, anxiety is defined as an emotional state comprised of feelings of tension, uneasiness, nervousness and worry, with arousal of the autonomic nervous system (Spielberger, 1976). Moreover, Spielberger classified two types of anxiety: state anxiety and trait anxiety. State anxiety is produced temporarily in specific stressful situations. Trait anxiety is produced according to the frequency of individual experiences and personality (Spielberger, 1966, 1976). Anxiety as a symptom and as a disorder is a physical and psychological result of illness, especially in a medical setting (Ball, Goddard & Shekhar, 2002). According to Kaempf and Amodei (1989), anxiety in surgical procedures is the feeling of worry or fear in expectation of surgery; it is measured by physiological assessments such as blood pressure, pulse and respiration rate, and by self-report through the state-trait anxiety inventory (STAI). Ferrer (2005) also mentioned that hospitals are unfamiliar places that differ from normal environments, and they readily elicit fear and worry, not only from the environment itself but also from uncertainties about a personal diagnosis and treatment. According to numerous studies, a number of factors contribute to anxiety; these include unfamiliar environment, insufficient understanding of medical procedures, uncontrolled situations, patient personality characteristics, staff behavior, etcetera (Jarred, 2003; Marley, 1984; Walworth, 2003).

As mentioned above, both hospitalization and, in particular, surgical procedures produce anxiety. This directly relates to fear in unfamiliar environments. Voulgari, Papanikolaou, Lykouras, Alevizos, Alexiou and Christodoulou (1994) studied causes of anxiety among 162 inpatients. They reported that about 10% of the patients presented anxiety for several days prior to surgery. Also, the survey by Zvara, Manning, Stewart, Mckinley and Cran (1994) showed that the main concern among the 200 day-surgery patients was about anesthesia. In particular, they were anxious about the induction method, the anesthetic drugs and the recovery from side effects. Some studies also assessed patients' preoperative anxieties. Badner, Nielson, Munk, Kwiatkowska and Gelb (1990) suggested the need for supplementary intervention for highly anxious patients. Beddows (1997) also examined preoperative anxiety among 40 inpatients. The patients were assigned randomly to the experimental and control groups according to whether patients were provided information about surgery through direct visits or merely by letters prior to surgery. The researcher demonstrated the difference in anxiety level experienced by the experimental group and the control group, prior to surgery. Results indicated that the control group experienced significantly more anxiety. Birch, Chakraborty and Miller (1993) studied 124 patients' anxiety levels on the day of elective day-case cystoscopy. The researchers demonstrated that patients' anxiety's levels on surgery day were higher than those of patients who had previous surgical experience. Additionally, they found that anxiety levels in female and novice patients were higher than in other patients.

Some studies demonstrated specific circumstances that evoked anxiety. Cobley, Dunne and Sanders (1991) studied the distress of patients who underwent general anesthesia. They found that the five most specific events for such distress were i) waiting for the operating theatre, ii) not being allowed to drink, iii) not being allowed to wear dentures, iv) going inside the operating theatre and v) being taken by trolley to the operating theatre. Jelicic and Bonke (1991) surveyed differences in anxiety between elective and general surgery among 20 patients; the latter group experienced more anxiety. Calvin and Lane (1999) demonstrated that all surgery patients experienced anxiety to some extent. Such anxiety presents itself in physical and psychological aspects, and negatively affects a patient's health. Therefore, as health professionals, ameliorating anxiety and eliminating stressors are important goals for recovery.

Use of Music in Surgical Procedures

Since antiquity, music has been used as a healing intervention for attaining harmony between body and mind. Music commonly relaxes humans and supports emotion (Aldridge, 1993; Schullian &Schoen, 1948), and music has been used in this way in many cultures and in diverse forms (Aldridge, 1993). After early uses of music as a therapeutic tool through the phonograph, recorded music was used as a non-pharmacological intervention for patients in the medical setting, including those experiencing a variety of problems such as cancer, severely compromised immune systems, pain and anxiety (Aldridge, 1993). As actual medical treatment, Cherry and Pallin (1948) reported the effect of music in anesthesia, and Jacobson (1957) and Gardner and Licklider (1959) demonstrated favorable results from the use of music in dental treatment. Many researchers reported the effect of music as audio analgesia (music has a relaxing effect as an auditory stimulus) in dental procedures (Atterbury, 1974; Corah, Gale, Pace, & Seyrek, 1981; Davila & Menendez, 1986; Foutz, 1970; Gardner and Licklider, 1959; Gardner, Licklider, & Weisz, 1960; Jacobson, 1957; Long & Johnson, 1978; Monsey, 1960; Schermer, 1960; Standley, 2000; Weisbrod, 1969).

Such findings pertinent to dental conditions also applied to other medical treatments. Especially in surgical procedures which are stressful to patients, because the anxiety or fear caused by such stressors negatively can affect patient health, music interventions may be effective in decreasing negative feeling (Ferrer, 2005). Since listening to music in the operating theater was attempted by Padfield (1976) and MacClelland (1979), it has been tried as a therapeutic tool for reducing anxiety. Chetta (1981) studied the use of music as a therapeutic intervention for 75 pediatric patients. There were three groups: i) verbal preoperative information and songs with lyrics about the information, ii) verbal preoperative information and songs with lyrics about the information and music before taking preoperative medication and iii) verbal preoperative information. As a result, the group with verbal preparation with music and music before taking preoperative medication had significantly-reduced anxiety. The researcher not only demonstrated the effect of music with verbal preparation for reducing preoperative anxiety but also emphasized that acquiring proper information about the surgery aided in coping with stressful conditions. Many subsequent studies reported the effect of music on anxiety reduction in surgical procedures, and demonstrated that, to be comfortable and relaxed in body and mind, negative stressors which cause fear and anxiety should be eliminated (Jarred, 2003; Finlaw, 1997; Sanderson, 1986; Standley, 1986, 1996, 2000; Staples, 1993).

According to Sanderson (1986), music listening was highly effective in reducing preoperative anxiety and postoperative pain or anxiety. The study was performed with 60 patients who underwent elective orthopedic surgery. Music was provided to the experimental group in the phase between leaving the hospital room until anesthetized in the operating room and while in the recovery room. Results showed significant differences between experimental and control groups in reduced preoperative anxiety, postoperative pain or anxiety, and amount of pain medication needed. Therefore, this study demonstrated that listening to music significantly decreased preoperative anxiety and postoperative pain or anxiety. MacDonald, Ashley, Davies, Serpell, Murray, Rogers and Millar (1999) also investigated the effect of music listening on reducing anxiety with 40 patients having minor foot surgery. To measure anxiety levels, the researchers thrice measured. The first assessment was measured as the baseline level of anxiety, and the second and third assessments were measured at 1hour and 4 hours after surgery. Music listening was provided to the experimental group between the second and third assessments. Results showed that the experimental group's anxiety levels in postoperative assessments were lower than those of the control group. Also, postoperative anxiety was lower than preoperative anxiety in the experimental group. The research suggested that this matter needs to be investigated for a longer period and relative to major surgical procedures.

Some researchers tried to demonstrate the effect of music intervention for the elderly undergoing surgery. Twiss, Seaver and McCaffrey (2006) examined the effect of music listening on postoperative anxiety with the elderly. Sixty elderly subjects undergoing cardiovascular surgery were assigned to the experimental and control groups. The experimental group was provided music listening during surgery and in surgical intensive care unit; the control group received normal postoperative care. Both groups' anxiety levels were measured before surgery, and three days after, by the State Trait Anxiety Inventory (STAI). Results showed that the experimental group's anxiety scores were significantly lower than those of the control group. Therefore, music listening was effective in reducing anxiety in elderly, cardiovascular-surgery patients. In another case of the elderly, Cruise, Chung, Yogendran and Little (1997) evaluated the effect of music with elderly outpatients undergoing cataract surgery, 121 of whom were assigned randomly to four groups: i) relaxing suggestions, ii) white noise, iii) operating room noise or iv) relaxing music. Anxiety levels measured by STAI and a Visual Analogue Scales (VAS) did not have significant differences among the four groups, but in physiological measurement, i.e., systolic blood pressure, differences were noted. In addition, the patients in the relaxing music group had more satisfaction about the whole operative experience than did other groups. This study indicated that, among elderly patients, music listening affected satisfaction about the surgical procedure. Barnason, Zimmerman and Nieveen (1995) also demonstrated the influence of music intervention on mood and anxiety among patients undergoing heart surgery. Ninety-six elderly patients were assigned randomly to three groups: i) music, ii) music and video and iii) scheduled rest. Patients received interventions during postoperative days 2 and 3, and anxiety levels were measured by STAI and both anxiety and mood levels were measured by Numeric Rating Scale (NRS). They also had physiological measurements. Although the results did not show significant differences between the three groups in anxiety and mood levels, there was effective mood-improvement in the post-operative recovery period.

As mentioned above, in the field of cardiac surgery, studies about the effect of music on anxiety reduction were performed actively. Among 46 cardiac patients, Parker (2004) examined the effects of music therapy on reducing pain and anxiety and negative psychosocial perceptions such as worry. Subjects participated in this study after undergoing cardiac procedures or surgery, and were assigned to one of three groups: i) relaxation and imagery with live music, ii) literature and iii) no intervention. Results revealed that the experimental group with relaxation and imagery with live music had significantly lower assessments of pain, anxiety and negative psychosocial perceptions than had other groups. Therefore, music intervention is beneficial in reducing cardiac patients' anxiety during the postoperative period. Sendelbach, Halm, Doran, Miller and Gaillard (2006) demonstrated the influence of music therapy on physiological and psychological symptoms for cardiac surgery patients. Eighty-six patients were randomly assigned to an experimental or a control group; the former had 20 minutes music listening. Anxiety, pain, physiological parameters, and medication consumption were measured after surgery. Results indicated significant differences between the groups in anxiety and pain, but in no other aspects. That study found that music therapy benefits anxiety reduction. In addition, many other researchers in the heart-surgery field tried to demonstrate the efficacy of music therapy on anxiety reduction (Barnason, Zimmerman, & Nieveen, 1995; Twiss, Seaver, & McCaffrey, 2006; Voss, Good, Yates, Baun, Tompson, & Hertzog, 2004).

Some researchers have examined the effect of sedative and relaxing music. Kaempf and Amodei (1989) evaluated the effect of sedative music on reducing anxiety among 33 outpatients awaiting arthroscopic surgery in the operation-room holding area. Anxiety levels first were measured by STAI and recorded via physiological measures such as blood pressure, pulse and respiration rates as soon as they arrived at the room. They were then measured again after a 20-minute interlude of classical music provided to the experimental group while they waited. Results were that respiration rates in the experimental group were lower, significantly so, than in the control group. However, anxiety scores and blood pressure of patients in both groups were lower. The research indicated that music can be used as a therapeutic tool for decreasing anxiety levels prior to surgery although anxiety scores and blood pressure were not significantly different. Voss, Good, Yates, Baun, Thompson and Hertzog (2004) also investigated sedative music for reducing anxiety and pain after open-heart surgery. The study was performed with 61 adult patients in a pre-post test experimental design. Patients were tri-grouped: i) 30 minutes of sedative music, ii) scheduled rest and iii) usual treatment. Music selected by each patient was provided to the music group. As a result, the sedative-music group and the scheduled-rest group showed significantly decreased anxiety and pain sensation and distress; however, the usual-treatment group, as the control group, showed no differences. By comparison, patients in the sedative- music group were significantly lower in all three variables than were the other two groups. Therefore, that study indicated that sedative music was effective for decreasing postoperative anxiety.

In the study about preoperative anxiety, Staples (1993) investigated the effect of music on reducing preoperative anxiety. Relaxing music was provided to reduce anxiety among 40 patients aged 18 to 86, in a preoperative room. For outcomes, anxiety levels in the experimental and control groups were measured by physiological responses as well as observable behaviors. As results, although no significant statistical differences showed between the two groups, the experimental group showed less anxiety than did the control group. The study indicated that music might be helpful in decreasing anxiety levels. Wang, Kulkarni, Dolev and Kain (2002) also investigated music and preoperative anxiety with 93 adult patients. Subjects undergoing anesthesia and surgery were assigned to two groups: i) 30-minutes of patient-selected music and ii) no intervention. Results measured via STAI and via physiological measures showed that the music decreased anxiety scores but that there was no difference in the physiological outcomes between two groups. Despite no differences in physiological outcomes, research indicated that music was effective in reducing preoperative anxiety. Additionally, with day-surgery patients, Cooke, Chaboyer, Schluter and Hiratos (2005) studied the effect of music on preoperative anxiety. There were three groups: i) an intervention, ii) placebo and iii) no intervention. Each group had 60 subjects and was measured by STAI before and after preferred music listening. Results showed that music significantly decreased anxiety levels in the experimental group compared to the other groups. Besides all the instances specified above many other researchers have investigated the relationship between preoperative anxiety and music (Arslan, Özer, & Özyurt. 2008; Augustin, & Hains, 1996; Gaberson, 1995; Haun, Mainous, & Looney, 2001; Hayes, Buffurn, Lanier, Rodahl, & Sasso, 2003; Jarred, 2003; Kaempf, & Amodei, 1989; Kain, Caldwell-Andrews, Krivutzs, Weinberg, Gaal, Wang, & Meyes, 2004; Sanderson, 1986; Staples, 1993; Szeto, & Yung, 1999; Wang, Kulkami, Dolev, & Kain, 2002; Williams, 2000; Winter, Paskin, & Baker, 1994; Yung, Chui-Kam, French, & Moon, 2002).

As mentioned by Chetta (1981), the effectiveness of music for pediatric patients on reducing anxiety has been demonstrated in research studies. Aldridge (1993) investigated the efficacy of music to relieve anxiety in children; 13 pediatric patients were provided music therapy sessions prior to elective surgery. Their anxious behaviors were observed by a therapist before each session, and additional patient-information was gathered through questionnaires. Results showed that the children were less anxious after sessions. The research recommended music sessions before surgery for anxiety reduction of pediatric patients. Oggenfuss (2001) studied the effects of music therapy on pediatric patients. The researcher reported the effect of a 30-minute music therapy session for reducing pediatric patient anxiety. This study reported that 95% of parents of child patients reported music therapy's positive effectiveness in decreasing anxiety. Although the result was not significant, parents positively recognized the need for music therapy for their children. The researcher reported that music therapy was helpful also for decreasing anxiety levels. In the study by Kain, Caldwell-Andrews, Krivutzs, Weinberg, Gaal, Wang and Mayes (2004), they also assessed the influence of interactive music therapy on reducing anxiety of children. The latter underwent anesthesia and surgery and were randomized to three groups: i) those provided interactive music therapy, ii) those orally medicated by *midazolam* and iii) a control group. As a result, those in the *midazolam* group were significantly less anxious than were the other two groups. Moreover, there was no significant difference between the music therapy group and the control group. However, the researchers argued that the trial condition itself, an intervention-induced anxiety, affected the result. That is, they asserted that because music therapy sessions were reviewed as one of the treatments which can induce anxiety, children in the experimental group were as anxious as those in the control group. Besides, researchers discussed the quality of the music therapists, which are music therapists' abilities to apply music interventions appropriately to each patient. Therefore, effects of music interventions can differ according to how appropriately and clinically music therapists apply music.

Meta-analysis in Music Therapy

Recently, much quantitative research about the use of music in the medical field has been done. Thus, via cumulative research, meta-analysis can be performed (Standley, 2000). Meta-analysis is the statistical method to summarize, integrate and interpret outcomes obtained from existing quantitative research data which have the same specific topic (Lipsey & Wilson, 2001). Lipsey & Wilson (2001) stated that "the key to meta-analysis, therefore, is defining an effect size statistic capable of representing the quantitative findings of a set of research studies in a standardized form that permits meaningful numerical comparison and analysis across the studies" (p. 5). Since a meta-analysis was attempted by Karl Pearson in 1904, to achieve more objective statistical power of research outcomes and evaluate the overall relationship between variables, the need for integrating previous research data has increased (Hunter, Schmidt, & Jackson, 1982; Rosenthal, 1984; Rosenthal & Dimatteo, 2001; Oh, 2007). Thus, such a need has caused many researchers to perform meta-analyses in diverse fields (Glass, 1976). Especially, in the fields of psychotherapy, as Glass and Smith (1977) synthesized the outcome from research studies about psychotherapy and counseling through meta-analysis; they emphasized the effect size in therapy.

In the field of music therapy, several researchers have attempted meta-analysis to generalize results of multiple studies. Standley (1986) was the first to implement a meta-analysis using 29 studies in medical and dental treatment. Through additional updating, as Standley (1996) finally analyzed 232 dependent variables in 92 studies, the research resulted in an overall average effect size (ES) of *d.* = 1.17. This showed that music therapy is effective in medical /dental treatment. Synthesizing the results of general meta-analysis in music and medicine, this research statistically showed the effects of music therapy in medical/dental settings, thus provided rationale for developing music therapy applications in medical settings (Standley, 1992, 1996, 2000). Standley also studied the effects of music as reinforcement in education and therapy settings through 208 variables in 98 studies. This research resulted in an overall average effect size (ES) of *d.* = 2.90 and demonstrated that contingent music is a more effective reinforcement than is continuous music or other stimuli (Standley, 1996). Subsequently, Standley (2002) studied the effectiveness of music therapy for premature infants in Neonatal Intensive Care Units (NICU). This study demonstrated that music is significantly effective for this population, showing a significant and large overall mean effect size ($d = .83$). Standley and Whipple (2003) conducted a meta-analysis with 29 studies to demonstrate the efficacy of music therapy in pediatric healthcare through meta-analysis. It showed an overall mean effect size to be $d = .64$ and that the music therapy is more effective with adolescents than for other ages.

Standley's work induced other music-therapy researchers to attempt meta-analysis for assessing music therapy effectiveness among diverse populations. Koger, Chapin and Brotons (1999) researched a meta-analytic review of literature in music and dementia. As this research statistically updated a qualitative review of Brotons, Kroger and Pickett-Cooper (1997), it demonstrated the effectiveness of music therapy in maintaining and improving social and cognitive skills and reducing inappropriate behavior by dementia patients. Analyzing 21 studies with 336 subjects with dementia, the results indicated an overall mean effect size (ES) of $d = .79$ with a confidence interval (CI) of .62 to .95. Therefore, music therapy is significantly effective for dementia. Specifically, as Q-value, obtained to investigate whether the mean effect size is homogeneous in studies, was 51.485 ($p < .01$), it was difficult to verify relative effectiveness between different methodological protocols in this research. Whipple (2004) conducted a meta-analysis of 12 dependent variables from 9 quantitative research studies. That research demonstrated the effectiveness of music interventions for children and adolescents with autism. The results reported an overall mean effect size (ES) of $d = .77$. Therefore, that research showed that all music interventions for treatment were highly effective for this population. Pelletier (2004) studied the effect of music on decreasing arousal caused by stress. The researcher analyzed 22 articles and resulted in an overall effect size (ES) of $d = .67$. Therefore, that research showed that music and relaxation with music are effective interventions for reducing stress.

In the population of psychiatry, Silverman (2003) analyzed 19 quantitative studies, and demonstrated the influence of music on the symptoms of psychosis. Results indicated an overall effect size (ES) of $d = .71$. This meta-analysis demonstrated that all types of music influence suppression of the patient's inappropriate behaviors associated with the symptoms of psychosis, and that there were no significant differences between active music therapy and passive listening. Specifically, it suggested that classical music is less effective than is non-classical music. It showed that classical music has structure and form that can improve health and well-being; however, this theory cannot be constantly applied. Therefore, popular music was verified to be an effective intervention as a therapeutic tool. Gold, Voracek and Wigram (2004) first performed a meta-analysis to investigate the efficacy of music therapy in the population of children and adolescents with psychopathology. After eliminating one of 11 studies which was outlying, that research statistically resulted in an overall mean effect size (ES) of $d. = .61$. Therefore, it demonstrated that music therapy is effective as a clinical intervention for psychopathology. In particular, it showed large effectiveness for developmental and behavioral disorders in this population. You and Wang (2002) evaluated the effect of music therapy for patients with chronic schizophrenia. Their research meta-analyzed 11 articles and 603 subjects and indicated that assisted music therapy has a short-term effect on the symptoms of chronic schizophrenia.

Related to music therapy in medical settings, Evan (2001) demonstrated music's effectiveness as a therapeutic intervention for adult hospital patients through a systematic review which included both an integrative literature review and meta-analysis. In this research, 19 studies were analyzed regarding dependent variables such as anxiety, pain, sedation, tolerance, satisfaction, mood and length of stay. As a result, music was shown to have an effective impact on anxiety, respiratory rate, mood, and tolerance. In addition, research by Rudin, Kiss, Wetz and Sottile (2007) focused on the efficacy of music therapy in gastrointestinal endoscopy. The research analyzed a total of 641 patients and indicated that music therapy has significant effectiveness for reducing anxiety levels, need for analgesia and sedation, and procedure times. Therefore, music therapy is a highly effective intervention for relief of stress and for analgesia for patients undergoing endoscopy procedures. Recently, Bechtold, Puli, Othman, Bartalos, Marshall and Roy (2009) conducted meta-analysis with patients undergoing colonoscopy. They analyzed the amount of sedative medications, pain scores, experiences about procedures, and willingness to repeat future procedures, with 8 studies and 712 subjects. Results indicated that patients' experience scores ($p < .01$) had statistically significant differences between two variables: music vs. non-music. That is, patients reported that music have beneficial intervention in decreasing negative symptoms. As a result, music positively affected patients' overall colonoscopy experience.

As mentioned above, meta-analysis in music therapy has been performed in diverse fields and populations, and is an effective approach to generate more objective and substantial theory for clinical application of music therapy. However, meta-analysis has a limitation: because it excludes qualitative research, and can be over-simplified and ignore characteristics from qualitative research. Nonetheless, because it increases the statistical power of quantitative summaries of each experiment, it is highly effective for generalizing research results.

CHAPTER 3

RESEARCH DESIGN AND METHODOLOGY

Chapter three describes research design and methodology in detail. The first section explains how to search and select studies for meta-analysis. The second describes selected studies and shows the statistics of each. The third explains how to code for meta-analysis, which is for the overall mean effect size and for analyses for each categorical- and sub-categorical variable. The final section explains how to analyze and interpret, including null hypotheses.

Literature Search and Selection

This meta-analysis focused on the effect of music to reduce anxiety in surgical procedures. Studies first were collected from *Standley's Music Research in Medical/Dental Treatment* literature references (2000). Secondly, they were sought from published and unpublished articles in English through the year 2008. They were collected through online databases such as Google Scholar, PubMed and Proquest using key words *music therapy, music and anxiety in medical setting, music and anxiety in hospital, music and anxiety in surgery.* Another search, manually, included *Music Therapy, Journal of Music Therapy, and Music Therapy Perspectives.* According to meta-analysis criteria, all studies were selected by the following conditions: (a) subjects were groups participating in empirical research, (b) studies compared two groups, experimental- and control groups, (c) studies had sufficient information in quantitative data for extracting an effect size, (d) studies measured by self-report. To eliminate bias, studies were excluded which assessed physiological measures, which can measure anxiety as well as other symptoms such as pain. Also, studies which addressed labor and delivery or caesarean birth were excluded. Finally, 29 studies (overall N = 1781) met the requirements, and all 29 assessed music's effectiveness by comparison with a control group.

Study Description

Twenty-nine studies with a total of 1781 subjects investigated the effect of music on reducing anxiety in surgical procedures. The present study was performed with 4 studies before 1990 and 25 studies from 1990 to 2008.The selected studies are marked with an asterisk in the references, and their descriptions and statistics are presented in Table 1: Parts A and B and Table 2. Only 6 studies were performed by music therapists (Armatas, 1964; Jarred, 2003; MacDonald, *et al.*, 1999; Sanderson, 1986; Staples, 1993; Steinke, 1991), and four of the six studies were unpublished master's theses. The other twenty-three studies were by medical professionals, and one of them was an unpublished master's thesis. Of the total studies, seventeen studies provided music intervention at the preoperative period, six studies provided it at the postoperative period (Armatas, 1964; Barnason *et al.*, 1995; Macdonald *et al.*, 1999; Nilsson *et al.*, 2003; Voss *et al.*; 2006) and three studies were on intraoperative anxiety (Cruise *et al.*, 1997; Kain *et al*, 2001; Mok *et al*, 2003; Steelman, 1990). One study was for perioperative anxiety (Moss, 1987). The remaining two studies provided a music intervention at the preoperative and postoperative period (Seinke, 1991) or intraoperative and postoperative period (Twiss *et al.*, 2006). Many studies had adult subjects, six were on the elderly (Barnason *et al*, 1995;

Cruise *et al.*, 1997; Hayes *et al.*, 2003; Sendelbach *et al.*, 2006; Twiss *et al.*, 2006; Yung *et al.*, 2002) and two were on children (Kain *et al.*, 2001; Steinke, 1991). The study by MacDonald et al (1999) did not provide age. Regarding gender in each study, there were female subjects with eleven studies, male subjects with nine studies, equal numbers of male and female subjects with three studies. Six studies did not provide the gender numbers. All 29 studies used self-report for measuring anxiety scores. Most studies used the state portion of State Trait Anxiety Inventory (STAI) by Spielberger and colleagues (1970), except for three studies (Garberson, 1995; Jarred, 2003; Voss et al., 2004) measured by a Visual Analog Scales and 2 studies (Armatas, 1964; Nilsson, 2003) by behavioral observation by a nurse and Observed Behavior Time Sampling Form (OBTSF). All 29 studies used music listening as an intervention and used recorded music, except for Jarred (2003) using live music. Studies also analyzed by whom the music was selected. Eighteen studies used music selected by patients, seven used music selected by medical professionals and four studies were by music therapists (Armatas, 1964; Hayes *et al.*, 2003; Nilsson *et al.*, 2003; Sendelbach *et al.*, 2006). Most control groups provided no intervention conditions, except for five which used interventions which were: scheduled rest (Barnason *et al.*, 1995), operating room noise (Cruise et al., 1997), placebo (Kain et al., 2001), blank tape (Nilsson *et al.*, 2003) and relaxation and imagery (Seinke, 1991).

As presented in Table 2, there were 21 studies with positive effect size and 8 with negative effect size. The study by Mok et al (2003) has the highest effect size ($d = 2.84$); the study by Cruise et al has the lowest effect size ($d = -.40$).

Table 1
Descriptions of Included Studies
Part A

Study	Publication source	Intervention period	Age	Gender
Armatas (1964)	UMTT	Postoperative	18 to 65	Female
Arslan et al. (2008)	Medical	Preoperative	18 to 65	Male
Augustin et al. (1996)	Medical	Preoperative	18 to 65	Male
Barnason et al. (1995)	Medical	Postoperative	Over 65	Female
Cooke et al. (2005)	Medical	Preoperative	18 to 65	Equal NO.
Cruise et al. (1997)	Medical	Intraoperative	Over 65	Female
Gaberson (1995)	Medical	Preoperative	18 to 65	Female
Haun et al. (2001)	Medical	Preoperative	18 to 65	Female
Hayes et al. (2003)	Medical	Preoperative	Over 65	Male
Jarred (2003)	UMTT	Preoperative	18 to 65	Female
Kaempf et al. (1989)	Medical	Preoperative	18 to 65	Unknown
Kain et al. (2001)	Medical	Preoperative	Less than18	Male
MacDonald et al. (1999)	MT	Postoperative	Unknown	Female
McRee et al. (2003)	Medical	Preoperative	18 to 65	Female
Mok et al. (2003)	Medical	Intraoperative	18 to 65	Female
Moss (1987)	Medical	Perioperative	18 to 65	Unknown
Nilsson et al. (2003)	Medical	Postoperative	18 to 65	Male
Sanderson (1986)	UMTT	Preoperative	18 to 65	Male
Sendelbach et al (2006)	Medical	Postoperative	Over 65	Male
Staples (1993)	UMTT	Preoperative	18 to 65	Equal NO.
Steelman (1990)	Medical	Intraoperative	18 to 65	Unknown
Steinke (1991)	MT	Pre, postoperative	Less than18	Equal NO.
Szeto et al. (1999)	Medical	Preoperative	18 to 65	Unknown
Twiss et al. (2006)	Medical	Intra, postoperative	Over 65	Female
Voss et al (2004)	Medical	Postoperative	18 to 65	Unknown
Wang et al. (2002)	Medical	Preoperative	18 to 65	Male
Williams (2000)	UMT	Preoperative	18 to 65	Female
Winter et al. (1994)	Medical	Preoperative	18 to 65	Unknown
Yung et al. (2002)	Medical	Preoperative	Over 65	Male

Note. UMTT: Unpublished Music Therapy Thesis. UMT: Unpublished Medical Thesis. Equal NO.: Equal Number.

Table 1

Part B

Study	Type of Measurement	Music Presentation	Music Preference	Control Group Condition
Armatas	BO	Recorded	MT	No intervention
Arslan et al.	S-STAI	Recorded	Patient	No intervention
Augustin et al.	S-STAI	Recorded	Patient	No intervention
Barnason et al.	S-STAI	Recorded	Patient	Scheduled rest
Cooke et al.	S-STAI	Recorded	Patient	No intervention
Cruise et al.	S-STAI	Recorded	MP	Operating room noise
Gaberson	VAS	Recorded	MP	No intervention
Haun et al.	S-STAI	Recorded	Patient	No intervention
Hayes et al.	S-STAI	Recorded	MT	No intervention
Jarred	VAS	Live	MP	No intervention
Kaempf et al.	S-STAI	Recorded	MP	No intervention
Kain et al.	mYPAS	Recorded	Patient	Placebo
MacDonald et al.	S-STAI	Recorded	MP	No intervention
McRee et al.	S-STAI	Recorded	Patient	No intervention
Mok et al.	S-STAI	Recorded	Patient	No intervention
Moss	S-STAI	Recorded	MP	No intervention
Nilsson et al.	S-STAI	Recorded	MT	Blank tape
Sanderson	OBTSF	Recorded	Patient	No intervention
Sendelbach et al	S-STAI	Recorded	MT	No intervention
Staples	10-S-STAI	Recorded	MP	No intervention
Steelman	S-STAI	Recorded	Patient	No intervention
Steinke	S-STAI	Recorded	Patient	Relaxation/Imagery
Szeto et al.	S-STAI	Recorded	Patient	No intervention
Twiss et al.	S-STAI	Recorded	Patient	No intervention
Voss et al	VAS	Recorded	Patient	No intervention
Wang et al.	S-STAI	Recorded	Patient	No intervention
Williams	S-STAI	Recorded	Patient	No intervention
Winter et al.	S-STAI	Recorded	Patient	No intervention
Yung et al.	S-STAI	Recorded	Patient	No intervention

Note. BO: Behavioral Observation.
S-STAI: State portion – State Trait Anxiety Inventory. 10-S-STAI: 10-items S-STAI. VAS: Visual Analogue Scale. mYPAS: modified Yale Preoperative Anxiety Scale.
MT: Music Therapist. MP: Medical Professional

Table 2

Statistics of Included Studies

Study	N	*d (SE)*	95% CI	*r*	*p*
Armatas	100	0.06 (0.02)	-0.04 / 0.15	0.03	0.39
Arslan et al.	64	1.14 (0.27)	1.05 / 1.24	0.5	0.01
Augustin et al.	42	-0.20 (0.31)	-0.3 / -0.11	-0.1	0.26
Barnason et al.	67	0.21 (0.25)	0.11 / 0.3	0.1	0.16
Cooke et al.	120	0.33 (0.18)	0.23 / 0.43	0.16	0.04
Cruise et al.	62	-0.40 (0.26)	-0.49 / -0.3	-0.2	0.06
Gaberson	31	0.32 (0.36)	0.22 / 0.41	0.16	0.19
Haun et al.	20	1.61 (0.51)	1.51 / 1.7	0.64	0.01
Hayes et al.	198	0.21 (0.14)	0.11 / 0.31	0.1	0.07
Jarred	130	-0.01 (0.18)	-0.1 / 0.09	-0	0.49
Kaempf et al.	33	-0.01 (0.35)	-0.11 / 0.09	-0	0.49
Kain et al.	70	0.59 (0.24)	0.5 / 0.69	0.29	0.01
MacDonald et al.	40	1.69 (0.37)	1.59 / 1.79	0.65	0.01
McRee et al.	26	0.56 (0.40)	0.46 / 0.66	0.28	0.08
Mok et al.	80	2.84 (0.32)	2.74 / 2.94	0.82	0.01
Moss	17	0.30 (0.49)	0.21 / 0.4	0.16	0.27
Nilsson et al.	115	-0.20 (0.19)	-0.3 / -0.11	-0.1	0.14
Sanderson	60	1.02 (0.27)	0.92 / 1.11	0.46	0.01
Sendelbach et al	86	0.82 (0.23)	0.72 /0.92	0.38	0.01
Staples	40	-0.20 (0.32)	-0.3 / -0.1	-0.1	0.26
Steelman	43	-0.03 (0.31)	-0.13/ 0.06	-0	0.46
Steinke	17	-0.20 (0.49)	-0.33 /-0.14	-0.1	0.34
Szeto et al.	9	1.94 (0.84)	1.84 / 2.04	0.74	0.01
Twiss et al.	60	0.56 (0.26)	0.47 / 0.66	0.27	0.02
Voss et al	40	1.43 (0.35)	1.33 / 1.52	0.59	0.01
Wang et al.	93	0.81 (0.22)	0.71 / 0.9	0.38	0.01
Williams	48	0.21 (0.29)	0.12 / 0.31	0.11	0.23
Winter et al.	50	0.25 (0.29)	0.16 / 0.35	0.13	0.19
Yung et al.	20	0.01 (0.45)	-0.08 / 0.11	0.01	0.49

Note. Reported effect sizes are Cohen's *d* with small-sample correction for unbiased effect sizes (Hedges, 1981). Therefore, values differ slightly from original effect sizes from studies.

Literature Coding

According to the above study characteristics, the 29 selected studies were systematically coded. First, corresponding to research hypothesis 1, the appropriate numeric data from each study were coded for computing an effect size. Ten studies were with more than 3 groups. To compute an effect size, the primary criterion for being the experimental group was a music listening intervention, and the control group criterion was non-intervention. Criteria were based on other 19 studies. Second, corresponding to research hypotheses 2 to 9, studies were categorized according to year of study, published source, type of measurements, patient age and gender, period of intervention, music selection and control group condition. Each categorical variable was classified by sub-categorical variables. Some studies did not provide sufficient information for categorical analyses. The study by MacDonald et al. (1999) which did not provide subjects' ages was excluded, as were six studies which did not provide gender information.

Each categorical variable was subdivided. The study year was categorized according to whether the published year was before 1990 and 1990 to 2008. The published source was classified also according to where the field of study was, such as music therapy and the medical fields. Types of measurement were subdivided also into the State portion of STAI, VAS, and other measurements by observation. The patient's characteristics were classified as age and gender. Age was classified as less than 18, 18 to 65, over 65, and gender included mainly male (more than 50%), mainly female (more than 51%), and equal numbers of both male and female (49% to 51%) as sub-categorical variables. Intervention period was subdivided into preoperative, intraoperative, postoperative, perioperative, and mixed which included pre-, intra- and postoperative periods. The categorical variable of music preference was classified according to whom selected the music. They were a patient, a medical professional, and a music therapist. Control group condition as a final categorical variable was no-intervention and other interventions.

Statistical Analyses

Coded quantitative data from 29 studies were converted to an effect size (ES) according to meta-analysis procedure by Glass, McGaw, and Smith (1984). To compute overall mean effect size, one effect size per study was computed, and effect sizes and the correlation coefficient were produced by the Effect Size Determination Program by Lipsey and Wilson (2001). Each effect size from the program was computed to a standardized mean difference effect size statistic by Hedge's correction for small sample size to eliminate bias (Hedges, 1981). Overall mean effect size across 29 studies was computed, and because each study had a different subject size, in order to overcome a less precise effect size value due to larger standard error, an overall effect size was applied with inverse variance weight (Lipsey & Wilson, 2001). In addition, the homogeneity test was performed to demonstrate whether the overall mean effect size is homogeneous. The statistical analysis about the overall mean effect size and homogeneity test was performed by SPSS Macro program. To explain variability between each sub-categorical variable across each categorical variable, the analog to the ANOVA was performed by SPSS Macro program. The effect size interpreted by Cohen's theory, "Rules-of-Thumb" was applied (1988); "standardized mean difference effect size", which is categorized into small ($ESsm \leq .20$), medium ($ESsm = .50$), and large ($ESsm \geq .80$)

(Lipsey & Wilson, 2001).

The above analyses were performed for testing the nine null hypotheses listed below to achieve this study's purpose:

Ho1: There is no significant difference between each effect size across studies.

Ho2: There is no significant difference between the effect sizes across the sub-categorical variables of the year of study.

Ho3: There is no significant difference between the effect sizes across the sub-categorical variables of the publication source.

Ho4: There is no significant difference between the effect sizes across the sub-categorical variables of the type of measurement.

Ho5: There is no significant difference between the effect sizes across the sub-categorical variables of the age of subjects.

Ho6: There is no significant difference between the effect sizes across the sub-categorical variables of the gender of subjects.

Ho7: There is no significant difference between the effect sizes across the sub-categorical variables of the intervention period.

Ho8: There is no significant difference between the effect sizes across the sub-categorical variables of the music preference.

Ho9: There is no significant difference between the effect sizes across the sub-categorical variables of the type of control group.

CHAPTER 4

RESULTS

This chapter presents findings on the effect of music in anxiety reduction in surgical procedures. The first section presents findings related to overall average effect size. The second section presents findings according to categorical- and sub-categorical variables.

Overall Effect Size

Table 3 shows that the overall mean effect size across the 29 studies included in the meta-analysis was significant (d = .39, p = .00), and the 95% confidence interval ranged from .29 to .48 which did not include zero. Thus, the effect size indicates that music intervention is effective in reducing anxiety in surgical procedures. The effect size can be considered also as the average percentile standing (Lipsey & Wilson, 2001). The effect size of .39 indicates that the mean of the experimental group is 65% when the mean of the control group is 50% in a normal distribution. In other words, 65% of the patients in the experimental group compared with patients in the control group reported low anxiety, and based on the experimental group, 35% of patients in the control group reported low anxiety (see Figure 1). Hypothesis 1, that there is no significant difference between each effect size across studies, was rejected by the test of homogeneity. It was statistically significant (Q (28) = 153.99, p = .00), which indicates that effect size variability was greater than expected from sampling error. In other words, the effect sizes of studies were not consistent, thus all included studies were not explained by the overall mean effect size.

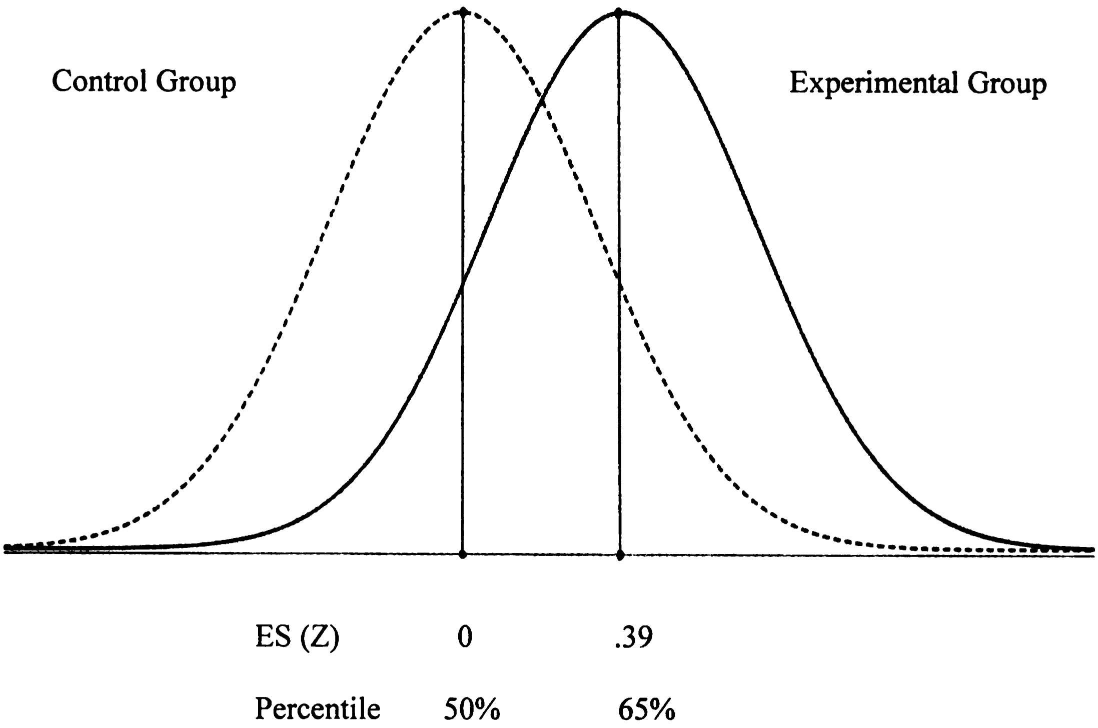

Figure 1. Distribution showing the effect of music on reducing anxiety

Table 3

Overall Meta-Analytical Effect of Music in Surgical Procedure, and Statistics in Categorical Variables

	Moderator analysis (ANOVA analogue)		Statistics in subsample						
	$Q_{between}$ (*df*)	Q_{within} (*df*)	*k*	*n*	*d*	*SE*	*z*	95% CI	Homogeneity *Q (df)*
Overall effect			29	1781	.39	.05	7.91*	.29 / .48	153.99**(28)
Year of Study	0.27 (1)	153.72** (27)							
Before 1990			4	210	.32	.14	2.27*	.04 / .60	9.04 (3)
1990-2008			25	1571	.40	.05	7.60**	.30 / .50	144.68 (24)
Publication Source	1.88 (1)	152.11** (27)							
Medical field			23	1394	.42	.05	7.63**	.32 / .53	123.27 (22)
Music therapy field			6	387	.26	.10	2.51*	.06 / .47	28.84 (5)
Type of Measurement	0.77 (2)	153.21** (26)							
STAI			22	1310	.41	.06	7.17**	.30 / .52	128.05 (21)
VAS			3	201	.28	.14	1.97*	.00 / .57	13.10 (2)
Behavioral Observed			4	270	.35	.12	2.84**	.11 / .60	12.06 (3)
Age of Subjects	1.71 (2)	139.78** (25)							
Under 18			2	87	.43	.22	1.96*	.00 / .86	2.28 (1)
18 to 65			20	1161	.40	.06	6.62**	.28 / .52	123.11 (19)
Over 65			6	493	.26	.09	2.90**	.09 / .44	14.39 (5)
Gender of Subjects	2.62 (2)	135.96** (20)							
Mainly male			9	748	.42	.08	5.61**	.27 / .57	36.87 (8)
Mainly female			11	664	.41	.08	5.05**	.25 / .57	96.28 (10)
Equal number			3	177	.16	.15	1.03	-.14 / .45	2.81 (2)

Table 3
Continued

	Moderator analysis (ANOVA analogue)		Statistics in subsample						
	$Q_{between}$ (*df*)	Q_{within} (*df*)	*k*	*n*	*d*	*SE*	*z*	95% CI	Homogeneity *Q* (*df*)
Intervention Period	1.98 (4)	152.01^{**} (24)							
Preoperative			17	1054	.37	.07	5.82^{*}	.24 / .49	42.94 (16)
Intraoperative			3	185	.61	.17	3.66^{**}	.28 / .94	69.30 (2)
Postoperative			6	448	.37	.10	3.76^{**}	.17 / .56	37.73 (5)
Perioperative			1	17	.30	.49	.62	-.65/1.26	.00 (0)
Mixed			2	77	.39	.23	1.66	-.07 / .84	2.04 (1)
Music preference	25.10^{**} (2)	128.88^{**} (26)							
Patient			18	929	.63	.07	9.12^{**}	.49 / .77	92.42 (17)
Medical professional			7	353	.09	.11	.84	-.12/ .30	23.92 (6)
Music therapist			4	499	.18	.09	1.97^{*}	.00 / .36	12.54 (3)
Type of Control group	14.65^{**} (1)	139.34^{**} (27)							
No intervention			24	1450	.48	.05	8.79^{**}	.37 / .59	128.96 (23)
Other interventions			5	331	.01	.11	.06	-.21/ .22	10.38 (4)

Note. Reported effect sizes are Cohen's *d*. One-tailed *z* tests. ANOVA = analysis of variance. $Q_{between}$ = Q-value between effect sizes of sub-categorical variables. Q_{within} = Q-value about effect sizes within each sub-categorical variable. k = the number of studies. SE = Standard Error. * $p < .05$. ** $p < .01$.

Analysis of Categorical Variables

The quality of all studies was analyzed to identify reasons for inconsistent results. In Table 3, results are presented with data of categorical- and sub-categorical variables analyzed by the analog to the ANOVA. There are eight categorical variables: i) year of study, ii) publication source, iii) type of measurement, iv) age of subject, v) gender of subject, vi) intervention period, vii) music preference and viii) type of control group. The moderator analysis shows whether there is significant difference between the effect sizes across sub-categorical variables. In other words, the moderator analysis is to evaluate adequacy of categorical variables for explaining inconsistent variability among effect sizes (Lipsey & Wilson, 2001).

Hypothesis 2, that there is no significant difference between the effect sizes across the sub-categorical variables of the year of study - before 1990 and 1990 to 2008, was retained ($Q\ (1) = .27, p = .60$). Thus, it indicates that the year of study had no significant effect on results. Hypothesis 3, that there is no significant difference between the effect sizes across the sub-categorical variables of the publication source - the medical and the music therapy fields, was retained, as the publication source had no significant effect on results ($Q\ (1) = 1.88, p = .17$). Hypothesis 4 is that there is no significant difference between the effect sizes across the sub-categorical variables of the type of measurement - STAI, VAS, and Behavioral Observed Measurements. It was retained, as the type of measurement had no significant effect on results ($Q\ (2) = .77, p = .68$). Hypothesis 5, that there is no significant difference between the effect sizes across the sub-categorical variables of the age of subjects - less than 18, 18 to 65 and over 65 was retained($Q\ (2) = 1.71, p = .43$). It indicates that the subjects' ages had no significant effect on results.

Because the study by MacDonald et al (1999) did not provide age, the study was excluded from this particular analysis. Hypothesis 6, that there is no significant difference between the effect sizes across the sub-categorical variables of the gender of subjects - mainly male, mainly female, and equal number, was retained, as gender had no significant effect on results (Q (2) = 2.62, p = .27). Six studies by Kaempf et al. (1989), Moss (1987), Steelman (1990), Szeto et al. (1999), Voss et al. (2004) and Winter et al. (1994) did not provide gender information, thus were excluded from this particular analysis. Hypothesis 7 was that there is no significant difference between the effect sizes across the sub-categorical variables of the intervention period - preoperative, intraoperative, postoperative, perioperative and others. It was retained, as the intervention period had no significant effect on results (Q (4) = 1.98, p = .74).

Hypothesis 8, that there is no significant difference between the effect sizes across the sub-categorical variables of music preference - patient, medical professional, music therapist, was rejected, as by whom the music is selected significantly affected the magnitude of effect sizes (Q (2) = 25.10, p = .00). Studies regarding music selected by patients indicated that the effect size was greater than in music selected by medical professionals and music therapists (d = .63, p = .00). Although studies regarding music selected by music therapists showed a small effect size (ES) of d = .18, it was greater than in music selected by medical professionals (p = .048), whereas studies regarding music selected by a medical professional showed no significant effect size (d = .09, p = .40). Hypothesis 9 was that there is no significant difference between the effect sizes across the sub-categorical variables of the type of the control group - non-music and other interventions. It was rejected, as the type of control group significantly affected the magnitude of effect sizes (*Q (1)* = 14. 65, *p* = .00). Studies comparing control group with no intervention showed that the effect size was greater than those comparing a control group with other interventions (*d* = .48, *p* = .00), whereas studies comparing a control group with other interventions significantly have small and no significant effect size (*d* = .01, *p* = .95).

CHAPTER 5

DISCUSSION

This chapter illustrates the efficacy of music on anxiety reduction in surgical procedures according to findings from this meta-analysis. The first section summarizes results and implications. The second illuminates strengths, limitations, and directions for further research.

Summary of Results and Implications

The present meta-analysis compiled results from 29 studies that demonstrated the effectiveness of music for anxiety reduction in surgical procedures. These studies all involved a control group with non-music or other interventions and, showing that the overall mean effect size across all studies was .39 (p = .00), results indicate that music intervention is significantly more effective than non-intervention or other interventions. However, as the test of homogeneity resulted in statistical significance, the effect sizes of studies were not consistent, which means that the overall mean effect size cannot explain all included studies. Furthermore, this meta-analysis identified each of eight categorical variables as a moderator variable which can affect the magnitude of effect sizes. Statistical results showed that two variables of eight categorical variables - music preference and type of control group significantly affected the magnitude of effect sizes, but six categorical variables - year of study, publication source, type of measurement, subjects' ages, subjects' genders and intervention period did not affect the magnitude of effect sizes.

First, as mentioned above, six categorical variables as moderator variables did not significantly affect results. Both variables of the year and the field of study did not significantly affect the magnitude of effect sizes. In comparison of the year of study, only four studies - Armatas (1964), Kaempf et al (1989), Moss (1987), and Sanderson (1986) were published before 1990, although studies which attempted to investigate the effect of music on anxiety reduction were done in the 1970s by Padfield (1976) and MacClelland (1979); Armatas (1964) attempted this even earlier via an unpublished thesis in the music therapy field. Since 1990, numerous experiments in this field have been published, so 25 studies could be used in the present study. As shown in comparison of effect sizes, the mean effect size of studies published from 1990 onwards ($d = .40, p = .00$) was greater than that of those published before 1990 ($d = .32, p = .04$) but there is not a big difference in this comparison. Therefore, when the study was published did not significantly affect the effectiveness of music on reducing anxiety in surgical procedures. Regarding publication source, most studies were performed by medical professionals. Only six studies: Armatas (1964), Jarred (2003), MacDonald, et al. (1999), Sanderson (1986), Staples (1993), and Steinke (1991) were performed by music therapists. This variable also did not significantly impact the magnitude of each effect size because the number of studies by music therapists is small, and five of the studies excepting Steinke's (1991) were unpublished theses in the music therapy field; six studies by music therapists are not sufficient to represent the music therapy field related to anxiety reduction in surgical procedures. Therefore, to effectively apply music for anxiety reduction in surgical procedures, more studies by music therapists should be done.

As to measurements used in these studies, there were the State portion of the State

Trait Anxiety Inventory (STAI), the Visual Analog Scale (VAS), and Behavioral Observed Measurements. This variable also did not significantly affect the magnitude of effect sizes. However, through studies which used STAI as a measurement for 1310 subjects, they demonstrated that STAI is a credible measurement as self-report to many researchers. As to subjects' characteristics, age and gender variables did not significantly impact the result. Regarding age, most studies were performed with adults (18 to 65), whereas only two studies with children and adolescents (less than 18) and six with the elderly (over 65). Thus, because the number of studies performed according to age level was very small, it is difficult to suggest that this result was not significantly affected by age in this analysis. Therefore, to demonstrate via meta-analysis the effect of music according to age level, more studies should be performed in each population. In addition, the effect size of music intervention for subjects less than 18 was greater than for both age 18 to 65 and over age 65 ($d = .43$, $p = .049$). It suggests the possibility that music intervention was effective for children and adolescents on reducing anxiety in surgical procedures even though the number of studies used in the present study was two. This result agrees with the study by Chetta (1981) demonstrating the effect of music on preoperative anxiety with children. Moreover, Standley (2000) and Standley and Whipple (2003) supported this theory demonstrating via meta-analysis that music is effective for pediatric patients in medical settings. As to the period in which music was applied, the intervention period did not significantly impact results. However, the effect size of music intervention during the intraoperative period was .61 ($p = .00$), definitely higher than the resulting effect sizes of other intervention periods. It indicates that the music intervention provided during surgery were effective on reducing anxiety in surgical procedures.

However, because the number of studies is only three, this should be researched more to be supported as scientific-based evidence.

Second, in the analysis of two categorical variables which significantly affected results, the result of the music preference variable showed significant difference between sub-categorical variable groups. In other words, according to by whom the music is selected, music differently affects anxiety reduction in surgical procedures. This is in accord with many studies demonstrating the importance of musical preference when using music as a therapeutic tool (Harvey, 1987; Hoffer, 1981; McClelland, 1979; Mornhinweg, 1992; Seigle, 1974; Stein, 1989). Studies which used music selected by patients in this meta-analysis showed the average effect size of .63 (p = .00). Additionally, studies which used music selected by music therapists had greater average effect size than did those which used music selected by medical professionals (d =.18, p = .049). This suggests the possibility that selecting music by a patient's musical preference, as well as by music therapists, is important to maximize the therapeutic effect of music. This is supported by the meta-analysis study by Silverman (2003) which demonstrated the influence of music for patients with the symptoms of psychosis. The study showed the effect size of sub-categorical variable of music preference by music therapists of d = .57 (p = .01). In the analysis according to the type of control group, this variable significantly affects the magnitude of effect sizes. Especially, the studies of the control group with non-intervention had a significant effect size (d = .48, p = .00), which was greater than that of the studies of the control group with other interventions. It can be assumed that when the experimental group was compared to the control group with non-intervention, the difference in the effect of music between the experimental and the control groups was maximized. In other words, it can be assumed that control group with other interventions are effective on anxiety reduction in surgical procedures.

Strengths, Limitations, and Directions for Further Research

This study compiled current studies available for meta-analysis to demonstrate the effectiveness of music in reducing anxiety in surgical procedures. Overall, results of this research suggest that music intervention is effective in anxiety reduction with patients undergoing surgery compared with non-intervention and other interventions such as placebo effect, scheduled rest, and relaxation and imagery. Additionally, numerous studies which demonstrated the effect of music in this field have been done since 1990. This study indicates that the need for developing medical techniques, as well as for improving the quality of medical services that consider patients' psychological- and emotional aspects, has increased in importance. In this view, music is used easily as an effective intervention in surgical procedure environments which normally do not readily provide interventions for patients' psychological- and emotional stability. Therefore, this meta-analysis statistically supports this theory for practical application.

To the contrary, potential limitations must be considered in the present research. First, although there have been numerous research studies done prior to 2008, the relatively small number of studies was appropriate in the present meta-analysis. One reason is because to meta-analyze, many qualitative and quantitative studies, of good quality but inappropriate in criteria for the present meta-analysis, were excluded. Thus, it is difficult to conclude that the present meta-analysis with 29 studies adequately represents research in music and anxiety reduction in surgical procedures. However, it is meaningful in that it provides scientific-based evidence for applying music interventions in medical settings, as is shows visible data. Secondly, it would be assumed that some factors exist to explain the overall average effect size to be in the medium range. One factor is the environment of a medical setting. Especially, because it is easy for medical professionals such as medical doctors and nurses to access surgeries, for music therapists, who are professionals using music as a therapeutic tool, it is not. Yet, as mentioned above, analysis shows that in music preference variables, the music therapist' role in selecting music is more effective than that of the medical professional. In addition, only music listening as a therapeutic intervention was used in all studies included in the present study. Related to this, it could be assumed that because it is difficult to apply active music therapy in surgical procedures, most studies that were included, as well as many that were excluded in this research used music listening. However, as music therapists who have professional knowledge are integrated into medical settings, therapeutic music intervention can be used as a diverse and systematic program which can be appropriately applied to each population. Therefore, to maximize the effect of music, music therapists should be involved in medical treatment and research in this field. Finally, their inclusion in treatment will ensure that a better quality of medical service will be provided to patients.

APPENDIX A

CODING CATEGORIES

STUDY – LEVEL CODING FORM

Bibliographic reference:

____

____

_______ 1. Study ID number [STUDYID]

_______ 2. Type of publication [PUBTYPE]
1. Medical (published, unpublished)
2. Music therapy (published, unpublished)

_______ 3. Published year [PUBYEAR]
1. Before 1990
2. 1990 to 2008

Sample Descriptors

_______ 4. Mean age [MEANAGE]
1. Less than 18
2. 18 to 65
3. Over 65
4. Unknown

_______ 5. Predominant gender [GENDER]
1. Mainly male
2. Mainly female
3. Equal number of them
4. Unknown

6. Type of surgery [SURTYPE]

____

Research Descriptors

_______ 7. Number of group [GROUP_NO]
1. 2 groups
2. 3 groups
3. More than 3 groups ____________________________________

_______ 8. Intervention period [INTER_PE]

1. Preoperative
2. Intraoperative
3. Postoperative
4. Perioperative
5. Mixed

_______ 9. Music presentation [MUSIC_PRE]

1. Listening (Recorded, Live)
2. Activity

_______ 10. Music selection [MUSIC_SE]

1. Patient
2. Medical professional
3. Music therapist

_______ 11. Type of measurement [MEATYPE]

1. STAI
2. VAS
3. Observation

_______ 12. Type of control group [CONTYPE]

1. No intervention
2. Other intervention.

EFFECT SIZE LEVEL CODING FORM

_______ 1. Study ID number [STUDYID]

_______ 2. Effect size sequence number [ESNUM]

Dependent Measure Descriptors

_______ 3. Effect size type [ESTYPE]

1. Pretest comparison
2. Posttest comparison

4. Outcome descriptor

____

Effect Size Data

_________ 5. Type of data effect size based on [ESTYPE]
1. Mean and standard deviations
2. t-value
3. f-value
4. others _________________________

_________ 6. Page number where effect size data found

7. Sample Size
1. Experimental group ______________
2. Control group ___________________

8. Means and Standard deviations
1. Experimental group ______________
2. Control group ___________________

9. Significance Tests
1. T-value a. Experimental group _______________
b. Control group ___________________
2. F-value a. Experimental group _______________
b. Control group ___________________
3. Others ____
____

10. Calculated Effect size
1. Effect size _________________________
2. Correlation coefficient ________________

APPENDIX B

LIST OF SYNTHESIZED STUDIES

Author	Title
Amatas, C. (1964)	A study of the effect of music on postoperative patients in the recovery room
Arslan, et. al. (2008)	Effect of music on preoperative anxiety in men undergoing urogenital surgery
Augustin, et. al. (1996)	Effect of music on ambulatory surgery patients' preoperative anxiety
Barnason, et. al. (1995)	The effects of music interventions on anxiety in the patient after coronary artery bypass grafting
Cooke, et. al (2005)	The effect of music on preoperative anxiety in day surgery
Cruise, et. al. (1997)	Music increases satisfaction in elderly outpatients undergoing cataract surgery
Garberson (1995)	The effect of humorous and musical distraction on preoperative anxiety.
Haun, et. al. (2001)	Effect of music on anxiety of women awaiting breast biopsy
Hayes, et. al. (2003)	A music intervention to reduce anxiety prior to gastrointestinal procedures
Jarred, J. D. (2003).	The effect of live music on anxiety levels of persons waiting in a surgical waiting room as measured by self-report
Kaempf, et. al. (1989)	The effect of music on anxiety
Kain, et. al. (2001)	Sensory stimuli and anxiety in children undergoing surgery: A randomized, controlled trial
Macdonald, et. al. (1999)	The anxiolytic and pain reducing effects of music on post-operative analgesia
McRee, et. al. (2003)	Using massage and music therapy to improve postoperative outcomes
Mok, et. al. (2003)	Effects of music on patient anxiety

Continued

Author	Title
Moss (1987)	The effect of music on anxiety in the surgical patient
Nilsson, et. al. (2003)	Analgesia following music and therapeutic suggestions in the PACU in ambulatory surgery; a randomized controlled trial
Sanderson (1986)	The effect of music on reducing pre-operative anxiety and postoperative pain and anxiety in the recovery room
Sendelbach, et. al. (2006)	Effects of music therapy on physiological and psychological outcomes for patients undergoing cardiac surgery
Staples (1993)	The effect of music listening on blood pressure, pulse rate, respiration rate, and anxiety state of patients in the preoperative room
Steelman, V. M. (1990)	Intraoperative music therapy
Steinke (1991)	The use of music, relaxation, and imagery in the management of postsurgical pain for scoliosis
Szeto, et. al. (1999)	Introducing a music programme to reduce preoperative anxiety
Twiss, et. al. (2006)	The effect of music listening on older adults undergoing cardiovascular surgery
Voss, et. al. (2004)	Sedative music reduces anxiety and pain during chair rest after open-heart surgery
Wang, et. al. (2002)	Music and preoperative anxiety: A randomized, Controlled study
Williams (2000)	The effect of music therapy on anxiety in surgical patients
Winter, et. al. (1994)	Music reduces stress and anxiety of patients in the surgical holding area
Yung, et. al. (2002)	A controlled trial of music and pre-operative anxiety in Chinese men undergoing transurethral resection of the prostate

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