

1986

Music: A Nursing Intervention for Increased Intracranial Pressure

Carol Roberts

Grand Valley State University

Follow this and additional works at: <http://scholarworks.gvsu.edu/theses>

 Part of the [Music Therapy Commons](#), and the [Nursing Commons](#)

Recommended Citation

Roberts, Carol, "Music: A Nursing Intervention for Increased Intracranial Pressure" (1986). *Masters Theses*. 88.
<http://scholarworks.gvsu.edu/theses/88>

This Thesis is brought to you for free and open access by the Graduate Research and Creative Practice at ScholarWorks@GVSU. It has been accepted for inclusion in Masters Theses by an authorized administrator of ScholarWorks@GVSU. For more information, please contact scholarworks@gvsu.edu.

**Music: A Nursing Intervention
for Increased Intracranial Pressure**

by

Carol Roberts

A thesis submitted in partial fulfillment
of the requirements for the degree of
Master of Science in Nursing

**Kirkhof School of Nursing
Grand Valley State College**

1986

Abstract

Music: A Nursing Intervention
for Increased Intracranial Pressure

Individuals with increased intracranial pressure (ICP) from all causes are subject to periods of marked increased intracranial pressures. Research since the 1960's has focused primarily on pathophysiologic causes and on variations between pathologies. Since 1978, nursing research has identified increases in ICP with patient-related activities such as suctioning, vagal stimulations, positioning, turning, noises, and emotive conversations. The use of therapeutic touch has been identified as a nursing intervention that correlates with a lowering of ICP. Since auditory pathways have been shown to be intact even in severely brain-injured individuals, the use of music (the universal language) may be effective in decreasing ICP. The purpose of this study was to identify music as an independent, nursing intervention that would be effective in lowering ICP. A convenience sample of 10 intensive care patients were the subjects in this study to monitor the effects of music on the level of ICP. A quasi-experimental design, utilizing a pre-test/post-test repeated measures format, was utilized with each subject serving as her/his own control. Subjects were exposed to a sedative music selection and a preferred music selection. Human rights protection was accomplished by an informed consent procedure and institutional review approval. Data was collected to observe for differences related to various pathologies, age (17-60 years), sex, musicality, and physiologic parameters. T-tests were performed on the means to determine the difference between treatments. There was no significant change seen in the physiologic parameters. However, sedative music showed a significant difference ($p < .02$) as compared to preferred music selections on ICP levels. This finding has implications for nurses caring for patients with neurological insults.

Acknowledgments

The author would like to express her appreciation to several groups of people for their efforts, guidance, support and encouragement given during this study.

A special word of thanks to my chairperson, Mary Horan, Ph.D., R.N. for her positive feedback and scholarly critique, to Dorothy Bouwman, R.N., M.S.N. for her encouragement and neurosurgical knowledge and to Leslie Eitzen, M.F.A. for her enthusiasm and musical expertise given to selecting the representative musical selections. Their contributions were significant to the completion of this study.

Data collection could not have been accomplished without the cooperation of the critical care nurses who willingly allowed their work to be interrupted. Their interest and support of this research endeavor was commendable. To Keith Sikkema, RN a special tribute is due for his encouragement, time and discernment in the data collection process. His efforts made this study possible. The interest and willingness of the subjects and their families toward this study despite the crisis they were experiencing was so reaffirming and appreciated. Lastly, but most importantly, I thank my husband, Ken, and my son, Chad. It is their patience, encouragement, endurance and support that have enabled me to complete this research study.

Table of Contents

Acknowledgments.....	ii
List of Tables.....	vi
List of Appendices.....	vii
Chapter	
1 Introduction	
Research Problem.....	1
Intracranial Pressure.....	2
Purpose.....	5
Rationale.....	5
2 Review of Literature	
General.....	7
Nurse/Patient Activities and ICP.....	8
Noise and ICP.....	9
Auditory Evoked Responses.....	11
Emotional Stimuli and ICP.....	12
Music and Medicine.....	15
Musicality.....	24
Summary.....	25
3 Conceptual Framework	
Statement of Purpose.....	27
Hypothesis.....	27

Definitions.....	27
Assumptions.....	28
4 Methodology	
Design.....	30
Sample.....	31
Setting.....	32
Human Rights Protection.....	32
Validity.....	33
Data Collection.....	34
Instrument.....	35
Procedure.....	35
Data Management.....	38
Summary.....	39
5 Results	
Statement of Purpose.....	40
Instrument Reliability.....	40
Description of Sample.....	40
Clinical Observations.....	48
Analysis of the Research Hypothesis.....	54
Additional Findings.....	55
6 Discussion of Results	
Statement of Purpose.....	56
Summary of Results.....	56
Discussion.....	57

Limitations of the Study.....	59
Implications for Nursing Practice.....	60
Recommendations for Future Research.....	61
Conclusion.....	61
Reference list.....	67
Appendix	63
Index of Cited Authors.....	75
Index.....	76

List of Tables

1. Central Tendencies of the Sample.....	42
2. Subgroup Deliniation.....	43
3. Closed Head Injury Means Differentiated by Sex.....	44
4. Female Means Compared with Male Means.....	45
5. Underlying Pathology of the Sample.....	46
6. Preferred Music Selection of Males and Females.....	47
7. Music Selection Differentiated by Age and Sex.....	48
8. ICP Measurements During Repeated Measures Design....	51
9. SBP Measurements During Repeated Measures Design....	52
10. Graphic Display of Intracranial Pressure Means.....	53
11. Comparison of t Tests on ICP and SBP Levels.....	55

List of Appendices

A Preferred Music Selections.....	67
B Informed Consent.....	68
C Data Collection Tool.....	70
D Introduction Procedure.....	72
E Glasgow Coma Scale.....	73
F Demographic Code Sheet.....	74

Chapter 1

Introduction

The concept of increased intracranial pressure is central for the nurse caring for patients with a cerebral neurological insult. In caring for this patient population, the nurse must be aware of not only the pathophysiology of the disease entity and the system's response, but also to the environmental factors and nursing interventions that might alter the intracranial pressure (ICP). The advent of ICP monitoring in the 1960's has allowed practitioners to more closely observe and study the effects of treatments, interventions, and the environmental impact on ICP. Because increases in ICP can be life-threatening, it is essential to define the factors that are associated with increases and to develop interventions that will modify or decrease the ICP. Bruya (1981) found that even small increases in ICP can be devastating, especially if the autoregulatory mechanism is impaired. Studies have been done that correlate specific factors with increases in ICP, namely arousal from sleep and emotional upset (Lundberg 1968), emotional stimuli and conversations regarding patient condition or prognosis (Mitchell and Mauss 1978) and alarm noises (MacLean 1983). Walleck (1982)

documented that personal touch diminished the ICP and recommended further research be done for identification of nursing interventions to lower ICP.

The patient population experiencing a potential for increased intracranial pressure usually resides in an Intensive Care Unit (ICU) environment that is replete with unfamiliar sounds, (Woods & Falk 1974), multiplicity of personnel, and a high frequency of interventions involving non-therapeutic touch. The author, while caring for patients (conscious or unconscious) with a pressure monitoring device in place, has noted variations in ICP during these events. Nursing interventions that would decrease ICP need to be identified so that the negative effects of both the environment and care of these patients can be diminished or modified. Music has been used throughout history in several ways for therapeutic purposes. It has been described as a powerful stimulus that affects man in all dimensions: physically, psychologically and spiritually (Cook 1981). A review of the literature found no studies that examined music as a potential intervention to decrease ICP.

Intracranial Pressure

The cranial cavity is composed of the three constituents: blood, brain, and cerebral spinal fluid (CSF). These are encased in the virtually closed container of the skull. The pressure exerted by these constituents is normally 0-15 millimeters of mercury (mmHg) and remains fairly constant due to

the processes of autoregulation and the compensatory mechanisms. However, compensation can be exhausted resulting in an increase in ICP. This rise in ICP causes a general reduction in the cerebral perfusion pressure (CPP), resulting in cerebral ischemia. When the CPP falls below 50 mmHg, hypoxia occurs at the cellular level. When MAP equals ICP, cerebral flow ceases (Shapiro, 1975). The compensatory mechanisms consist of decreased production of CSF, a decrease in total blood volume, and the displacement of the brain tissue's water content. At times of brain injury, with its resultant cellular edema, the ability to continue compensation becomes limited and an increase in ICP occurs. Also, if there is bleeding present within the subarachnoid space, the ability to compensate by an increased reabsorption of CSF is decreased because of the clogging of the arachnoid villi (Youmans, 1982).

Autoregulation is the ability of the cerebral blood vessels to constrict and dilate to maintain a continual flow. This is regulated by carbon dioxide and oxygen levels in the blood, and by the ICP level. When the ICP is greater than 33 mmHg, the blood flow will passively alter with fluctuations in MAP. It has been found that hypoxia causes dilatation and hypocarbia results in vasoconstriction of the cerebral vessels (Shapiro, 1975). Other factors that alter the body's ability to autoregulate are cerebral acidosis and rapid, abrupt increases in MAP (>150 mmHg). At the regional level, damaged cerebral

tissues can cause a loss in the ability to autoregulate (Shapiro, 1975). As intracranial pressure rises, the body compensates by increasing the MAP so that no significant loss of CPP will occur. This feedback mechanism exists as long as the autoregulatory function is intact (Langfill, 1968).

The advent of ICP monitoring allowed practitioners to detect changes early and institute treatments and interventions promptly. It also facilitates assessment on these interventions to assist in the determination of the severity of the cerebral injury and prognosis.

The majority of research for the past decade has been in the area of pathophysiology and pressure dynamics as they relate to intracranial pressures. These will not be included in the body of this paper as not to detract from the nursing focus of the study. However, the critical care nurse has at his/her disposal the ability to accurately and closely monitor the fluctuations in ICP as they relate to either environment, interventions, or pathology.

The actual measurement of ICP is accomplished by measuring the level of pressure in the epidural, subdural (subarachnoid), or the intraventricular space. The use of the subarachnoid bolt or the intraventricular catheter are the most widely used devices. Because of its more central location, the intraventricular catheter may be the most accurate and sensitive device (Hanlon, 1976). Changes in the ICP are transmitted via

the device to a pressure transducer which converts the pressure impulse to an electrical impulse. The electrical signal is visually displayed on a monitor by both a digital read-out and a waveform display (Hanlon, 1976). Intracranial pressures greater than 15 mmHg are considered moderate elevations. Persistent elevations of pressures >40 mmHg have been correlated with having a grave prognosis (Langfit, 1968).

The nurse's role in caring for patients with increased ICP has great potential for assessing this delicate homeostatic balance. An understanding of the interrelatedness of pathophysiology, treatments, daily care, activities, pressure monitoring devices, and the environment could play a role in the outcome of this patient population.

Purpose

This study attempted to validate the use of music as a therapeutic intervention to diminish ICP levels and thereby add to the already existing body of clinical nursing research.

Rationale

In 1980, the American Association of Critical Care Nurses commissioned a nationwide Delphi study under the direction of Lewandowski (1983). Its purpose was to identify research priorities for Critical Care nursing. In reporting the top fifteen research priorities of critical care nursing, the

question "What effects do verbal and environmental stimuli have on increased intracranial pressure?" ranked fourth. This study, built on the previous research results (Lundberg, 1960; MacLean, 1983; Mitchell, 1980; Mitchell & Mauss, 1978) will examine the use of music as a nursing intervention and its effects on ICP. Critical care nurses frequently modify the environment by dimming lights, limiting the number of visitors at one time, clustering and spacing of activities, and playing radios and music tapes for their patients. Increased intracranial pressure is detrimental to neurologic functioning and if sustained or severely elevated may be life threatening. Because nursing has a major role in caring for these patients, it is imperative to identify and develop independent interventions to decrease the levels of ICP for this patient population.

Chapter 2

Review of Literature

Throughout history, music has been used for healing the mind and the body. Primitive man utilized incantations, chants and rhythms, the Egyptians called music the "psyche of the soul", and the Hebrews recorded several instances of music's positive effects on refreshing the spirit. Homer and Plato were the first to investigate and use music systemically and scientifically to diminish the negative emotions of worry, fear and anxiety and to promote health and wellness of both the body and the soul (Cook, 1981). Music and medicine continued their close collaboration until the period of the Dark Ages. After World War II, there was another increase seen in the use of music as a therapy for the wounded and battle-fatigued. The Association of Music Therapists was founded in 1950 and currently has over 2,000 registered therapists (Ziporyn, 1984). There is, therefore, historical support for the use of music in alleviating stress and tension.

Neurologically unstable patients are subject to the environmental stressors of an ICU, physiologic compromise, and a high frequency of care activities. The review of literature for this study, therefore, includes the research related to nurse/patient activities and ICP, noise and ICP, auditory evoked potentials, emotional stimuli, the findings from music research

and the musicality of individuals. This review includes only those studies that have direct relevance to the use of music as a nursing intervention in the intensive care setting for patients with increased intracranial pressures. It is not an exhaustive review of studies in these areas.

Nurse/Patient Activities and ICP

The daily activities of an ICU patient have been shown to be correlated with changes in ICP. Factors that increase ICP are valsalva maneuvers, head and neck positioning, pain, loud noises, clustering of activities, and conversations about the patient's condition (Bruya, 1981; Lipe and Mitchell, 1980; MacLean, 1983; Mitchell, 1980; Mitchell and Mauss, 1978; Mitchell, Ozuna and Lipe, 1981; Parsons, 1984; Snyder, 1983). The mechanisms mediated by the above factors are increased cerebral blood volume, and decreased venous outflow.

Walleck (1982) conducted an experimental pretest/post test design with 30 ventilated patients randomly assigned to two groups to examine the effects of purposeful touch on ICP. The Glasgow Coma scores indicated a moderate to severe neurologic problem. Interrater reliability for the tool was established at 100% for the baseline data and 89% for measurement data. The dependent variable of ICP was found to be decreased by touch ($p < .001$). The difference between the areas of the body touched (face versus the back of the hand) was not significant. No statistical difference was seen in changes in blood pressure

(BP) or heart rate. It was suggested that touch was perceived as warm concerned stimulus and not as a threat to their well-being. This is the only study found where a nursing intervention was actively instituted for the purpose of lowering intracranial pressures. It has, however, not been replicated.

Noise and ICP

Noise has been defined by Slonim (1974) as an unwanted signal or stimulation. He states that "we assign probabilities and expectancies to a limited set of possible signals, and the signals outside this set we consider noise" (Slonim, 1974, p. 147). The sounds in an ICU are neither familiar, pleasant, nor therapeutic and thus can be categorized as intrusive and disruptive noise (Hansell, 1984). Leak (1970) in his summary statements on the physiologic effects of noise, reported that neurologic stimuli may spill into the autonomic nervous system (ANS) and produce cardiovascular, renal, endocrine and metabolic abnormalities. The reticular activation system (RAS) is responsible for general arousal state, and for transmissions from the cortex to the autonomic nervous system. Shevrin (1973) reported that subliminal perception of stimuli such as white noise, odors, etc., could produce anxiety demonstrated by changes in brain waves without cognitive awareness of the feeling. This mind/body connection is thought to be in the RAS (Pelletier, 1977).

Woods and Falk (1973) studied noise stimuli in acute care hospital areas. Their study revealed a significant correlation between the noise level and number of staff at the bedside ($p < .01$). They also found the mean noise level to be louder in an intensive care unit (range 50-76 decibels) as compared to a recovery room (range 45-84 decibels). Normal conversation is approximately 50 decibels (db), while ICU noise levels regularly exceed 60 db (Woods and Falk, 1974). These findings are supported by Haslam (1970) who reported patients' perceptions of conversations as being the most annoying. Nobel (1979) in her study of ICU's environments found that 65% of all conversations were related to patients, and that 18-40% of these took place at the bedside.

MacLean (1983) conducted an experimental study with 20 ICU patients, each serving as his/her own control. Each subject was randomly assigned to two groups and subjected to prescribed ventilator cycle and alarm sounds (70-80 db). Blood pressure, heart rate, and ICP were recorded at one minute intervals. Changes in intracranial pressure between treatment (noise) interval and the rest period interval were statistically significant ($p < .001$). Responses to ventilator alarm sounding were not significantly different. The difference for sedated and non-sedated patients was not significant ($p < .05$). There was no correlation between BP and ICP, but there was a significant rise in heart rate ($p < .001$).

Owing to the nature of the intensive care environment (Baker, 1984), patients are subjected to sensory overload and sensory deprivation. The environmental factors that contribute to this are the noise of machines, continuous lighting, multiplicity of personnel, unfamiliarity, and the fast (hectic) pace of these units. When these factors are combined with a neurologically impaired sensory perceptual state, the susceptibility to noise is increased. Nursing interventions that would decrease noise and promote comfort and familiarity need to be identified.

Auditory Evoked Responses: Hearing and Cerebral Hypertension

An assumption basic to nursing practice is that hearing and the possibility of processing auditory stimuli remains in both unconscious and anesthetized states. MacLean's Study (1983) supports this as does the literature on auditory evoked responses (AER's). AER's are a series of neuroelectric voltage changes which reflect the activation of the eighth cranial nerve in the auditory regions of the cortex and the brainstem by sound stimuli (Hall 1982). This system remains intact despite various levels of coma as long as the brainstem is functioning. AER's were recorded during the barbituate coma treatment of six severely head injured patients (Marshall, 1979). In four patients, AER's improved during coma. The response was tolerant to high blood levels of barbituate. In both the patients that eventually died, responses showed progressive deterioration.

Although these sample sizes are small, the assumption that hearing does continue and is processed is supported. The author is aware of no studies that looked at pleasant versus noxious sounds. However, MacLean's (1983) did find that noxious noise increased ICP. The reverse may be true therefore, that pleasant sounds could lower ICP.

Since the ability to hear and process sounds is maintained even in unconscious states, the use of pleasant and familiar sounds may have a positive effect on patients with cerebral hypertension and altered sensory perceptual processing. These data support the use of music for neurological patients in an intensive care setting.

Emotional Stimuli and ICP

The majority of evidence associating emotional stimuli to ICP levels has been found to be anecdotal. Lundberg (1960) in his study of 143 persons observed that bodily activity, arousal from sleep and emotional upset preceded increases in ICP. His study did not define the frequency nor the nature of the "emotional upset" and his findings were anecdotal in a sample of eight subjects. Mitchell and Mauss (1978) found consistent increases in cerebral spinal fluid drainage as a response to conversations about the patient's condition and/or prognosis. Similar elevations in ICP were not found with general conversational stimuli. Bruya (1981) observed that the level of ICP diminished when the patient's family talked to or touched

the patient. This was an incidental finding in comatose patients. Betz (1975) noted that discussions with patients about their families resulted in an increase in venous jugular outflow. These increases were not quantified. An increased incidence of subarachnoid hemorrhage following emotional events was documented in a retrospective study by Storey (1971) which supports the premise that emotional stimuli affect levels of ICP.

Stressful stimuli have been correlated to physiologic responses by Selye (1956) in studies of the stress response. He found that stressors trigger the autonomic nervous system (ANS). The perception of these stressors is processed by the hypothalamus, limbic system, and the reticular activity system (RAS). The hypothalamus, modulated by the RAS has a direct vascular link to the pituitary gland and the ANS. Stimulation of the posterior medial portion of the pituitary gland results in the release of its stress hormone (vasopressin). This hormone then proceeds to stimulate the adrenal medulla causing the secretion of norepinephrine and epinephrine. The physiologic effects of these hormones are vasoconstriction, tachycardia, hyperthermia, and an increase in oxygen consumption. These effects combined with an increased blood volume from aldosterone's sodium chloride retention and the antidiuretic hormone effects from the posterior pituitary complicate and compromise the neurologic picture of increased ICP (Selye, 1956). Vasopressin also affects the thyroid gland

causing an increased production of thyroxine resulting in tachycardia, increased respiratory and metabolic rate, and an enhanced sensitivity to epinephrine. These effects may further increase the oxygen consumption demands in an already compromised cerebral ischemic area.

Pollack and Goldstein (1981) utilized taped voices of family members and gentle touch and reported a lowering of ICP in seven comatose children with Reye's Syndrome. The subjects were all paralyzed pharmacologically and coma was induced with pentobarbital. These results support the assumption that cognitive perception and processing does occur in comatose states.

There are several factors which may be associated with changes in ICP secondary to emotional stimuli. These include volume-pressure relationships, cerebral blood flow, and the hemodynamic factors.

Benson's (1984) research in the relaxation response has identified a parasympathetic (trophotropic) response in the anterior pituitary that when stimulated by relaxation techniques does result in a lowered oxygen consumption (13%), diminished carbon dioxide production (12%) and a drop in the respiratory rate of four-six breaths per minute. The other effects that have been correlated to this response are a decrease in muscle tension, metabolic rate, blood lactate levels, heart rate, and blood pressure. Wallace (1970) also found a drop in carbon

dioxide blood levels, oxygen consumptions, and metabolic rates with meditative techniques. These results document that there is a physiologic response that when triggered does negate the sympathetic response of "flight or fight". There have been no firm studies that document the ANS response of elevated BP to increases in ICP, but pulse elevations do occur (MacLean, 1983). It cannot be assumed from this however, that lowering the pulse rate will correlate with a drop in ICP.

Emotional and stressful stimuli, such as are frequently found in the intensive care environment could be detrimental to the delicate balance of the dynamics of ICP. This may be especially true when compensatory mechanisms are limited and autoregulation is lost (ICP then fluctuates passively with changes in blood pressure). Peach (1984) reported studies of guided imagery with music that documented the positive effect that music has on enhancing relaxation. This lends support to the concept of utilizing music as a therapy in the care of the neurologically impaired patient.

Music and Medicine

Music has been called the universal language of the soul, the common denominator, when verbal communication has been lost or impaired (Alvin 1975). Its primary use in medicine from the early primitive eras to today has been to promote pleasantness and relaxation. The review of music literature for this study will be limited to that of music's physiologic effects,

psychological effects and its use in hospitals as a therapeutic modality.

The harmonious link between man and music is believed to be the common bond of rhythm. Man cannot remain aloof from music because of the rhythmic nature of his being. This is evidenced by heartbeat, blood pressure, respiratory patterns, gait, brain waves, and the circadian cyclic hormonal patterns. Music shares these properties of rhythm, tempo, sounds, harmony, pitch and intensity. It is, however, the rhythm that touches and impacts the primitive physiologic level (Alvin, 1975). The perception of music occurs at the cerebral cortex in conscious states and at the hypothalamic level in unconscious states. The response that is stimulated is both physiological and psychological (Alvin, 1975; Gaston, 1968). It may, in fact, be difficult to clearly separate these two responses. The hypothalamus is a regulator of metabolism, sleep, body rhythms and emotions. When stimulated, the hypothalamus transmits its messages via nerve pathways to the thalamus. This thalamic relay station controls emotions, sensations and feelings. This in turn stimulates the cerebral cortex (Ader, 1981). This close interrelatedness is a most complex process, giving support to the mind-body link present in man.

A resurgence of interest in music as a therapy developed parallel to the theories of holism and wellness in the 1960's. The stressor response documented by Selye (1956) is processed at

the hypothalamic area. The techniques of biofeedback, meditations, imagery, and relaxation utilize these concepts to induce relaxation in achieving wellness by assisting the mind to control the physiologic responses (Ader, 1981; Bensen, 1984; Pelletier, 1975, Wallace, 1970). The recent addition of Guided Imagery with Music (GIM) and its success supports these concepts (Peach, 1984). In fact, the use of music has become prevalent as a modality to promote a pleasant and relaxing atmosphere. This is seen (or rather heard) by the use of background music in waiting rooms, offices, operating rooms, recovery rooms, telephone systems and most prominently, by the dental profession (McClelland, 1976).

Music has been found to elicit demonstrated changes in electrical activity, pulse rate, blood pressure (Schonauer, 1930), body metabolism, muscular energy, respirations, blood volume and the threshold for sensory stimuli (Desrens and Fine, 1939) as reported by Cook (1981). Patrice (1896) demonstrated that soothing music slows cerebral blood circulation and decreases its volume and that lively music has the adverse effect. This was supported by Shepard in 1906 (as reported by Cook, 1981). The pitch of a musical selection affects the autonomic nervous system (ANS). Those selections with high pitch increase tension and those with low pitch decrease tension (Alvin, 1975). The tempo of the music has been found to be the major cause of physiologic responses. Those selections with a

"pulse rate" of 70-80 beats per minute (bpm) are associated with relaxation effects, and those exceeding 80 bpm with an elevation in heart rate (Alvin, 1975). Alvin also concluded that the physiologic effects are greater if the music has meaning to the listener. Farnsworth (1969) supported this individualistic effect in his findings. The ANS's control of blood pressure and respiration seems to be stronger if there is familiarity and meaning, whereas the heart rate may be controlled more by simply the tempo of the music (Alvin, 1975; Cook, 1981; Ellis, 1951; Mitkov, 1981).

In 1920, Gatewood established the "neurological fact" that when two separate sensory stimuli enter the nervous system simultaneously, they tend to neutralize each other. Only the stronger and more persistent one enters into the consciousness (as reported by Taylor, 1981). "Therefore, if the attention of an individual is sufficiently centered on one stimulus such as music, this stimulus may effectively exclude all others" (Ellis, 1981, p. 65). The use of ear phones for playing music has been suggested as an excellent tool for enhancing this effect (McClelland, 1975).

The University of Chicago study in 1948 (Taylor), 1981) reported that the use of music during anesthesia resulted in a reduction in necessary sedation dosages, increases in post-operative recovery, and a smoother induction phase in children. Music is found in many operating/recovery rooms

(McClelland, 1979) and in several dental offices. A recent study done by Metera (1975) to determine the effects of music on basal metabolic rate and oxygen consumption revealed a decrease in both factors during the playing of soothing music and an increase in both factors with exciting music. Ellis (1951) reported his study on the respiratory and cardiac effects of music on 36 college students. The results documented an elevation in respiratory rate at minute one and two of the treatments with a sloping decrease back to baseline at minute four. The heart rate effects were not consistent between subjects. This supported the earlier finds by Schoen and Soibelma in 1940 as reported by Ellis that there seems to be no general trait reactivity to music and individual's pulse rate reactions will vary widely. In 1947, Lewis documented that there was significantly less nitrous oxide induced hypoxia when music was used in conjunction with this anesthetic (reported by Taylor, 1981).

Bruya (1984), in a study of forty-seven normal adult volunteers, reported an increase in alpha brain waves when they listened to music with their eyes closed. [The alpha brain waves are associated with the right brain and relaxed wakefulness states. Beta brain waves are associated with sleep states. The alpha waves are the ones most frequently found in meditative, relaxed, GIM states (Bruya, 1981; Mitkov, 1981)]. The mean age of the sample was 31 years and it consisted of

mostly females. They listened to each music selection for five minutes. There was no significant difference found for type of music. The conclusions were that 1) the presence of alpha brain waves in subjects with eyes closed was pivotal to the habituation of stress; 2) that personal preferences appeared to have a role in the responses; and that 3) all subjects reported that it was a pleasurable experience (Bruya, 1981).

Mitkov (1981) also studied brain wave patterns in conjunction with music selections. His subjects were 60 normal adults (ages 18 to 55). They were exposed to 10 minutes of various musical selections. The results documented that 1) classical selections decreased mean arterial blood pressure (MAP) and heart rate in both the youth and elderly group, 2) that EEG activity increased with "pop" selections ($p < .02$), 3) that with classical music the youths had a decrease in cerebrovascular tone in small vessels and arterioles, thus diminishing the cerebral blood supply ($p < .02$) and 4) that these same classical selections in the elderly showed ($p < .03$) an increase in cerebrovascular tone in the large and moderate caliber vessels, thus increasing cerebral vascular blood supply. Again, all subjects reported the experience to be pleasurable. He concluded that both the sympathetic and parasympathetic branches of the ANS reacted to positive emotions (Mitkov, 1981).

These studies all demonstrate a complex physiologic response to music that may be altered or enhanced by the listener's perception, familiarity with the selection, or the degree of meaning associated with the selection. There were no studies found that examined intracranial pressures and music interventions.

The positive emotional effects of music dates back to the early writings of the Egyptians, Hebrews and Greeks (Cook, 1981). Weimer (1890) found that musical rhythm has no effect unless it evoked memories. Podalsky (1954) reported that slow music soothed the more severely ill. Altschuler (1948) believed that on the conscious level, music modified moods by stimulating the imagination and the intellect. For the unconscious person, music changed moods by stimulating the automatic response at the thalamic level. He felt that music which carried no symbolic or intellectual meaning for the listener may have no affect in an unconscious state (Altschuler, 1948; Podalsky, 1954; Weimer, 1890, as reported by Cook, 1981).

Maher (1980) studied the effect of musical intervals on psychological states and found that the minor intervals promoted sadness and depression, whereas the major intervals associated with positive emotions. The major intervals that he found most frequently correlated with these positive emotions were the major second, third, and sixth. He also found that rhythms could relax tensions or create relaxation and stated that these

rhythms may be the most crucial factor in the overall effect of the music. The regular rhythms gave a perceived sense of orderliness, harmony and pleasantness, whereas the syncopated patterns resulted in a disharmonious, more unpleasant perception (Maher, 1980).

In McClelland's (1979) documentation on the use of music in the operating room, hymns, spirituals, marches, jazz and rock affected an increased tension state and smooth, flowing, melodious, slow tempo music affected a lessening of tension. The method of measurement of these findings was not described. Both Cook (1981) and McClelland (1979) recommend the use of slow tempo, major key, low pitch music without lyrics if relaxation and pleasant sensations are the desired outcome of a music intervention. The use of headphones with a volume close to that of a normal conversation (50-60 db's) has the most positive effect when the goal is to dampen the effects of a stressful environment, to act as a diversional focus, and reduce the audibility of unwanted, unpleasant conversations (Alvin, 1975; Cook, 1981; McClelland, 1979).

The first use of music in a hospital setting was reported by Vandewall in 1948 with the wounded and shell-shocked soldiers of World War II. Farnsworth (1969) reported the use of music in physical therapy areas to make the exercises more endurable and enjoyable (Farnsworth and Vandewall, reported by Cook, 1981). Herth (1978) studied the use of music with post-operative

patients as an adjunct to ambulation. The subjects listened to five minutes of their favorite music prior to ambulating. She reported a decrease in feelings of lightheadedness and faintness and a 30% decrease in the use of pain medications in the experimental group. She also commented that the listener's appreciation of music seemed to correlate with its effectiveness. McClelland (1979) used headphones for patients in the operating room with positive subjective results. Livingston (1979) reported on the use of music during pregnancy and childbirth. Pop rock was used for the pre-natal conditioning exercises and the patient's favorite selection was used for the labor and delivery period. The purpose as stated, was to enhance both the atmosphere and a relaxation state. The use of music in labor and delivery periods of childbirth was studied by Clark (1981). Music was used as an attention focusing and/or distraction stimulus with 20 expectant mothers. Results showed significantly more positive perceptions of childbirth ($p < .05$) for the experimental group than for the group without music therapy. Locasin (1981) studied the effect of music on pain in selected post-operative patients. Music was used as a distractor stimulus for 24 female gynecologic patients. Random selection and matching were used. The experimental group had a diminished overt pain reaction ($p < .05$), BP and pulse lowering ($p < .01$), and a reduction in the use of pain medications. The recent literature shows an increasing number

of studies utilizing music as a therapeutic intervention. Its use has been to enhance relaxation, childbirth experiences, pain relief and environmental dampening. There were no studies found involving music as a therapy in the intensive care setting, nor with neurologically impaired patients. This study attempts to validate music's effectiveness in the ICU setting for this patient population.

Musicality

The reactions to music are a composite result of maturation, culture, tradition, education and training (especially in the field of music), personality traits (melancholics being more sensitive), sex and familiarity (Alvin, 1975; Hudson, 1973; Landreth, 1974; Locasin, 1981; Maher, 1980; Peretti, 1975).

Kennard (1983) described three levels of musical response: 1) sensory or perceptual, 2) excitement, and 3) imaginal (based on memories). Individuals with a greater musical background and most females tend to have an increased anxiety reduction level with music (Peretti, 1975). In addition, there seems to be an overall heightening of the effects if there is no vocal component (a distracting effect) and if the music is associated with meaning of a remembered event (Alvin, 1975; Hudson, 1973; Landreth, 1974; Peach, 1984).

Musicality is a complex interrelatedness of memory, emotions, intellect and socialization. The scientific pursuit

of music research is a complicated endeavor because of the intra and inter-variability of responses.

Summary

Man has a rhythmic bond with music and thus has a universal commonality with music as a means of non-verbal communication. The use of music for healing the mind and the body has been established throughout history from the most primitive cultures to the high technology of the twentieth century. The mind-body interconnectedness is established by the emotive and physiologic responses that it elicits. The response is individualistic, based on the musicality of the subject. The interval, rhythm, pitch, and character of music can be used to affect both psychologic and physiologic individualistic responses. Thus, the perception and sense of meaning to the listener become important factors. Man is clearly a unique, interrelated system that is much more than the sum of its component parts.

The research in this area has shown progressive scientific qualities in recent years, although many of the findings regarding music as a therapy remain descriptive or anecdotal. Further clinical research is needed to substantiate the type of music to be used, and its place in acute care hospital settings. This study utilized sedative music and preferred music to evaluate its effect on intracranial pressure in the critical care units, thus adding to the existing body of nursing research.

Chapter 3

Conceptual Framework

The conceptual framework for this study is that of the mind-body relationship. Man is defined as a complex, dynamic, and synergistic being composed of psychosocial/spiritual (the mind) and physical (body; physiologic) properties that are continually interacting with the environment (Ader, 1981; Blattner, 1981; Pelletier, 1977). The perception of his environment and the sense of meaning or confusion it has for him precipitates both his physiologic and emotive responses (Ader, 1981; Selye, 1956; Slonim, 1974).

Consider an acutely ill person in the milieu of an intensive care unit (Baker, 1984; Hansell, 1974; Leak, 1970). The sights, sounds, and activities are neither familiar nor pleasant. Compound this state with an impaired neurological system and the result is an altered sensory/perceptual state in the midst of an unfamiliar and disquieting environment.

Music, the universal language of man (Alvin, 1975; Cook, 1981), may be the appropriate denominator to provide an unthreatening, peaceful, and sedative effect to restore a sense of harmony and homeostatis. Its capability to reverse disease is not the goal or purpose of its use. Rather, the purpose is to dampen and mollify the existing environmental stressors. The objective for utilizing music for the patient with a

neurological insult is to introduce and enhance the perception of familiarity, peacefulness and relaxation in an effort to promote a more stable neurophysiologic state.

Statement of Purpose

This study compared the effect of sedative music and preferred music on intracranial pressure in patients with a pressure monitoring device in place. More specifically, the study investigated the following research hypotheses:

Hypotheses

1. The level of intracranial pressure recorded after music therapy will be lower than the level measured prior to the music therapy.
2. Preferred music selections will have a greater effect on the intracranial pressure than the sedative music selections.

Definitions

1. Music therapy: the controlled use of music with headphones to aid in the physiologic and psychologic integration of a person.
2. Sedative music: an instrumental musical performed by flute and harp entitled Masters of the Flute and Guitar (Sonata for Flute and continuo in C Major by Bach) as recorded by Klavier Records,

lasting five minutes, with a tempo of 71 beats per minute (bpm).

3. Preferred music: a selection of instrumental musical performances (lasting five minutes with a tempo equal to or less than 80 bpm) that the patient (or significant other) selected from the following categories: classical, country/western, spiritual or pop selection. Specific representative selections were determined by the investigator. (See Appendix A. A "significant other" was asked to select an appropriate category of music if the patient was unable to make his/her own decision.)
4. Intracranial pressure: the pressure readings corresponding to the pressure exerted by the cranial contents (brain tissue, cerebrospinal fluid, and blood) in the skull as measured by an intraventricular catheter, subarachnoid catheter or subarachnoid bolt in millimeters of mercury (mmHg).

Assumptions

1. Music appeals to all human beings regardless of sex, religion, culture, language or traditions.

2. The monitors in the critical care areas are properly balanced and calibrated.
3. All subjects have intact auditory pathways and hearing is present in both ears.
4. During the testing procedure, routine stimuli other than auditory will have minimal effect on intracranial pressure.
5. When the headphones are in place, the routine sounds of the environment will be diminished.
6. Intracranial pressure dynamics are balanced four hours post-insertion of the pressure monitoring device.
7. The pressure readings from subarachnoid bolts, catheters, or ventricular catheters will be relatively equal.
8. The trending of intracranial pressures is more significant than actual pressure values.

Chapter 4

Methodology

Design

This quasi experimental study used a pretest/post-test repeated measures design where each subject served as his own control. Each subject was exposed to two five-minute treatments (sedative and preferred music) separated by a five minute rest period. Subjects were chosen from a convenience sample and randomly assigned to one of two groups by a flip of a coin. The two groups were differentiated by the order in which they heard the music. Group 1 listened to the sedative music first, and group 2 listened to the preferred music first. The primary dependent variable was intracranial pressure. Secondary dependent variables were MAP, systolic and diastolic BP, CPP, HR, and the respiratory rate. The independent variables were treatment 1 and treatment 2. Data were recorded on the dependent variables at the end of each one minute interval for five minutes before and after each treatment during the entire 20 minute study period with each patient serving as his own control. The final one minute interval for each of the five minute sections were determined to be the most significant, however, data were collected for each one minute interval so that an in depth evaluation could be done, if appropriate, on any of the dependent variables. A time span of four hours was

allowed between the insertion of the pressure device and the initiation of the treatments to allow for stabilization of pressure dynamics. The five minute treatment period was selected to allow sufficient time to penetrate the consciousness. Small earphones that fit inside the external ear were utilized because they were the least obtrusive and most easily disinfected between subjects. Habituation could be a variable if a longer time period was used, thus the five minute treatment period was selected.

The Sample

A convenience sample of 10 subjects was obtained for this study from two intensive care units. All subjects in the sample were to be between the ages of 17 and 60 to control for the different autoregulation process of cerebral vessels in the 17 year old age group and the potential loss of elasticity in cerebral vessels in persons over 60 years of age. An intracranial pressure monitoring device, cardiac monitor and an arterial line was in place. Subjects who had musicogenic epilepsy, deafness in both ears, a history of depression/mental illness/schizophrenia, or those in neurologic crisis requiring mannitol (one hour or less prior to the study) were excluded from the sample. All subjects were randomly assigned to one of two groups by a flip of a coin. It was anticipated that this randomization process would equally distribute sex and levels of musicality between the two groups. The data collector was

notified of subjects by either the head nurse or the neurosurgeon/neurosurgical nurse responsible for patient management.

The Setting

After institutional approval, the sample was obtained from two hospitals in a large midwestern city. The average number of beds in each unit was thirteen. Two units were selected to increase the size of the sample. The units were similar in size, population and layout. All subjects were in private rooms with the door closed during the data collection period.

Human Rights Protection

The investigator obtained institutional approval from each of the selected Hospital Review Boards and from the Human Research Review Committee at Grand Valley State College. In addition, each subject (or closest relative) was visited prior to testing to provide a thorough explanation of the study and answer questions. A consent form was used to insure consistency of information, assure confidentiality and to make clear that denying consent would not affect the nursing or medical care of the patient. This consent form was signed and witnessed by the data collector (see Appendix B). Subjects who were cognitively intact signed their own consent forms. Verbal consent was obtained when possible from subjects with an altered level of consciousness or cognition, with written consent obtained from the next of kin.

Subjects were assigned a code number for the remainder of the study. The signed consent forms were kept in a location separate from the study data.

If at any time during the study the patient would have become restless, agitated, or the ICP elevated by 5 mmHG, the session would have been terminated and the physician notified if the behavior or pressure did not return to baseline within five minutes.

Validity

The pretest/post-test design, although it controls for most threats to internal validity, does not control for the rival hypothesis of disease pathology, degree of cerebral hypertension, affects of medication, musicality, unexpected environmental events/stimuli, or sudden changes in hemodynamic status (BP-pulse). The data collection tool documented these variables so as to better control for them and make possible the exclusion of these from the data base if appropriate. This design would not control for mortality or intra-session history. It was not anticipated that mortality will be a major issue in this study since all readings were taken during one twenty minute session. The data collector directly observed the patient and the environment to record events/stimuli that could influence the data. The collection of data took place between the hours of 1400 and 0500 when there were less personnel and

the ICU environment was generally quieter to better control extraneous stimuli.

Data Collection

All data were collected over a 6 month period from August 1985 to February 1986. A two page data collection tool was designed specifically for this study (Appendix C), using tools by MacLean (1983) and Walleck (1982) as models. Historical and demographic information was obtained from the patient, closest relative or significant other, and from the medical record. The ICU flow sheet and direct observation were also used.

The instrument was divided into six sections: demographics, medical history, medications, treatment/laboratory, musicality, and physiologic measurements. For the physiologic measurements section, all parameters were recorded at the end of the one minute periods. In addition, a Glasgow Coma Score (GCS) was performed by the data collector for all patients prior to the study. The GCS is a standard scale which reflects neurological status and is performed at a maximal arousal state. The stimulation necessary to achieve maximal arousal may cause an elevation in ICP, therefore a minimum of 10 minutes was allowed between the assessment and the initiation of the study to allow ICP to come back to baseline. The highest possible GCS of 15 would describe a person who was fully awake, could obey commands, open eyes spontaneously, and be able to converse in an orientated and appropriate manner. The lowest possible score of

3 would describe a person with no motor response, no eye opening response, and no verbal response. The score of 3 correlates with absence of cerebral functioning. A score of 8 indicates a moderate degree of neurological impairment (see Appendix D).

Instrument

The five part instrument used for this study was adapted from an observational tool established by Walleck (1982). The musicality section was developed specifically for this study.* Other modifications to Walleck's tool were made to expand the specificity and detail of the data collected in the demographics, medications, treatments/laboratory findings and the physiologic measurements sections. (See Appendix C)

Procedure

Informed consent and the musicality section of the data collection tool (Appendix C, Section IV) were obtained prior to the study from either the subject (if alert and orientated) or the next of kin (i.e. parents, spouse, or closest living relative). The data collector introduced self and the study utilizing a consistent procedure (See Appendix D).

*A music appreciation (MA) score was developed by the researcher and has no tested validity or reliability. It is merely a subjective assessment by the subject or his/her significant other related to his/her perception of music appreciation on a scale from one to five (five indicating the highest degree of music appreciation).

The data collector then determined the Glasgow Coma Score (Appendix E) by direct observation and stimulation. A period of at least 10 minutes of nonstimulation was provided following the Glasgow Coma evaluation to allow the ICP to return to baseline. Data for Section I, through III of the tool (demographics, medication and treatment/laboratory findings) was obtained from the medical record during this poststimulation period.

The physiologic measurement recordings for the treatment portion of the study (Section V) were obtained by direct observation of the ICP and cardiac monitors at the bedside. The baseline 1 and 2 measurements were recorded without earphones at the beginning and the end to observe for patterns or trends in the physiologic parameters. Random selection by a flip of the coin was used to place subjects into Group I (sedative music first) and Group II (preferred music first) to control for potential habituation effects of the second treatment section. At the conclusion of baseline 1, the data collector approached the bedside and informed all patients (regardless of level of consciousness) that small ear phones were being placed in their ears in order to play music selections for them. The recorder was turned on to the preset, uniform volume of 70-80 decibels. This volume (mean 75 decibels) was determined to be an easy listening volume by the researcher data collector and two other ICU nurses. The cassette tape ran continuously for the remainder of the study (15 minutes) during the five minute

periods of treatment 1, silence with earphones in place without music or sounds, and treatment 2.

Graphic Example:

	Earphones in place																			
	Baseline 1					Treatment 1					Silence					Treatment 2				
Minutes	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Data	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·

The earphones were left in place for the five minute period between treatments so that the subject would not be stimulated by the act of touching and replacing the earphones. There was no sound during this period on the tape recorder.

Cassettes were prepared for all possible combinations of preferred and selected music for Groups 1 and 2. The unusual environmental stimuli (suctioning, loud noises, malfunction of equipment) and the presence/absence of REM sleep (observed for rapid eye movements) were recorded because these variables have been correlated with increases in ICP. At the conclusion of the study, the cassette recorded was turned off and the earphones removed and Baseline 2 was recorded to monitor for potential transient elevations in ICP that might be related to the treatments.

Cleaning of the equipment after use by each subject was done with an antiseptic solution. The demographic code sheet (Appendix F) was filled out at the end of each session to facilitate ongoing evaluation of subjects. The amount of time necessary for each subject's data collection period was approximately one hour.

Data Management

The interval level data (SBP, MAP and ICP) collected at one minute intervals throughout the testing period were selected to analyze the effect of the music selections. Respiratory rates were not studied because all except 2 subjects were on continued ventilatory support and no fluctuations were seen. The systolic and mean arterial pressures were selected as being the most reflective of the physiologic vasculature effects. Heart rate data demonstrated only minimal fluctuation (>8 beats/minute) and thus were not included in the statistical analysis for this study. Heart rate has been correlated with the tempo of music. All selections played during this study had a controlled tempo of <80 beats/minute which may account for the lack of variability seen. A t test between the final one minute measurements was done to compare the ICP levels prior to treatment (preferred and sedative music selections) with the final one minute measure of the treatment period. The final minute reading was determined to most accurately reflect the music's habituation effect on ICP for the five minute treatment

period. The mean ICP of each of the one minute intervals would not measure the habituation effect of the music. It is not known if a five minute period is adequate to reflect habituation effect. The demographics were summarized with descriptive statistics.

Summary

The sample consisted of ten subjects, all of which had intracranial pressure devices in place. Each subject was exposed to two five minute music selections, sedative and preferred, at a preset volume of 70-80 decibels. The physiologic measurements were recorded at one minute intervals during the treatments and the baselines before, between and after each treatment. The selection to be played first (sedative or preferred) was randomly assigned by the flip of a coin. Each subject served as his/her own control for this repeated measures design.

Chapter 5

Results

Statement of Purpose

The purpose of this study was to add a previously undefined perspective to the body of knowledge on nursing care of the critically ill patient with cerebral pathology. This quasi experimental study examined the effect of sedative and preferred music on intracranial pressure.

Instrument Reliability

The instrument utilized in this study was developed by Connie Walleck RN, MSN. She had established inter-rater reliability with 89% agreement between six nurses on the physiologic parameters and 100% agreement on the demographic section.

Description of Sample

The mean age of the sample was 33.9 (Table 1). All subjects were Caucasian and the majority of the sample was female (67%). None of the subjects were pharmacologically sedated during the study. Two of the subjects were receiving maintenance drug therapies that could have influenced their cerebral hemodynamics (Dopamine and Dobutamine). Six of the subjects were receiving Decadron (16-40 mg per 24 hour period), two of the subjects received intermittent doses of Pitressin (1-5 units) > one hour prior to the study, four subjects received intermittent doses of

Mannitol (12-40 Gms) > 3 hours prior to the study, and 3 subjects received intermittent doses of morphine sulfate (2-4 mg) > 2 hours prior to being studied. All of the subjects had an intracranial monitoring device in place (8-ICP Bolt, 1-Subarachnoid catheter, and 1 ventricular catheter). The trending of ICP values is considered similar for these pressure monitoring devices. An arterial line was in place in nine subjects, the other subject's BP was taken by doppler. The mean Glasgow Coma score was 7.7. This score reflects a moderate degree of cerebral impairment. The mean baseline ICP was 11 which is within the normal range (0-15 mmHg). Data were collected within seventy-two hours for nine of the 10 subjects. Six of these nine subjects (67%) were studied within twenty-four hours of injury.

Table 1

Central Tendencies of the Sample Subject Characteristics

Characteristics of the sample	Mean	Range	SD
Age	33.9	21-57	14.1
Glasgow Score	7.7	3-15	5.1
Baseline ICP	11.0	3-26	6.6
MA Score	3.1	1-5	0.9

The music appreciation (MA) score shows the sample's MA mean of 3.1 to be higher than the scale mean of 2.5, indicating an above average music appreciation for the sample. The females in the 20-35 age group had the highest mean MA score of 3.5.

The sample divided into two fairly distinct subgroups of sex and underlying pathology (See Table 2). There were 6 female subjects and closed injured subjects (CHI). Of the total sample, 60% were in the CHI group and in this subgroup, 67% were female.

Table 2

Subgroup Delineation

Sex	Mass	SAH	CHI	Total
Male	1	1	2	4
Female	0	2	4	6
Total	1	3	6	10

Sixty percent of the total sample were in the closed head injury group (CHI) and 67% of this group were female. The delineation (See Table 3) within this CHI subgroup demonstrated differences between male and female Glasgow Coma scores, baseline ICP's and preferred music selection.

Table 3

Closed Head Injury Means Differentiated by Sex

Characteristic	Female (n=4)	Male (n=2)	Total group (n=6)
Age	21.75	33.0	27.4
MA Score	3.5	3.5	3.5
Glasgow Score	4.0	8.0	6.0
Baseline ICP	10.5	5.0	7.75
Popular music preference	4.0	0.0	2.0

The mean scores on selected variables in the female subgroup (n=6) of the total sample of 10 subjects were not significantly different from the males in the sample (See Table 4).

Table 4

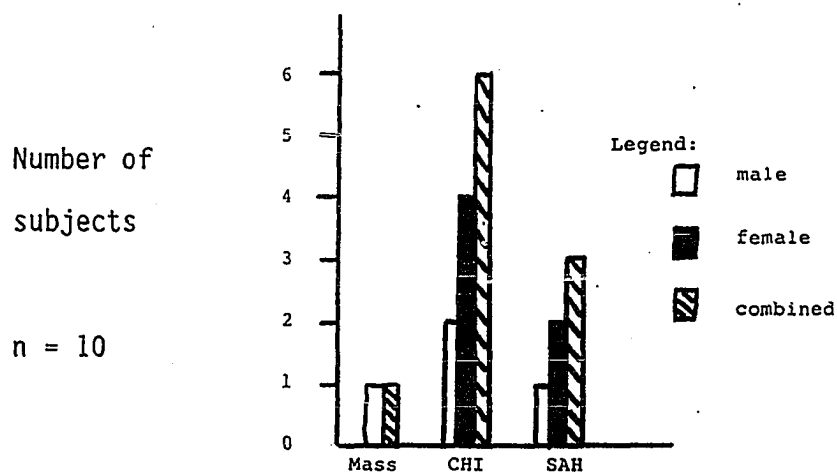
Female Means Compared with Male Means

Characteristic	Female	Male	Total subjects
Age	30.2	39.5	33.9
MA Score	3.0	3.25	3.1
Glasgow Score	7.6	7.75	7.7
Baseline ICP	10.0	12.5	11.0

The underlying pathology of the total sample portrayed a heterogeneous population with 6 CHIs, 3 subarachnoid hemorrhages (SAH), and 1 male subject with a cerebral mass (Table 5). In both the CHI and SAH group 67% were female subjects.

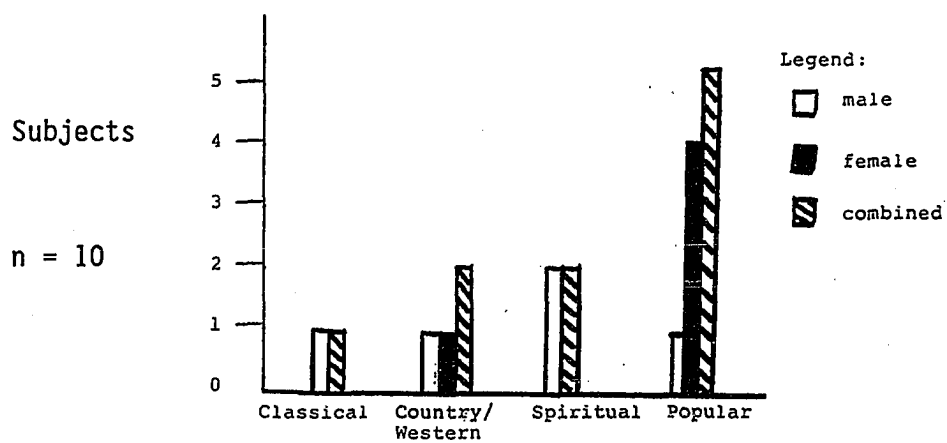
Table 5

Underlying Pathology of the Sample



The preferred music selections were five minute representative recordings from the following classifications: country western, spiritual, popular and classical (Table 6). (See Appendix A for the listing of the specific selections).

Table 6

Preferred Music Selection of Males and Females

The 25-30 age group female subjects preferred music selection was popular music. There was no other consistency seen in subjects selection of music (Table 7).

Table 7

Music Selection Differentiated by Age and Sex

Preferred Selection	Male		Female	
	25-30	36-50	20-35	36-60
Classical				1
Country Western	1			1
Popular		1	4	
Spiritual		2		

Clinical Observations

During the data collection of physiologic measurements each subject was monitored at the bedside (with the door closed) for 25 uninterrupted minutes. The physiologic parameters (SBP, DBP, MAP, ICP, CPP, respiratory rate and HR) were recorded at one minute intervals during the two five minute treatment periods, the five minute silence, the initial and ending five minute baseline periods.

Graphic Example:

Baseline	Treatment 1	Earphone silence	Treatment 2	Baseline
1 2 3 4 [5]	1 2 3 4 [5]	1 2 3 4 [5]	1 2 3 4 [5]	1 2 3 4 5
↓ (Baseline for Treatment 1)		↓ (Baseline for Treatment 2)		

Legend:

[] = final one minute data measurement

Because the earphones were kept in place between treatments, the baseline for treatment 2 was influenced by this induced silence. Music selections for treatment 1 and 2 were not consistent due to the random selection process. Four of the ten subjects heard the sedative control music during treatment 1, the remaining six subjects listened to their preferred music selection during treatment 1.

The final minute data for each five minute treatment period, the earphone induced silence period and the baseline is presented in Table 8. The intracranial pressure and systolic pressure (Table 9) were determined to be the most sensitive parameters for reflecting the effect that music would display.

The lowest means (\bar{X}) for intracranial pressure and systolic blood pressure were found during the sedative music treatments. The standard deviation (SD) shows that two thirds of the sample means fell within these parameters in each five minute segment of the data collection period. Standard deviations in this

range depict a heterogeneous sample and a skewed curve of distribution. The ICP means, ranges, and standard deviations are displayed in Table 10.

During the clinical observation period, the presence of extraneous stimuli (i.e. suctioning, nurse/patient activities, unusual noise, emotional stimuli) were recorded. In addition, no REM sleep manifestations of rapid eye movements were noted. Extraneous stimuli and REM sleep have been correlated with increased ICP levels and their presence could have altered the results of this study. Four of the subjects were exposed to the sedative music first and six to the preferred music first which reflects the random selection process.

Table 8

ICP Measurements During Repeated Measures Design

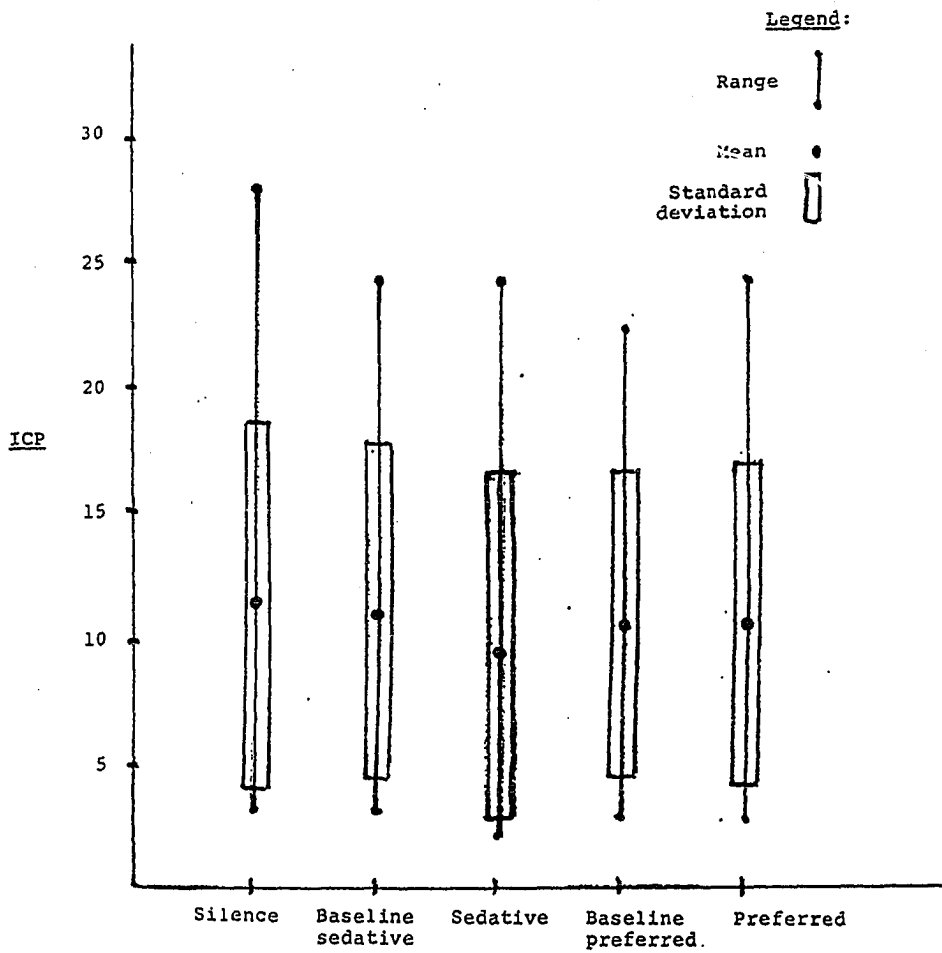
Subject	Earphone silence	Baseline sedative	Treatment sedative	Baseline preferred	Treatment preferred
1	8	8	7	8	6
2	12	12	12	13	13
3	16	14	14	16	16
4	12	12	8	10	9
5	9	9	8	9	9
6	5	5	3	8	6
7	6	6	2	5	5
8	3	3	2	3	3
9	14	14	13	15	14
10	28	24	24	28	24
X	11.3	10.7	9.3	11.5	10.5
SD	7.2	6.4	6.8	5.9	6.3

Table 9

SBP Measurements During Repeated Measures Design

Subject	Earphone silence	Baseline sedative	Treatment sedative	Baseline preferred	Treatment preferred
1	113	126	120	113	110
2	180	180	185	196	186
3	125	124	131	125	115
4	135	135	136	135	133
5	148	148	148	147	148
6	168	168	165	182	172
7	145	145	128	150	150
8	155	145	137	155	148
9	67	67	70	68	66
10	137	143	135	137	129
X	137.3	138.1	135.5	140.8	135.7
SD	31.5	31.2	30.0	35.7	33.9

Table 10
Graphic Display of ICP Means



Analysis of the Research Hypotheses

Hypothesis I

The level of intracranial pressure recorded after music therapy will be lower than the level measured prior to music therapy.

No significant changes in ICP means were located using a one-tailed t test to observe differences between baseline and treatment ICPs. Thus the research hypothesis is not supported.

Hypothesis II

Preferred music selections will have a greater effect on the intracranial pressure than the sedative music selection.

The t test statistics performed measured a significant decrease in ICP at the end of the sedative music treatment when compared to ICP levels recorded at the end of the preferred music selections. The significance was in favor of sedative versus the preferred selections at $p < .02$ in the lowering of ICP. Thus this research hypothesis was not supported (See Table 11).

Table 11

Comparison of t Test on ICP and SBP Levels for Music Selections

Music Selections	Intracranial Pressure		Systolic BP	
	<u>t</u> score	p	<u>t</u> score	p
Silence vs Preferred	1.5	<.10	1.10	<.20
Preferred vs Sedative	2.7	<.02	.06	NS

The t test measures the significance of differences between means. The p score indicates the probability of statistical significance. A probability level of $p < .05$ was established for this study. Therefore, it can be said that sedative music had a significant effect in decreasing intracranial pressure as compared with preferred music. There was no significance noted in the secondary dependent variables: SBP, DBP, MAP, CPP.

Additional Findings

The subgroups of six females and six closed head injured subjects were evaluated for their physiologic response to music selections. There were no significant differences between these sample means.

Chapter 6

Discussion

Statement of Purpose

This quasi experimental study was designed to compare the effect of sedative and preferred music on ICP. The goal was to investigate the effect of music on the intracranial pressures of ICU patients.

Summary of Results

The dependent variable of intracranial pressure was found to be decreased by sedative music ($p < .02$) as compared with preferred music. Sedative music lowered ICP in 6 of the 10 subjects in this study. None of the subjects experienced an increase in ICP by listening to either the sedative or preferred music selections. However, the group ICP means during the induced silence were found to be higher than either the preferred or the sedative treatment period's ICP levels. The random selection process affected the order in which music treatments were given, causing treatment 2 to follow the induced earphone silence. Although this was not found to alter or influence the significance, the fact that the ICP levels were higher during silence than the treatment periods is to be considered.

The research hypothesis that intracranial pressure recorded after music therapy would be lower than the level measured prior to music therapy was not supported. The second research hypothesis that preferred music selections would have a greater effect on the ICP than the sedative music was also not supported. In fact, the effects seen were in the opposite direction from the hypothesis. Sedative music had a more significant effect ($p < .02$) on lowering intracranial pressure as compared to the preferred music selections. There were no significant effects noted on measurements of systolic blood pressures, MAP, or the other physiologic parameters.

Discussion

Sedative music was found to be more effective in lowering than preferred music selections in this study. Patients in an intensive care setting experience numerous physiologic and psychologic variations. The environment contributes to disharmony due to the frequency and nature of nurse/patient activities, unpleasant and unfamiliar sounds, conversations of many personnel, high levels of noise and emotional stimuli related to stress. The neurologic patients in this sample had a mean Glasgow Coma score of 7.7. Despite varying levels of coma, auditory evoked potentials indicate that the auditory pathways remain intact as long as the brain stem is functional. Therefore, the researcher assumed that there is at least some degree of perception of auditory stimuli in this

group of subjects. In addition, the sensory stimuli of the ICU environment that are perceived and processed by the hypothalamus and autonomic nervous system have an effect that would not be characterized as pleasant and relaxing. The variables of sedation, medication and Glasgow Coma scores were not significant factors for the subjects in this sample.

Ninety percent of the subjects were studied within 72 hours after admission to the intensive care unit. It would appear that music could safely be used as a nursing intervention for similar subjects, as its use did not elevate ICP levels. ICU nurses frequently are hesitant to use music during the acute phase of cerebral insult due to their concern that this intervention may elevate ICP levels. The results of this study show no elevations in ICP with either the preferred or sedative selections. It should be noted that the highest ICP levels were recorded during the induced silence periods, suggesting that the absence of sound would not be conducive to control and lower ICP levels. Sedative music would be recommended over preferred music for ICU patients with cerebral pathology that are between the ages of 21-57 with normal levels of ICP. This recommendation is based on the results of this study. Further research is needed before full endorsement can be given to utilizing music as an effective intervention for lowering ICP.

The female subjects comprised 67% of the closed head injury group, were younger than the males, all preferred popular music

selections, and their Glasgow Coma scores (mean score of 4) indicated a more severe pathology than the male subjects in this subgroup (mean score 8). The lower coma scores reflect a lower cognitive/responsive status indicating that the preferred music was selected by the significant others or next of kin rather than by the subject themselves. This is not as reliable as it would be if the subjects had identified the preference.

Limitations of the Study

The multiplicity of variables limits generalization of the results of this study. The major factors that limit generalization are the small sample size of 10, the variability of underlying pathology, and the fact that all subjects in this convenience sample, except one, had ICP levels that were within the normal range. However, the Glasgow Coma scores do indicate a moderate degree of neurologic insult. In addition, each subject was exposed to music for only five minutes. It is not known what effect would occur if the music continued over a longer period of time. The random selection process caused treatment 2 to follow the induced silence period during which the higher levels of ICP were found. Further research would be needed before advocating the use of music with subjects experiencing acute cerebral pathology.

Implications for Nursing Practice

Results of this study show that music played at 70-80 decibels via earphones does not increase intracranial pressures that are within the normal range. Music is used frequently in the intensive care setting at various volumes and via tape recorders and radios. The selection of music type is usually matched to the patient's preference. There is also a reluctance and concern expressed by intensive care nurses to use music as a therapy or intervention during the initial crisis period. Rather, most nurses prefer to allow physiologic stability and some improvement in the clinical and cognitive status to be demonstrated prior to using music at the bedside.

This study suggests that the use of sedative music, regardless of the clinical condition of the patient and normal ICP's, has a positive effect when played at an easy listening volume of 70-80 decibels. It has not been determined however whether this response to music was a direct effect or due to a dampening of the noxious, unfamiliar environmental noise measured at 50-76 decibels in ICU settings (Woods and Falk, 1974).

It appears that if music is used, the sedative selections would be indicated rather than preferred selections and that either selection would be preferred to absolute silence.

Recommendations for Future Research

Further studies are needed to explore the use of music in the ICU setting. Suggested studies include:

1. Replication of this study with increased sample size to validate findings.
2. Replication of this study controlling for:
 - a. pathology
 - b. sex
 - c. increased intracranial pressure levels
 - d. various decibel levels
 - e. habituation effects of music.
3. Replication of this study using longer music treatment periods.
4. Replication of this study correlating music and auditory evoked potentials.
5. Initiation of a study to validate a music appreciation score.

Conclusion

Music is currently being used in several ICU settings. This study examined the effect of music on the ICP in patients with a cerebral neurologic insult. Literature has been presented that examined the effect of noise, emotional stimulus and nurse/patient activities on intracranial pressure. In addition, studies related to the use and effect of music on physiologic

parameters were reviewed. Methodology has been described and the results of the study have been presented and discussed.

From this study it appears that the use of music does not have a harmful effect on normal intracranial pressure. In most cases sedative music had a greater effect on ICP than did the preferred music selection. It appears that the use of music can safely be added to nurse's current strategies when caring for patients with normal intracranial pressures. Further studies are needed to validate these findings and expand the depth of this study.

Reference List

- Ader, R. (1981). Psychoneuroimmunology. Academic Press, Florida.
- Alvin, J. (1975). Music Therapy. Basic Books, Inc., New York.
- Baker, C.F. (1984). Sensory overload and noise in the ICU: Sources of environmental stress. Critical Care Quarterly, 6, 66-80.
- Benson, H. (1984). Beyond the Relaxation Response. Times Books, New York Book Co., Inc., New York.
- Betz, E. (1975). Cerebral Blood Flow during Emotional Stimuli. Brainwork. Alfred Benzon Symposium VIII. Munksgaard.
- Blattner, B. (1981). Holistic Nursing. Prentice-Hall, Inc., New York.
- Bolin, R. (1974). Sensory deprivation: An overview. Nursing Forum, 13, 241-258.
- Bruya, M. (1981). Planned periods of rest in the intensive care unit: Nursing care activities and intracranial pressure. Journal of Neurosurgical Nurses, 13(4), 184-194.
- Bruya, M. and Severtsen, B. (1984). Evaluating the effect of music on EEG patterns of normal subjects. Journal of Neurosurgical Nurses, 16(2), 96-100.
- Clark. (1981). Music therapy assisted labor and delivery. Journal of Music Therapy, 18(2), 88-100.
- Cook, J. (1981). The therapeutic use of music: A literature review. Nursing Forum. 20(3), 252-256.
- Ellis, D. (1948). Effects of Music on Respiration and Heartrate. MA Thesis. Occidental College.
- Hall, J., Spielman, G., Gennarelli, T. (1982). Auditory evoked responses in acute severe head injury. Journal of Neurosurgical Nurses, 14(5), 225-230.
- Hanlon, K. (1976). Description and use of intracranial pressure monitoring, Heart Lung, 5(2), 225-230.

- Hansell, H. (1984). The Behavioral Effect of Noise on Man. Heart Lung, 13(1), 59-65.
- Haslam, P. (1970). Noise in hospitals. Nursing Clinics in North America, 5(4), 715-724.
- Herth, K. (1978). The therapeutic use of music. Supervisor Nurse, 9, 22-23.
- Houghey, P. (1984). Considerations in applying research findings into practice. Dimensions in Critical Care Nursing, 3(5), 288-292.
- Huck, S., Cormier, W., Bounds, W. (1974). Reading Statistics and Research. Harper & Row Publishers.
- Hudson, P. (1973). Music: A physiologic language. Journal of Music Therapy, 10, 137-140.
- Kennard, D. (1983). A touch of music for physiotherapists. Physiotherapy, 69(4), 114-116.
- Krampitz, S., Pavlovich, N. (1981). Readings for nursing research. C.V. Mosby Co.
- Landreth, J., Landreth, L. (1974). Effects of music on physiologic response. Journal of Research in Music Education, 22, 4-12.
- Langfitt, T. (1968). Increased intracranial pressure. Clinical Neurosurgery, 16, 436-471.
- Lewandowski, L., Kositsky, A. (1983). Research priorities for crical care nursing. Heart Lung, 12:35.
- Lipe, H., Mitchell, P. (1980). Positioning the patient with intracranial hypertension: How turning and head rotation affect the internal jugular vein. . Heart Lung, 9, 1031.
- Livingstone, M. (1979). Music for the childbearing family.. Journal of Gynocological Nursing, 13, 241-258.
- Locsin, G. (1981). The effect of music on the pain of selected post-operative patients. Journal of Advanced Nursing, 6, 19-25.
- Lundberg, N., Crosquist, S., Kjallquist, A. (1968). Clinical investigation of interrations between ICP and intracranial hemodynamics. Progress in Brain Research, 30, 69-71.

- MacClelland, D. (1979). Music in the operating room. AORN Journal, 29(2), 252-260.
- MacLean, S. (1983). The effect of noise on intracranial pressure in head injured patients. Unpublished Master's Thesis, University of Maryland.
- Maher, T. (1980). A rigorous test of the proposition that musical intervals have different psychological states. American Journal of Psychology, 93(12), 309-327.
- Metera, A. (1975). Effect of music on airway resistance in patients. Anesthesia, Resuscitation, and Intensive Therapy, 265-269.
- Metera, A. (1975). Influence of music on the minute oxygen consumption and basal metabolic rate. Anesthesia, Resuscitation, and Intensive Therapy, 3, 259-264.
- Mitchell, P. (1980). Intracranial hypertension: Implications of research for nursing care. Journal of Neurosurgery, 12, 145-54.
- Mitchell, P., Mauss, N. (1978). Relationship of patient/nurse activities to intracranial pressure variations a pilot study. Nursing Research, 17, 4-10.
- Mitchell, P., Ozuna, J., Lipe, H. (1981). Moving the patient in bed: effects on ICP. Nursing Research, 30, 212-218.
- Nobel, M. (1979). Communication in the ICU: Therapeutic or disturbing. Nursing Outlook, 17(3), 197-201.
- Parsons, S. and Shogan G. (1984). The effects of the endotracheal tube suctioning/manual hyperventilation procedure on patients with severe closed head injuries. Heart Lung, 13(4), 342-379.
- Peach, S. (1984). Some implications for the clinical use of music facilitated imagery. Journal of Music Therapy, 20(1), 27-34.
- Pellitier, K. (1977). Mind as Healer, Mind as Slayer. Dell Publishing Company, New York.
- Peretti, P. (1975). Changes in galvanic skin responses as affected by musical selection, sex, and academic discipline. Journal of Psychology, 89, 183-187.

- Polit, D., Hunger, B. (1983). Nursing Research. J.B. Lippencott.
- Pollack, L., Goldstein G. (1981). Lowering of intracranial pressure in Reye's syndrome by sensory stimulation. New England Journal of Medicine, 304 732.
- Selye, H. (1956). The Stress of Life. McGraw Hill Book Co., New York.
- Shapiro, H. (1975). Intracranial hypertension: Therapeutic and anesthetic considerations. Anesthesiology, 43(4), 445-469.
- Shevrin, H. (1973). Brainwave correlates of subliminal stimulation.. Psychological Issues, 8(2), 56-d87.
- Shonim, N. (1974). Environmental Physiology. C.V. Mosby Co., St. Louis.
- Snyder, A. (1983). Relationship of nursing activities to increases in intracranial pressure. Journal of Advanced Nursing, 273-279.
- Taylor, D. (1981). Music in general hospital treatment from 1900-1950. Journal of Music Therapy, 18(2), 62-73.
- Wallace, B. (1970). The physiology of transcendental meditation. Science, 1751-1754.
- Walleck, C. (1982). Effects of touch on intracranial pressure. Unpublished Master's Thesis, University of Maryland.
- Welch, B. and Welch, A. (1970). Physiologic Effects of Noise. Plantum Press, New York. 337-340.
- Wilson, H. (1984). Research reflections: Making research ethical. Journal of Nursing Administration, 6-7.
- Wilcoxin F., Wilcox R. (1964). Some Rapid Approximate Statistical Procedures, Lederle Labs.
- Woods, N. and Falk, S. (1974). Noise stimuli in the acute care area. Nursing Ressearch, 23, 144-150.
- Youmans, D. (1977). Music in the operating room. AORN Journal, 29(2), 252-260.
- Ziporyn, T. (1984). Music therapy accompanies medical care. JAMA, 252(8), 986-987.

Appendix A

Preferred Music Selections

Album	Song	Singer	Type
Country Sides	"Lonesome"	Red Rhodes Velvet Hammer in a Cowboy Band	Country/ Western
Spyro Gyra	"Little Linda"	Chet Catello produced by Jay Beckenstein & Richard Calandra	Popular
Music for Quiet Listening Eastman- Rochester Symphony	"Sarabande: For Katherine in April"	Ron Nelson	Classical
John Wimber	"Spirit Song"		Spiritual

Appendix B

Consent: Music Intervention for Intracranial Pressure Study

I hereby authorize _____ R.N. to expose _____ (patient's name/myself) to recorded music selections for the purpose of studying changes in intracranial pressure.

1. I understand that earphones will be placed on his/her head while the music is played and that during this 30 minutes the blood pressure, heart rate and intracranial pressure will be continually monitored. Information from the Medical Record will also be collected.
2. I understand that this study will not alter or change his/her nursing or medical care.
3. I understand that although there are no anticipated risks to this study, the testing will be discontinued in the event of significant changes in vital life functions or intracranial pressure, and that the appropriate medical personnel will be notified.
4. I understand that any information obtained will be kept confidential and that his/her identity will not be shared with anyone outside the research staff and will not be revealed in the published research results.

Appendix B (continued)

5. I understand that I am free to withdraw from this study at anytime without affecting nursing or medical care.
6. I have been informed of all testing procedures and have had the opportunity to ask questions.
7. Although no risks are anticipated, I understand that neither the researcher nor the hospital will assume liability related to this study.
8. I understand that the results of this study will be shared with me if I request them.

_____ date: _____
signature (patient or next of kin)

_____ date: _____
witness' signature

Primary Investigator: Carol Roberts, phone: 774-1443
Data Collector: Keith Sikkema, phone: 459-5626

Hospital number _____ Code number _____

copy to Investigator's File and Participant (or Participant's family only)

Appendix C
Data Collection Tool

Code # _____ Date _____ Time _____

I Demographics

Hospital: S _____ BW _____ BM _____ M _____
 Age _____ Sex _____ Race _____
 Date of injury/surgery _____ Description: CHI _____ MASS _____ SAH _____ HYPOXIA _____
 Other _____
 Date of pressure apparatus _____ Bolt _____ Epidural _____ Ventricular _____
 SA Catheter _____
 BP Device: A Line _____ Date _____ Glasgow Coma Score _____

II Medications	Dose	Time of last dose	Cum 24 hr dose	Levels (if approp)
a) Pentobarb (Pento)				
b) Pavulon (Pav)				
c) Morphine (MS)				
d) Valium (Val)				
e) Codeine (Cod)				
f) Thorazine (Thor)				
g) Lidocaine (Lido)				
h) Mannitol (Man)				
i) Dopamine (Dop)				

III Treatment/Laboratory

a) treatments time last done:

b) ABG ph _____ pCO₂ _____ Time _____
 c) Temp _____ c
 d) Respiratory support _____

IV Musicality (source: _____)

a) Favorite type of music: Classical _____; Pop _____; Country/Western _____; Spiritual _____
 b) Has patient taken music lessons? _____ How long? _____
 c) Does patient have a special degree in music? yes _____ no _____
 d) How many hours/day would you say the patient listens to or participates in musical activities? _____
 e) How would you score the patient on music appreciation, using 0 as low appreciation and 5 as high appreciation? _____ M.A. score.
 f) History: deafness _____ R _____ L _____ hard of hearing _____ R _____ L _____
 Epilepsy triggered by music _____ yes _____ no _____
 mental illness/depression/schizophrenia _____ yes _____ no _____

Appendix C (continued)

Data Collection

V Physiologic Measurement

Minutes	Baseline 1					Treatment 1					Silence with earphones					Treatment 2					Baseline 2				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
S/D																									
MAP																									
ICP																									
CPP																									
Resp																									
HR																									
Extraneous stimuli present																									
Music treatment																									
Comments*																									

*note REM sleep
+ or -

Legend

S/D = Systolic/diastolic blood pressure (mm/Hg)
 MAP = Mean arterial blood pressure

$$\frac{\text{systolic} + 2 \times \text{diastolic}}{3} \text{ (mmHg)}$$

 ICP = Intracranial pressure (mmHg)
 CPP = Cerebral perfusion pressure (Map-ICP)
 Resp = Respiratory rate (breaths/min)
 HR = Cardiac beats/min
 + = REM sleep observed
 - = REM sleep not observed

Treatments

C = control
 C/W = country/western
 S = spiritual
 P = pop
 Cl = classical

Patient/family wishes feedback information on this study.

Appendix D

Introduction Procedure

Hello, my name is (data collector) . I am assisting in a research study that involves the use of music as a potential treatment for patients with neurological problems. Previous studies have suggested that soothing, pleasurable treatments may be helpful in lowering or stabilizing intracranial pressures. The study requires the use of small earphones to be placed on (patient) so that he/she can hear two different music selections for 5 minutes each. The study will take 20 minutes to complete. While the music is being played, I will be recording information from the bedside monitors to look for changes in pressures, heart rate and breathing rates. I will also need to review part of the medical chart for laboratory and medication information. All of the information will be kept confidential and his/her name will not be shared with anyone except the researcher. I will be present at the bedside during the entire study to make sure that necessary care is attended to. If any problems develop, the study will be stopped immediately and his/her nurse will be called. Your participation is strictly voluntary and you can ask to stop the study at any time. After the entire study is finished on all the patients, we will be glad to share our results with you. I would like to ask your permission to include patient in our study.

Appendix E
Glasgow Coma Scale

EYES	Open	Spontaneously	4
		To verbal command	3
		To pain	2
	No response		1
BEST MOTOR RESPONSE	To verbal command	Obeys	6
	To painful stimulus	Localizes pain	5
		Flexion-withdrawal	4
		Flexion-abnormal (Decorticate rigidity)	3
		Extension (Decerebrate rigidity)	2
No response		1	
BEST VERBAL RESPONSE (t) = trached or tubed	Oriented & converses		5
	Disoriented & converses		4
	Inappropriate words		3
	Incomprehensible sounds		2
	No response		1
TOTAL (possible score) =			3 - 15

This scale is for the assessment of consciousness. The numbers next to the responses indicate the score assigned to the response. Numbers are totaled to give the Glasgow Coma Score. The lowest score is 3, the highest score is 14.

Appendix F
Demographic Code Sheet

Code	Age	Sex	Dx.	G.C.S.	B. ICP	Hosp.	MA Score	Selection
1.								
2.								
3.								
4.								
5.								
6.								
7.								
8.								
9.								
10.								

Legend

M = Male

F = Female

Dx = Diagnosis

CHI = Closed Head Injury

SAH = Subarachnoid Hemorrhage

M/T = Mass/Tumor

H = Hypoxia

O = Other

G.C.S. = Glasgow

B. ICP = Baseline ICP

H = Hospital

BH = Butterworth Hospital

BM = Blodgett Memorial

Medical Center

MA Score = Music Appreciation

Score (L) 0 - 5 (H)

Selection

C/W = Country/Western Music

S = Spiritual Music

P = Popular Music

Cl = Classical Selection

Ader, 16, 17, 26, 63
Altschuler, 21
Alvin, 15-18, 22, 24, 26, 63
Baker, 11, 26, 63
Bensen, 17
Betz, 13, 63
Blattner, 26, 63
Bruya, 1, 8, 12, 19, 20, 63
Clark, 23, 63
Cook, 2, 7, 17, 18, 21, 22, 26, 63
Ellis, 18, 19, 63
Falk, 2, 10, 60, 66
Farnsworth, 18, 22
Fine, 17
Gaston, 16
Gatewood, 18
Goldstein, 14, 66
Hall, 11, 63
Hanlon, 4, 5, 63
Hansell, 9, 26, 64
Haslam, 10, 64
Herth, 22, 64
Homer, 7
Hudson, 24, 64
Kennard, 24, 64
Klavier, 27
Landreth, 24, 64
Langfill, 4
Langfit, 5
Leak, 9, 26
Lewandowski, 5, 64
Lewis, 19
Lipe, 8, 64, 65
Livingston, 23
Locasin, 23, 24
Lundberg, 1, 6, 12, 64
MacLean, 1, 6, 8, 10-12, 15, 34, 65
Maher, 21, 22, 24, 65
Marshall, 11
Mauss, 1, 6, 8, 12, 65
McClelland, 17-19, 22, 23
Metera, 19, 65
Mitchell, 1, 6, 8, 12, 65
Mitkov, 18-20
Nobel, 10, 65
Ozuna, 8, 65
Parsons, 8, 65
Patrice, 17
Peach, 15, 17, 24, 65
Pelletier, 9, 17, 26
Peretti, 24, 65
Plato, 7
Podalsky, 21
Pollack, 14, 66
Schoen, 19
Schonauer, 17
Selye, 13, 16, 26, 66
Shapiro, 3, 4, 66
Shepard, 17
Shevrin, 9, 66
Slonim, 9, 26
Snyder, 8, 66
Soibelma, 19
Storey, 13
Taylor, 18, 19, 66
Vandewall, 22
Wallace, 14, 17, 66
Walleck, 1, 8, 34, 35, 40, 66
Weimer, 21
Woods, 2, 10, 60, 66
Youmans, 3, 66
Ziporyn, 7, 66

Index

- AER, 11
 ANS, 9, 13, 15, 17, 18, 20
 Abnormalities, 9
 Acidosis, 3
 Activities, 5-8, 26, 50, 57, 61, 63, 65, 66, 75
 Acute, 10, 25, 58, 60, 63, 66
 Ader, 16, 17, 26, 63
 Alarm, 1, 10
 Aldosterone, 13
 Alpha, 19, 20
 Altschuler, 21
 Alvin, 15-18, 22, 24, 26, 63
 Anesthesia, 18, 65
 Antidiuretic, 13
 Antiseptic, 38
 Anxiety, 7, 9, 24
 Appendix, 28, 32, 34-36, 38, 46, 67-76
 Arachnoid villi, 3
 Arterioles, 20
 Association of Music Therapists, 7
 Autonomic, 9, 13, 17, 58
 Autoregulatory mechanism, 1
 BP, 9, 10, 15, 23, 30, 33, 41, 55, 75
 Baker, 11, 26, 63
 Barbituate, 11
 Baseline, 8, 19, 33, 34, 36, 37, 41, 42, 44, 45, 48, 49, 51, 52, 54, 76
 Battle-fatigued, 7
 Behavior, 33
 Bensen, 17
 Beta, 19
 Betz, 13, 63
 Biofeedback, 17
 Blattner, 26, 63
 Bruya, 1, 8, 12, 19, 20, 63
 CHI, 43, 44, 46, 75
 CPP, 3, 4, 30, 48, 55, 76
 CSF, 2, 3
 Cardiovascular, 9
 Catheters, 29
 Cerebral, 1-4, 8, 11, 12, 14, 16, 17, 20, 31, 33, 35, 40, 41, 46, 58, 60, 61, 63, 76
 Cerebrovascular, 20
 Character, 25
 Circadian, 16
 Clark, 23, 63
 Coma, 8, 11, 14, 34, 36, 41, 44, 57-59, 73, 75
 Comatose, 13, 14
 Conclusion, 36, 37, 61
 Cook, 2, 7, 17, 18, 21, 22, 26, 63
 Cortex, 9, 11, 16
 Crisis, 31, 60
 Cyclic, 16
 Dark Ages, 7
 Data, 8, 12, 30-36, 38, 40, 41, 48, 49, 69-72
 Deafness, 31, 75
 Decadron, 40
 Decibels, 10, 36, 39, 60
 Delphi, 5
 Demographics, 34-36, 39, 75
 Depression, 21, 31, 75
 Design, 8, 30, 33, 39, 51, 52
 Desrens, 17
 Deviations, 49, 50
 Diastolic, 30, 76
 Differences, 44, 54, 55
 Dioxide, 3, 14, 15
 Discussion, 56, 57
 Distribution, 50
 Dobutamine, 40
 Dopamine, 40, 75
 Doppler, 41
 EEG, 20, 63
 Edema, 3
 Egyptians, 7, 21
 Ellis, 18, 19, 63
 Emotional, 1, 7, 12-15, 21, 50, 57, 61, 63
 Emotions, 7, 16, 20, 21, 24
 Endocrine, 9
 Environment, 2, 4-6, 11, 15, 22, 26, 29, 33, 34, 57, 58
 Epidural, 4, 75
 Epilepsy, 31, 75
 Epinephrine, 13, 14
 Evaluation, 30, 36, 38
 Falk, 2, 10, 60, 66
 Farnsworth, 18, 22

- Fine, 17
 Fluctuation, 38
 GCS, 34
 GIM, 17, 19
 Gaston, 16
 Gatewood, 18
 Generalization, 59
 Gland, 13
 Glasgow Coma, 8, 34, 36, 41, 44,
 57-59, 73, 75
 Goldstein, 14, 66
 Greeks, 21
 Groups, 8, 10, 30, 31, 37
 HR, 30, 48, 55, 75, 76
 Habituation, 20, 31, 36, 38, 39, 61
 Hall, 11, 63
 Hanlon, 4, 5, 63
 Hansell, 9, 26, 64
 Haslam, 10, 64
 Headphones, 22, 23, 27, 29
 Healing, 7, 25
 Hebrews, 7, 21
 Hemodynamic, 14, 33
 Hemorrhage, 13
 Herth, 22, 64
 Heterogeneous, 46, 50
 Homeostatis, 26
 Homer, 7
 Hormone, 13
 Hudson, 24, 64
 Hymns, 22
 Hypertension, 11, 12, 33, 64-66
 Hyperthermia, 13
 Hypocarbica, 3
 Hypothalamus, 13, 16, 58
 Hypothesis, 33, 54, 57
 Hypoxia, 3, 19, 75
 ICP, 1-10, 12-15, 33, 34, 36-39, 41,
 42, 44, 45, 48, 50, 51, 53-62,
 64, 65, 76
 ICU, 2, 7-10, 24, 34, 36, 56, 58,
 60, 61, 63, 65
 Imagery, 15, 17, 65
 Impaired, 1, 11, 15, 24, 26
 Implications, 60, 65
 Insult, 1, 27, 58, 59, 61
 Intensive care, 2, 8, 10-12, 15, 24,
 26, 31, 57, 58, 60
 Intervals, 10, 21, 38, 39, 48, 65
 Interventions, 1, 2, 4, 6, 11, 21
 Intracranial pressure, 1, 2, 4, 6,
 10, 25, 27-31, 39, 40, 49,
 54-57, 61-66, 68, 76
 Intraventricular, 4, 28
 Intraventricular catheter, 4, 28
 Ischemic, 14
 Jazz, 22
 Kennard, 24, 64
 Klavier, 27
 Landreth, 24, 64
 Langfill, 4
 Langfit, 5
 Leak, 9, 26
 Levels, 3, 5, 6, 10-15, 24, 31, 38,
 50, 54-59, 61, 75
 Lewandowski, 5, 64
 Lewis, 19
 Life-threatening, 1, 6
 Limbic, 13
 Limitations, 59
 Limits, 59
 Lipe, 8, 64, 65
 Listening, 36, 56, 60, 67
 Livingston, 23
 Locasin, 23, 24
 Lundberg, 1, 6, 12, 64
 MAP, 3, 4, 20, 30, 38, 48, 55, 57, 76
 MacLean, 1, 6, 8, 10-12, 15, 34, 65
 Maher, 21, 22, 24, 65
 Mannitol, 31, 41, 75
 Mannitol, 31, 41, 75
 Marches, 22
 Marshall, 11
 Mauss, 1, 6, 8, 12, 65
 McClelland, 17-19, 22, 23
 Mean, 10, 19, 20, 36, 38-42, 57, 59,
 76
 Medication, 33, 36, 58, 72
 Meditations, 17
 Medulla, 13
 Metabolic, 9, 14, 15, 19, 65
 Metabolism, 16, 17
 Metera, 19, 65

- Methodology, 30, 62
 Mitchell, 1, 6, 8, 12, 65
 Mitkov, 18-20
 mmHg, 2, 3, 5, 28, 33, 41, 76
 Monitoring, 1, 2, 4, 5, 27, 29, 31, 41, 63
 Monitors, 29, 36, 72
 Morphine, 41, 75
 Mortality, 33
 Music, 2, 5-8, 12, 15-28, 30, 35-40, 42, 44, 46-50, 54-68, 72, 75, 76
 Musicality, 8, 24, 25, 31, 33-35, 75
 Nervous, 9, 13, 17, 18, 58
 Neuroelectric, 11
 Neurologic, 6, 8, 9, 13, 31, 57, 59, 61
 Neurological, 1, 12, 18, 26, 27, 34, 35, 72
 Nobel, 10, 65
 Noise, 7, 9-12, 50, 57, 60, 61, 63-66
 Norepinephrine, 13
 Normal, 10, 19, 20, 22, 41, 58-60, 62, 63
 Noxious, 12, 20
 Nursing interventions, 1, 2, 11
 Odors, 9
 Ozuna, 8, 65
 Paralyzed, 14
 Parameters, 34, 36, 40, 48, 49, 57, 62
 Parasympathetic, 14, 20
 Parsons, 8, 65
 Pathology, 4, 33, 40, 43, 46, 58-61
 Pathophysiology, 1, 4, 5
 Patients, 1, 2, 5-8, 10-13, 23, 24, 27, 34, 36, 56-58, 60-62, 64, 65, 72
 Patrice, 17
 Peach, 15, 17, 24, 65
 Pelletier, 9, 17, 26
 Pentobarbital, 14
 Perception, 9, 13, 14, 16, 21, 22, 25-27, 35, 57
 Peretti, 24, 65
 Periods, 23, 34, 37, 48, 56, 58, 61, 63
 Permission, 72
 Pharmacologically, 14, 40
 Physiologic, 7, 9, 13, 15-18, 21, 25-27, 34-36, 38-40, 48, 55, 57, 60, 61, 64, 66, 76, 77
 Pitch, 16, 17, 22, 25
 Pitressin, 41
 Pituitary, 13, 14
 Plato, 7
 Podalsky, 21
 Pollack, 14, 66
 Pop, 20, 23, 28, 75, 76
 Preferred, 25, 27, 28, 30, 36-40, 44, 46-52, 54-60, 62, 67
 Pressure, 1-6, 8, 10, 14-18, 20, 25, 27-31, 33, 39-41, 49, 54-57, 61-66, 68, 75, 76
 Pretest/post-test, 8, 30, 33
 Procedure, 29, 35, 65, 72
 Psychologic, 25, 27, 57
 Pulse, 15, 17-19, 23, 33
 RAS, 9, 13
 REM, 37, 50, 76
 Range, 10, 41, 42, 50, 59, 60
 Rationale, 5
 Recommendations, 61
 Relaxation, 14, 15, 17, 18, 21-24, 27, 63
 Reliability, 8, 35, 40
 Renal, 9
 Researcher, 35, 36, 40, 57, 69, 72
 Response, 1, 11-16, 21, 24, 25, 35, 55, 60, 63, 64, 73
 Reye's Syndrome, 14, 66
 Rhythm, 16, 21, 25
 Rock, 22, 23
 SAH, 43, 46, 75
 SBP, 38, 48, 52, 55
 Sample, 12, 19, 30-32, 39, 40, 42-46, 49, 50, 55, 57-59, 61
 Schizophrenia, 31, 75
 Schoen, 19
 Schonauer, 17
 Sedation, 18, 58
 Sedative, 25-27, 30, 36, 38-40, 49-52, 54-60, 62
 Selye, 13, 16, 26, 66
 Shapiro, 3, 4, 66

- Shepard, 17
Shevrin, 9, 66
Significant, 4, 8, 10, 20, 28, 29,
34, 35, 54-59, 68
Silence, 37, 48, 49, 51, 52, 55, 56,
58-60, 76
Slonim, 9, 26
Snyder, 8, 66
Sodium chloride, 13
Soibelma, 19
Spinal fluid, 2, 12
Spirituals, 22
Standard, 34, 49, 50
Statistical, 8, 38, 55, 59, 66
Stimuli, 1, 6, 7, 9-15, 17, 18, 29,
33, 34, 37, 50, 57, 58, 63, 66,
76
Storey, 13
Studies, 1, 2, 8, 12, 13, 15, 21,
24, 61, 62, 72
Subarachnoid, 3, 4, 13, 28, 29, 41,
46
Subarachnoid bolt, 4, 28
Subdural, 4
Subject, 7, 10, 25, 30, 32, 35,
37-39, 41, 42, 46, 48, 51, 52, 59
Subliminal, 9, 66
Suctioning, 37, 50, 65
Summary, 9, 25, 39, 56
Systolic, 30, 38, 49, 55, 57, 76
t test, 38, 54, 55, 59
Tachycardia, 13, 14
Taylor, 18, 19, 66
Tempo, 16-18, 22, 28, 38
Tension, 7, 14, 17, 22
Thalamus, 16
Therapeutic, 2, 5, 9, 16, 24, 63-66
Therapy, 7, 15, 16, 22-25, 27, 54,
57, 60, 63-66
Thyroid, 13
Thyroxine, 14
Tool, 8, 18, 33-36, 70
Treatment, 10, 11, 30, 31, 34,
36-39, 48, 49, 51, 52, 54, 56,
59, 61, 66, 72, 75, 76
Trophotropic, 14
Unconscious, 2, 11, 12, 16, 21
Validity, 33, 35
Valsalva maneuvers, 8
Vandewall, 22
Variables, 30, 33, 37, 55, 58, 59
Vasoconstriction, 3, 13
Vasopressin, 13
Ventilated, 8
Volume, 3, 9, 13, 14, 17, 22, 36,
39, 60
Wallace, 14, 17, 66
Walleck, 1, 8, 34, 35, 40, 66
Weimer, 21
Woods, 2, 10, 60, 66
World War II, 7, 22
Youmans, 3, 66
Ziporyn, 7, 66