The Effects of Mothers' Singing on Full-Term and Preterm Infants and Maternal Emotional Responses

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THE EFFECTS OF MOTHERS’ SINGING ON FULL-TERM AND PRETERM INFANTS
AND MATERNAL EMOTIONAL RESPONSES

By

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ABSTRACT

The purpose of this research was to determine the effects of mothers’ singing on their adjustment to their new infants, bonding with the new infants, and use of music in the home environment in the first two weeks after birth. Preterm mothers were also assessed for coping with their child’s stay in the Neonatal Intensive Care Unit (NICU).

Full-term participants were 54 healthy infants and their mothers who were randomly assigned to experimental \((n = 27)\) or control \((n = 27)\) conditions. Preterm participants included 16 mothers and 20 premature infants (born after 28 weeks CGA and prior to 36 weeks weighing less than 2500 grams), including two mothers with twins, who were randomly assigned to experimental \((n = 8 \text{ mothers, } 10 \text{ infants})\) or control \((n = 8 \text{ mothers, } 10 \text{ infants})\) conditions. Mothers in both experimental groups were recorded singing lullabies and children’s songs of their choice. They also had the option of individualizing and recording Brahms’s *Lullaby* with infants’ names and phrases of their choice. A second component of the research study involved the researcher playing the preterm mother’s CD for her infant in the NICU when the mother was not able to visit. The recording of the preterm mother’s voice was played for each infant 20 minutes per day, 3 to 5 times per week, until time of discharge. All full-term and preterm mothers in the experimental and control group completed assessments two weeks after their infants were discharged from the hospital.

The Parental Perception Inventory (PPI) revealed that full-term mothers in both the control and experimental groups had similar scores for adjustment to the new babies and lifestyle changes. Several factors appear to have influenced mothers’ responses on the PPI. First-time mothers indicated less adjustment to the new baby and lifestyle. Also, mothers with medical complications did not adjust as well to the new changes in their life. A significantly greater relationship existed between experimental mothers’ medical complications and scores than between control mothers’ medical complications and scores. Confounding these results was a greater incidence in the full-term experimental group of first-time mothers and mothers with medical complications.

Full-term mothers in the control group scored higher on for the Mother-Infant Bonding Scale than did mothers in the experimental group, indicating a greater mother-infant bond.
Individual and total scores for the Value of Music Scale indicated that mothers in the experimental group rated music more positively than did mothers in the control group. In addition, more mothers in the experimental group indicated that they played music for their baby and sang to their infants on a daily basis than did mothers in the control group. There was also a significant difference in number of comments made at the end of the survey, with experimental mothers providing more positive comments regarding music, especially for mother-infant bonding, $Z(27, 27) = -3.34, p = .001$. Finally, mothers in the experimental group rated highly the importance of the recorded CD of their singing, believing that it helped their babies, was very important to play for their babies, and promoted a strong mother-infant bond.

Overall, preterm mothers in the experimental group scored higher on the PPI, indicating less adjustment to the new babies and lifestyle changes, and slightly lower on the Mother-Infant Bonding Scale than preterm mothers in the control group. These differences were not statistically significant. Preterm mothers in the experimental group reported more medical complications; this included more mothers reporting problems and these mothers reporting multiple complications compared to mothers in the control group. Preterm mothers in the experimental group had higher scores for the Value of Music Score, the amount of general music used, and amount of time spent singing than control mothers. Mothers commented on how important and meaningful it was for their infants to hear their singing in the NICU when they could not visit. They indicated that knowing their infant listened to the CD of their singing helped them to cope with their infants’ stay in the NICU, especially when medical complications as well as returning to work hindered their ability to visit. The correlation between the CD Importance Score and mothers’ reports that the CD helped them to cope with their infants’ stay was strong ($r = .94$).

Furthermore, there was a significant difference between the number of positive comments made by mothers for the open-ended section at the end of the survey, with more positive comments regarding music and mother-infant bonding from mothers in the experimental group, $U(8, 8) = -2.25, p = .03$.

Comparisons between full-term and preterm infants revealed that experimental preterm mothers scored the highest on the PPI, indicating less adjustment to their baby and lifestyle changes compared to the other three groups of mothers. Control preterm mothers scored the lowest on the PPI. Preterm mothers in the control group reported the highest score for mother-infant bonding, followed by experimental preterm mothers, compared to full-term mothers.
Preterm mothers in the experimental group reported the greatest number of medical complications, followed by experimental full-term mothers; preterm mothers in the control group reported the least medical complications, which might explain their PPI and bonding scores.

Overall, results indicated greater value for and use of music by experimental preterm and experimental full-term mothers. Preterm and full-term experimental mothers scored higher on the Value of Music Scale, used greater amounts of music with their infants, and sang to their infants more compared to preterm and full-term mothers in the control group. Similarly, full-term and preterm mothers in the experimental group had a higher mean score for positive comments made at the end of the survey. The personalized CD was used more by full-term mothers in the experimental group than by preterm mothers, suggesting that preterm mothers might have viewed it primarily as an intervention for the NICU. Full-term mothers in both groups indicated that they used music with their infants during quiet time or to calm their fussy infants, especially the experimental mothers’ use of their personalized CD. Preterm mothers in both groups indicated that they used music with their infants at no specific time. The behaviors preterm and full-term infants evinced the most in response to music was listening and attending.

Data on frequency of song selection were compiled from all of the full-term and preterm mothers in the experimental group. *You are My Sunshine* was sung most, followed by *Twinkle, Twinkle, Little Star*. The third most frequently performed song was the individualized song to the tune of Brahms’s *Lullaby*, in which mothers chose to rewrite and sing special messages to their infants. Most mothers of premature infants composed messages about their infants growing and coming home soon. Overall, most mothers chose traditional children’s songs to sing and record.

Results indicated that there was no significant difference for weight gained and number of days in the hospital for preterm infants that listened to the CD recording of mothers’ singing and those in the control group. Infants in the experimental group left the hospital an average of two days sooner than those in the control group.
INTRODUCTION

Parents of newborn infants experience much stress and anxiety over the new addition in the family, which may last three to six weeks after the birth of the infant. Parents of premature infants experience greater amounts of stress, depression, and anxiety while their infant is in the NICU, especially since this is an unexpected and stressful event (Carter, Mulder, Bartram, & Darlow, 2005; Fowlie & McHaffie, 2004; Macey, Harmon, & Easterbrooks, 1987). Mothers of preterm infants stated that expectation for the birth of the infant was quite different from the experience they had desired. The NICU is a foreign environment for parents: noisy, bright, hot, overcrowded, and containing extremely high technological equipment that creates a barrier between the infant and family members (Allen, 2002; Fowlie & McHaffie, 2004; Macey et al., 1987). At times during the infant’s stay in the NICU parents are not allowed to hold, feed, or touch their critically ill infant. Amidst all of this, parents often experience feelings of fear and isolation (Backman & Lind, 1997; Pederson, Bento, Graham, Chance, Evans, & Fox, 1987). Furthermore, visiting is difficult, exhausting, and financially expensive (Fowlie & McHaffie, 2004).

Staff in the NICU needs to provide a holistic approach to care, accepting, responding to, and supporting the unique needs of each family (Fowlie & McHaffie, 2004). Affleck, Tennen, and Rowe (1990) proposed that the NICU staff might provide husbands and wives opportunities to engage in personal control activities. Personal control activities include visiting the NICU frequently, supplying breast milk, providing social and nonsocial stimulation, completing caregiving tasks, monitoring treatment procedures, and praying. Based on their research, mothers evinced more personal control over the infant’s recovery when they provided social stimulation and supplied breast milk for their babies (Affleck et al., 1990). The neonatal staff strived to create positive partnerships with parents, empowering them and providing them with confidence and competency regarding the well-being and care of their infants.

Cassidy and Standley (1995) suggested providing parents of premature infants opportunities to choose music to play for their infant, since music is not contraindicated for infants in the NICU. This opportunity might be one means for parents to feel some control over their situation when so many variables are out of their control. Furthermore, results of a meta-
analysis on music for premature infants indicated statistically significant benefits (Standley, 2003b). In one research study in which premature infants received music in the NICU, mothers reported their babies’ achievements with pride. It was possible that these babies were happier and calmer babies, thus resulting in a stronger bond between the mother and infant (Standley, 1991). Based on these results, music in the NICU may have long-term benefits on the developing relationship between mother and infant.

Researchers indicated that the fetus learns prenatally and asserted that the prenatal experiences with others’ voices may contribute to later language development as well as attachment/bonding (Hepper, Scott, & Shahidullah, 1993). The prenatal experiences of hearing the mother’s voice prepared the infant to prefer the mother’s voice and provided the appropriate response the mother seeks. Even after only 12 hours of contact with their mothers, newborn infants discriminated between mothers’ voices and other females’ voices, learned to produce their mother’s voice, and evinced a preference for their mother’s voice. This preference for the mother’s voice seemed to indicate that even the short period after birth might be essential in the initiation of mother-infant bonding (DeCasper & Fifer, 1980). It is theorized that listening to the mother’s voice during the first week of life may facilitate the social responsiveness process between infant and mother, especially since premature infants are deprived of social aspects of mother-infants bonding while in the NICU (Bozzette, 1997). According to the Newborn Individualized Care and Assessment Program (NIDCAP) model, parents are encouraged to be involved in the care of their infants. Parents can have positive interactions with their infants through appropriate music interventions (Abromeit, 2003). This includes singing lullabies to help parents bond with their infants.

The purpose of this research was to determine the effects of creating a CD of preterm mothers’ singing for use with their babies during the NICU stay. Assessed were levels of coping with pre-term birth. A second aspect of the study investigated whether mothers of full-term infants benefited from recording their singing to use in the home with their infants during the first two weeks after birth. Assessments included adjustment to the new baby and lifestyle changes, bonding, use of music in the home environment, and value of music use with infants.
CHAPTER ONE

PRETERM AND LOW BIRTHWEIGHT INFANTS

Definition and Prevalence

Infants that complete 37 weeks of pregnancy are considered full-term, infants born prior to 37 weeks gestational age are preterm, and those born prior to 32 weeks are very preterm; the gestational age of an infant is calculated by determining the time from the first day of the mother’s last normal menstrual period to the date of birth. Low birthweight (LBW) is used to describe infants that weigh less than 2500 grams, or 5 ½ pounds, and very low birthweight (VLBW) describes infants that weigh less than 1500 grams, or 3 1/3 pounds (Centers for Disease Control [CDC], 2002).

The number of preterm and LBW births in the United States has steadily increased in the past decade (CDC, 2002). The percentage of preterm births for 2002 was 12.1%, higher than the 10.7% from 1992. Similarly, there was a 0.7% increase of LBW infants from 1992 to 2002, with the 2002 percentage of 7.8% being the highest in three decades. In 2002 there were 480,812 preterm births. During an average week for 2002, 9,246 infants were born preterm and 1,497 were deemed very preterm; 6,040 infants born during a given week were LBW and 1,126 of these infants were considered VLBW (March of Dimes [MOD], 2005). The increasing proportion of multiple births, with the rate of twins increasing 65% since 1980, has contributed to the high incidence of preterm infants and LBW infants over the past two decades (CDC, 2002).

The survival rate of infants in the Neonatal Intensive Care Unit (NICU) has also steadily increased over the past two decades. In one study, survival rates of infants with birth weights of 501 to 800 grams from the years 1979-1984 versus 1989-1994 increased from 20% to 59% (O’Shea, Klinepeter, Goldstein, Jackson, & Dillard, 1997). A comparison of cohorts during 1984 to 1989 versus 1990 to 1994 also indicated a significant increase in the rate of survival, from 27% to 42%, for 23 to 25 weeks old gestation infants (Emsley, Wardle, Sims, Chiswick, & D’Souza, 1998). Stevenson, Wright, Lemons, Oh, Korones, Papile, et al. (1998) engaged in
perinatal data collection for infants born from January 1993 through December 1994, with infants weighing between 501 to 1500 grams. Eighty-three percent of the infants survived through at least discharge, which was an improvement from the 74% survival rate in 1988. Survival rates increased as birthweight of infants increased; 49% of infants weighing between 501 to 750 grams at birth survived, 85% of infants between 751 to 1000 grams, and 93% of infants between 1001 to 1250 grams. The majority of deaths occurred during the first three days of life, and males had greater mortality rates than females.

Recently researchers have determined chances of survival based on brain scans, and an extremely premature infant with a clinically significant abnormal brain scan was more likely to die than survive (Emsley et al., 1998). Almost one-third of the children who survived had significant abnormalities on their brain scans as neonates, despite whether or not they were disabled.

**Cost of Care in the NICU**

The average length of stay in the NICU has increased over the years (Marbella, Chetty, & Layde, 1998; Stevenson et al., 1998). Stevenson et al. (1998) found that the average length of hospital stay was 68 days, varying according to the weight of the infant; length of stay was 122 days for infants weighing 501 to 750 grams and 43 days for infants between 1251 and 1500 grams. With technological advances, care in the NICU has lowered the threshold of viability, resulting in longer care for very preterm infants (Marbella et al., 1998). In addition, most infants were born with many health problems that resulted in costly medical interventions and consequently longer hospital stays.

Due to the lower threshold of viability and necessary medical treatment, the average hospital costs for premature infants greatly exceed the cost for healthy newborn infants; the costs for premature infants start at $79,000, compared to the $1,500 for a healthy newborn infant (MOD, 2005). During a five-year period from 1989 to 1994 the delivery charges for preterm infants increased 215% (Marbella et al., 1998). Stolz and McCormick (1998) found that from 1988 to 1992 the average cost for surviving infants who weighed less than 500 grams was $250,654, and those who weighed from 1000 to 1500 grams was $74,101. Oftentimes increases in gestational age and birthweight resulted in decreased hospitalization costs (Cuevas, Silver,
Brooten, Youngblut, & Bobo, 2005; Rogowski, 1998). Research regarding the cost effectiveness of care for VLBW infants during the first year of life revealed that the average cost of treatment was $93,800 during 1986 and 1987, and infants less than 750 grams accrued expenditures of $273,900 (Rogowski, 1998). Many premature and LBW infants needed more care after initial discharge from the hospital, including rehospitalization, physician visits, visits that were not routinely scheduled, and laboratory work (Cuevas et al., 2005; Rogowski, 1998). The long-term financial impact of an infant’s admittance to the NICU continues to accrue and affect society long after discharge from the hospital, creating an extensive need for special education and social services (Petrou, Sach, & Davidson, 2001).

Disabilities

Neonatal mortality and birth-related morbidity were due most often to preterm deliveries and LBW (CDC, 2002). A comparison of cohorts from 1984 to 1989 versus 1990 to 1994 indicated a significant increase in the rate of disability for survivors, from 38% to 68% (Emsley et al., 1998). Disability was associated with a lower birthweight and a higher clinical risk index for babies (CRIB) score. The rates for developmental disabilities of infants born before 36 weeks gestational age or who were extremely low birthweight (ELBW) was 14% for mental retardation, 12% cerebral palsy, 8% visually impaired, and 3% hearing impaired (Lorenz, Wooliever, Jetton, Paneth, 1998). More ELBW children met the criteria for one or more areas for specific learning disability: 65% compared to 13% of the full-term children (Grunau, Whitefield, & Davis, 2002). Furthermore, chronic lung disease occurred for 19% of the infants who were born between 501 and 1500 grams and 32% had intracranial hemorrhage (Stevenson et al., 1998). Infant survivors who weighed 401 to 500 grams at birth faced increased morbidities, with 94% diagnosed with respiratory distress syndrome, 26% had cranial ultrasound abnormality, 89% diagnosed with retinopathy of prematurity, and 74% had chronic lung disease upon discharge (Lucey, Rowan, Shiono, Wilkinson, Kilpatrick, Payne, et al., 2004). At 20 months corrected age, 24% of the children who were less than 1000 grams at birth had a major neurosensory abnormality, including cerebral palsy, deafness, and blindness (Hack, Wilson-Costello, Friedman, Taylor, Schluchter, & Fanaroff, 2000). Other researchers stated that the increasing number of ELBW neonates, 501 through 800 grams, since the late 1970’s, has not resulted in an increased rate of
major developmental problems, such as cerebral palsy, delayed mental development, and blindness, during the first year (O’Shea, Klinepeter, Goldstein, Jackson, & Dillard, 1997).

**Implications of Preterm Birth**

**Discharge Through the First Year**

Researchers have determined distinct differences between preterm and full-term infants, early differences that continue throughout the first year of life. Such differences might be due to the medical complications these infants experience and possibly the hospital environment and length of hospital stay. Duffy, Als, and McAnulty (1990) compared infants two weeks after expected due date; this comparison involved early-born preterms at 26-32 weeks, middle-group of preterm infants at 32-37 weeks, and full-term infants between 38-41 weeks gestational age. Full-term infants evinced better behavioral function compared to the two preterm groups of infants. These infants had better autonomic, motoric, state, attentional, and self-regulatory organization compared to the two preterm groups; consequently, they needed less facilitation than the two preterm groups. Differences for the two preterm groups were only evident for autonomic and motoric organization, with the 32-37 week infants evincing better organization.

Greene, Fox, and Lewis (1983) also found that preterm infants evinced less motor control, more abnormal reflexes, and less autonomic regulation than infants born at term. Birthweight status and pregnancy duration effect the development of communicative behaviors of infants, with small for gestational age (SGA) preterm infants being most different from full-term infants (van Beek, Hopkins, & Hoeksma, 1994). Duffy et al. (1990) stated that at discharge and three months later the differences between full-term and preterm infants seemed to be due to the medical complications of premature birth, even when comparing healthy preterm infants. The extrauterine NICU environment might also have long-term consequences, resulting in less optimal neural development.

Research throughout the infants’ first year of life indicated disparity between preterm and full-term infants’ cognition, language, affect, and play behaviors (Crnic, Ragozin, Greenberg, Robinson, & Basham, 1983; Macey, Harmon, & Easterbrooks, 1987). Assessments for the first 12 months following hospital discharge revealed that preterms scored significantly lower than full-term infants for cognitive and language development, especially in expressive language
skills, even when corrected for gestational age; increases in group differences occurred across time (van Beek et al., 1994; Crnic et al, 1983). Researchers also indicated preterm infants evinced less positive affect, were more fretful and less active, explored less, and engaged in less free-play behavior than full-term infants during the first year of life (van Beek et al., 1994; Crawford, 1982; Macey et al., 1987). Even though they interacted more passively with their environment, their behaviors became more like full-term infants as they grew older (Crawford, 1982).

Researchers have found significant differences between preterm and full-term infants’ abilities to tolerate different sensory stimulation and combinations of stimuli (Lawson, Ruff, McCarton-Daum, Kurtzberg, & Vaughan, 1984; McGehee & Eckerman, 1983). Full-term infants and premature infants were exposed to visual, auditory, tactile, and combined auditory and tactile social stimulation prior to discharge (McGehee & Eckerman, 1983). While full-term infants moved less often, moved smoothly, and maintained alert or nonalert states throughout the interactions, premature infants scored significantly higher for frequency of jerky movements, gasps/grunts, and state transition. Preterm infants did not maintain their ongoing state of arousal, which suggests disconnected organizational abilities. Tactile stimulation resulted in more gasps and grunts as well as state transitions. It seems that the tactile stimulation resulted in greater amounts of infant regulation and physiological arousal. Both premature and full-term infants engaged in alert behaviors, did not fuss, and visually explored parents faces during interactions.

Researchers have indicated significant differences between three-month-old full-term versus low-risk and high-risk preterm infants’ ability to attend and learn about unimodal and multimodal aspects of auditory and visual stimuli (Lawson et al., 1984). While impairments still existed at three months for both preterm groups, significant impairments still existed for high-risk infants at six months. The multimodal aspect of auditory and visual stimuli might involve an increasing complexity of processing for the preterm infants at three months of age, but by six months low-risk infants were also attending and learning about unimodal and multimodal objects in their environment. High-risk infants, however, did not increase attention to auditory objects and did not learn about objects on the basis of vision only or the multimodal properties. The authors believed that differences between the two groups might be due to extensively longer hospital stays, and the hospital environment might affect intersensory functioning. These
differences, present at six months, were probably indicative of problems in information processing and learning.

**Two to Three Years of Age**

In one study evaluations of preterm and full-term infants from birth through 2 years of age revealed that differences were no longer apparent in child development, mental development, expressive and receptive language skills at the age of two. The only exception occurred for motor skills, with preterm children evincing poorer skills (Greenberg & Crnic, 1988). The authors discovered that the amount of direct stimulation provided to the infant in the home during the first 2 years was imperative to subsequent developmental abilities. Engelke, Engelke, Helm, and Holbert (1995) also indicated the importance of follow-up care and early intervention for preterm infants, as the high risk neonates in their study evinced a significant changes from 12 to 36 months in cognitive areas; this included infants who were considered to have only a social risk, those with neurologic and social risk, and those with medical and social risk. More than half of the children were considered normal at 12 months, indicating the importance of follow-up care and planning for high risk infants, including the need for early intervention within the community for the first few years.

Severity of medical problems was also related to developmental difficulties. The type and severity of medical complications resulted in higher risk for problems in social development through at least the first 3 years of life. In one study mothers of high-risk infants thought their children were less intense when responding to stimulation and less persistent at tasks than the mothers of full-term and low-risk infants (Landry, Chapieski, Richardson, Palmer, & Hall, 1990). Thus, not only did directiveness have a direct role in their social behaviors, but also medical risk.

**Preschool Age**

Preschool children who were preterm or low birthweight evince the beginning indications of difficulty in academia in addition to the deficits already evident in their social skills. Preschool children who were ELBW infants had lower Stanford-Binet IQs as well as worse spelling skills, motor skills, and receptive language measurements compared to their full-term siblings; children from high socioeconomic status did not experience as great deficits for cognitive and language
scores (Kilbride, Thorstad, & Daily, 2004). A meta-analysis comparing premature children and control children after their fifth birthday revealed that control children had higher cognitive scores compare to those who were preterm babies (Bhutta, Cleves, Casey, Cradock, & Anand, 2002). Mean cognitive scores were directly proportional to gestational age and birth weight. Children born prematurely evinced increases in externalizing and internalizing behaviors in 81% of the studies analyzed, and the possibility of developing ADHD was more than twice the relative risk compared to full-term infants. In general, these premature children were at a great risk for poor school performance.

When measuring the health status and quality of life of preschoolers, NICU children were different from healthy children or their siblings in the areas of physical disabilities, growth and development, and general health perceptions (Kilbride, Thorstad, & Daily, 2004; Klassen, Lee, Raina, Chan, Matthew, & Brabyn, 2004). These children weighed less, were shorter, and had smaller head circumference compared to their siblings (Kilbride, Thorstad, & Daily, 2004). Children who were NICU babies had the following health problems at preschool age: sight, speech, getting around, using hands and fingers, taking care of self, learning and remembering, thinking and solving problems, pain and discomfort, general health, and behavior; even children from high economic status still had low motor scores (Kilbride, Thorstad, & Daily, 2004; Klassen, Lee, Raina, Chan, Matthew, & Brabyn, 2004). Parents also reported that they helped their child more with self-help skills, such as eating, bathing, dressing, or using the toilet. Children born at less than 27 weeks gestation had poorer health status and health-related quality of life, but even infants who did not have a major morbidity reported poorer health in most areas of their life compared to healthy children; their understated abnormalities may have resulted in poor health in later areas in life (Klassen et al., 2004).

**School Age**

While researchers have found that a majority of children who were VLBW infants had improved verbal and IQ tests from 3 years of age to 8 years and that special services supplementing the student’s education resulted in even greater benefits (Ment, Vohr, Allan, Katz, Schneider, Westerveld, et al., 2003), others are still reporting negative effects of preterm and low birthweight infants (Anderson, Doyle, & The Victorian Infant Collaborative Study Group, 2003; Hack, Taylor, Klein, Eiben, Schatschneider, & Mercuri-Minich, 1994; Olsen, Vainionpaa,
Paakko, Korkman, Pyhtinen, & Jarvelin, 1998; Taylor, Klein, Minich, & Hack, 2001). Low birthweight had significant consequences on neurobehavioral impairments, creating a greater risk for children to develop such disabilities in intellectual, educational, or behavioral areas (Anderson et al., 2003; Hack et al., 1994). Children who weighed 500 to 749 grams at birth evinced significantly lower scores for some cognitive and academic tasks than those who were 750 to 999 grams; in addition, those who were 23 to 25 weeks gestational aged had lower scores on cognitive and academic tests, but they were not significantly different from those 26 to 27 weeks (Anderson et al., 2003). Compared to full-term children, preterm children at 8 years had significantly lower cognitive skills, although their abilities were within the normal range (Olsen et al., 1998). When comparing children ages 6 to 7 years with birthweights under 750 grams, between 750 and 1499 grams, or born at term, children under 750 grams had poorer cognitive abilities, psychomotor skills, and academic achievement. (Hack et al., 1994). The most important factor associated with mental retardation involved cerebral abnormality on ultrasonographic exams as well as dependence on oxygen at 36 weeks corrected age (Hack et al., 1994). Another significant finding was that major developmental outcomes were more often associated with neonatal complications than with social disadvantages.

Parents reported greater developmental and learning difficulties for VLBW 7-year-old children (Taylor et al., 2001). At ages 8 and 9 years significantly more ELBW children than normal birthweight children met the criteria for one or more areas for specific learning disability, and their greatest areas of need were written output, followed by arithmetic, and reading (Grunau, Whitefield, & Davis, 2002). Anderson et al. (2003) found similar results, with 8-year-old ELBW children scoring significantly lower than normal birth weight children on IQ, verbal comprehension, and perceptual organization as well as in reading, spelling, writing, and arithmetic; ELBW children were more likely to evince learning disabilities in reading. Performance in arithmetic and reading for ELBW children was associated with visuospatial and visual-motor abilities in combination with verbal functioning (Anderson et al. 2003). Preterm children scored extremely poorly on tasks requiring spatial and visuoperceptual abilities, and these deficits were linked to pentriventricular leukomalacia in MRI scans (Olsen et al., 1998).

Preterm children with minor neurodevelopmental dysfunction had the most problems on neuropsychological tests, especially concerning attention, which affected school performance (Olsen et al., 1998). They scored poorly on distractibility, attention and working memory, and
processing speed (Anderson et al., 2003; Hack et al., 1994). Other deficits included attentional difficulties, internalizing behavior problems, and immature adaptive skills. They also evinced more hyperactivity, somatic complaints, and atypical behaviors.

Children who weighed less than 750 grams at birth evinced poor social skills and maladaptive behavior (Hack et al., 1994). Parents reported more emotional and behavioral problems from 7-year-old children that were VLBW versus full-term infants (Taylor et al., 2001). Anderson et al. (2003) found that parents reported behavior problems, and teachers reported more behavior problems in the ELBW compared to normal birthweight children. Teachers also reported that these students evinced more depression, deficits in leadership skills, less social skills, deficits in basic motor generalizations, and poor social behaviors.

Based on all of these deficits, it is not surprising that significantly more ELBW or very preterm students (20%) had repeated a grade level at school and 39% needed supplementary educational support. Hack et al. (1994) found that 45% of the VLBW children needed special educational services in school due to behavioral and attention deficits. Based on these results, the authors stated that it was important to reduce the rate, degree, and impact of the neurodevelopmental problems through medical and psychosocial interventions.

**Preadolescents and Adolescents**

Children who were ELBW or born at a lower gestational age continue to experience the aftereffects of prematurity as they approach adolescence. Children who were less than 750 grams at birth had significantly higher rates of functional limitations and greater compensatory dependence at ages 10 to 14 years than those who weighed more than 750 grams (Hack, Taylor, Klein, & Mercuri-Minich, 2000). These children needed special services, including special education, counseling, and occupational and physical therapy. Physical growth, mental or emotional deficits, restriction in physical activities, inability to participate in sports, and visual deficits were major functional limitations of these students.

Children who were born in the NICU versus full-term healthy children did not have statistically different full-scale IQ scores or WISC-III subsets of vocabulary, block design, or digit span scores at ages 11 to 12 (Curtis, Lindeke, Georgieff, & Nelson, 2002). On the other hand, these preterm children had shorter spatial memory span length and spatial working memory task compared to full-term children; their scores for working memory/strategic planning
factors were worse than full-term children. A lower gestational age was associated with a shorter spatial memory span and more memory errors of spatial working memory task. Also, an increase in neurobiological risk in the neonatal period was associated with a shorter spatial memory span, a lower percentage of correct solutions, and poor spatial recognition memory. An increased neurobiological risk was also associated with lower full-scale IQ, and gestational age predicted spatial memory span.

Curtis et al. (2002) concluded that the deficits in spatial working memory might be due to the effect of neurobiological risk on the networks within the prefrontal cortex. The environment during brain development for the premature infant may produce a process in which deficits are more discrete, with less widespread neural circuitry due to deficits in spatial memory span. The authors theorized that it is possible that brain maturation and neural plasticity are factors that lead to nearly normal levels of neurobehavioral functioning evident in the participants. Furthermore, children in this study came from middle to upper-middle class socio-economic background, and the environmental factors might have also contributed to the normative functioning.

Assessments in early childhood were highly predictive of disability at 14 years of age, as these ELBW children had greater rates of neurosensory impairments and lower psychological test scores compared to normal birthweight children (Doyle & Casalaz, 2001). By age 17, adolescents who were ELBW infants evinced lower cognitive scores and academic skills than control adolescents (Grunau, Whitefield, & Fay, 2004). Parents stated their ELBW teens evinced more internalizing and externalizing and also had more problems; they also had clinically significant behavior problems, such as delinquent behavior, aggression, attention problems, social problems, and socially withdrawn behavior. These adolescents stated that they had lower scholastic scores, athletic abilities, job competence, and romantic confidence than their peers; they also thought they were more likely to need help finding a job.

**Young Adulthood**

The long-term deficits evident in VLBW children continue into young adulthood (Hack, Flannery, Schluchter, Carter, Borowski, & Klein, 2002). Only 74% of VLBW students graduated from high school compared to 83% of those who were healthy infants; the VLBW adults had significantly lower academic achievement scores and a lower average IQ. Further complications
in their lifestyle involved higher rates of medical conditions due to neurosensory impairments. Despite all of the setbacks within their life, young adults who were VLBW infants had lower use of alcohol and drugs as well as lower rates of pregnancy compared to those who were healthy during infancy.

**Stressors in the NICU**

**Infant Contact/Handling and Routine Medical Care**

Premature infants experience great amounts of handling while in the NICU, contact that results in stress responses from infants. As a matter of fact, Appleton (1997) investigated 26 to 36 weeks gestational age infants during the first two weeks of life and found that infants received an average of 113 direct contacts in a 24-hour period; thus, infants’ undisturbed rest periods ranged from 2 to 59 minutes in length. Contacts included investigational, such as suctioning or checking intravenous infusions, which was 48% of the time; monitoring consisted of adjustment or removal of continuous monitoring devices, which was 4% of the contact time; nursing which was 21% of the time and involved tasks such as washing or changing positions; and parental which was only 27% of the time and did not result in infant distress. Appleton stated that the NICU staff needed to have better understanding and recognition of specific preterm infant behaviors. By doing so, the staff can reschedule interventions at a better time, so that infants do not have to engage in defensive strategies to stabilize their internal behavioral system; thus, individualized care-plans can be created to guarantee that infants receive adequate rest for optimal development.

Many of the medical procedures premature infants experience while in the NICU are stressful and aversive. Premature infants responded physiologically and behaviorally to these distressful and painful medical procedures, such as heelstick, endotracheal suctioning, routine vaccinations, and circumcision (Appleton, 1997; Grunau, Holsti, Whitfield, & Ling, 2000; Warnock & Sandrin, 2004). Premature infants undergoing routine medical care as well as blood collection had significant increases in distress signals (Grunau et al., 2000). ELBW infants seemed less physiologically able to adjust their immediate and recovery response to an acute noxious event compared to full-term infants (Oberlander, Grunau, Whitfield, Fitzgerald, Pitfield, & Saul, 2000). Researchers in the medical field have focused on the long-term effects of painful
experiences at early ages. Researchers determined that gestational age at birth and increasing number of invasive procedures were correlated with reduced behavior and autonomic pain; early pain experience for low gestational age infants resulted in perpetual states of stress (Grunau, Oberlander, Whitfield, Fitzgerald, & Lee, 2001).

**Noise**

Based on a compilation of research studies, the American Academy of Pediatrics Committee on Environmental Health (1997) indicated that infants might experience cochlear damage when exposed to noise and environmental factors in the NICU, resulting in disruption of growth and development. The committee suggested further research on noise and its effect on the fetus and newborn infant. Recommendations to pediatricians included monitoring sound in the NICU, especially within the incubators, and avoiding noise levels greater than 45 decibels (dB). Pediatricians should inform manufacturers of the need to reduce noise from medical equipment.

Benini, Magnavita, Lago, Arslan, and Pisan (1996) investigated sound intensity in the NICU environment. Surprisingly, while the incubator was turned off, sound intensity inside the incubator was between 58 to 68 dB. The noise in the room outside of the incubator ranged from 59 to 69 dB SPL. The greatest noise peaks inside an incubator occurred between 6 am and 6 pm, with an increase in impulsive noise peaks occurring in the middle of the day; this was more than twice the amount between 6 pm and 6 am. Noise in the incubator was due to several factors, including the environment in the NICU, the incubators’ control systems for ventilation and temperature, medical and premedical staff, incubator alarms and other such devices, and daily procedures associated with newborn care. At times specific events, especially opening and closing the access ports, resulted in an intensity peak of over 110 dB SPL; the Plexiglas dome of the incubator forms a resonant environment, with the least amount of contact resulting in an increased intensity of sound within. The authors stated that NICU staff needed to reduce noise for the infants in the incubators and avert their resulting stress from the fluctuating noise levels. By implementing methods of reducing noise, these fragile patients experience humanizing and optimal conditions.

Most recently Graven (2000) created recommendations for noise and sounds for the fetus and newborn based on a compilation of literature reviewed. For the fetus, the mother’s voice as presented through natural means is adequate for auditory development. Her voice alone during
her daily activities is important in the auditory development; however, the fetus does not need supplemental stimulation. In order to protect premature infants, Graven stated that infant intensive care units should limit sounds, especially through measuring and recording noise levels in the NICU. Controlling noise levels provides infants opportunities to hear and discriminate human voices. Sound levels of recorded voice or music should be played for brief periods at levels below 55 dB (Scale A). Furthermore, hospitals should incorporate guidelines that allow family members to participate in the infant’s care for extended periods of time; there should be opportunity for the parents to talk to the infant and for the infant to hear and respond to the voices of family members.

**Interventions for Infants in the NICU**

The American Academy of Pediatrics’ Committee on Fetus and Newborn Committee (2000) recommended that health care professionals utilize interventions, whether environmental, behavioral, and/or pharmacologic, to prevent, decrease, or eradicate stress and pain. Researchers have investigated a variety of possibilities, including developmental care, kangaroo care, and music therapy.

**Developmental Care**

Efforts have been made to improve the quality of care for premature and LBW infants, starting from the time these infants are admitted to the NICU. Early efforts involved examining infant behavior, especially organization and modulation abilities, as well as environmental conditions to create an individualized program based on the infant’s needs. Such early programs were called individualized behavioral and environmental care or individualized developmental care, eventually evolving into the Newborn Individualized Developmental Care and Assessment Program (NIDCAP).

Infants who were VLBW and were at high risk for developing bronchopulmonary dysplasia participated in an individualized behavioral and environmental care or standard NICU care (Als, Lawhon, Brown, Gibes, Duffy, McAnulty, & Blickman, 1986). The number of days on respirator and oxygen were statistically significant between the two groups, with those receiving the individualized care receiving better scores. Respiratory needs for the experimental group
were decreased by 25 days compared to the control group, and oxygen need was half of what the control infants needed. Furthermore, successful completion of bottle and breast-feeding was achieved 29 days sooner for the individualized care group than the control group. There were no differences between the two groups for weight, height, or head circumference growth. Als et al. (1986) also learned that the infants receiving the developmental care evinced significantly better organized behavior for several dimensions of functioning. At 3, 6, and 9 months the Bayley Scales of Infant Development indicated highly significant differences for the three checkups, with experimental infants showing significantly higher scores for mental and motor performance. Interestingly, the control infants declined significantly with time for the 3, 6, and 9 months checkups, reaching less than one standard deviation below the mean. Further testing took place by examining a parent-infant play episode, called the Kangaroo Box Paradigm, which indicated that experimental infants had significantly better fine motor fluidity and modulation, degree of differentiation, range and appropriateness of affective functioning, higher affective phase achieved in the course of the interaction, modulation and speed of movement, and overall summary rating of performance. Infants also evinced greater understanding of the task without the mother’s help, greater ability to stay engaged in the task and break it down into manageable subcomponents, and more pride and pleasure in accomplishments.

Als, Lawhon, Duffy, MCAuluty, Gibes-Grossman, and Blickman (1994) provided individualized developmental care for VLBW preterm infants who were initially very ill, providing nurses with training to focus on infants as a competent and active participant in the care and shaping of their own development. Results indicated significant differences between the infants who received developmental care and those who received standard care. Infants who received developmental care had earlier oral feedings, improved daily weight gain, decreased hospital stays and discharge at younger ages, and reduced hospital costs. As for the medical needs, infants had significantly shorter length of mechanical ventilation as well as supplemental oxygen support, and they had reduced incidence of intraventricular hemorrhage, pneumothorax, and severe bronchopulmonary dysplasia. For developmental outcomes infants evinced improved autonomic regulation 2 weeks post due date; furthermore, motor system functioning, self-regulatory abilities, and visual evoked potential measures also improved two weeks after due date. These infants had improved on Bayley Mental and Psychomotor Developmental Index scores and Kangaroo Box Paradigm by 9 months.
The Newborn Individualized Developmental Care and Assessment Program (NIDCAP), a program involving individualized care and modifications in the environment according to the infant’s developing organization and modulation abilities, was utilized with premature infants who were less than 32 weeks gestational age (Kleberg, Westrup, Stjernqvist, & Lagercrantz, 2002). Those infants who received care according to the NIDCAP guidelines had higher scores on the Mental Developmental Index than those infants who received standard care. Although the Psychomotor Developmental Index scores did not significantly differ for the two groups, those who received NIDCAP care had higher scores. The researchers stated that the improved developmental score might be due to the fact that the NIDCAP care provides infants with a more favorable environment for regular brain development, most particularly because it is adjusted according to the developmental stage of the infant.

**Kangaroo Care**

Kangaroo Mother Care (KMC) has provided many positive developmental benefits for premature and LBW infants (Feldman, Eidelman, Sirot, & Weller, 2002; Tessier, Cristo, Velez, Giron, Nadeau, de Calume, et al. 2003). There are several components to KMC, and one major component involves the kangaroo position. The kangaroo position is implemented once premature infants can breastfeed and once they have adjusted to extra-uterine life; at this time infants are placed directly on the mother’s chest in an upright position for 24 hours a day, receiving skin-to-skin contact. By 37-38 weeks gestational age infants indicate through behavioral signals that they are ready to be separated. At this point the skin-to-skin contact is terminated. The other components of Kangaroo Mother Care entail nutrition and clinical monitoring; clinical monitoring provides daily following, and when the infant gains at least 20 grams per day the infant is monitored weekly up through 40 weeks gestational age.

Infants in the KMC group scored higher on the global IQ score and for mental and psychomotor development compared to those who received standard care (Feldman et al., 2002; Tessier et al., 2003). In addition, Hearing and Speech, Personal-Social, and Performance were three subscales scores that were affected the most from KMC intervention (Tessier et al., 2003). High-risk infants experienced the greatest gains in motor development from KMC (Feldman et al., 2002). Other positive relationships occurred between the infants’ health at birth and mental development; infants who had transient neurological scores at 6 months and those who had
intensive care at birth experienced even greater effects from KMC. Infants who were fragile at birth and evinced doubtful neurological status at 6 months of age gained the most from KMC, indicating the importance of early intervention for at-risk infants at birth, especially the importance of providing preventive intervention (Feldman et al., 2002; Tessier et al., 2003).

**Nonnutritive Sucking**

Clinicians have used nonnutritive sucking (NNS) to elicit positive behavior states from premature infants prior to and following gavage feedings as well as bottle feedings (DiPietro, et al., 1994; Gill, et al., 1988; McCain, 1992; McCain, 1995; Pickler, et al., 1996). Pickler et al., (1993) stated that NNS appeared to help premature infants adjust and reorganize their behavior, thus returning to a resting state quicker after stressful experiences. Researchers have also used pacifiers or even pacifiers combined with other interventions to avert pain and stress from medical procedures. Although pacifiers provided analgesia for newborns during minor procedures, the combination of pacifiers and sucrose or glucose resulted in greater analgesic effects compared to the sucrose and glucose alone (Carbajal, Chauvet, Coudere, & Olivier-Martin, 1999).

**Music Therapy**

In a recent survey 187 staff members of a NICU were interviewed regarding their views of music therapy (Kemper, Martin, Block, Shoaf, & Woods, 2004). Staff members believed that music could be used with premature infants to reduce stress and crying as well as improve sleep. Sixty-eight percent of the staff members stated that they would like to have music in the NICU, and interestingly, recorded music was preferred over live music. Since the early 1990’s researchers have indicated the effectiveness of music with premature infants to create homeostasis, teach feeding skills, increase tolerance for stimuli, improve physiological and behavioral states, decrease length of hospital stay, and promote infant-parent interactions (Standley, 2002).
CHAPTER 2

LITERATURE REVIEW: MOTHER AND INFANT RELATIONSHIPS

Parents in the NICU

The NICU Environment

Admittance of an infant to the NICU is an unexpected and stressful event, especially since couples never contemplate the likelihood of having a preterm or ill infant (Carter, Mulder, Bartram, & Darlow, 2005; Fowlie & McHaffie, 2004; Macey, Harmon, & Easterbrooks, 1987). Mothers of preterm infants stated that expectation for the birth of the infant was quite different from the experience they had desired, especially since the NICU is a foreign environment for parents: noisy, bright, hot, overcrowded, and containing extremely high technological equipment that creates a barrier between the infant and family members (Allen, 2002; Fowlie & McHaffie, 2004; Macey et al., 1987). Amidst all of this, parents often experience feelings of fear and isolation (Backman & Lind, 1997; Pederson, Bento, Graham, Chance, Evans, & Fox, 1987). The NICU staff often uses unfamiliar terminology with parents, who not understand the complex problems their infant is facing, which adds to the uncertainty of the future; all of this leads to a major cause of stress (Fowlie & McHaffie, 2004; Pederson et al., 1987). Furthermore, visiting is difficult, exhausting, and financially expensive (Fowlie & McHaffie, 2004).

Emotional Responses to the Premature Birth

During the First Weeks. Family members with infants in the NICU experience many emotions, including guilt, fear, anxiety, helplessness, and grief during the infant’s hospitalization (Backman & Lind, 1997; Carter, Mulder, Bartram, & Darlow, 2005; Trause & Kramer, 1983). These emotions differ greatly from mothers of full-term infants. NICU parents cried more, worried about their ability to cope, and had a higher percentage of relevant anxiety compared to parents of full-term infants (Carter et al., 2005; Trause & Kramer, 1983). Compared to parents of full-term infants, preterm parents wanted to talk to hospital staff more during the first week after birth (Trause & Kramer, 1983).
During the first weeks of their infants’ life, 41% of the mothers cried during the interview or reported that they could not stop crying (Pederson et al., 1987). Seventy-eight percent of the mothers of ill preterm infants expressed concern about their infants’ survival (Pederson et al., 1987). With a decrease in gestational age of the infant, an increase in anxiety and depression occurred (Carter et al., 2005). Mothers of VLBW infants, with and without bronchopulmonary dysplasia, reported significantly greater distress levels than mothers of full-term infants, with one-third of the mothers of VLBW infants reporting moderately severe symptoms of distress; this stress especially occurred for mothers who felt that they had low levels of social support (Singer, Davillier, Bruening, Hawkins, & Yamashita, 1996). Also, 48% of the mothers of VLBW infants experienced psychological distress at the time of birth (Thompson, Oehler, Catlett, & Johndrow, 1993), and even in the first postpartal week mothers of preterm infants were significantly more anxious and depressed than mothers of full-term infants (Gennaro, 1988).

Fear continues throughout the course of the hospitalization, changing according to the status of the infant (Backman & Lind, 1997). Parents experience helplessness as they feel the need to protect and care for the infant, but they are limited in this ability since the fragile condition of the infant often limits parent contact.

**At Discharge.** In one study mothers of preterm infants experienced no significant changes in maternal anxiety, depression, or hostility at time of birth and at discharge (Brooten et al., 1988). This indicated that preterm parents need continuous support throughout the hospitalization period, including the time at discharge (Brooten et al., 1988), especially since more than 50% of mothers in one study reported that they felt special preparations needed to be made prior to their infant’s discharge (Pederson et al., 1987). Mothers were significantly more depressed and anxious prior to discharge than when the infant was 9 months old (Brooten et al., 1988). Mothers whose infants had longer hospital stays were significantly less depressed than those whose infants had shorter hospitalizations, possibly because they had a longer period to adjust to the physical and emotional events concerning their infant.

**Long-term Concerns.** Not only do parents express immediate concerns and stress regarding the status of their infant in the NICU, they also worry about the long-term physical and cognitive implications. In one study, only 23% of preterm mothers recalled that they thought their child would be healthy and normal compared to 93% of full-term mothers (Macey et al., 1987). Parents often reported concern about the possibility of mental retardation, sensory
handicaps, physical disabilities, and health problems in their child’s future, with significantly more mothers than fathers reporting at least a slight concern that their child might be mentally retarded (Affleck, Tennen, & Rowe, 1990).

Furthermore, researchers have determined that the health status of the child also has a greater negative impact on the family (Taylor, Klein, Minich, & Hack, 2001). The preterm birth resulted in issues such as increased financial problems and marital difficulties (Macey et al., 1987). NICU parents also were in a lower family income bracket, and disadvantaged families had worse outcomes than those who came from advantaged families (Carter, Mulder, Bartram, & Darlow, 2005; Taylor et al., 2001). In addition to the financial implications of a preterm infant, parents also worried about losing touch with reality and future pregnancies (Trause & Kramer, 1983).

One month after hospital discharge mothers of both full-term and preterm infants still thought about the baby more, cried more, and worried about future pregnancies more than the fathers; interestingly, full-term mothers cried more and did not want to be left alone compared to preterm mothers (Trause & Kramer, 1983). For mothers of VLBW infants, however, the distress continues long after the infant is discharged from the hospital. Thirty-three percent of the mothers of VLBW infants experienced psychological distress from 3 to 6 weeks postpartum, and 41% at 6 months corrected age (Thompson, Oehler, Catlett, & Johndrow, 1993). Singer, Salvator, Guo, Collin, Lilien, and Bailey (1999) found that mothers of both VLBW infants, with and without bronchopulmonary dysplasia, experienced greater psychological distress at one month when compared to full-term infants; these behaviors included depression, anxiety, and obsessive-compulsive behaviors as well as difficulty making decisions and concentrating. Trause and Kramer (1983) discovered that at seven months after discharge there were no differences in responses between mothers of preterm and full-term infants; however, parents of VLBW infants reported more parenting difficulties and greater stress (Taylor et al., 2001).

Researchers have reported conflicting results concerning the mother’s response to the preterm infant during the first two years of life. Greenberg and Crnic (1988) reported that mothers with high-risk preterms had significantly more positive attitudes concerning their infant, parenting role, and marital relationship. Likewise, they reported greater general life satisfaction. Conversely, Singer et al. (1999) learned that by the second year mothers of high-risk infants reported psychological distress, and parenting stress continued for mothers of high-risk VLBW
infants. Maternal depression was correlated to lower child developmental outcomes for both low and high-risk VLBW infants. In a different study 95% of the mothers of ill premature infants reported emotional stress, and 68% of preterm mothers reported stress even when the infant was not ill (Pederson et al., 1987). Other parents reported that at the time their NICU babies had reached preschool age, they still had more anxiety, worried about their child’s health, and often had less time for their own personal needs (Klassen, Lee, Raina, Chan, Matthew, & Brabyn, 2004).

Compared to fathers, mothers reported significantly greater overall mood disturbances, but they experienced less difficulty in acclimating to the infant when the father was more aware of the mother’s needs and emotions (Affleck et al., 1990; Trause & Kramer, 1983). Even still, fathers with an infant in the NICU had higher anxiety and depression scores than control fathers, and the depression was significantly higher for those fathers who had a premature infant less than 33 weeks of age (Carter et al., 2005). Interestingly, fathers reported that they were most concerned about their spouses’ ability to cope, and over time, both spouses were increasingly sensitive to each other (Trause & Kramer, 1983).

Coping with Preterm Birth

Backman and Lind (1997) proposed three phases that parents go through upon having their infant admitted to the NICU. During the Entry Phase parents encounter a premature birth or illness and the admission of the infant to the NICU. Parents begin to encounter anxiety, and it continues to escalate as regular methods of coping are utilized, sometimes without success. Throughout this stage parents learn to admit and cope with this unexpected occurrence, grieve the loss of the wished for child, face the potential loss of the infant, and adapt to the NICU environment.

During the second phase, called the Connecting Phase, new coping mechanisms are employed, helping parents adjust to the crisis and placing the parents at greater ease. Parents continue to acclimate to the NICU and develop an understanding of the medical needs of their infant and the ensuing medical status.

The Launching Phase, the final phase, occurs when parents view their infant as a normal baby rather than a sick neonate. Parents start to engage in the care of their infant by making decisions regarding their child and focusing on the necessary post-hospital care. Some parents
begin to cope with the long-term implications of the infant’s disabilities. Present theories hypothesize that if parents complete the tasks in each stage, resolution will occur, leading to appropriate parent-infant relationships.

Researchers investigated coping mechanisms parents utilized, which included efforts to understand problems, gaining a degree of control over the situation, seeking social support from others, and escaping or minimizing the situation (Fowlie & McHaffie, 2004). Affleck, Tennen, and Rowe (1990) investigated four appraisal processes in dealing with a NICU infant. This included harm appraisal - the threat or harm imposed by the NICU crisis, benefit appraisal – the gain from the crisis, control appraisal – personal control over the infant’s recovery, and outcome appraisal – the view of the infant’s health and development for the future. Mothers and fathers reported similar results for benefit appraisal, harm appraisal, and outcome appraisal. For the coping strategies, there were significant differences between mothers and fathers, with mothers seeking social support and trying to escape from the present situation. Mothers who tried to escape from their present situation reported significantly more distress. Even though they tried to escape from the situation, they also evinced more personal control over their infant’s recovery as well as sought social support. Those fathers who were significantly less distressed reported taking instrumental actions to cope or minimize the situation. Significant correlations occurred between husbands and wives for harm appraisal, control appraisal, outcome appraisal, and seeking meaning as a coping mechanism during crisis. Furthermore, there was not a relationship between one parent’s coping strategy and the other parent’s mood. An investigation of confounding variables, including gestational age at birth, birth weight, length of hospital stay, and number of perinatal/neonatal complications did not alter significant findings related to coping strategies and distress.

Staff in the NICU needs to provide a holistic approach to care, accepting, responding to, and supporting the unique needs of each family (Fowlie & McHaffie, 2004). Affleck, Tennen, and Rowe (1990) proposed that the NICU staff might provide husbands and wives opportunities to engage in personal control activities. Personal control activities include visiting the NICU frequently, supplying breast milk, providing social stimulation, providing nonsocial stimulation, carrying out caregiving tasks, monitoring treatment procedures, and praying. Based on their research, mothers evinced more personal control over the infant’s recovery when they provided social stimulation and supplied breast milk for their babies (Affleck et al., 1990). Another
researcher noted that parents often watched from beside the incubator or even gently touched the infant when visiting; it is important to note that parents responded appropriately to infant cues (Appleton, 1997). The neonatal staff needs to create a positive partnership with parents, empowering them and providing them with confidence and competency regarding the well-being and care of their infant.

Later researchers stated that initially parents made adaptations to having an infant in the NICU, and providing intervention for the parents is not necessary; at the hospital where the study took place parents had a role in the NICU care of the infant (Carter et al., 2005). This included open access to the NICU and infant’s medical records, taking part in clinical decisions, skin-to-skin contact between parents and infant, and having a clinical nursing coordinator as a primary contact person.

In addition to providing opportunities for mothers and fathers to interact with the infant, health care providers also need to develop positive relationships with families while their infant is in the NICU. Mothers who reported positive and family-centered relationships with their primary care provider also reported more satisfaction with care and even being more amenable to request help from the health care providers (Van Riper, 2001). Mothers who desired and believed that they had positive family-centered relationships with the primary health care provider were more satisfied with the care received; they also reported higher levels of psychological well-being.

**Mother-Infant Interaction**

Stern and Hildebrandt (1986) investigated the responses of mothers to full-term infants and full-term infants who were labeled preterm. Infants labeled preterm were preferred less and touched less than those labeled full-term; they were considered smaller, finer-featured, and not as cute. Furthermore, they were often given a toy to play with that was appropriate for a younger infant, and those infants with the prematurity label responded with less activity during the interactions. The premature stereotype existed and it was theorized that adult perceptions and behavior, during an interaction of less than 5 minutes, influenced infants’ behavior.

While the premature stereotype resulted in negative behavior from adults, parents of premature infants experience a variety of emotions due to the long-term separation and the
medical complications of their infant. The separation between the infant and mother occurs once the infant is admitted to the NICU, and this separation may even exist over many months, thus affecting both the parents’ behavior and infant’s behavior as well as the quality of infant-mother interactions (Fowlie & McHaffie, 2004).

Parental feelings and perception played a role in how parents act at the beginning and end of the NICU stay (Levy-Shiff, Sharir, & Mogilner, 1989). Parental disappointment at birth resulted in less involvement; however, mother and fathers’ initial concern for their infant and disappointment in their infant decreased from time of birth to time at discharge. Furthermore, infants’ behavior states significantly predicted parents’ behaviors at the beginning of the NICU stay and at discharge. Compared to fathers, mothers reported that their infants were more difficult, and parents that reported the infant as difficult were more likely to interact with their infant through talking, playing, stimulating, or caregiving.

Researchers have reported different results concerning the mother’s interactions with her preterm infant. Crnic, Ragozin, Greenberg, Robinson, and Basham (1983) found mothers of preterm infants spent more time in closer proximity to infants, held their babies while in close proximity, and provided more tactile-kinesthetic stimulation. There were no differences in full-term and preterm mothers’ behaviors for looking at infant, playful movement or demonstrating toys, and changing toys. Several researchers reported that mothers of preterm infants were more responsive to and vocal with their infants than mothers of term infants (Crnic et al., 1983; Greene, Fox, & Lewis, 1983), Crnic et al. (1983) concluded that mothers of preterm infants were more active and stimulating. Furthermore, an evaluation of 30 mother-preterm and 40 mother-full-term dyads from birth to 2 years of age revealed that differences were no longer apparent for any maternal attitudinal measures for the two groups at the age of 2 (Greenberg & Crnic, 1988).

Other research efforts have revealed quite different results, indicating that mothers of premature infants spent less time overall with their infants (Crawford, 1982), smiled less and evinced less positive affect when interacting with infants (Crnic et al., 1983; Willie, 1991), were less sensitive if they had a VLBW infant (Zarling, Hirsch, & Landry, 1988), and did not hold their infant as close to their body during the infants first two years of life compared to mothers of full-term infants (Leifer, Leiderman, Barnett, & Williams, 1972). Zarling, Hirsch, and Landry (1988) proposed that maternal sensitivity seemed to be due to the infant’s developmental status; intensive medical complications resulted in long-term effects. Parents who had very small infants
with serious medical complications for extensive periods of time did not engage in many interactions, even when the infants had already recovered (Minde, Whitelaw, Brown, & Fitzhardinge, 1983). The authors theorized that the long-term medical complications and possibility of not surviving might have overwhelmed the mother and resulted in an emotional withdrawal. Another idea was that parents understood the hypersensitivity of the infants and thus responded with low interaction rates. In a different study infants who were active resulted in less parental involvement; parents engaged in passive behaviors of holding, smiling, and looking (Levy-Shiff et al., 1989). Infant inactivity resulted in heightened parental behavior, with parents providing more stimulation by talking and playing; parents adjusted their behavior according to the needs of their infant.

Infant behavior is also crucial to the infant-mother relationship and significant differences were evident between full-term and preterm infants as well as healthy and sick infants. Greene, Fox, and Lewis (1983) found that healthy infants looked significantly longer at mothers than sick infants during play periods, and full-term infants were more responsive to their mothers than VLBW infants (Zarling, Hirsch, & Landry, 1988). Malatesta, Grigoryev, Lamb, Albin, and Culver (1986) investigated full-term and preterm infants and mothers interacting at 2 ½, 5, and 7 ½ months, and discovered that preterm infants engaged in less eye contact during face-to-face interactions with their mothers and evinced more negative emotions than full-term infants. Crnic et al. (1983) also found similar behaviors during the first year of life, with premature infants smiling less, evincing less positive affect, and averting gaze from their mothers significantly more; furthermore, premature infants also vocalized significantly less and earned lower scores for clarity of cues and responsiveness. The researchers, however, found no difference between infants for closing eyes, looking around room, looking at mother, tracking mother, and crying. Overall, compared to full-term infants, preterm infants were less active and responsive at 4, 8, and 12 months.

Although Willi (1991) revealed that a greater proportion of preterm infants had insecure attachments, at 6 months preterm infants’ interactions with mothers were similar to those of full-term infants and their mothers. They also were involved in the interactions and responsive to mother’s positive affect during structured interactions. Results indicated that the combination of preterm status and low socioeconomic status might have had an effect on quality of attachment. Other researchers also found that preterm infants evinced more interest in their mothers and
initiated more interactions with mothers; however, full-term infants at 12 months evinced a greater positive affect upon reuniting with mothers and interacted more with strangers than preterm infants (Macey, Harmon, & Easterbrooks, 1987).

Crnic et al. (1983) evaluated the dynamics between premature infants and their mothers. While premature infants signaled less often, mothers of premature infants provided more social signals to their infants even when infants did not reciprocate. The mother-premature infant relationship was dependent on the activity of only one member. If the mother was active, then the infant was not; this occurred across the first year. Furthermore, the unresponsive behavior of the infant was not as satisfying to both the mother and infant across the first year and was more evident at 12 months. Greenberg and Crnic (1988) found that differences were no longer apparent for any mother-child interactions for preterm and full-term groups at the age of 2 years and the positive attitudes and behaviors involving the mother’s parenting role, marital relationship, and infant were strongly related to the preterm infant’s ensuing behavior. Thus maternal attitudes seem to have a greater influence on premature infants’ outcomes, especially at one month, which predicted later preterm developmental outcomes at 2 years of age. This implied that the mother’s early adaptation to the infant’s neonatal crisis was of upmost importance.

The effects of a high-risk preterm birth last throughout the first 3 years of life, permeating the mother-infant relationship (Landry, Chapieski, Richardson, Palmer, & Hall, 1990). High-risk children evinced significantly less self-directed behavior in cognitive and social contexts and had significantly greater inappropriate behaviors to maternal responses and directives. Mothers of both low-risk and high-risk low-birth weight children did not give as many choices to their children, but provided increased use of directives, which was appropriate for these children with cognitive delays and provided the structure to create learning experiences. Interestingly, mothers of high-risk children provided the same amount of praise as the other parents.

**NICU Procedures that Develop Relationships**

Researchers have determined that specific procedures implemented in the NICU resulted in greater social interactions between infants and parents, which also produced long-term benefits in developmental areas (Als, Lawhon, Brown, Gibes, Duffy, McAnulty, & Blickman, 1986; Tessier, Cristo, Velez, Giron, Nadeau, de Calume, et al. 2003; Zeskind & Iacino, 1984).
Infants who were VLBW, were at high risk for developing bronchopulmonary dysplasia, and participated in an individualized behavioral and environmental care rather than standard NICU experienced many long-term gains in mother-infant interactions during the first 9 months (Als et al., 1986). Testing revealed that those receiving individualized behavioral and environmental care had greater ability to elicit the mother’s help by socially positive measures and ability to combine object play with social elicitation.

The parent-infant contact through Kangaroo Mother Care (KMC) provided many social benefits for parents and infants as well as developmental benefits for premature infants (Tessier et al. 2003). The skin-to-skin care provided parents with opportunities to adjust to their infant by participating in the care of their infant, thus becoming more attuned to their infant’s needs and gaining confidence in their abilities to care for the infant. Infants in the KMC intervention evinced high scores for Hearing and Speech as well as Personal-Social, which might possibly be affected by the parent-infant bonding that takes place throughout this intervention. This early social interaction resulted in emotional attachment and communication between both parent and infant. Furthermore, complex hand and eye coordination might be affected by the skin-to-skin contact between infant and parent. KMC provided an alternative environment to the womb; the parents’ bodies decreased the environmental disturbances providing an optimal environment for the developing brain during the last few months of development. Therefore, only pertinent sensory information was provided to the infant, that which was needed for basic development, providing regulation of cortical organization.

Zeskind and Iacino (1984) implemented an experiment to promote early mother-infant interaction in the NICU. Mothers assigned to the experimental condition participated in an intervention group, receiving advocacy and support by a project interventionist. Each week the project interventionist made an appointment to visit the NICU with the mother. Mothers were encouraged to visit often, participate in the level of care deemed appropriate by the staff, and discuss the infant’s status with the NICU staff. These mothers had twice as many visits with their infants. Mothers in the experimental group had more negative perceptions of their infant at time of discharge, but not before or after their first visit. Although the mothers in the intervention group had more unpleasant perceptions of their infants, they scored higher for their optimal outlook of their infant’s future, for both medical and intellectual developments. Infants whose
mothers visited twice as often left the hospital a significant eight days earlier than those in the control group.

Researchers have proposed several ideas to assist the development of mother-infant relationships. One suggestion was that the mother and infant should not be separated, and when separation must occur it should be minimal (Leifer et al., 1972). Furthermore, appropriate stimulation involving visual, auditory, tactile and combined auditory and tactile social stimulation is necessary to create optimal social interactions of premature infants, thus developing mother-infant relationships (McGehee & Eckerman, 1983).

**Effects of Music Therapy on Premature Infants**

Over the past 15 years researchers have investigated the effects of various music interventions on premature infants in the NICU. Standley (2003b) conducted a meta-analysis of music research with premature infants and found an overall large effect size of almost a standard deviation (d=.83) for infants receiving music. Gestational age at time of study, birthweight, or type of music delivery did not have any effect on results; physiological, behavioral, or developmental measures also did not alter effects of music. Overall, music provided statistically significant benefits for premature infants, resulting in important clinical implications for early intervention.

**Music Listening**

Cassidy and Standley (1995) stated that music provides a soothing and predictable environment while masking aversive environmental sounds in the NICU, especially when environmental auditory stimulation is difficult to control. Researchers have reported many positive physiological effects when premature infants listened to music, including oxygen saturation rate, heart rate, systolic blood pressure, and respiratory rate (Butt, 1998; Cassidy & Standley, 1995; Coleman, Pratt, Stoddard, Gerstmann, & Abel, 1997; Lorch, Lorch, Diefendorf, & Earl, 1994; Standley & Moore, 1995). In addition, no negative effects concerning apnea/bradycardia episodes occurred for those listening to music (Cassidy & Standley, 1995; Standley & Moore, 1995). Even young and medically fragile infants, ages 24-30 weeks gestation, evinced greater stability for oxygen saturation, heart rate, and respiratory rates due to
music presented during the first week of life (Cassidy & Standley, 1995). Other researchers suggested using sedative music to positively affect physiological measurements, particularly systolic blood pressure, which might be used to decrease the amount of sedative drugs given to infants on ventilators as well as to decrease pulmonary barotraumas (Lorch et al., 1994).

Other benefits of music listening included significant retention of birthweight, increased daily average weight, and lower total days of oral feedings as well as formula and caloric intake (Caine, 1991; Coleman et al., 1997). Furthermore, premature infants listening to music had lower daily mean stress behaviors, which continued to improve over time (Caine, 1991; Coleman et al., 1997). Kaminiski and Hall (1996) reported positive effects of music listening for full-term infants, with infants evincing fewer high arousal states during the music listening period, as well as fewer state changes occurring during the music listening period; music seemed to result in an organization of behavior states, resulting in less energy loss, leading to greater homeostasis. Caine (1991) found that infants in the experimental condition had significantly decreased length of time in newborn intensive care unit, isolette, and total hospital stay, all which resulted in infants leaving the hospital 5 days earlier than those in the control group and important savings for the hospital. Coleman et al. (1997) found that infants listening to singing and speaking left the NICU 3 days earlier than the infants in the control group.

Standley (1991a) reported long-term effects of music on premature infants in the NICU. Mothers of premature infants who participated in a music research project and were surveyed six months following discharge reported that they thought their babies cried less than other babies of same age as well as reported that their babies stopped crying, sang, smiled, or fell asleep in response to music. Furthermore, infants who had received music in the NICU listened more intently to music compared to those who did not receive music, especially when presented with a novel musical stimulus.

Music and Nonnutritive Sucking

Early research indicated that newborn infants learned cause-effect relationships and produced contingent music upon sucking (Decasper & Carstens, 1981). Standley (2000) initiated a pilot study to determine if premature infants could suck to produce contingent music. Premature infants, corrected gestation age of 35 weeks, were referred for participation due to fatigue during nutritive sucking. Nonnutritive sucking rates during music were 2.43 times greater
than during silence, and infant learning and discrimination took place. Furthermore, infants did not startle when music was started and stopped. In another study the Pacifier Activated Lullaby (PAL) provided contingent lullaby reinforcement for sucking (Standley, 2003a). Infants at 34 weeks PCA who had not made the transition to bottle-feeding had one 15 to 20 minute trial and performed significantly better compared to a control group; the rate of PAL music reinforcement might possibly influence pacing skill during feeding. Research by Cevasco and Grant (2005) compared weight gain prior to use of PAL, during, and post use of PAL. Results revealed that premature infants who participated in PAL trials gained more weight on the days of PAL trials and the effects of PAL trials lasted up to at least three days post use of PAL. Standley, Cassity, Grant, Cevasco, Szuch, Nguyen, et al. (2005) found that the length of gavage feedings was significantly shortened when 34 week babies utilized the PAL, and this was significant for infants that experienced 3 trials compared to 1 trial.

**Multimodal Stimulation**

In an effort to decrease hypersensitivity and increase premature infants’ tolerance of multimodal stimulation, Standley (1998) provided reciprocal multimodal (ATVV) stimulation paired with humming Brahms’s *Lullaby* for 15-30 minutes, one to two times a week, until infants were discharged from the hospital. Multimodal stimulation resulted in significantly faster discharge time for females and increased weight gain per day for both genders. Males and females evinced increased toleration of stimulation; infants sustained stimulation for longer periods of time than those in the control group, especially since quiet live humming was provided. This procedure provided greater homeostasis, and provided cause-effect relationships for these infants, resulting in greater developmental gain.

**Music Combined with Kangaroo Care**

Researchers combined lullabies with kangaroo care for 60 minutes over a 3-day period to decrease maternal anxiety; however, several positive effects also occurred for preterm infants (Lai, Chen, Peng, Chang, Hsieh, Huang, & Chang, In press). On the first day behavior states did not differ between infants who received music combined with kangaroo care versus those who received only the kangaroo care, but there were more occurrences of quiet sleep and fewer occurrences of crying on the second day for those who received the combined treatment. By the
third day the control group had significantly more occurrences of active awake states and crying when compared to the music group. Nevertheless, infants in the two groups evinced no difference for oxygen saturation, respiratory rate, and heart rate.

**Music During and Following Medical Procedures**

Music has also benefited premature infants experiencing routine medical procedures in the NICU (Burke, Walsh, Oehler, & Gingras, 1995; Butt, 1998; Chou, Wang, Chen, & Pai, 2003; Whipple, 2005). Music listening and music presented vibrotactilely reduced agitation and increased physiological stability for premature infants following suctioning; some infants experienced a decrease in stress-related behavior (Burke et al., 1995). Premature infants who received music during endotracheal suctioning had significantly higher oxygen saturation during the procedure and had a significantly faster return to baseline levels than those who did not receive music (Chou, Wang, Chen, & Pai, 2003).

Two different music interventions resulted in positive effects for physiological and behavior states during heelstick (Butt, 1998; Whipple, 2005). Older preterm infants (31 weeks PCA) listening to music evinced a reduction in heart rate, state-of-arousal, and facial expressions of distress when experiencing a heel-lance (Butt, 1998). Whipple (2005) found significant differences between preterm low-birth weight infants receiving the (PAL) and the no-contact control group and the pacifier only and no-contact control group during heelstick. The PAL treatment seemed to facilitate a return to homeostasis following the heelstick procedure as evidenced by oxygen saturation, behavior state, and stress level changes.

Several researchers have investigated different music interventions for male infants experiencing circumcision. Classical music, intrauterine sounds, pacifier, music and pacifier, intrauterine sounds and pacifier, and no intervention were used during circumcision; infants did not receive any anesthesia during the procedure and very few differences occurred among the groups (Marchette, Main, & Redick, 1991). Joyce, Keck, and Gerkensmeyer (2001) found positive effects of music listening during circumcision; however, only 11 full-term infants received music in this study.
Fetal, Premature, and Newborn Infants’ Responses to Auditory Stimuli

Fetal and Infant Responses to the Maternal Voice

Newborn and one-month-old infants preferred their mothers’ voice more than another female’s (DeCasper & Fifer, 1980; Hepper, Scott, & Shahidullah, 1993; Mehler, Bertoncini, Barriere, & Jassik-Gerschenfeld, 1978), especially when the mother used regular intonation for the infant versus monotone (Mehler et. al, 1978). This preference for the mother’s voice existed even when infants were staying in a group nursery in which many nurses handled the care and night feedings and only had 12 hours of contact with their mothers before the research was conducted (DeCasper & Fifer, 1980). Nevertheless, these infants still discriminated between mother’s voice and other females’ voices, learned to produce mother’s voice, and evinced a preference for mother’s voice within the short period of time (DeCasper & Fifer, 1980).

This preference for the mother’s voice might be due to each infant’s prenatal experiences during the third trimester, in which maternal speech is at an audible level, influencing auditory preferences (Decasper & Spence, 1986). During the third trimester infants learned and recalled the specific acoustical properties of a recited passage, including prosodic cues such as syllabic beat, voice-onset-time of consonants, the harmonic structure of sustained vowel sounds, and/or the temporal order of these sounds.

Further research with 36-week gestational age fetuses indicated that they could discriminate mother’s voice from another female’s voice, but not when both were played via a loudspeaker on the abdomen (Hepper et al., 1993). Discrimination took place when the mother spoke versus when the mother’s voice was played on the loudspeaker on the abdomen. It may be possible that both voices, the mother’s and other female’s, were unfamiliar to the fetus when presented via the loudspeaker, especially since the mother’s voice was transmitted as it vibrated through the maternal tissue to the fetus’ ear. The airborne transmission may be unfamiliar compared to internally transmitted speech. Hepper et al. (1993) also revealed significant differences between the number of movements that occurred when the taped voice was played versus when the mother was speaking. The fetus recognized the mother speaking from other voices, and low frequency sounds from the mother were transmitted internally to the fetus; thus, low frequencies were important in the recognition of the mother’s voice.
Even though 6-month-old infants demonstrated better discrimination for higher rather than lower frequencies (Olsho, 1984), later research revealed that infants listening to the maternal voice preferred the low-pass filtered voice; this might be due to infants’ prenatal experiences with mothers’ low frequency voice sounds (Spence & Decasper, 1987). Furthermore, researchers revealed that newborn infants preferred their mothers’ voice over an unfamiliar female voice when 500 Hz low-pass filtered voice samples were used (Spence & Freeman, 1996). Infants heard whispers, discriminated two unfamiliar female whispers, and did not find whispers reinforcing when compared to silence, and even did not find the mothers’ whispers reinforcing. The authors proposed that whispering does not contain the acoustical properties that are present in female voices, which assisted infants in recognition of voices. Vocal properties during prenatal experiences nurtured newborn infants’ preference for their mothers’ voice, and the fundamental frequencies present were crucial for neonatal vocal recognition after birth.

**Infants’ Responses and Preferences of Auditory Stimuli**

Premature infants, aged 31-34 weeks gestation, attended to intermittent exposure of their mothers’ voice during the first week of life, and evinced no stress (Bozzette, 1997). Significantly lower respiration rates occurred from the baseline to the tape segment as well as a significant increase in respiratory rate during the post tape segment. Attending behaviors were greatest while listening to mother’s voice. Coleman et al. (1997) found that heart rate and oxygen saturation of premature infants were affected significantly more by singing than speaking. The same results occurred for the behaviors of infants, with singing resulting in better results than speaking. Overall, it seemed that infants responded in a very similar manner to the male and female voice.

In a comparison of music and the mother’s voice, LBW infants listening to music had fewer oximeter alarms than those listening to mothers’ voice, thus stabilizing the oxygen saturation levels (Standley & Moore, 1995). The authors theorized that the music might have helped regulate oxygen intake, and its termination and absence resulted in a disturbance to the infants’ autonomic response. Those listening to the mother’s voice did not respond in a consistent manner until the third day; however, they never evinced the decreased oxygen level following cessation of the mother’s voice, which occurred when music listening ended.
Infants ranging from 2 to 8 months of age indicated no significant differences for mother’s voice combined with music, another female’s voice combined with music, or music alone; however, infants preferred mother’s voice the most, then the other female’s voice, and finally music (Standley & Madsen, 1990). Younger babies preferred the mother’s voice and older babies preferred both the mother’s voice and other female’s voice equally. Behavioral analysis of videotapes indicated that infants listened more intently to music than mother’s or other female’s voice. Eye fixation was greatest during music compared to the other two stimuli, infants were mostly silent during all conditions, gross motor moving was less for music compared to the other two stimuli. Intent listening was greatest during music, almost three times more than any other stimulus. Sometime in the fifth to sixth month infants begin to listen to novel auditory stimuli compared to mother’s voice.

Parental Singing to Infants

Motherese

Motherese is the distinct exaggerated intonation mothers use to communicate to their infants, and is considered a component of infant-directed speech. Newborns who were 2-4 days of age discriminated motherese from adult-directed speech, and the mother’s voice and adult-directed speech were preferred the most (Hepper, Scott, & Shahidullah, 1993). Other researchers discovered that 4-month-old infants indicated a significant preference for the fundamental frequency of motherese speech, neither the amplitude nor duration patterns of infant-directed speech had any significant effect on preference (Fernald & Kuhl, 1987). The authors thought that infants preferred the wide range of the fundamental frequency rather than the continuous high pitch monotone because the constant high pitch resulted in habituation.

Characteristics of Mothers’ and Fathers’ Singing

Mothers and fathers sang more expressively, either playful or soothing, as well as rhythmically, lovingly, and appropriately when in the presence of their infant (Milligan, Atkinson, Trehub, Benoit, & Poulton, 2003; O’Neill, Trainor, & Trehub, 2001; Trainor, Hill, & Kamenetsky, 1997). Even those mothers who were considered dismissing or preoccupied sang emotionally in the presence of infants (Milligan et al., 2003). The style of singing is dependent
upon the gender of the singer and listener, especially when the gender is the same for both the singer and listener, resulting in more playful singing; expressiveness was greater in presence of infant, and more so for same-sex infants (Trainor et al., 1997). Interestingly, parents slowed down the tempo at the end of phrases and engaged in rubato, utilized legato – even in playsongs, and at times glided from one note to the next and at times spoke rather than sang.

Fathers did not consistently raise the pitch during their infant-directed versions, which were different from mothers (O’Neill et al., 2001). Only when the infant-directed version was transformed to a higher pitch did infants indicate preference for infant-directed versions over infant-absent versions; otherwise, both were equally accepted. Infants evinced greater visual attention when listening to fathers’ singing than mothers’. Fathers also used a softer voice, a smiling tone, and slower pace for infant-directed singing. Fathers’ playsongs were judged as more rhythmic and were performed with intensity and stimulation in a happy excited voice. The fact that the fathers’ singing resulted in greater attention than mothers’ might stem from the novelty of the male voice. Altering the fathers’ infant-directed version higher and the infant-absence lower resulted in greater preference for the infant-directed song, indicating the importance of pitch in infant attentiveness.

Trainor and Zacharias (1998) found that infants listened for a significantly longer period to the higher version than the lower version of a song. To determine if comfort level affected the quality of the singing for the high or low version compared to a person’s comfortable singing range, a second analysis was conducted with different professional singers for the high and low versions. Infants still preferred listening to the higher version. The authors indicated that pitch of the voice most likely plays a role in infants’ preference for infant-directed over non-infant-directed singing. They felt that there was no explanation for this phenomenon since infants prefer low-pass filtered versions of their mothers’ voice over a stranger, which cannot be explained by prenatal experiences. Maybe the loving tone of infant-directed speech and high-pitched singing was considered friendly and more non-threatening than the lower-pitched voice.

Lullabies and Playsongs

Trehub, Unyk, and Trainor (1993a) found that lullabies were differentiated from other songs due to their repetitiveness, soothing quality, softness, simplicity, and slow tempo, characteristics that are present in lullabies of many cultures. Even when words were filtered out
from recordings, lullabies were still discerned from other songs. Removal of vocal cues decreased identification of lullabies; however, some melodic cues were still consequential in the identification of synthesized lullabies. Furthermore, infant-directed singing was also evident across cultures, and tone of voice was used the most to identify infant-directed songs (Trehub, Unyk, & Trainor, 1993b).

Researchers have also investigated types of songs parents sing for infants, who sang in the family, and when singing occurs. In one study when parents were instructed to sing to their infants, parents sang more playsongs than lullabies, using conventional children’s songs such as *Twinkle, Twinkle Little Star* or *Itsy Bitsy Spider* (Trainor, Hill, & Kamenetsky, 1997). The results of another study indicated that mothers sang 74% of songs to infants, 14% by fathers, 8% by siblings, and 4% by others (Trehub, Unyk, Kamenetsky, Hill, Trainor, Henderson, & Saraza, 1997). Singing most often occurred during daily activities, such as play, feeding, traveling in car, preparing infant for sleep, etc.

**Communicating Through Singing**

Playsongs and lullabies are distinct, and mothers evinced the ability to sing lullabies and play songs in very distinctive styles for their infants and used these two types of songs to communicate different information (Rock, Trainor, & Addison, 1999; Trainor, 1996). When mother sang play songs, the songs were rated as brilliant, clipped, and rhythmic as well as involving more smiling and evident consonants. The lullaby songs were considered airy, smooth, and soothing.

Fernald (1989) found that adults were significantly more accurate in identifying the intent of females’ speech when they used infant-directed vocalizations rather than adult-directed vocalizations; this occurred for all five categories of communication intent, which included seeking the infant’s attention, stopping the infant, providing approval, providing comfort, and playing a game. Thus, the melody provided the message when adults addressed infants versus other adults. The melody of the mothers’ speech to infants was informative to the preverbal infant, and the prosodic cues provided might be the primary method that infants used to access the communicative intent of the mother (Fernald, 1989).

Parents also engaged in infant-directed singing, resulting in significantly higher pitches of songs and slower tempo compared to singing when the infant was absent; parents intuitively
adjusted these components when in the presence of their infants (Trehub, Unyk, Kamenetsky, Hill, Trainor, Henderson, & Saraza, 1997). Listeners also identified infant-directed versions of songs. Differences in pitch and tempo for each version predicted emotional engagement ratings, with mothers and fathers both equally conveying emotion in their singing.

Trainor (1996) found that infants preferred the infant-directed versions, and their preference was correlated with adults’ ratings of loving tone of voice. Mothers sing differently in the presence of their infants, and infants attend to this singing. What other adults consider to be a loving tone was also important to infants. Through singing, the mother’s voice conveyed positive emotion and important messages to infants, and results seem to indicate that these emotional nuances regulated her infant’s state, either arousing or soothing according to specific circumstances. When infants listened to lullabies and play songs, those listening to lullabies evinced specific behaviors associated with focusing attention to themselves versus focusing more on their environment during play-songs (Rock et al., 1999). Results indicate that singing may be used to regulate infants’ states and even communicate emotion in messages.

**Implications and Suggestions for Music Protocol in the NICU**

Researchers have investigated audiological issues related to infants listening to music (Cassity & Ditty, 1998; Cassidy & Ditty, 2001; Dureau, 2005). Cassity and Ditty (1998) examined research and determined protocols for premature and full-term infants listening to music. Based on the research reviewed, several considerations were provided for future researchers and clinicians. Scale A is used to measure the voice, and Scale C should be used to measure decibel levels of music; Scale A plus 10 dB is equal to Scale C. Considerations included measuring decibel level close to the ear drum rather than the sound source, fading music in and out, and using the least decibel level while still providing the desired effect. Research conducted by Dureau (2005) determined that decibel levels, which ranged on Scale C from 55-60 dB, 65-70 dB, and 75-80 dB, did not result in any significant changes in heart rate and behavior state in newborn full-term infants. Furthermore, both males and females responded equally to music presented at 1.6 kHz; however, gender differences existed, with females evincing significantly more sensitive hearing than males as determined in hearing screening procedures (Cassidy & Ditty, 2001). Hearing sensitivity between genders increased as frequency increased. Males were
less sensitive at higher frequencies and females became more responsive. Female newborns’ outer hair cells responded with greater sensitivity than males.

Abromeit (2003) provided clinical applications for music therapy based on the Newborn Individualized Developmental Care and Assessment Program (NIDCAP) model. Music therapy interventions based on the NIDCAP model need to be individualized according to each infant’s specific needs and provide a balance of sensory stimulation parallel to the maturity of the infant’s developmental level. Standley (2003b, 2003c) suggested several music interventions to utilize in the NICU at various ages with premature infants and included specific guidelines for each intervention. Recorded lullaby music can be used in the isolette starting at 28 weeks to improve oxygen saturation levels, increase weight gain, and shorten hospital stay; maximum amount of music stimulation per day is one and a half hours, with music on and off for half hour increments. Music utilized with premature infants needs to facilitate habituation through musical elements such as constant volume, voice unaccompanied or with single accompanying instrument, constant rhythm with light emphasis, and melodies in the higher range; furthermore, the volume should be set to 70 decibels and never exceed 75 to 80 decibels on scale C. Another intervention, the Pacifier Activated Lullaby (PAL) system, reinforces nonnutritive sucking for infants at 30 weeks and increases feeding rate for poor feeders at 34 to 36 weeks; PAL opportunities may be provided for 10 to 15 minutes per session at least once or twice a day. Duration of sucking reinforcement as well as strength of sucking required to elicit music can be programmed according to each infant’s developmental skill level. Other PAL uses include pain relief during medical procedures. Another intervention involves live singing combined with multimodal stimulation, which can be started at 32 weeks adjusted gestation age to shorten hospital stay and increase tolerance for stimulation through accumulating modes of stimulation.

**Using Music to Enhance Parent-Infant Relationships**

Researchers have reported that it is important for nurses to understand the benefits of using music with newborn infants during their stay at the hospital, especially since the environment is noisy and results in higher arousal states and more fluctuations in behavior states; nurses who understand the implications of music can teach the parents how to use music to benefit the baby as well as themselves (Kaminiski & Hall, 1996). Parents have even commented
that they would like to use music with their infants after going home from the hospital; these parents enjoyed watching the calming effects of music on their newborn infant during one music therapy research project (Dureau, 2005).

Since parents experience stress while their infant is in the NICU, Cassidy and Standley (1995) suggested letting parents choose music to play for their infant since music is not contraindicated for infants in the NICU. This is especially important at times when they are not allowed to hold, feed, or touch their fragile and critically ill infant; providing the parent this opportunity might be one means for the parents to feel some control over their situation. Interestingly, in one research study mothers of premature infants who received music in the NICU reported their babies’ achievements with pride, and it is possible that these babies were happier and calmer babies, resulting in a stronger bond between the mother and infant (Standley, 1991). These results indicated that music in the NICU may have long-term benefits on the developing relationship between mother and infant.

Abromeit (2003) stated that the NIDCAP model encouraged the involvement of parents in their infant’s care, especially helping parents to have positive interactions with their infants through appropriate music interventions. This includes singing lullabies to help parents develop a positive interaction and connect to their infants, as well as multimodal stimulation. A music therapy program was developed to provide bonding time between infants and parents through training in multimodal stimulation, provide parents of infants in the NICU training in music and multimodal stimulation, and teach parents massage techniques and behaviors that indicate infant stress and overstimulation as well as appropriate infant behaviors (Whipple, 2000). Parents who received training provided significantly more appropriate interactions, infants evinced significantly fewer stress behaviors, and parents reported spending significantly more time in the NICU compared to parents who did not receive training; all of these positive effects promote bonding. Furthermore, infants experiencing music and multimodal stimulation from parents had greater average daily weight gain and were discharged earlier from the hospital. Other researchers combined lullabies with kangaroo care for 60 minutes over a three-day period to decrease maternal anxiety (Lai, Chen, Peng, Chang, Hsieh, Huang, & Chang, In press). Music significantly decreased maternal anxiety, and the effects of music listening during kangaroo care were cumulative as anxiety continued to decrease throughout the intervention; maternal anxiety scores remained the same for those in the control group.
Even still, researchers indicate that the fetus learns prenatally and assert the importance of prenatal experiences of voices that might possibly contribute to later language development as well as attachment/bonding (Hepper, Scott, & Shahidullah, 1993). The prenatal experiences of hearing the mother’s voice prepare the infant to prefer the mother’s voice and provide the appropriate response the mother seeks. Even after only 12 hours of contact with their mothers, newborn infants discriminated between mothers’ voices and other females’ voices, learned to produce their mothers’ voice, and evinced a preference for their mothers’ voice. This preference for the mother’s voice seems to indicate that even the short period after birth might be essential in the initiation of mother-infant bonding (DeCasper & Fifer, 1980). Listening to mother’s voice during the first week of life may facilitate the social responsiveness process between infant and mother, especially since premature infants are deprived of social aspects of mother-infants bonding while in the NICU (Bozzette, 1997).

**Purpose**

The purpose of this study is to determine the following: 1) the effects of creating a CD of the mother singing lullabies combined with simple guitar accompaniment for her premature infant on the mother’s responses to a modified version of the Parental Perception Inventory; 2) the effects of creating a CD of singing by mothers of full-term infants on responses to a modified version of the Parental Perception Inventory; 3) the effects of the mother’s lullabies on preterm infants’ weight gain, bottle feedings, and discharge time and date; 4) how the process of creating a CD and utilizing the CD affects mother-infant bonding; and 5) whether parents of preterm and full-term infants use the CD and find it beneficial after the infant is discharged from the hospital; and 6) if playing the CD of the mother’s singing when she was unable to visit the NICU helped her to cope with her infant’s hospitalization.
CHAPTER 3

METHOD

Participants and Setting

Full-term Mothers and Infants

Participants were 72 healthy full-term infants, from the Newborn Nursery, who were born at or later than 37 weeks gestational age and weighed more than 2500 grams at birth, and their mothers who were randomly assigned to experimental \( n = 34 \) or control \( n = 38 \) conditions. Full-term infants and mothers in this study resided in a NICU 1 setting in a regional medical center, during their hospitalization.

The researcher consulted the nurses in the full-term nursery for a copy of the census each day to establish potential full-term infants and mothers. Most mothers who had vaginal deliveries were approached about the research study after they had been in the hospital for one day; mothers who had delivered the baby less than 15 hours earlier were not contacted until the following day. Mothers who had Cesarean section deliveries were approached at the end of the first or second day after delivery. The researcher did not contact mothers who had a “Do Not Disturb” or “Breastfeeding” sign on their door. The rationale and procedure for the study were explained to mothers, as approved by the Florida State Human Subjects Committee and Tallahassee Memorial HealthCare Institutional Review Board (see Appendices A and B). Informed Consent was signed (see Appendix C). Mothers were randomly assigned to the experimental or control group. Therefore, mothers’ age, race, marital status, and previous number of children were not controlled for in the study design.

Demographic variables were analyzed using an alpha level of .05. At total of 72 mothers consented to participate in the research, with 38 mothers in the control group and 34 in the experimental group. Eleven full-term mothers in the control group and 7 in the experimental group did not complete the survey conducted 2 weeks after discharge; hence, 27 of the 38 full-term mothers in the control group and 27 of the 34 full-term
Table 1. Subject Demographics by Group for Full-term Mothers Who Completed and Failed to Complete the Survey.

<table>
<thead>
<tr>
<th></th>
<th>Race</th>
<th>Marital Status</th>
<th>Type of Delivery</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Age</td>
<td>SD</td>
<td># of children</td>
</tr>
<tr>
<td>Completed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experimental</td>
<td>27.22</td>
<td>7.27</td>
<td>1.89</td>
</tr>
<tr>
<td>Control</td>
<td>30.33</td>
<td>5.22</td>
<td>2.11</td>
</tr>
<tr>
<td>Not Completed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experimental</td>
<td>23</td>
<td>3.06</td>
<td>NA</td>
</tr>
<tr>
<td>Control</td>
<td>27</td>
<td>7.46</td>
<td>NA</td>
</tr>
</tbody>
</table>

Table 2. Subject Demographics by Group for Preterm Mothers Who Completed the Study.

<table>
<thead>
<tr>
<th></th>
<th>Race</th>
<th>Marital Status</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Age</td>
<td>SD</td>
</tr>
<tr>
<td>Experimental</td>
<td>28.13</td>
<td>6.53</td>
</tr>
<tr>
<td>Control</td>
<td>23.50</td>
<td>5.37</td>
</tr>
</tbody>
</table>
mothers in the experimental group completed the entire study. All data analyses were based on the 27 mothers in the experimental group and 27 mothers in the control group, except song selection, which was based on all 34 mothers in the experimental group to obtain a larger number of subjects. Chi-square analyses indicated that there were no significant differences for those that completed the study versus those that did not complete the study by race, $\chi^2 (2, 54) = 2.43, p > .05$, or by treatment group, $\chi^2 (1, 54) = .669, p > .05$; although, significant differences occurred for completion of study and marital status, with more single mothers failing to complete the study, $\chi^2 (1, 54) = 9.86, p = .001$. See Table 1 for subject demographics of mothers who did not complete the study and for those who completed the study. For those experimental and control mothers that completed the study, Chi-Square analysis indicated that there were no significant differences for group by marital status, $\chi^2 (1, 54) = .081, p > .05$, nor race, $\chi^2 (2, 54) = 2.291, p > .05$. A t-test indicated that there was no significant difference between groups for number of children, $t (51) = -.623, p > .05$; however, a Chi-square analysis for experimental versus control groups for first-time mothers indicated that it approached significance, $\chi^2 (1, 53) = 3.26, p = .071$, with more first-time mothers in the experimental, $n = 13$, than control, $n = 7$. Furthermore, there was a significant difference between groups and mothers’ ages, $t (52) = 1.81, p = .03$, with mothers in the control group being older. Experimental mothers’ ages ranged from 16-37 and control mothers’ ages ranged from 16-44.

**Preterm Mothers and Infants**

Twenty-one mothers and 25 premature infants, including four mothers with twins, participated and were randomly assigned to experimental ($n = 11$ mothers, 13 infants) or control ($n = 10$ mothers, 11 infants) conditions. Preterm infants, born prior to 36 weeks corrected gestational age (CGA), and low birthweight infants (LBW), weighing less than 2500 grams at birth, hospitalized in a Level II and III Neonatal Intensive Care Unit (NICU) in the same regional medical center were referred for participation in the study if they evinced the following criteria:

- infants born at or later than 28 weeks and before 36 weeks CGA
- infant evinced toleration of auditory stimulation between 30-32 weeks CGA
- infant had no severe abnormalities which affected ability to listen to music, including significant neurological disorders such as periventricular leukomalacia or intraventricular hemorrhage
- mother nor infant tested positive for illegal drugs
- infant had no disease necessitating quarantine
- infant not on ventilator or continuous positive airway pressure past 30 weeks CGA

The researcher reviewed daily the NICU staff assignments to identify new infants admitted to the NICU, read admission notes, and consulted charge nurses to ensure that infants were eligible for the study. Once the researcher determined an infant was eligible according to criteria for inclusion, parents were approached. The rationale and procedure for the study were explained to the parents. Mothers who agreed to participate and enroll their infants in the study signed an Informed Consent (see Appendix D), and were randomly assigned to either the experimental or control group; thus mothers’ age, race, and marital status as well as infant’s gestational age and gender were not controlled for in the study design.

This study was implemented at Tallahassee Memorial HealthCare in Tallahassee, FL. Premature infants in this study resided in a NICU Level II or III, though most infants graduated from Level III to Level II at some point during their hospitalization, with the exception of one who remained in Level III due to high census.

Demographic variables for mothers of premature infants were analyzed using an alpha level of .05. A total of 21 mothers consented to participate in the research, with 11 mothers in the experimental group and 10 in the control group. Two mothers of twins in the experimental group were dropped from the study due to early discharge and only one or two days of music intervention and one mother in the control group had an infant that became extremely sick and participation in the study was discontinued. One mother in the experimental group and one mother in the control group did not complete a phone or mail survey. Thus, 8 preterm mothers in the experimental group and 8 preterm mothers in the control group completed the entire study, with a total of 10 infants in each group. All
data, with the exception of song selection, were based on the 8 preterm mothers in the experimental and 8 in the control group who completed the entire study.

Analysis of demographic information revealed that there was no significant difference between groups and mothers ages, \( t(18) = .006, p > .05 \). The age range for mothers in the experimental group was from 18 to 36 and 16 to 30 for mothers in the control group. Further analysis indicated that there were no significant differences in groups for race, \( \chi^2(1, 16) = 1.07, p > .05 \); however, a significant difference between groups by marital status occurred, \( \chi^2(1, 16) = 4, p < .05 \), with more mothers in the control group being single. See Table 2 for subject demographics of mothers in the experimental and control groups. A t-test indicated that there were no significant differences between groups and number of children, \( t(14) = -.239, p > .05 \). A Chi-Square analysis for experimental versus control groups for first-time mothers indicated no significant difference, \( \chi^2(1, 16) = 1.02, p > .05 \).

Table 3. Subject Demographics by Group for Preterm Infants.

<table>
<thead>
<tr>
<th></th>
<th>Mean Birth CGA</th>
<th>Mean Birthweight</th>
<th>Race White</th>
<th>Race Black</th>
<th>Gender Boys</th>
<th>Gender Girls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>31.73</td>
<td>1551.7</td>
<td>6</td>
<td>4</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Control</td>
<td>32.46</td>
<td>1762.80</td>
<td>6</td>
<td>4</td>
<td>6</td>
<td>4</td>
</tr>
</tbody>
</table>

Analysis of demographic information for preterm infants revealed that there was no significant difference between groups and birth CGA, \( t(18) = .960, p > .05 \). The age range for infants in the experimental group was from 28 weeks to 34 weeks and 4 days CGA and 30 weeks to 34 weeks and 6 days in the control group. Also, there were no
significant differences for birthweight between groups, $t (18) = .214, p > .05$. Birthweight ranged from 954 to 2080 grams for the experimental group and from 1200 to 2535 grams for the control group. See Table 3 for subject demographics of preterm infants in the experimental and control groups.

**Equipment**

An Olympus WS-100 digital voice recorder and Audio-technica ATR35s omnidirectional microphone were used for recording the singing of mothers of both term and preterm infants. DBpowerAMP Music Converter was used to transfer the Windows Media Audio files to wave files, and Audacity was used to edit the wave files, providing repetition as well as fading in and fading out each song. Nero burning rom software was used to compile and make the CD. Music was played for preterm infants on RadioShack Moisture Resistant Speaker System MX 1 (Cat No. 40-1400), which was connected to a RadioShack AM/FM Stereo Portable CD player (Cat. No. 42-6013). A RadioShack Sound Level Meter (Cat. No. 33-2055) was used to determine that the decibel level for each infant’s isolette and open crib was within the guidelines provided by the American Academy of Pediatrics Committee on Environmental Health.

**Research Design**

In this study a Posttest-only experimental/control group design was utilized to measure mothers’ responses. Groups included mothers of full-term infants participating in the music condition versus those in the control condition and mothers of preterm infants participating in the music condition versus those in the control condition. Data collection occurred over a 5-month period.

**Dependent Measures and Data Collection**

Most mothers of both preterm and full-term infants in the experimental and control group completed a phone interview approximately 14-25 days post infant’s discharge, answering questions from the modified Parental Perception Inventory as well as other questions regarding mother-infant bonding and the use of music with their infants. One full-term mother who was Korean preferred receiving the survey via e-mail, and one preterm mother completed the survey.
via e-mail. One preterm mother was not reached by phone; the survey was mailed, completed by the mother, and returned to the researcher. The survey included sub-categories of responses analyzed separately. Each is described below.

**Parental Perception Inventory.** The mother completed an adaptation of the Parental Perception Inventory (PPI), a questionnaire rating her adjustment to her new infant and lifestyle changes. This questionnaire was modified from the original 31 items to 13 items to decrease the length of the survey, and several questions were rephrased for clarification and scoring purposes. The highest possible score, 26, indicated less adjustment to the new baby and lifestyle changes; a score of 0 indicated a positive adjustment to the baby and lifestyle changes. See Appendix E for a copy of the form.

**Mother-Infant Bonding Scale.** Mother-infant bonding was addressed through the use of a 5-point Likert scale for the following 4 indices: I feel that I have been helpful to my baby, I feel that I know how to nurture my baby, I feel that there is a strong mother-infant bond between me and my baby, and I feel that I know how to calm my infant. All four items composed the Mother-Infant Bonding Scale, with a low score of five indicating little mother-infant bonding and a high score of 20 indicating a positive mother-infant bond. See Appendix F for a copy of the form.

**Value of Music Scale.** Mothers rated the importance of music for their babies, which was assessed through a 5-point Likert scale for the following items: I feel that music helps my baby, I think that it is very important to sing to my baby, and I think that it is very important to play music for my baby. The Value of Music Scale ranged from three to fifteen, with a higher score indicating more positive feelings for using music with infants. See Appendix G for a copy of the form.

**CD Importance Score.** Those mothers who participated in creating a CD of lullabies answered additional questions regarding the use of this CD. Mothers in the experimental group rated the importance of the CD in terms of a 5-point Likert scale for the following three items: I feel that the CD of my singing helps my baby, I think that it is very important to play the CD of my singing for my baby, and I feel that the CD of my singing helps promote a strong mother-infant bond between me and my baby. The highest possible score of 15 indicated more positive feelings for use of the CD. See Appendix H for a copy of the form. Preterm mothers in the experimental group also completed one other item, using a 5-point Likert scale for the item:
Knowing my infant listened to my singing helped me cope with my infant’s stay in the NICU (see Appendix H).

**After-Birth Complication Score.** Mothers were asked if they experienced any complications as a result of the birth and delivery of their infant, such as lactation complications, post-partum depression, uterine prolapse, episiotomy complications, or any other problems. Mothers were given a point for each problem that they reported. See Appendix I for a copy of the form.

**Comments Made by Mothers at the End of the Survey.** Both preterm and full-term mothers in the experimental and control group were provided the opportunity to add any comments regarding mother-infant bonding and/or music at the end of the survey. Statements were recorded and rated according to the types of comments made by parents. A rating of 1 indicated that the statement was general concerning the use of music or their philosophy of music. A rating of 2 indicated that the statement included only one positive term, such as good, thank you, enjoyed, help/helpful; this also included mentioning the positive benefits of using music or the personalized CD, the helpfulness of music, or using the personalized CD for bonding. A rating of 3 was given when the statement included at least 2 of the previous mentioned positive terms, a 4 was used when at least 3 of the previously mentioned positive terms were utilized, and a 5 was used when at least 4 of the previously mentioned positive terms were utilized. Further analysis was conducted to determine types of comments mothers made, which included the following types of statements; appreciation/thanks; positive comments regarding the process of making the CD, general music use since birth, and use of CD for bonding; philosophy of music/general music; baby’s responses to music; and negative comments. Two board-certified music therapists rated and classified the comments, maintaining a reliability level of 85%.

**Other Measures.** General music use was computed based on mothers’ responses of how often they used music with their baby (not at all = 1, a few times a week = 2, every day = 3, or several times a day = 4) in the two weeks following discharge. Experimental mothers also indicated how often they used the CD of their singing with their baby in the two weeks following discharge (not at all = 1, a few times a week = 2, every day = 3, or several times a day = 4). Amount of singing was indicated by how often full-term and preterm mothers sang to their baby (not at all = 1, a few times a week = 2, every day = 3, or several times a day = 4). Additional
dependent measurements for preterm infants collected from the medical charts included infants’
gestational age and weight at birth and at discharge. See Appendix J for a copy of the form.

**Procedures**

**Full-term Mothers and Infants.** Full-term mothers were approached about the study only when census listing indicated that mothers with vaginal deliveries had been in the hospital for one day and mothers who had Cesarean section deliveries for 1 or 2 days. Mothers were told that the purpose of this research was to record a CD of their singing lullabies, children’s songs, and popular tunes for their baby while the researcher provided guitar accompaniment. The mother could choose to use the CD in any manner that was useful to her. Mothers also were informed that they might be in the control group, in which information would be obtained in a follow-up survey to make comparisons as to the effectiveness of this intervention. Mothers in the control group signed consent forms and were told they would receive a phone call regarding the follow-up survey in approximately two weeks. Mothers in the experimental group also signed consent forms and then the recording took place in the mother’s room immediately after or at a time that was convenient for the mother and researcher.

The researcher provided experimental mothers a notebook containing a list of 41 song titles, including lullabies, children’s songs, and popular songs (see Appendix K) as well as the words for each song. Mothers were informed that they could also sing songs not on the list. The researcher also rewrote Brahm’s *Lullaby*, leaving blanks in the song for the baby’s name and for a personalized message from the mother to the infant. Each mother had the option of filling in the blanks to Brahm’s *Lullaby* and/or creating an individualized message for her infant (see Appendix L). Seventeen out of 27 full-term mothers chose to participate in this opportunity and sing their composed song. The researcher guided each mother through the process, assisting with word choices as requested as well as the rhythm and flow of the new words within the song.

Prior to recording the songs, each mother sang the first few lines of a song. The researcher matched the appropriate key with the mother’s comfortable vocal range. The mother was provided the option of practicing the song once or twice before recording the song, and the researcher informed the mother that if she was not pleased with the recording the song could be erased and recorded again. The recording process took approximately 20 minutes to an hour,
depending on the number of songs the mother chose. Songs were recorded and placed on a CD for the parents to take home with them from the hospital that day.

**Preterm Mothers and Infants.** Consent was obtained from mothers of preterm infants by the researcher or nurses, approximately the first week after their infant was admitted to the NICU. After obtaining consent the researcher met with the experimental mothers to record her singing lullabies with guitar accompaniment to create a CD. For those preterm mothers who consented after their discharge, the recording took place in the nesting rooms which provided the privacy and quiet atmosphere needed for the CD recording.

The researcher provided the preterm experimental mothers the same notebook containing the list of 41 song titles, including lullabies, children’s songs, and popular songs (see Appendix K) as well as the words for each song. Mothers were informed that they could also sing songs not on the list and/or create a personalized message by filling in the blanks to Brahms’s *Lullaby* (see Appendix L). Seven out of 9 full-term and preterm mothers chose to participate in this opportunity and sing their composed song. The researcher guided each mother through the process, assisting with word choices as requested as well as the rhythm and flow of the new words within the song.

The researcher kept a copy of each preterm mother’s CD to play for her infant throughout the premature infant’s hospitalization. Once premature infants reached 30 weeks AGA, daily opportunities to listen to mother’s singing were implemented when the nurse caring for the infant gave permission and affirmed that the stimulation would be appropriate for the infant on that day. The recording of the mother’s voice was played for each infant 20 minutes per day, 3 to 5 times per week until time of discharge. Time of day for music listening was determined according to mothers’ visiting schedule, infants’ daily schedule, and nurses’ suggestions. Efforts were made to provide music listening at a time when each mother was unable to visit; for example, one mother went back to work in the morning and music listening to her voice was provided in the morning hours of each day. During the 20 minutes of music listening infants often were awake, sleeping, receiving NG feedings, or even receiving routine medical procedures. (For example, one infant listened to mother’s singing during an IV start). Only one mother and father were present twice during the music listening experience; they were interested in watching their infant’s responses to the music.
Volume was measured via a decibel meter and set on 65 dB (Scale C), which researchers have recommended as safest for premature infants. Music speakers were cleaned with CaviWipes and then placed binaurally at least 8 inches from the infant’s head; infants remained lying on their backs or sides while in the crib or incubator during music listening. Music was discontinued if signs of infant distress occurred, including: irregular respiration or apnea, flushing or mottling of sin, tremors, startles, splayed fingers or hand in stop position, eye rolling or floating, whimpering, hiccoughing, spitting up, gagging, etc. Infants with infections requiring quarantine were omitted from the study. Only one infant evinced distress after 17 minutes of music listening during one trial; the last three minutes of music listening in this trial was discontinued by the researcher.

Preterm mothers in the control group signed the consent form and the preterm infants in the control group did not receive any music listening. Mothers in the control group completed the survey two weeks after their infants’ discharge, and a CD of lullabies and children’s songs was mailed to their home addresses as a gift.
CHAPTER 4

RESULTS

Full-term Infants and Mothers

Parental Perception Inventory

The Parental Perception Inventory (PPI), which was administered post-test only, revealed that full-term mothers in control and experimental groups had similar scores for adjustment to the new baby and lifestyle changes (see Table 4). The highest possible score, 26, indicated less adjustment to the new baby and lifestyle changes and a score of 0 indicated a positive adjustment to the baby and lifestyle changes. For individual questions within the PPI, mothers in the experimental group indicated that they worried less about their babies, did not cry more in sadness, and were encouraged by seeing other babies; however, they also reported more concerns about their ability to take care of their family, coping with the situation, and finances. Other difficulties experienced by experimental mothers included feeling tired and feeling guilty about the baby’s situation as well as fears of losing touch with reality and former friends and lifestyle.

Table 4. Full-term Mothers’ Mean Responses to the PPI.

<table>
<thead>
<tr>
<th></th>
<th>PPI</th>
<th>SD</th>
<th>Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>4.56</td>
<td>3.23</td>
<td>10.49</td>
</tr>
<tr>
<td>Control</td>
<td>4.29</td>
<td>2.05</td>
<td>4.22</td>
</tr>
</tbody>
</table>

A Point-Biserial Correlation revealed a relationship between experimental first-time mothers versus mothers of several children and scores for the PPI; first-time mothers scored higher on the PPI, indicating less adjustment to the new baby and lifestyle changes (see Table 5).
Similar results occurred for mothers in the control group. A Point-Biserial Correlation between marital status and scores for the PPI revealed very little relationship for either the experimental group or the control group.

Medical complications were also related to experimental mothers’ responses on the PPI. As experimental mothers reported greater medical complications, they also reported less adjustment to lifestyle changes and their new baby; this relationship was not as strong for the control mothers. The Fisher r-to-z transformation was used to determine the Significance of the Difference Between Two Correlation Coefficients, which indicated that the experimental group was significantly different from the control group regarding the correlations for medical complications and the PPI, \( z = 1.62, p < .05 \). Considering the difficulties encountered with a Cesarean section delivery versus a vaginal delivery, it seems interesting that a Point-Biserial Correlation for type of delivery and responses on the PPI revealed a slight association for the experimental group but not for the control group. See Table 5 for a compilation of all correlations involving the PPI and other variables.

### Table 5. Correlations Between PPI and Other Variables.

<table>
<thead>
<tr>
<th>Measurements</th>
<th>Experimental</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>First-time Mothers vs. Mothers of Several Children</td>
<td>( r_{pb} = -.38^* )</td>
<td>( r_{pb} = -.25 )</td>
</tr>
<tr>
<td>Marital Status</td>
<td>( r_{pb} = .11 )</td>
<td>( r_{pb} = -.01 )</td>
</tr>
<tr>
<td>Medical Complications</td>
<td>( r = .55, r^2 = .30^{**} )</td>
<td>( r = .15, r^2 = .04^t )</td>
</tr>
<tr>
<td>Type of Delivery</td>
<td>( r_{pb} = .21 )</td>
<td>( r_{pb} = -.1 )</td>
</tr>
</tbody>
</table>

*\( p < .05 \). **\( p < .01 \).

\( t \) = Significant difference between correlations of experimental and control groups, \( p < .05 \).

**Mother-Infant Bonding Scale**

Mothers in the control group reported slightly higher scores for the Mother-Infant Bonding Scale compared to mothers in the experimental group, with higher scores indicating a
greater mother-infant bond. Mothers in the experimental group reported a slightly higher mean score for the items of bonding with their infant as well as being able to calm their infant. This indicated a greater mother-infant bond and perceived ability to calm their infants than held by mothers in the control group. Mothers in the control group reported higher scores for feeling helpful to their baby as well as feeling that they knew how to nurture their infant (see Table 6).

Table 6. Full-term Experimental Mothers’ Mean Scores for Individual Questions from the Mother-Infant Bonding Scale.

<table>
<thead>
<tr>
<th></th>
<th>Helpful</th>
<th>Nurture</th>
<th>Bond</th>
<th>Calm</th>
<th>Total Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>4.85</td>
<td>4.85</td>
<td>4.93</td>
<td>4.48</td>
<td>19.11</td>
</tr>
<tr>
<td>Control</td>
<td>5.0</td>
<td>4.88</td>
<td>4.88</td>
<td>4.44</td>
<td>19.22</td>
</tr>
</tbody>
</table>

A Pearson Correlation indicated an inverse relationship between experimental mothers’ responses on the PPI and Mother-Infant Bonding Scale, $r = .53, p = .005$, indicating that mothers who were not adjusting to their new baby and lifestyle changes tended to report less bonding with their infants. This relationship was not as strong for control mothers, in which the correlation was $r = .23, p > .05$. Correlations revealed that there was some relationship for experimental and control mothers who were first-time mothers versus mothers of several children and their score on the Mother-Infant Bonding Scale, with first-time mothers scoring lower. There was also a relationship for medical complication and mother-infant bonding for experimental mothers, and as experimental mothers reported increased medical complications, they also reported less mother-infant bonding. There was little association between marital status and mother-infant bonding. See Table 7 for a compilation of correlations regarding the Mother-Infant Bonding Scale and other variables.
Table 7. Correlations Between Mother-Infant Bonding Scale and Other Variables.

<table>
<thead>
<tr>
<th>Measurements</th>
<th>Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Experimental</td>
</tr>
<tr>
<td>First-time Mothers vs. Mothers of Several</td>
<td>$r_{pb} = .28$</td>
</tr>
<tr>
<td>Children</td>
<td></td>
</tr>
<tr>
<td>Marital Status</td>
<td>$r_{pb} = .11$</td>
</tr>
<tr>
<td>Medical Complications</td>
<td>$r = -.29$</td>
</tr>
<tr>
<td>PPI</td>
<td>$r = -.53^*$</td>
</tr>
</tbody>
</table>

* $p < .01$.

Value of Music Scale

Individual and total scores for the Value of Music Scale indicated that mothers in the experimental group rated music more positively than did mothers in the control group. This score included items regarding whether mothers considered music helpful to their infant, thought it was important to sing to their baby, and believed it was important to play music for their infants. (See Table 8 for mean scores for mothers in the experimental and control groups.) A Pearson Correlation revealed a positive relationship between experimental mothers’ Value of Music Score and the amount of music they used with their infants, $r = .47$, $p = .01$; control mothers also had a similar positive relationship for their Value of Music Score and amount of music they used with their infants, $r = .41$, $p = .03$.

Table 8. Full-term Mothers’ Mean Scores for Individual Questions from the Value of Music Scale.

<table>
<thead>
<tr>
<th></th>
<th>Music Helps</th>
<th>Singing Important</th>
<th>Playing Music Important</th>
<th>Total Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>4.48</td>
<td>4.48</td>
<td>4.48</td>
<td>13.44</td>
</tr>
<tr>
<td>Control</td>
<td>4.22</td>
<td>4.30</td>
<td>4.44</td>
<td>13.07</td>
</tr>
</tbody>
</table>
CD Importance Score

Mothers in the experimental group also rated their feelings concerning three additional statements regarding the importance of the CD of their singing: I feel that the CD of my singing helps my baby, I think it is very important to play the CD of my singing for my baby, and I feel that the CD of my singing helps promote a strong mother-infant bond between me and my baby. Mothers rated a mean of 4.22 for the first statement, a mean of 4.19 for the second statement, and a mean of 4.38 for the third statement (see Table 9). A rating of 5 meant the mothers strongly agreed with the statement. Further analysis indicated that there was a relationship of $r = .59$, $p = .001$, for the CD Importance Score and the amount of time parents used the CD. Furthermore, a Pearson correlation indicated that that there was a relationship between the scores for parents’ reports that the CD promoted bonding and scores on the Mother-Infant Bonding Scale, $r = .57$, $p = .003$. There was little relationship between the CD Importance Score and PPI, $r = .14$, $p > .05$.

Table 9. Full-term Mothers’ Mean Scores for Individual Questions from the CD Importance Score.

<table>
<thead>
<tr>
<th></th>
<th>CD Helps Infant</th>
<th>Important to Play CD</th>
<th>CD Promotes Bonding</th>
<th>Total Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>4.22</td>
<td>4.19</td>
<td>4.38</td>
<td>12.61</td>
</tr>
</tbody>
</table>

Comments Made by Mothers at the End of the Survey

Mothers were provided the opportunity to make comments about mother-infant bonding and/or music at the end of the survey. Twenty mothers in the experimental group (see Appendix M) and seven mothers in the control group made comments at the end of the survey (see Appendix N). Statements were rated according to the types of comments made by parents, with higher numbers indicating a greater and more positive attitude. A rating of 0 indicated that no comment was made or that a negative comment was made and a rating of 1 indicated that the statement was general concerning the use of music or their philosophy of music. A rating of 2 indicated that the statement included only one positive term, such as good, thank you, enjoyed,
helpful; this also included mentioning the positive benefits of using music or the personalized CD, the helpfulness of music, using music or the personalized CD for bonding, or any other type of comment regarding mother-infant bonding. Additional points were added according to number of positive statements made. Mean score for comments made by mothers in the experimental group was 1.56, and mothers in the control group scored .41. A Mann-Whitney U indicated a significant difference between experimental and control mothers’ positive comments, \( Z(27, 27) = -3.34, p = .001 \).

Further analysis was conducted to determine types of comments mothers made, which included the following types of statements; appreciation/thanks; positive comments regarding the process of making the CD, general music use since birth, and use of CD for bonding; philosophy of music/general music; baby’s responses to music; and negative comments. Fourteen out of 20 experimental mothers made comments regarding the personalized CD, including comments about using the CD, comments about using the CD for bonding, and also appreciation and thanks for the opportunity and experience. Interestingly, 2 mothers made negative comments, with one mother stating that her infant did not respond to the CD of her voice and another mother thinking that music did not affect this infant as much as her first baby. Mothers in both groups made general comments about their infants as well as philosophical comments about music. See Table 10 for additional types of comments.

Table 10. Classification of Comments Made by Mothers at the End of the Survey.

<table>
<thead>
<tr>
<th></th>
<th>Appreciation</th>
<th>CD Use (Including Bonding)</th>
<th>Bonding &amp;/or Music Use</th>
<th>Philosophy &amp; General Comments</th>
<th>Baby’s Responses</th>
<th>Negative Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>10</td>
<td>10</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Control</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>5</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

Several correlations provided further information regarding the comments mothers made at the end of the survey and how they relate to other variables measured. One significant
correlation involved the relationship between comments made by mothers at the end of the survey and experimental mothers’ PPI score; this indicated that as mothers reported less adjustment to the new baby and lifestyle, they also reported greater appreciation and positive comments concerning music, with the greatest number of comments regarding the CD. Furthermore, the amount of CD use was also related to the greater appreciation and positive comments, to a significant degree, $r = .39$. An interrelationship also occurred for mothers in the control group regarding the Mother-Infant Bonding Scale. See Table 11 for other correlations concerning comments made at the end of the survey and other variables.

Table 11. Correlations Between Comments Made at the End of the Survey and Other Variables.

<table>
<thead>
<tr>
<th>Measurements</th>
<th>Experimental</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>PPI</td>
<td>$r = .49^*$</td>
<td>$r = -.12$</td>
</tr>
<tr>
<td>Medical Complications</td>
<td>$r = -.08$</td>
<td>$r = .12$</td>
</tr>
<tr>
<td>Mother-Infant Bonding Scale</td>
<td>$r = -.23$</td>
<td>$r = .30$</td>
</tr>
<tr>
<td>Music Importance Scale</td>
<td>$r = .16$</td>
<td>$r = .24$</td>
</tr>
<tr>
<td>CD Importance Score</td>
<td>$r = .17$</td>
<td>NA</td>
</tr>
</tbody>
</table>

*$p < .01$

**Amount of Music Used with Infants**

One question on the survey involved mothers’ approximations of how often they used music with their infants. See Figure 1 for the amount of time mothers in the control and experimental groups reported using music with their infants, including experimental mothers’ CD of their singing. A Friedman Analysis indicated that there were no significant differences for the amount of music used with infants by mothers who had the personalized CDs, these same experimental mothers when using general music, and control mothers using general music, $\chi^2_r (3, 4) = 1, p > .05$. Compared to mothers in the control group, mothers in the experimental group indicated somewhat greater use of music with their infants, especially regarding the use of music every day and several times a day. Mean averages were computed on a scale from 1 to 4, with a
4 indicating greatest music use. Experimental mothers scored 2.48 for the personalized CD and 2.85 for general music use. Combined average scores for both the CD and general music use was 2.67, whereas the control group averaged 2.59 for general music use. Other than the 2 mothers who did not use their CD at all, mothers in the experimental group indicated that they used the CD of their singing at least several times a week; one of the mothers who did not use the CD also did not use general music with her infant. Four mothers in the experimental group indicated that they used the CD of their singing more than other types of music, and 9 of the mothers conveyed that they used the CD the same amount of time per week as other music. More mothers in the control than the experimental group reported that they did not use any music with their infant.

Figure 1. Amount of Time Full-term Mothers Used Music with Their Infants.
Time Spent Singing to Infants

Mothers reported how often they sang to their infants. A Mann-Whitney Test indicated that there was no significant difference for the amount of time mothers spent singing to their infant, \( z (20, 22) = 1.05, p > .05 \). Overall, mothers in the control group sang less to their infants than mothers in the experimental group, and more mothers in the experimental groups indicated that they sang to their infants on a daily basis than mothers in the control group (see Figure 2). Mothers in the experimental group, on a scale from 1 to 5, with 5 indicating greatest amount of time spent singing, averaged a score of 4.1; mothers in the control group averaged 3.5. Two mothers in the control group indicated that they never sang to their infant and four indicated that they did not sing often. One hundred percent of experimental moms reported that they engaged in singing to their infants, and only one mother reported not often singing. Information was from 20 experimental and 22 control mothers.

Figure 2. Amount of Time Full-term Mothers Sang to Their Infants.
Mothers’ Use of Music with Their Infants

While completing the survey, mothers indicated how they used music with their infants. Possible answers provided to mothers included the following: at a fixed time, at no specific time, to calm my infant, to simulate my infant, during diaper changes, during feedings, or during other times. Many mothers provided answers for the other category, including when my infant was fussy, at night or when I put my infant down to sleep, in the car, and in a swing, bassinet, or vibrating seat that comes with music. Thus, additional categories were added in the analysis due to the high number of additional responses to the “other” category. Mothers in both groups reported that they mostly used music with their infants during quiet time or to calm their fussy infants; mothers in the experimental group reported that they used the CD of their singing for this reason more than any other reason. The second highest overall use of music by control and

Figure 3. Full-term Mothers Uses of Music with Their Infants.
experimental mothers was when putting their infants to sleep, and the third highest use of music was at no specific time. (see Figure 3). Experimental mothers were more likely to use music for quiet time or to calm their fussy infants than control mothers, while control mothers reported using automated swings, bassinets, or vibrating swings that came with automated music. None of the experimental mothers reported using these devices.

**Infants’ Responses to Music**

Mothers were asked to describe how their infants responded to music. Possible answers included to sleep, cease crying, smile, listen and attend, or other response. The behavior that mothers of full-term infants reported the most was that their infants listened and attended to music, and the second highest response was ceased crying. Mothers in the experimental group also reported that their infants responded by smiling to the CD of their singing; they did not report that their infant responded by smiling to other types of music. Interestingly, several mothers reported that they were not sure of their infants’ response to music, stating that it was

![Figure 4. Full-term Mothers’ Report of Babies’ Responses to Music.](image-url)
hard to determine any changes in their infants’ behavior. See Figure 4 for further information regarding mothers’ perceptions of how their infants responded to music.

**Song Selections**

Data on frequency of song selection were compiled from all of the full-term mothers, including those that did not complete the study; this was done to obtain a number that is more representative of the general population. Thus, responses for the song selections are based on

<table>
<thead>
<tr>
<th>Song Title</th>
<th>Total #</th>
<th>Song Title</th>
<th>Total #</th>
</tr>
</thead>
<tbody>
<tr>
<td>You are My Sunshine</td>
<td>23</td>
<td>Jack &amp; Jill</td>
<td>1</td>
</tr>
<tr>
<td>Twinkle, Twinkle Little Star</td>
<td>20</td>
<td>Jesus Loves Me</td>
<td>1</td>
</tr>
<tr>
<td>Individualized Lullaby</td>
<td>17</td>
<td>Jesus Loves the Little Children</td>
<td>1</td>
</tr>
<tr>
<td>I'm a Little Teapot</td>
<td>12</td>
<td>Korean Lullaby</td>
<td>1</td>
</tr>
<tr>
<td>ABC Song</td>
<td>11</td>
<td>Let Me Call You Sweetheart</td>
<td>1</td>
</tr>
<tr>
<td>Amazing Grace</td>
<td>9</td>
<td>Old MacDonald</td>
<td>1</td>
</tr>
<tr>
<td>He's Got the Whole World</td>
<td>7</td>
<td>Row, Row, Row the Boat</td>
<td>1</td>
</tr>
<tr>
<td>Itsy Bitsy Spider</td>
<td>6</td>
<td>Somewhere Over Rainbow</td>
<td>1</td>
</tr>
<tr>
<td>Mary Had a Little Lamb</td>
<td>6</td>
<td>This Little Light of Mine</td>
<td>1</td>
</tr>
<tr>
<td>Are You Sleeping</td>
<td>5</td>
<td>All Night, All Day</td>
<td>0</td>
</tr>
<tr>
<td>Rockabye Baby</td>
<td>5</td>
<td>All the Pretty Little Horses</td>
<td>0</td>
</tr>
<tr>
<td>The Wheels on the Bus</td>
<td>5</td>
<td>All Through the Night</td>
<td>0</td>
</tr>
<tr>
<td>Swing Low, Sweet Chariot</td>
<td>4</td>
<td>Baby Mine (from Dumbo)</td>
<td>0</td>
</tr>
<tr>
<td>Edelweiss</td>
<td>3</td>
<td>Beautiful Dreamer</td>
<td>0</td>
</tr>
<tr>
<td>Hickory Dickory Dock</td>
<td>3</td>
<td>By ’n By</td>
<td>0</td>
</tr>
<tr>
<td>Brahms’ Lullaby</td>
<td>2</td>
<td>Down by the Bay</td>
<td>0</td>
</tr>
<tr>
<td>Favorite Things</td>
<td>2</td>
<td>Lavender's Blue</td>
<td>0</td>
</tr>
<tr>
<td>Home on the Range</td>
<td>2</td>
<td>Moon River</td>
<td>0</td>
</tr>
<tr>
<td>My Girl</td>
<td>2</td>
<td>Rainbow Connection</td>
<td>0</td>
</tr>
<tr>
<td>Oh What a Beautiful Morning</td>
<td>2</td>
<td>Scarborough Fair</td>
<td>0</td>
</tr>
<tr>
<td>Skinamarink</td>
<td>2</td>
<td>Shenandoah</td>
<td>0</td>
</tr>
<tr>
<td>BINGO</td>
<td>1</td>
<td>Teddy Bear</td>
<td>0</td>
</tr>
<tr>
<td>Goodnight Sweetheart</td>
<td>1</td>
<td>The Ants Go Marching</td>
<td>0</td>
</tr>
<tr>
<td>Hey Diddle Diddle</td>
<td>1</td>
<td>What a Wonderful World</td>
<td>0</td>
</tr>
</tbody>
</table>
all 34 mothers from the experimental group. From the list of 41 songs provided to each mother in
the experimental group, *You are My Sunshine* was sung by 23 of the 34 mothers of full-term
infants, followed by *Twinkle, Twinkle, Little Star* (20). Seventeen mothers chose to sing the
individualized song to the tune of Brahms’s *Lullaby*, which was the third most frequently
performed song. Three mothers requested songs that were not listed, including *BINGO, Jesus
Loves Me, Jesus Loves the Little Children, Old MacDonald, Row, Row, Row Your Boat*, and *This
Little Light of Mine*. Furthermore, one mother sang *Fere Jacques, Twinkle, Twinkle, Little Star,*
and the *ABC* song in French. One mother sang the *Itsy Bitsy Spider* in Spanish and another sang
a Korean lullaby. See Table 12 for the total number of mothers who sang each song. Overall,
mothers recorded an average of 5 songs, ranging from 1 to 9 songs total.

**Preterm Mothers**

**Parental Perception Inventory**

Scores on the Parental Perception Inventory (PPI) indicated that preterm mothers in the
experimental group had higher scores than mothers in the control group, signifying less
adjustment to the new baby and lifestyle changes (see Table 13). For individual questions on the
PPI, mothers in the experimental group expressed that they worried about their babies, cried in
sadness, felt concerned about their ability to take care of the families, felt tired, and experienced

<table>
<thead>
<tr>
<th></th>
<th>PPI</th>
<th>SD</th>
<th>Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>5.25</td>
<td>4.33</td>
<td>18.79</td>
</tr>
<tr>
<td>Control</td>
<td>3.88</td>
<td>1.89</td>
<td>3.55</td>
</tr>
</tbody>
</table>

helplessness more than mothers in the control group. Compared to mothers in the experimental
group, those in the control group indicated that they felt more worried about their babies’ future,
guilt about the babies’ situation, concern about losing touch with former friends and lifestyle, and concern regarding their ability to cope with the situation. Mothers in both groups reported the same amount of concern regarding finances and the same emotional response when seeing other babies.

A Point-Biserial Correlation revealed an inverse relationship between first-time experimental preterm mothers versus mothers of more than one child and scores on the PPI; first-time experimental preterm mothers reported less adjustment to new lifestyle changes and the infant compared to mothers with more than one child (see Table 14). There was no relationship between first-time mothers versus mothers of several children and PPI scores for control preterm mothers. Further correlations indicated there was some relationship for marital status and PPI scores for both experimental and control mothers, indicating that mothers with more than one child did not adjust as easily to the new infant and lifestyle changes. Scores for PPI and medical complications indicated a stronger relationship for control than experimental mothers; as mothers reported greater complications, they also reported less adjustment.

Table 14. Correlations between PPI and Other Variables.

<table>
<thead>
<tr>
<th>Measurements</th>
<th>Experimental</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>First-time Mothers vs. Mothers of Several Children</td>
<td>$r_{pb} = -.18$</td>
<td>$r_{pb} = 0$</td>
</tr>
<tr>
<td>Marital Status</td>
<td>$r_{pb} = .25$</td>
<td>$r_{pb} = .20$</td>
</tr>
<tr>
<td>Medical Complications</td>
<td>$r = .21, r^2 = .05$</td>
<td>$r = .49, r^2 = .24$</td>
</tr>
</tbody>
</table>

Mother-Infant Bonding Scale

For the Mother-Infant Bonding Scale, preterm mothers in the control group reported a slightly higher mean score for mother-infant bonding compared to preterm mothers in the experimental group, indicating greater mother-infant bonding (see Table 15). Mothers in the experimental group reported a higher mean score for feeling that they knew how to nurture their
infants, while mothers in the control group reported a higher score for bonding with their infant and for being able to calm their infant. Mothers in both groups equally reported feeling that they were helpful to their babies.

Table 15: Preterm Experimental Mothers’ Mean Scores for Individual Questions from the Mother-Infant Bonding Scale.

<table>
<thead>
<tr>
<th></th>
<th>Helpful</th>
<th>Nurture</th>
<th>Bond</th>
<th>Calm</th>
<th>Total Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>5</td>
<td>4.88</td>
<td>4.88</td>
<td>4.63</td>
<td>19.38</td>
</tr>
<tr>
<td>Control</td>
<td>5</td>
<td>4.75</td>
<td>5</td>
<td>4.88</td>
<td>19.63</td>
</tr>
</tbody>
</table>

A Point-Biserial Correlation indicated differing results for experimental versus control mothers’ responses on the Mother-Infant Bonding Scale according to first-time mothers versus mothers of several children. Experimental preterm mothers with more than one child indicated greater bonding with the baby. Conversely, control first-time preterm mothers indicated bonding. As experimental mothers reported greater medical complication, bonding decreased. Pearson Correlations indicated that as both experimental and control mothers’ PPI scores increased, mother-infant bonding decreased, more so for control mothers (see Table 16).

Table 16. Correlations Between Mother-Infant Bonding Scale and Other Variables.

<table>
<thead>
<tr>
<th>Measurements</th>
<th>Experimental</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>First-time Mothers vs. Mothers of Several Children</td>
<td>$r_{pb} = .36$</td>
<td>$r_{pb} = -.26$</td>
</tr>
<tr>
<td>Marital Status</td>
<td>$r_{pb} = -.36$</td>
<td>$r_{pb} = -.75^*$</td>
</tr>
<tr>
<td>Medical Complications</td>
<td>$r = -.34$</td>
<td>$r = .07$</td>
</tr>
<tr>
<td>PPI</td>
<td>$r = -.11, r^2 = .02$</td>
<td>$r = -.35, r^2 = .12$</td>
</tr>
</tbody>
</table>

* $p < .01$. 

67
Value of Music Scale

Individual and total scores for the Value of Music Scale indicated that preterm mothers in the experimental group rated music more positively than mothers in the control group (see Table 17). A Mann Whitney Test indicated that the Value of Music score for experimental mothers was significantly higher than those in the control group, \( U (9, 9) = -2.12, p = .03 \). Mothers in the experimental group indicated greater belief in the importance of music, as evidenced through their belief that music was helpful for their infants, it was important to sing to their babies, and it was important to play music for their babies. Pearson Correlations revealed a slightly negative relationship between experimental mothers’ Value of Music Score and the amount of music they used with their infants, \( r = -.045 \), and a positive relationship for control mothers, \( r = .31 \). One mother in the experimental group did not play general music with her infant, possibly resulting in skewed results.

<table>
<thead>
<tr>
<th>Music Helps</th>
<th>Singing Important</th>
<th>Playing Music Important</th>
<th>Total Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>4.88</td>
<td>5.00</td>
<td>4.88</td>
</tr>
<tr>
<td>Control</td>
<td>3.88</td>
<td>4.50</td>
<td>4.63</td>
</tr>
</tbody>
</table>

CD Importance Score

Preterm mothers in the experimental group rated the importance of the personalized CD on a Likert Scale, with a 5 indicating that mothers strongly agreed with the statement. For the statement “I feel that the CD of my singing helps my infants”, mothers reported a mean score of 4.71. Mothers reported a mean score of 4.75 concerning “I think it is very important to play the CD of my singing for my baby.” Mothers reported a 4.88 for the statement “I feel that the CD of my singing helps promote a strong mother-infant bond between me and my baby” (see Table 18).
Table 18. Preterm Mothers’ Mean Scores for Individual Questions from the CD Importance Score.

<table>
<thead>
<tr>
<th>CD Helps Infant</th>
<th>Important to Play CD</th>
<th>CD Promotes Bonding</th>
<th>Total Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>4.71</td>
<td>4.75</td>
<td>4.88</td>
</tr>
</tbody>
</table>

A positive relationship existed between the scores from the mothers’ reports that the CD promoted bonding and scores on the Mother-infant Bonding Scale. See Table 19 for the correlations regarding the personalized CD and other variables. Preterm mothers also completed an additional statement regarding the personalized CD: Knowing my infant listened to my singing helped me to cope with my infant’s stay in the NICU. Mothers reported a mean score of 4.75, with a score of 5 indicating that mothers strongly agreed with the comment. Further analysis indicated a strong relationship existed between scores on the CD Importance Score and mothers’ report that CD helped them to cope with their infants’ stay in the NICU, $r = .94$, $p < .01$.

Table 19. Correlations between Questions Regarding Personalized CD and Other Variables.

<table>
<thead>
<tr>
<th>Measurements</th>
<th>Correlations</th>
</tr>
</thead>
<tbody>
<tr>
<td>CD Importance Score</td>
<td></td>
</tr>
<tr>
<td>Use of CD</td>
<td>.35</td>
</tr>
<tr>
<td>PPI</td>
<td>.28</td>
</tr>
<tr>
<td>CD Helped Mothers Cope</td>
<td>.94</td>
</tr>
<tr>
<td>CD Helped Mothers Cope</td>
<td></td>
</tr>
<tr>
<td>PPI</td>
<td>.46</td>
</tr>
<tr>
<td>Mother-Infant Bonding Scale</td>
<td>.51</td>
</tr>
<tr>
<td>CD Promoted Bonding &amp; Mother-Infant Bonding Scale</td>
<td>.38</td>
</tr>
</tbody>
</table>
Comments Made by Preterm Mothers at the End of the Survey

Preterm experimental and control mothers were provided the opportunity to make comments about mother-infant bonding and/or music at the end of the survey. Six mothers in the experimental group and 3 in the control group made comments (see Appendices O and P). Statements were rated according to the types of comments made by parents, with higher numbers indicating a greater and more positive attitude. A rating of 0 indicated that no comment was made or that a negative comment was made and a rating of 1 indicated that the statement was general concerning the use of music or their philosophy of music. A rating of 2 indicated that the statement included only one positive term, such as good, thank you, enjoyed, help/helpful; this also included mentioning the positive benefits of using music or the personalized CD, the helpfulness of music, using music or the personalized CD for bonding, or any other type of comment regarding mother-infant bonding. Additional points were added according to number of positive statements made. Mean score for comments made by mothers in the experimental group was 2.5, and mothers in the control group scored .50. A Mann-Whitney U indicated a significant difference between experimental and control mothers’ comments, $U(8, 8) = -2.25, p = .03$.

Further analysis was conducted to determine types of comments mothers made, which included the following types of statements; appreciation/thanks; positive comments regarding the process of making the CD, use of CD, and the use of the CD for bonding; general music use since birth, general use of music for bonding, and mother-infant bonding; philosophy of music/general music; baby’s responses to music; and negative comments. Four of the experimental mothers stated that they felt better knowing that their infant was listening to their voices when they were not able to be there; all of the experimental mothers expressed thanks and appreciation. One experimental mother mentioned that her infant seemed to recognize her voice when she played the CD at home. Three mothers in the control group made comments at the end of the survey, and only 2 of these mothers mentioned music; however, 1 mother mentioned how her world was so much better since her baby’s birth. Interestingly, 1 mother from the control group asked if music was the best way to bond with her infant. See Table 20 for additional classifications of comments.
Table 20. Classification of Comments Made by Mothers at the End of the Survey.

<table>
<thead>
<tr>
<th></th>
<th>Appreciation</th>
<th>Bonding &amp;/or Music Use</th>
<th>Philosophy &amp; General Comments</th>
<th>Baby’s Responses</th>
<th>Negative Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>6</td>
<td>5</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Control</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

Correlations provided further information regarding the comments preterm mothers made at the end of the survey and how they related to other variables. One significant correlation involved the relationship between comments made by mothers at the end of the survey and mothers’ PPI score, which indicated that as experimental and control mothers reported less adjustment to the new baby and lifestyle, they also reported greater appreciation and positive comments concerning music, with the greatest number of comments regarding the CD. Furthermore, there was a strong relationship between medical complications and comments made by mothers; this indicated that experimental mothers with greater medical complications also tended to provide more comments regarding the use of the CD and control mothers.
regarding music use and philosophy. An interrelationship also occurred between experimental mothers’ comments and CD Importance Score as well as between control mothers and Music Importance Scale. See Table 21 for further information regarding correlations between mothers’ comments at the end of the survey and other variables.

**Amount of Music Used with Infants**

Mothers reported how often they used music with their infants. Mothers rated their music use as not at all = 1, several times a week = 2, every day = 3, and several times a day = 4. Mean averages indicated that experimental mothers scored 2.88 for general music use and 1.75 for the CD; control mothers rated 2.63 for general music use. See Figure 5 for the amount of time mothers in the experimental and control groups used music with their infants. A Friedman Analysis indicated that there were no significant differences for the experimental mothers use of the personalized CDs, experimental mothers use of general music, and control mothers use of general music, \( \chi^2 (3, 4) = 5.08, p = .08 \).
Time Spent Singing to Infants

Some of the preterm mothers reported how often they sang to their infants. Only 6 mothers in the control completed information regarding singing; however, all 8 mothers in the experimental completed information. Six mothers in the experimental group reported singing to their infant several times a day, 1 indicated at least every day, and 1 indicated several times a week. Mean score for time spent singing for preterm mothers in the experimental group was 3.63. Only 2 mothers in the control group reported that they sang several times a day, 1 indicated every day, 2 reported a several times a week, and 1 stated not at all. Mean score for time spent singing for preterm mothers in the control group was 2.83.

Mothers’ Use of Music with Their Infants

Preterm mothers also indicated how they used music with their infants. Options provided to mothers included at a fixed time, at no specific time, to calm my infant, to stimulate my infant, during diaper changes, during feedings, or during other times. Additional categories were created

Figure 6. How Preterm Mothers Used Music with Their Infants.
due to many mothers providing similar answers for the other category. The greatest response for mothers in both groups was that they used music with their infants at no specific time. The second highest response was during quiet time or to calm their fussy infants. Interestingly, only one mother reported using music at a fixed time. The “other” response from an experimental mother was around the house. See Figure 6 for additional information regarding how mothers used music.

Infants’ Responses to Music

Mothers described their infants’ responses to music. Possible answers provided to mothers included sleeps, ceases crying, smiles, listens and attends, locates sounds, or not sure. Mothers reported that their infant listened and attended to music the most. The next highest response reported was sleeps, ceases crying, and smiling. One mother in the experimental group reported that her infant seemed to recognize her voice on the CD. See Figure 7 for further information regarding how infants responded to music.

Figure 7. Preterm Mothers’ Report of How Babies Responded to Music.
**Song Selections**

Data were compiled from all of the preterm mothers, including mothers who were dropped from previous data analysis, to provide a better representation of the general population. Hence data is based on the 11 mothers from the experimental group that recorded songs for their infants. From the list of 41 song selections, more mothers sang *Twinkle, Twinkle Little Star* than any other song. The next most frequently recorded song was the individualized lullaby,

Table 22. Total Number of Preterm Mothers Who Sang Each Song.

<table>
<thead>
<tr>
<th>Song Title</th>
<th>Total #</th>
<th>Song Title</th>
<th>Total #</th>
</tr>
</thead>
<tbody>
<tr>
<td>Twinkle, Twinkle Little Star</td>
<td>8</td>
<td>Jack &amp; Jill</td>
<td>0</td>
</tr>
<tr>
<td>Individualized Lullaby</td>
<td>7</td>
<td>Skinamarink</td>
<td>0</td>
</tr>
<tr>
<td>You are My Sunshine</td>
<td>6</td>
<td>BINGO</td>
<td>0</td>
</tr>
<tr>
<td>Itsy Bitsy Spider</td>
<td>5</td>
<td>Jesus Loves the Little Children</td>
<td>0</td>
</tr>
<tr>
<td>I'm a Little Teapot</td>
<td>3</td>
<td>Let Me Call You Sweetheart</td>
<td>0</td>
</tr>
<tr>
<td>ABC</td>
<td>3</td>
<td>Old MacDonald</td>
<td>0</td>
</tr>
<tr>
<td>Mary Had a Little Lamb</td>
<td>3</td>
<td>Row, Row, Row the Boat</td>
<td>0</td>
</tr>
<tr>
<td>Amazing Grace</td>
<td>2</td>
<td>This Little Light of Mine</td>
<td>0</td>
</tr>
<tr>
<td>He's Got the Whole World</td>
<td>2</td>
<td>All Night, All Day</td>
<td>0</td>
</tr>
<tr>
<td>Rockabye Baby</td>
<td>2</td>
<td>All the Pretty Little Horses</td>
<td>0</td>
</tr>
<tr>
<td>Hickory Dickory Dock</td>
<td>2</td>
<td>All Through the Night</td>
<td>0</td>
</tr>
<tr>
<td>Favorite Things</td>
<td>2</td>
<td>The Ants Go Marching</td>
<td>0</td>
</tr>
<tr>
<td>Are You Sleeping</td>
<td>1</td>
<td>Baby Mine (from Dumbo)</td>
<td>0</td>
</tr>
<tr>
<td>Swing Low, Sweet Chariot</td>
<td>1</td>
<td>Beautiful Dreamer</td>
<td>0</td>
</tr>
<tr>
<td>My Girl</td>
<td>1</td>
<td>By 'n By</td>
<td>0</td>
</tr>
<tr>
<td>Goodnight Sweetheart</td>
<td>1</td>
<td>Down by the Bay</td>
<td>0</td>
</tr>
<tr>
<td>Hey Diddle Diddle</td>
<td>1</td>
<td>Scarborough Fair</td>
<td>0</td>
</tr>
<tr>
<td>Jesus Loves Me</td>
<td>1</td>
<td>Lavender's Blue</td>
<td>0</td>
</tr>
<tr>
<td>Oh What a Beautiful Morning</td>
<td>1</td>
<td>Moon River</td>
<td>0</td>
</tr>
<tr>
<td>Somewhere Over Rainbow</td>
<td>1</td>
<td>Rainbow Connection</td>
<td>0</td>
</tr>
<tr>
<td>The Wheels on the Bus</td>
<td>0</td>
<td>Shenandoah</td>
<td>0</td>
</tr>
<tr>
<td>Edelweiss</td>
<td>0</td>
<td>Teddy Bear</td>
<td>0</td>
</tr>
<tr>
<td>Home on the Range</td>
<td>0</td>
<td>What a Wonderful World</td>
<td>0</td>
</tr>
</tbody>
</table>
in which 7 of the 11 mothers of premature infants composed messages about their infants growing and coming home soon (see Appendix X). Most mothers chose traditional children’s songs to sing and record on their CD (see Table 22).

Preterm Infants

Average number of days infants listened to mothers singing on the CD was 13.3, with total number of listening opportunities ranging from 3 to 28, SD = 8.26; mean number of days of music listening per week was 4.2. An experimental infant who was born at 28 weeks gestational age, weighing the least at 954 grams, received the greatest number of music listening opportunities, at a total of 28 days. Overall, the music listening experience started on an average of 8.7 days of life, with ranges from 4 to 17. One infant was not started until the 17th day of life, at the mother’s request to do the CD recording after the Christmas holidays. Twins were started on the 15th day of life due to possible infectious disease; once the lab results came back negative, mother was contacted and the recording was completed within two days.

Mean weight gained per day was 17.70 grams for infants in the experimental group and 16.95 for infants in the control group. A t-test indicated that there was no difference between groups for weight gained, \( t(18) = -0.214, p > .05 \), and number of days in hospital, \( t(18) = 0.53, p > .05 \). Infants in the experimental group left the hospital two days sooner than those in the control group, at an average of 15.6 days, compared to those in the control group who left the hospital in 17.8 days.

Comparison of Preterm and Full-term Mothers

Results indicated that experimental preterm mothers scored the highest on the PPI, indicating less adjustment to their baby and lifestyle changes compared to control preterm mothers as well as experimental and control full-term mothers (see Table 23). Interestingly, control preterm mothers scored the lowest on the PPI. Preterm mothers in the control group reported greater mother-infant bonding, followed by experimental preterm mothers, then control full-term mothers, and lastly, experimental full-term mothers. Preterm mothers in the experimental group reported the greatest number of medical complications, followed by
experimental full-term mothers; preterm mothers in the control group reported the least medical complications. Six of the 8 preterm experimental mothers reported medical complications compared to 3 out of 8 control mothers; 7 of 27 full-term experimental mothers and 9 out of 27 full-term control mothers reported medical complications.

Overall, results indicated greater value and use of music by experimental preterm and experimental full-term mothers. Preterm mothers in the experimental group scored highest on the Value of Music Scale and use of music, with the next highest scores by full-term experimental mothers. Similarly, preterm mothers in the experimental group had the highest mean score for comments made at the end of the survey, followed by experimental full-term mothers. Experimental preterm mothers and then full-term experimental mothers used general music the most with their infants. Greatest time spent singing to infants was by full-term experimental mothers, followed by preterm experimental, full-term control, and then preterm control. The personalized CD was used more by full-term mothers in the experimental group than by preterm mothers. Full-term mothers in the both groups indicated that they used music with their infants during quiet time or to calm their fussy infants, especially the experimental mothers’ use of their personalized CD, while preterm mothers in both groups indicated that they mostly used music with their infants at no specific time. Full-term and preterm mothers reported that the behavior their infants evinced the most in response to music was listening and attending to music.

Several interesting trends occurred for the correlations between the PPI and other variables for full-term and preterm mothers (see Table 24). There was a relationship between first-time mothers and adjustment to the new baby and lifestyle changes, especially for full-term mothers in the experimental group who did not easily adjust to the new baby and lifestyle changes; there was no relationship evident between these two variables for preterm mothers in the control group. There was a greater relationship between marital status and scores on the PPI for preterm mothers than full-term mothers, indicating married mothers reported less adjustment to the new baby and lifestyle changes. The relationship for medical complications and adjustment to the new baby and lifestyle changes indicated more medical complications were associated with less adjustment, which was greatest for full-term mothers in the experimental group, followed by preterm mothers in the control group, and then preterm mothers in the experimental group; full-term mothers in the control group had the least relationship. One preterm mother in the experimental group who did not have medical complications scored high
Table 23. Comparison of Mean Scores for Full-term and Preterm Mothers in Experimental and Control Groups.

<table>
<thead>
<tr>
<th></th>
<th>Full-term</th>
<th></th>
<th>Preterm</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Experimental</td>
<td>Control</td>
<td>Experimental</td>
<td>Control</td>
</tr>
<tr>
<td>PPI</td>
<td>4.56</td>
<td>4.30</td>
<td>5.25</td>
<td>3.88</td>
</tr>
<tr>
<td>Mother-Infant Bonding Scale</td>
<td>19.11</td>
<td>19.22</td>
<td>19.38</td>
<td>19.63</td>
</tr>
<tr>
<td>Medical Complications</td>
<td>.56</td>
<td>.41</td>
<td>.88</td>
<td>.38</td>
</tr>
<tr>
<td>End of Survey Comments</td>
<td>1.56</td>
<td>.41</td>
<td>2.5</td>
<td>.50</td>
</tr>
<tr>
<td>CD Importance Score</td>
<td>12.61</td>
<td>NA</td>
<td>13.86</td>
<td>NA</td>
</tr>
<tr>
<td>General Music Use</td>
<td>2.85</td>
<td>2.59</td>
<td>2.88</td>
<td>2.63</td>
</tr>
<tr>
<td>Personalized CD Use</td>
<td>2.48</td>
<td>NA</td>
<td>1.75</td>
<td>NA</td>
</tr>
<tr>
<td>Time Spent Singing</td>
<td>4.1</td>
<td>3.5</td>
<td>3.63</td>
<td>2.83</td>
</tr>
</tbody>
</table>

Table 24. Comparisons of Correlations for Full-term and Preterm Mothers in Experimental and Control Groups.

<table>
<thead>
<tr>
<th></th>
<th>Full-term</th>
<th></th>
<th>Preterm</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Experimental</td>
<td>Control</td>
<td>Experimental</td>
<td>Control</td>
</tr>
<tr>
<td>PPI &amp;:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>First-time Mothers Vs. Several Children</td>
<td>-.38</td>
<td>-.25</td>
<td>-.18</td>
<td>0</td>
</tr>
<tr>
<td>Marital Status</td>
<td>.11</td>
<td>-.01</td>
<td>.25</td>
<td>.20</td>
</tr>
<tr>
<td>Medical Complications</td>
<td>.55</td>
<td>.15</td>
<td>.22</td>
<td>.49</td>
</tr>
<tr>
<td>Mother-Infant Bonding Scale &amp;:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>First-time Mothers Vs. Several Children</td>
<td>.28</td>
<td>.21</td>
<td>.36</td>
<td>-.26</td>
</tr>
<tr>
<td>Marital Status</td>
<td>.11</td>
<td>-.01</td>
<td>-.36</td>
<td>.75</td>
</tr>
<tr>
<td>Medical Complications</td>
<td>-.29</td>
<td>0</td>
<td>-.34</td>
<td>.07</td>
</tr>
<tr>
<td>PPI</td>
<td>-.53</td>
<td>-.23</td>
<td>-.11</td>
<td>-.35</td>
</tr>
<tr>
<td>Value of Music Score &amp; Amount of Music Used</td>
<td>.47</td>
<td>.41</td>
<td>-.05</td>
<td>.31</td>
</tr>
<tr>
<td>CD Importance Score &amp; Amount of CD Used</td>
<td>.59</td>
<td>NA</td>
<td>.35</td>
<td>NA</td>
</tr>
<tr>
<td>CD Importance Score &amp; PPI</td>
<td>.14</td>
<td>NA</td>
<td>.28</td>
<td>NA</td>
</tr>
<tr>
<td>CD Promoted Bonding &amp; Mother-Infant Bonding Scale</td>
<td>.57</td>
<td>NA</td>
<td>.38</td>
<td>NA</td>
</tr>
<tr>
<td>Comments at End of Survey &amp;:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PPI</td>
<td>.49</td>
<td>-.12</td>
<td>.24</td>
<td>.35</td>
</tr>
<tr>
<td>Medical Complications</td>
<td>-.08</td>
<td>.12</td>
<td>.94</td>
<td>.82</td>
</tr>
<tr>
<td>Mother-Infant Bonding Scale</td>
<td>-.23</td>
<td>.30</td>
<td>-.11</td>
<td>.18</td>
</tr>
<tr>
<td>Music Importance Scale</td>
<td>.16</td>
<td>.24</td>
<td>.11</td>
<td>.45</td>
</tr>
<tr>
<td>CD Importance Score</td>
<td>.17</td>
<td>NA</td>
<td>.32</td>
<td>NA</td>
</tr>
</tbody>
</table>
on the PPI, possibly skewing data results for the correlation, considering that these mothers had
the highest mean PPI score and medical complications score.

Several variables were interrelated to the Mother-Infant Bonding Scale.Mother-infant
bonding scores for first-time mothers versus mothers of several children indicated that mothers
with several children had better bonds with their infants, especially experimental preterm
mothers; interestingly, there was an inverse relationship for preterm control mothers and mother-
infant bonding scores, with first-time mothers having higher mother-infant bonding scores than
those who already had children. Marital status also was related to mother-infant bonding for
preterm mothers more than full-term mothers, with single preterm mothers experiencing greater
bonding with their infants. The relationship between medical complications and mother-infant
bonding also indicated that preterm and full-term mothers in the experimental group experienced
less bonding with their infants. There was a very strong relationship between Mother-Infant
Bonding Scale and the PPI for full-term experimental mothers and very little relationship for
preterm experimental mothers. This indicated that as full-term experimental mothers reported
greater adjustment to the new infant, their score for mother-infant bonding also increased.

There was a strong relationship between the Value of Music Score and the amount of
general music played, especially by full-term experimental mothers but not for preterm
experimental mothers. While the correlation for preterm experimental mothers is negative and
extremely low, one mother did not use general music with her infant, resulting in skewed results.
For the full-term experimental mothers, there was a strong relationship between the CD
Importance Score and the amount of music used, which was even greater than the preterm
experimental mothers and greater than the correlation for the Value of Music Score and the
amount of music used. For experimental mothers in both groups there was very little relationship
between the CD Importance Score and the PPI. There was a strong relationship for the question
regarding whether the CD promoted bonding and the Mother-Infant Bonding Scale, especially
for the full-term experimental mothers.

Preterm mothers who reported increased medical complications also reported more
positive comments at the end of the survey, with a slightly greater relationship occurring for
mothers in the experimental group than mothers in the control group; the correlations for the full-
term mothers are not as strong. This difference might be due to the fact that two of the three
preterm control mothers that had medical problems also made comments at the end of the survey.
Similarly, all of the preterm experimental mothers who reported medical problems also made comments at the end of the survey. See Table 24 for all of the correlations for the preterm and full-term experimental and control mothers.

**Summary of Results**

- Full-term mothers in the control group indicated slightly greater adjustment to the new baby and lifestyle changes than mothers in the experimental group.
- Correlations indicated that first-time mothers indicated less adjustment to their new babies and lifestyle changes, and this occurred to a greater degree for full-term experimental mothers.
- As full-term mothers reported greater medical complications, they also reported less adjustment to lifestyle changes and their new baby. The experimental group had a stronger correlation, which was significantly different from the control group’s correlation.
- Full-term control mothers reported a slightly greater mother-infant bond than experimental mothers.
- There was a strong inverse correlation between full-term experimental mothers’ scores on the PPI and Mother-Infant Bonding Scale, with mothers who were not adjusting to their new baby and lifestyle changes reporting less bonding with their infants.
- Full-term experimental mothers rated music more positively than mothers in the control group.
- Full-term experimental mothers rated the CD of their singing as being very important for their babies. A strong relationship occurred between the CD Importance Score and Mother-Infant Bonding Scale.
- A significant difference occurred between full-term experimental and control mothers’ positive comments about mother-infant bonding and/or music at the end of the survey; experimental mothers made more comments about the CD or music, mother-infant bonding, and using music to promote bonding.
- Preterm experimental mothers indicated less adjustment to the new baby and lifestyle changes compared to preterm control mothers.
- Preterm control mothers reported a slightly greater mother-infant bond than experimental mothers.
There was a correlation between marital status and the Mother-Infant Bonding Scale; single preterm mothers in both groups reported greater mother-infant bonding.

A significant difference occurred for the Value of Music Scale, with preterm experimental mothers rating music more positively compared to mothers in the control group.

A very strong relationship existed between scores on the CD Importance Score and mothers’ report that the CD helped them to cope with their infants’ stay in the NICU.

A strong relationship occurred between mothers’ reports that the CD helped them to cope with their infants’ stay in the NICU and the Mother-Infant Bonding Scale.

A significant difference occurred between preterm experimental and control mothers’ positive comments regarding mother-infant bonding and/or music at the end of the survey; all experimental mothers expressed appreciation and thanks. Most mothers stated that they felt better knowing that their infant was listening to their voices when they were not able to be there.

There was no significant difference between preterm experimental and control infants’ weight gain and length of hospital stay; preterm experimental infants went home 2 days sooner.

Comparisons between full-term and preterm mothers revealed that the preterm experimental mothers indicated the least adjustment to the new baby and lifestyle while the preterm control mothers indicated the greatest adjustment.

Full-term and preterm experimental mothers indicated greater value for music and use of music than full-term and preterm control mothers.

Experimental mothers in both groups sang more to their infants compared to control mothers in both groups.

Full-term mothers in both groups indicated that they used music with their infants during quiet time or to calm their fussy infants, especially experimental mothers’ use of their personalized CD. Preterm mothers indicated that they used music at no specific time.

Full-term and preterm mothers reported that the behavior their infants evinced the most in response to music was listening and attending to music.

Based on full-term and preterm experimental mothers’ songs choices, *You are My Sunshine* was the most popular song choice, followed by *Twinkle, Twinkle Little Star* and then the individualized Brahm’s *Lullaby*. 
CHAPTER 5

DISCUSSION

Full-term Mothers

In summary, mothers in the experimental and control groups scored similarly on the Parental Perception Inventory, Mother-Infant Bonding Scale, and the Value of Music Scale; however, there was a significant difference in comments made by mothers, with more positive comments from mothers in the experimental group. In addition, more mothers in the experimental group indicated that they sang to their infants on daily basis than mothers in the control group, which might be attributed to many factors in the study. Furthermore, the mothers in the experimental group commented on the value of the CD and the memory of creating the CD for their infants and expressed appreciation for the opportunity.

Mothers in the experimental group scored slightly lower on the Parental Perception Inventory, indicating less adjustment to their infant and lifestyle changes. While neither marital status nor type of delivery had any effect on the Parental Perception Inventory, several other factors emerged as possible influences on mothers’ responses. There were more first-time mothers in the experimental group, and these mothers indicated less adjustment to their infant and lifestyle changes than did first-time mothers in the control group. A possible confounding variable was the fact that more medical complications were experienced by more experimental mothers than control mothers. A significantly greater positive relationship existed for experimental mothers’ medical complications and PPI scores than for control mothers’ medical complications and PPI scores. Despite medical complications, some mothers still wished to participate in the experimental group, and later reported positive comments about their participation. One mother who experienced great complications in the hospital due to a Cesarean section wanted to participate but asked the researcher to come back the next day when she felt better. As it was, this mother remained hospitalized for 5 days due to Cesarean section complications and was appreciative of the interaction during the CD recording process on the fourth day. On several occasions mothers also requested coming back to them later on in the day,
or even the next day, as they were not feeling well at the time that informed consent was obtained.

Overall, more mothers in the control group reported not using music and not singing to their infant compared to those in the experimental group. Results of this study coincide with other research findings regarding use of music with infants. Thirty-eight percent of experimental mothers reported using their personalized CD daily, and 66% percent of the experimental and control mothers reported using music daily. These data coincide with Custodero and Johnson-Green’s (2003) study, in which 64.5% of the parents reported playing music for their children daily, 22% reported more than once a week, and 11% reported once a week or less. In the present study, 11% of the control mothers reported never playing music, 7% of the experimental mothers reported never playing their personalized CD, and 4% never played any type of music compared to the 3% of the parents that reported never playing music in the Custodero and Johnson-Green study.

Campbell (2000) found that low-income and primarily minority caregivers reported little use of a classical CD sent home with their babies from the hospital; use of the CD in the past year was between seldom and sometimes, with 17.3% reporting that they never used it, 18.5% reported seldom, and 32.1% reporting sometimes. Average use within the past month was rated between never and seldom, with 66.7% reporting that they had never used it, 11.1% reporting using it once or twice, and 17.3% reporting using it 3 to 4 times. These caregivers, however, reported a high use of other music, such as rhythm and blues and jazz music. Conversely, the highly educated parents from the Custodero and Johnson-Green (2003) study reported playing classical music more than other types of music for their infants. Researchers and clinicians should take into account families’ cultural background when implementing music treatment or when investigating music used with infants.

While 69% of the parents in the Custodero and Johnson-Green study reported that they sang daily, 80% of the mothers in this experimental group sang daily. On the other hand, only 55% of the control parents sang daily. Furthermore, 6% of the parents in the Custodero and Johnson-Green study reported never singing, and 9% of the control parents in this study reported the same; however, none of the mothers in the experimental group reported never singing to their baby. The process of making the CD recording might have provided parents the opportunity to realize that they knew many songs that would be appropriate to utilize with their infants. Many
mothers reported that they did not know many lullabies or children songs, but often started commenting on the songs that they knew once they read the list of songs that was provided by the researcher. Another explanation for this high frequency of singing in the experimental group compared to the control group, as well as the Custodero and Johnson-Green study, might be attributed to the fact that those mothers in the experimental group realized, via the research study, the importance of singing to their infant. Some mothers even commented that they realized that this was important for the baby, despite the fact that they felt self-conscious singing. Some of the experimental mothers stated that they only sang when alone or played the CD of their singing during the day when other family members were not present. The encouragement and positive feedback given to the mothers during the recording process might have given them confidence about their singing, and thus have positively empowered them to sing.

Even though the classical CDs sent home in the Campbell (2000) study resulted in little use by the parents, the results of the present study indicate that creating a personalized CD of each mother’s singing resulted in the positive use of music in the home environment. All but two mothers of the experimental group reported using their CD at home. One mother in the experimental group reported using only the personalized CD of her singing and no other type of music, 4 mothers reported using their personalized CD of their singing more than other types of music, and 9 mothers used the personalized CD the same amount of time as other music. Thus, more than half of the mothers utilized the CD on an equal or greater basis compared to using other music.

Many mothers found the personalized CD of their singing beneficial for calming their infants and for promoting mother-infant bonding. Previous researchers have indicated that infants ages 2-8 months preferred their mother’s voice more than any other female and more than music; younger infants preferred mother’s voice more than older infants (Standley & Madsen, 1990). Other researchers reported calming effects of music; two-thirds of the caregivers in one study reported that playing classical music had a calming, soothing, and relaxing effect on infants as well as helping infants to sleep (Campbell, 2000) and 62% of the respondents in another study reported that they used music to strengthen the bond between parent and child (Johnson-Green & Custodero, 2002). Many mothers in the present study reported similar uses of the personalized CD in the open-ended question at the end of the survey. One mother stated that she used the personalized CD when she was too tired to even think at the end of the day. She
often played the CD while holding her infant, prior to putting her infant down to sleep; she found this time period of music listening relaxing for her and her infant. Another mother found the personalized CD beneficial at times when her infant was crying and waiting for a bottle. She played the CD for her infant while she was in the kitchen, working quickly to prepare and heat the bottle. Both of these mothers, as well as others, found creative ways to use their CD.

Combined scores for experimental and control mothers indicated the greatest use of music was to calm infants, followed by using music to put infants to sleep and then at no specific time. Some experimental and control mothers reported using music during the transitional times of feeding and diaper changing, and several mothers reported using music during car rides. Other researchers have found similar results, with 20% of parents reporting using music during routines such as bathing, feeding, or changing as well as during car rides (Johnson-Green & Custodero, 2002). These are important times in which mothers can incorporate singing and music to enhance daily interactions and create bonding moments. Mothers in the control group reported using swings, bassinets, and vibrating seats that have the preprogrammed, repetitive electronic music compared to the mothers in the experimental group, who did not report using these devices. It seems possible that the personalized CD promoted a variety of ideas of music use for experimental mothers compared to control mothers. Only 11 mothers from both groups reported using music to stimulate their infant, while many mothers utilized music for its calming effect.

The minimal use of music for stimulation provides many implications for music therapists and educators concerning the importance of promoting and teaching mothers appropriate methods of using music to stimulate their infants. De l’Etoile (2001) implemented a music training program for child-care personnel who worked with infants and toddlers, and results indicated that their attitude improved regarding implantation of music activities, their music skills improved over time, and their knowledge about meaningful music activities resulted in positive benefits for the infants and toddlers. Future researchers might want to investigate the effects of a mother-infant music class on mothers’ use of music in the home environment and long-term effects on the infant.

Since many mothers reported using music to calm their infants, it was predictable that mothers reported that their infants ceased crying when music was played. Similarly, de l’Etoile (2005) found that infants reduced movement during infant-directed singing and during recorded music. Other interesting infant responses in the present study included looking for the sound
source, which is an important developmental objective. It is surprising that none of the experimental mothers reported that their infant responded with smiling to other types of music, but mothers reported that their infants ceased crying and smiled in response to the CD of their singing more than other music. This type of response might have been reinforcing to the mothers and resulted in further singing interactions which continued to increase frequency of these interactions and as a result, mother-infant bonding increased. In one study, infant-directed singing resulted in different responses compared to other maternal interactions (de l’Etoile, 2005). De l’Etoile found that infants ages 6 to 9 months attended more to infant-directed singing more than when mothers read a book, played with a toy, and when mother and infant listened to recorded music.

Results reported herein indicated that *You Are My Sunshine* was the most popular song chosen by mothers, followed by *Twinkle, Twinkle Little Star*, and then *Brahm’s Lullaby*. Other songs that were chosen frequently included *I’m a Little Teapot*, *ABC Song*, and *Itsy Bitsy Spider*. These choices are similar to results from an online survey by Johnson-Green and Custodero (2002, who found that most parents reported that their baby’s favorite song was *Itsy Bitsy Spider*; (Johnson-Green & Custodero, 2002). While the sample in both of these studies indicated a high response for children’s songs, Custodero and Johnson-Green (2003) found differing results for the types of songs parents sang to their infants, based on a sample in which parents were more highly educated than the national average and resided in two-parent households. They found that 66% sang lullabies, 21% created their own songs, and 13% sang popular songs. The sample in the present study was fairly evenly distributed between single and married mothers who were Caucasian and African American, and many did not sing lullaby-type songs, such as *Rock-a-Bye Baby*. A majority of the mothers liked the idea of individualizing lyrics to *Brahm’s Lullaby* and chose to do so. These mothers seemed proud of the songs that they composed, and it is evident that each mother had incorporated phrases into the song that were meaningful in her life (see Appendix Q). Nevertheless, there were several mothers that stated that they did not know the lullaby, even after the researcher sang the melody, or they recognized the tune but did not feel like they knew it well enough to sing comfortably all the way through. Future researchers and clinicians might want to create another individualized song to the tune of a familiar song so that all mothers could participate in this aspect of the study if they desired. Other mothers were excited about singing multiple children’s songs, show tunes, or even songs in various languages.
rather than spending time on the individualized lullaby. In one instance, one husband wanted his wife to sing the individualized lullaby, but she did not think they had time to write the lullaby and she did not feel extremely comfortable singing it by herself. Since the mother had already recorded several songs by herself, the researcher informed the couple that they could sing the original tune together if they wanted, and they both agreed that this was a viable alternative.

The recording process brought about many other unpredictable occurrences. At times mothers said they were extremely interested in participating, but family was visiting; they asked if it was possible to come back at a later time after friends and family had left. Only a few mothers recorded with friends and family in the room and several sent their family out during the recording process. During one mother’s recording process, family friends arrived after we had recorded several songs, and she decided that she wanted her close friends to participate in singing several more songs with her for the baby. The mother and her friends responded that they had fun choosing the songs and making the CD. In other cases, mothers involved their other children in the process, having an older sibling record one or two songs on the CD for the new baby.

One consideration for music therapy clinicians working with this population is to be sensitive to the mothers’ self-confidence when singing. Many mothers vocalized concern about the quality of their singing and seemed very insecure of their voices, which was especially evident when mothers made family members leave the room during the recording process. Some mothers even asked if their singing would result in harm to the infant. The therapist helped ease the mother through the singing process by providing encouragement and by practicing the songs prior to recording. The therapist instructed the mother to sing the first line or two of the song, and then determined the key that the mother was singing for each song. Many mothers preferred lower keys and did not want to sing in the upper register of their voice. A practice trial before recording each song seemed to help the mothers and provided opportunities for questions and clarification, such as when to start singing. During the practice trial, the researcher often started singing with the mother, and then gradually faded her singing as the mother seemed more comfortable. Picking and strumming patterns were primarily determined by each mother’s rhythmicity and style of song. In general, most mothers sang in rhythm and on pitch throughout each song. For a few mothers the perfect fifth in *ABC Song* and *Twinkle, Twinkle Little Star* and
other large ascending intervals in songs were slightly flat; however, they still managed to return to the original key after the altered interval.

Other information obtained in the course of the study involved postpartum depression, with two mothers in the experimental group and one mother in the control group reporting varying degrees of postpartum depression. As of late, researchers have determined that postpartum depression is apparent across marital status, all age groups, and varying socioeconomic backgrounds (Josefsson, Angelsioo, Berg, Ekstrom, Gunnervik, Nordin, & Sydsjo, 2002; Yonkers, Ramin, Rush, Navarrete, Carmody, March, Heartwell, & Leveno, 2001). Furthermore, years married and parity had no effect on efficacy or depression of mothers (Cutrona & Troutman, 1986). Recently researchers have pinpointed that high depression rates occurred during late pregnancy and at the maternity ward rather than later (Josefsson, Berg, Nordin, & Sydsjo, 2001). Thus, if postnatal depression is detected in late pregnancy, early intervention can occur.

For many mothers depression begins to occur on day 3 postpartum, about at the same time that they are discharged from the hospital (O’Hara, Zekoski, Philipps, & Wright, 1990). This depression might be due to mothers’ realizations that child care may interfere with lifestyle or normal hormonal readjustment. Depressive symptoms peaked at 3 weeks postpartum, a time when mothers are recuperating from childbirth and taking care of a new baby, and these symptoms have mostly faded by 6 weeks postpartum (O’Hara et al., 1990).

When asked if they have been very tired, somewhat tired, or not tired since the baby’s birth, mothers in both groups often reported feeling tired, and even laughed. Twenty-two percent of the mothers in the control group reported being very tired and 40% reported being somewhat tired compared to 33% of the mothers in the experimental group who reported being very tired and 56% being somewhat tired. These percentages are similar to those reported by other researchers, in which 42% of the mothers at four weeks postpartum who reported that they often felt tired (Dennis & Ross, 2005).

One of the mothers who reported feelings of postpartum depression as well as other medical complications reported she did not use the CD with her child, with the reason being was that she was sleep deprived. Other researchers have found that mothers who evinced major depressive symptoms often reported that their babies cried often, they were woken up 3 or more times from 10 pm to 6 am, received less than 6 hours of sleep during a 24-hour period during the
past week, indicated that their baby did not sleep well, and believed that their infants’ sleep pattern resulted in their not receiving enough sleep (Dennis & Ross, 2005). While this mother was excited about the research project at the hospital, and even requested notification of the final results, she still did not utilize the CD other than one time, in which she reported that her infant did not seem to respond to the music.

Based on this information, future researchers and clinicians might want to investigate the possibility of working with mothers and making a personalized CD with the mothers during the last trimester of pregnancy. Other music therapy interventions might also assist with the onset of depressive symptoms, especially prior to birth. Music therapy interventions seem crucial at the time of discharge from the hospital through the first four weeks, especially since postpartum depression peaks during that time period. Future implications for music therapy interventions are necessary to negate the negative effects of postpartum depression on infants. Infants of depressed mothers evinced less positive interaction with mothers and with strangers, and their interactive behavior generalized across situations and with others; strangers even responded differently to depressed infants, due to the infants’ behavior negatively influencing strangers’ behavior (Field, Healy, Golstein, Perry, Brendell, Schanberg, Zimmerman, & Kuhn, 1988). While, infants of mothers with and without depressive symptoms evinced no difference in affect, brain activity indicated that infants of mothers with symptoms evinced different hemispheric activation, especially greater activation in the right hemisphere, which is associated with emotions of withdrawal. Other music therapy interventions might involve teaching mothers how to engage with their infants through highly structured interactive musical activities. Music therapists can provide mothers with age appropriate musical interactions in which the mothers as well as infants experience success.

Several limitations of this study were evident and might be noted for future research. The scales for the Parental Perception Inventory might be rated on a 1-5 scale rather than the 3-point scale used, as some mothers indicated that they thought that the answers did not indicate how they felt. For example, several mothers reported that they were worried about their baby, but did not think that “not been able to stop worrying” or “worried quite a bit” was appropriately weighted to indicate their level of concern, which was between quite a bit and “not worried”. Future researchers may attempt to counterbalance the number of first time mothers in control and experimental groups to decrease differences in groups. Controlling for medical complications
might take greater efforts and coordination through the medical treatment team. Another consideration for future research involves changing the research design, from a post-test only design, to determine the effectiveness of the intervention for each mother. Examples include utilizing a pretest during the last trimester or a pretest within the one-to-two days after delivery. Another factor that might have affected outcomes involved the rapport that was developed with mothers during the time period of process of making the CD, which often took more than 30 minutes to record the songs. The mothers in the experimental group seemed to enjoy talking with the researcher. This relationship might have resulted in genuine and honest answers during the follow-up phone survey from these mothers versus mothers in the control group, in which the only time spent with these mothers was during the time period of obtaining consent.

**Preterm Mothers**

Overall, preterm mothers in the control group scored higher on the PPI and slightly higher on the Mother-Infant Bonding Scale; however, mothers in the experimental group reported more medical complications, with more mothers reporting problems and these mothers reporting multiple complications. Preterm mothers in the experimental group had higher scores for the Value of Music Score, the amount of general music used, and amount of time spent singing. While these mothers did not use the personalized CD at home as often as other types of music, these mothers commented on the importance of their infants hearing their singing in the NICU. They indicated that knowing their infant listened to the CD of their singing helped them to cope with their infants’ stay in the NICU, especially when medical complications as well as returning to work hindered their ability to visit their infants. This was evident when examining the relationship between the CD Importance Score and mothers’ reports that the CD helped them to cope with their infants stay. Furthermore, there was a significant difference between the comments made by mothers at the open-ended section at the end of the survey, with more positive comments regarding music and mother-infant bonding from mothers in the experimental group.

Future researchers might think of using a different design from the post-test only design or utilizing the PPI while the infants are still in the hospital. Some of the preterm mothers indicated that they were happy and calm once their infant was discharged, but their answers
would have been different during the time that their infants were in the NICU. One mother reported that she was upset whenever she saw other babies while her baby was still at the hospital; after her infant’s discharge she felt encouraged when other babies were seen. This mother also reported at the time of the follow-up survey that she worried about the baby quite a bit; however, when her infant was in the NICU she could not stop worrying about her. During her infants stay in the NICU she also worried somewhat about her ability to cope, which now is not as much of a problem. With this mother the timing of the survey would have influenced her responses, as previous researchers have reported many emotional needs of mothers with infants in the NICU (Brooten et al., 1988; Pederson et al., 1987; Singer et al., 1996). Mothers of premature infants experienced great amounts of anxiety, depression, and hostility that occurred from the time the infant was born and continued through the period before the infant was discharged; this decreased by the time the infant was nine months old (Brooten et al., 1988; Pederson et al., 1987). Mothers also continued to cry and experience guilt and shock, even at the end of their infants’ hospitalization (Pederson et al., 1987). Mothers of VLBW infants evinced substantial amounts of distress, especially those who believed they lacked social support; thus, the neonatal period may be the optimal time to identify mothers at risk (Singer et al., 1996). Based on the finding from this dissertation, two weeks after discharge mothers were already reporting decreased stress and anxiety.

The stress and anxiety of preterm mothers abated after their infants were discharged from the hospital, but emotional distress during their infants’ hospitalization was often evident. One mother confided to the researcher upon the initial visit to obtain consent, “I am willing to do anything to help my baby. I am so worried about her that I often just sit in the room to be with her with the port holes open. Sometimes I worry about holding her because I’m scared I will overstimulate her, so I just sit here in the room with her. I really appreciate you doing this for me.” In the follow-up survey, she commented that this opportunity should be provided for all mothers. “It put me more at ease to know you were playing the CD when I went back to work. I feel that this helped our mother-infant relationship.”

The mother with the highest score on PPI reported extremely high emotional distress after her son was discharged, seemingly due to her son’s apnea episodes at home. She stated that she was scared to turn her back to him for fear that she would not realize that he had stopped breathing and was turning blue. She completed the follow-up survey three days after he was
discharged from the hospital for the second time. This mother also stated during the follow-up survey, “I have been singing to him, which is why I have not used the CD as much. I have found the two songs that calm him, *Jesus Love Me* and the *ABC Song*” (both songs were on the CD). “My baby was back in the hospital from Sunday to Friday of this past week due to apnea episodes. While he was there he had several nights in which he was very upset and I sang and sang to him to the point in which my voice went out, but it seemed to be the only thing that would calm him.”

Rapport was developed with most preterm mothers during the process of making the CD, even more so than the mothers of full-term infants, especially when mothers confided in the researcher their concerns about their infants. This relationship might have resulted in genuine and honest answers on the survey from these mothers, especially in the comments that occurred at the end of the survey. Future researchers might incorporate music versus nonmusic interventions so that a similar rapport would be established with all mothers. Similarly, rapport was also developed with the medical staff. By the end of the study, several nurses reported to mothers that their infants were listening to their singing, providing this information when mothers called in to check on their infants at times that they could not visit their infant.

Many mothers seemed to enjoy picking out the songs for the CD recording as well as writing the individualized song to Brahm’s *Lullaby*. These mothers often incorporated very personal messages to their infants (see Appendix R for lyrics). One mother ended the song by telling her infant, “Please, go to sleep, ‘cause you really need your rest. We hope you can come home, sooner than later.” The recording process was therapeutic for this mother, as she had commented at the end of the music recording process, “I’m really glad that you came today because I was really feeling depressed and worrying about my baby this morning, being all by myself up here. The doctors temporarily put him on the ventilator this morning.”

Similar to the full-term mothers, these mothers also worried about the quality of their singing and seemed insecure. One husband wanted his wife to participate, but it took her more than two weeks before she decided to follow-through with the CD recording; she seemed very concerned about the quality of her singing, despite reassurance from the researcher during the recording process. Her babies, however, were discharged from the NICU two days after the recording and data were not used due to the short treatment period. Another mother commented that her voice was not so good, but that she realized the importance of her infant hearing her
singing. When I arrived the next day to record her singing, she had commented that she had called all of her family members to ask them what tunes they thought they would sing to her infant. She recorded those songs and staid, “Now I can sing these songs and record them so that my son will become familiar with the tunes while at the hospital.”

Other mothers also seemed concerned about singing, asked where the recording would take place, and wanted to know if nurses would overhear their singing. Based on this information, it is possible that mothers might not sing during visits, since singing is a very personal interaction with their infants, and nurses and other hospital personnel are often moving in and out of the infants’ rooms. In most rooms two to three infants resided, and sometimes parents’ visits overlapped. Thus, those times that the researcher played the CD of the mother’s singing might have been the only opportunities for the infant to hear her singing while in the NICU. Future research questions might include asking mothers how often they sang to their infant in the NICU.

Pederson et al. (1987) found that 32% of the mothers reported feelings of alienation from their premature infant, which involved feeling like the infant was not hers and worrying about feeling close to her infant after discharge. Many mothers in this study stated that knowing their infant listened to the CD recording of their voice helped them to cope with their infants’ stay in the NICU and they also felt like it helped with the mother-infant bonding. Pederson et al. also found that many mothers experienced difficulties in visiting their infant, including arrangements in transportation to visit the infant or child care for other siblings or due to expense of traveling to visit at the hospital. The nurses at the hospital stated how great it was for the infant to still hear the mother’s voice, especially since two mothers had a difficult time in arranging transportation to the hospital. Pederson also found that more than half of the mothers felt their infants would need special preparations for infant when at home, including physical care and monitoring the infant. Future research might incorporate other music therapy techniques to help the mother cope with the additional needs of the infant, use music in an appropriate manner to facilitate mother-infant bonding, and use music to help the infant to develop appropriate developmental skills.
Preterm Infants

While there were no significant differences in weight gained and number of days in the hospital between infants in the experimental and control groups, infants in the experimental group went home two days sooner. Possible differences in this study parallel another study, in which infants with respiratory disorders who received 20 minutes of recorded sedative music for four days evinced no significant differences for heart rate, respiration rate, oxygen saturation rate, and infant behavior (Calabro, Wolfe, & Shoemark, 2003). These authors thought that the music did not establish an effect on infants due to not enough exposure. Infants in the Caine (1991) study received an hour and a half of music every day until time of discharge, and infants in the experimental group went home 5 days sooner. Recently, researchers have been providing four hours of music listening to premature infants who were between 25 to 30 weeks gestational age, and results indicated that the length of hospital stay was significantly reduced, with infants leaving 7 days earlier than those receiving standard care and 12 days earlier than those receiving ear muffs for four hours a day (Baily, Kantak, Jarjoura, Reuman, & Knatak, 2005). In a follow-up study Bailey and Kantak (2005) indicated that eight hours a day resulted in negative effects, including longer length of hospital stay. Consequently, listening to mothers’ singing for longer periods, such as an hour and a half but no longer than four hours a day, might provide increased benefits.

Data were not collected on oxygen saturation rate, heart rate, or respiratory rate. Future researchers might want to investigate these variables, especially since several infants evinced positive physiological signs while listening to the CD. For example, on an extremely busy day in the NICU, a nurse checked on a 31 week CGA infant before giving the researcher permission to provide music listening. The nurse informed the researcher five minutes following the 20-minute music listening condition that the infant’s oxygen saturation levels went from 40% to 80% after music therapy, which was the only change in her routine that day. She took time out from her busy schedule to find the researcher since she thought that this positive information needed to be included in the dissertation.

Several times during the course of the study the music intervention occurred during routine care tasks despite efforts to provide the music intervention at appropriate times for infants and nurses. In one extreme case the CD of the mother’s singing was utilized while a nurse
was starting an IV; the 2 nurses in the room were surprised at the infant’s response, especially since she cried for a short time and then returned to a calm state rather quickly. Future researchers might investigate the use of the mothers’ voices to attenuate stress of preterm infants following medical procedures. Information regarding infants’ behavior states might provide valuable information. While data were not collected on either variable, the researcher often noticed that preterm babies who were nearing discharge often seemed to smile when they heard their mothers sing.

**Comparisons of Preterm and Full-term Mothers**

Comparisons between full-term and preterm infants revealed that experimental preterm mothers scored the highest on the PPI, indicating less adjustment to their baby and lifestyle changes compared to control preterm mothers as well as experimental and control full-term mothers. Surprisingly, control preterm mothers scored the lowest on the PPI. Preterm mothers in the control group reported the highest score for mother-infant bonding, followed by experimental preterm mothers, compared to full-term mothers. Preterm mothers in the experimental group reported the greatest number of medical complications, followed by experimental full-term mothers; preterm mothers in the control group reported the least medical complications.

Researchers found that mothers of preterm infants evinced greater psychological distress, including anxiety and depression, than mothers of term infants in the first postpartal week and at one month; these differences decreased by the seventh week (Carter et al., 2005; Gennaro, 1988; Singer et al., 1999). Based on this information, it seems unusual that preterm mothers in the control group reported the greatest bonding and adjustment to the new infant and lifestyle changes, with only 2 mothers reporting depression; 3 preterm experimental mothers also reported postpartum depression. The scores between the four groups, however, do not differ vastly, especially in regards to the Mother-Infant Bonding Scale. Researchers stated that most parents adjusted to NICU stay, and the anxiety and depressive symptoms were low and not greatly different for NICU and control parents (Carter et al., 2005).

Within this study it seemed that the medical complications might have possibly resulted in less adjustment to the new baby and lifestyle changes as well as the lower mother-infant bonding score for the experimental mothers. While rapport was established between
experimental full-term and preterm mothers, which might have resulted honest answers, it is also possible that the relationship resulted in greater awareness of the complications of a new birth or even brought out more insecurities regarding the baby and new motherhood responsibilities. Zeskind and Iacino (1984) found that mothers who frequently visited the NICU had more negative perceptions of their infants at the time of discharge and even six weeks later compared to mothers who did not visit as often; they theorized that the mothers were becoming familiar with their infants, and these perceptions indicated a more realistic view of the infant.

Despite less adjustment and mother-infant bonding scores, results indicated greater value and use for music by experimental preterm and experimental full-term mothers. Preterm and full-term experimental mothers scored higher on the Value of Music Scale, used greater amounts of music with their infants, and sang to their infants more compared to preterm and full-term mothers in the control group. Similarly, full-term and preterm mothers in the experimental group had higher mean score for comments made at the end of the survey. The personalized CD was used more by full-term mothers in the experimental group than by preterm mothers, which might have been due to the fact that preterm mothers might have viewed it primarily as an intervention for the NICU, especially since these mothers sang to their infants, played music more for their babies, and rated music as more important than any other group. Full-term mothers in both groups indicated that they used music with their infants during quiet time or to calm their fussy infants, especially experimental mothers’ use of their personalized CD, while preterm mothers in both groups indicated that they used music with their infants at no specific time. Mean responses indicated that full-term and preterm mothers reported that their infants listened and attended to music foremost.

Carter et al. (2005) reported that there is a small group of preterm parents who experience significant distress, and thus, intervention may be beneficial for these parents. Providing these mothers the opportunities to create a CD of their singing might be one intervention to provide these parents with locus of control of the situation. Furthermore, providing these parents the opportunity to create an individualized lullaby, providing a specific message to their infant, might further alleviate the turmoil of a premature birth. One noticeable difference between the experimental preterm and full-term mothers involved their individualized lullabies. Many preterm mothers sang that they hoped their infant was resting and gaining weight, others stated
that they wanted their infant to come home soon, and others told their infants that they were thinking and praying for them daily (see Appendices Q and R).

In summary, preterm and full-term mothers in the control group reported greater adjustment to the new infant and lifestyle changes compared to the preterm and full-term mothers in the experimental group. Further research is merited to determine if medical complications significantly affected their adjustment. On the other hand, those mothers who participated in the experimental groups tended to valued music more and utilize music more in the home. While the experimental full-term mothers expressed great appreciation for the opportunity to create the CD, it might not be cost-effective for music therapists to work with all mothers and newborn infants. Thus, future music therapists in the medical field might want to investigate the effects of creating a CD with full-term mothers who are experiencing postpartum depression. Based on the genuine responses from experimental preterm mothers throughout the course of their infants’ hospitalization, when answering the question regarding the importance of the CD in helping them to cope, when rating whether the CD helped promote mother-infant bonding, and during the open-ended section at the end of the survey, it seems important to continue to provide preterm mothers with a positive intervention to help them cope with the situation.
APPENDIX A

Florida State Human Subjects Committee Approval
Office of the Vice President For Research
Human Subjects Committee
Tallahassee, Florida 32306-2783
(850) 644-8633 · FAX (850) 644-4392

APPROVAL MEMORANDUM

Date: 10/27/2005

To: Andrea Covasco
MC 1180

Dept.: MUSIC THERAPY

From: Thomas L. Jacobson, Chair

Re: Use of Human Subjects in Research
Maternal emotional responses to singing and the effects of music and singing on
full-term and pre-term infants

The forms that you submitted to this office in regard to the use of human subjects in the proposal
referenced above have been reviewed by the Human Subjects Committee at its meeting on
10/12/2005. Your project was approved by the Committee.

The Human Subjects Committee has not evaluated your proposal for scientific merit, except to weigh
the risk to the human participants and the aspects of the proposal related to potential risk and
benefit. This approval does not replace any departmental or other approvals which may be required.

If the project has not been completed by 10/11/2006 you must request renewed approval for
continuation of the project.

You are advised that any change in protocol in this project must be approved by resubmission of the
project to the Committee for approval. The principal investigator must promptly report, in writing, any
unexpected problems causing risks to research subjects or others.

By copy of this memorandum, the chairman of your department and/or your major professor is
reminded that he/she is responsible for being informed concerning research projects involving
human subjects in the department, and should review protocols of such investigations as often as
needed to insure that the project is being conducted in compliance with our institution and with DHHS
regulations.

This institution has an Assurance on file with the Office for Protection from Research Risks. The
Assurance Number is IRB00000446.

cc: Jayne Standley
HSC No. 2005.762
APPENDIX B

Tallahassee Memorial HealthCare Institutional Review Board Approval
Tallahassee Memorial
HealthCare

Andrea Cevasco, MMEd, MT-BC
Principal Investigator
Tallahassee, FL 32301

September 27, 2005

RE: IRB #2005-14
Maternal Emotional Responses to Singing
and the Effects of Music and Singing on
Full-Term and Pre-term Infants

Dear Ms. Cevasco:

Following the presentation of your study to the Tallahassee Memorial Institutional Review Board on September 27, 2005, the above-named study was unanimously approved for one year to end September 27, 2006.

IRB # 2005-14 Maternal Emotional Responses to Singing and the Effects of Music
and Singing on Full-Term and Pre-term Infants
Principal Investigator: Andrea Cevasco
Informed Consent: Approved as is
Reporting Requirements: TMH IRB Policy & Procedure, IRB
Monitoring Of Research On Human Subjects.
Supplemental Reporting Requirements: None
Expiration Date: September 27, 2006
Continuation Review Date: September 27, 2006
Continuation Review Requirements: TMH IRB Policy & Procedure,
Scheduled Continuation of Review.

You will need to request approval throughout this study to make any amendments to either the study protocol or the informed consent. Additionally:
• Report to the IRB any planned change in the study and do not implement any change without receiving prior approval, except to eliminate immediate hazard;
• Report to the IRB any unanticipated problems involving risks to subjects;
• Report to the IRB any new information on the project that adversely influences the risk/benefit ratio;
• Report to the IRB any adverse events (AE)
For your records, a copy of the Informed Consent with stamped IRB approval, and the approved IRB Record of Approval of Requested Waiver is enclosed. Please provide a copy of your completed results to the Medical Staff Office at Tallahassee Memorial HealthCare so that the results can be archived and presented to the Institutional Review Board.

Sincerely,

[Signature]

Richard F. MacArthur, M.D.
Administrative Liaison/IRB

PWA 900006166
Tallahassee Memorial Healthcare, Inc. Institutional Review Board is organized and operates according to ICH-GCP standards and applicable laws and regulations.
APPENDIX C

Informed Consent for Full-term Mothers
INFORMED CONSENT FORM FOR MOTHERS OF FULL-TERM INFANTS

I _______________________ freely and voluntarily and without element of force or coercion, consent to be a participant in the research project entitled “Maternal emotional responses and the effects of music and singing on full-term and preterm infant.”

This research is being conducted by Andrea Cevasco, who is a doctoral student in Music Therapy at Florida State University. I understand the purpose of her research project is to determine the effects of music on infants. I understand that if I participate in the project I might be recorded singing or reading to my infant. Recording the CD will take 20 minutes during my hospital stay; if I desire, I have the option of using the CD recording for my baby in my home after being discharged from the hospital. I will also be asked questions concerning my feelings about my infant and myself two weeks after my infant is discharged from the hospital; the researcher will contact me either through e-mail or by telephone to complete the survey. The recording and the questionnaire will be kept by the researcher in a locked filing cabinet and I understand that only the researcher will have access to this information. All of the tapes and questionnaires will be destroyed by August 2006.

I understand my participation is totally voluntary and I may stop participation at anytime. All my answers to the questions will be kept confidential to the extent allowed by law and identified by a subject code number. Neither my name nor my infant’s name will appear on any of the results. No individual responses will be reported; only group findings will be reported. I understand that information will be taken from my infant’s medical records: date of birth, weight and gestational age at birth, and weight and date at discharge.

I understand there is a possibility of a minimal level of risk involved if I agree to participate in this study. I might experience anxiety when answering questions about my infant. Also, the infant may become restless due to the music, although this has not been observed in prior research with full-term infants.

I am also able to stop my participation at any time I wish. I understand that this consent may be withdrawn at any time without prejudice, penalty or loss of benefits to which I am otherwise entitled. I have been given the right to ask and have answered any inquiry concerning the study. Questions, if any, have been answered to my satisfaction.

I understand there are benefits for participating in this research project. First, my own awareness about my emotions and my infant may be increased. Also, I will be providing health care professionals with valuable insight into mothers’ feelings and behaviors regarding mother-infant bonding. This knowledge can assist music therapists in providing services that help mothers during and after stressful events concerning their infants. Furthermore, if I participate in this research study, I will receive a music CD after I complete the phone interview 2 weeks after my infant is discharged from the hospital.

I understand that I may contact the following for questions about this research or my rights: 1) Andrea Cevasco, Florida State University, College of Music, (850) 644-4565; 2) Dr. Jayne Standley, Florida State University, College of Music, (850) 644-4565; or 3) Florida State Institutional Review Board, (850) 644-7900, for answers to questions about this research or my rights. Group results will be Tallahassee Memorial HealthCare, Inc.

I have read and understand this consent form.

(Signature)

Address: ________________________________

City __________________ State ______ Zip Code ______

Phone number: ____________ E-mail Address (if available) ______________ 

TMH IRB # 2005-14

9-12-05

APPROVAL

Date of Approval 1-7-05

Date of Expiration 9-27-06

IRB# 2005-14

Version Date of Consent 9-12-05

Institutional Review Board
APPENDIX D

Informed Consent for Preterm Mothers
INFORMED CONSENT FORM FOR MOTHERS OF PRETERM INFANTS

I ___________________________ freely and voluntarily and without element of force or coercion consent to be a participant in the research project entitled “Maternal emotional responses and effects of music and singing on full-term and preterm infant.”

This research is being conducted by Andrea Cevasco, who is a doctoral student in Music Therapy at Florida State University. I understand the purpose of her research project is to determine the effects of music on infants. I understand that if I participate in the project I might be recorded singing or reading to my infant; recording the CD will take 20 minutes. This recording will be played for my infant during the hospital stay. I will also be asked questions concerning my feelings about my infant and myself two weeks after my infant is discharged from the hospital; the researcher will contact me either through e-mail or by telephone to complete the survey. The recording and the questionnaire will be kept by the researcher in a locked filing cabinet and I understand that only the researcher will have access to this information. All of the tapes and questionnaires will be destroyed by August 2006.

I understand my participation is totally voluntary and I may stop participation at anytime. All my answers to the questions will be kept confidential to the extent allowed by law and identified by a subject code number. Neither my name nor my infant’s name will appear on any of the results. No individual responses will be reported; only group findings will be reported. I understand that information will be taken from my infant’s medical records: date of birth, weight and gestational age at birth, and weight and date at discharge.

I understand there is a possibility of a minimal level of risk involved if I agree to participate in this study. I might experience anxiety when answering questions about my infant. Also, the infant may become restless due to the music, although this has not been observed in prior research with preterm infants. I also understand that the medical staff will advise me to stop the music at any time they feel it is harmful to the infant’s welfare.

I am also able to stop my participation at any time I wish. I understand that this consent may be withdrawn at any time without prejudice, penalty or loss of benefits to which I am otherwise entitled. I have been given the right to ask and have answered any inquiry concerning the study. Questions, if any, have been answered to my satisfaction.

I understand there are benefits for participating in this research project. First, my own awareness about my emotions and my infant may be increased. Also, I will be providing health care professionals with valuable insight into mothers’ feelings and behaviors regarding mother-infant bonding. This knowledge can assist music therapists in providing services that help mothers during and after stressful events concerning their infants. Furthermore, if I participate in this research study, I will receive a music CD after I complete the phone interview 2 weeks after my infant is discharged from the hospital.

I understand that I may contact the following for questions about this research or my rights: 1) Andrea Cevasco, Florida State University, College of Music, (850) 644-4565; 2) Dr. Jayne Standley, Florida State University, College of Music, (850) 644-4565; or 3) Florida State Institutional Review Board, (850) 644-7900, for answers to questions about this research or my rights. Group results will be sent to me upon my request.

I have read and understand this consent form.

(Participant) ___________________________ (Date) ____________

Address: ___________________________ City ___________________________ State ___________________________ Zip Code ___________________________

Phone number: ___________________________ E-mail Address (if available): ___________________________
APPENDIX E

Parental Perception Inventory
Parental Perception Inventory

Where are you staying now? ____________________________________________

Where is your baby: _____ Hospital    _____ Home    _____ Other

How many children do you have? ______________

Please place an X next to the statement that best describes you at this time.

1. Since our baby’s birth, I have
   _____ not been able to stop worrying about the baby
   _____ worried about the baby quite a bit
   _____ not worried about the baby

2. Since our baby’s birth, I have
   _____ not been happy about the baby
   _____ been happy about the baby once in awhile
   _____ been happy about the baby quite a bit

3. Since our baby’s birth, I have
   _____ cried in sadness a lot
   _____ cried in sadness occasionally
   _____ not cried in sadness at all

4. Since our baby’s birth, I have
   _____ felt extremely worried about my ability to take care of our family
   _____ felt somewhat worried about my ability to take care of our family
   _____ not felt worried about my ability to take care of our family

5. Since our baby’s birth, I have
   _____ been pessimistic or negative about our baby’s future
   _____ had questions about our baby’s future
   _____ been optimistic or positive about our baby’s future

6. Since our baby’s birth, I have
   _____ been very tired
   _____ been somewhat tired
   _____ not been tired
7. Since our baby’s birth, I have
   _____ felt very guilty about our baby’s situation
   _____ felt somewhat guilty about our baby’s situation
   _____ not felt guilty about our baby’s situation

8. Since our baby’s birth, I have
   _____ felt totally helpless
   _____ felt somewhat helpless
   _____ not felt helpless

9. Since our baby’s birth, I have
   _____ often feared losing touch with reality
   _____ sometimes feared losing touch with reality
   _____ not feared losing touch with reality

10. Since our baby’s birth, seeing the other babies has
    _____ been upsetting to me
    _____ not particularly affected me
    _____ been encouraging to me

11. Since our baby’s birth, I
    _____ have frequently worried about our losing touch with our former friends and lifestyle
    _____ have occasionally worried about our losing touch with our former friends and lifestyle
    _____ am not worried about our losing touch with our former friends and lifestyle

12. Since our baby’s birth, I have
    _____ been very worried about my ability to cope with the situation
    _____ been somewhat worried about my ability to cope with the situation
    _____ not been worried about my ability to cope with the situation

13. Since our baby’s birth, finances have
    _____ been a major concern for me
    _____ been a concern for me
    _____ not been a concern for me
APPENDIX F

Mother-Infant Bonding Scale
Place an X next to the number that corresponds to the way you feel at this time.

I feel that I have been helpful to my baby
Disagree 1  2  3  4  5  Strongly Agree

I feel that I know how to nurture my baby
Disagree 1  2  3  4  5  Strongly Agree

I feel that there is a strong mother-infant bond between me and my baby
Disagree 1  2  3  4  5  Strongly Agree

I feel that I know how to calm my infant
Disagree 1  2  3  4  5  Strongly Agree
APPENDIX G

Value of Music Scale
I feel that music helps my baby
Disagree _____ 1  _____ 2  _____ 3  _____ 4  _____ 5
Strongly Agree

I think that it is very important to sing to my baby
Disagree _____ 1  _____ 2  _____ 3  _____ 4  _____ 5
Strongly Agree

I think that it is very important to play music for my baby
Disagree _____ 1  _____ 2  _____ 3  _____ 4  _____ 5
Strongly Agree
APPENDIX H

CD Importance Score
I feel that the CD of my singing helps my baby
Disagree 1 2 3 4 5  Strongly Agree

I think that it is very important to play the CD of my singing for my baby
Disagree 1 2 3 4 5  Strongly Agree

I feel that the CD of my singing helps promote a strong mother-infant bond between me and my baby
Disagree 1 2 3 4 5  Strongly Agree

Preterm Mothers:

Knowing that my infant listened to the CD of my singing helped me cope with my infant’s stay in the NICU.
Disagree 1 2 3 4 5  Strongly Agree
APPENDIX I

After-Birth Medical Complication Score
Place an X beside any after birth complications you have experienced, such as the following:

____ Lactation complications
____ Post-partum depression
____ Uterine prolapse
____ Episiotomy complications
    Other: ________________________________
____ No complications
APPENDIX J

Other Measures
Place an X beside the statement that best describes how often you use ANY OTHER TYPE OF MUSIC.

Since my baby has been home, I have used music

_____ not at all *(Do not continue with the last two questions if you check this blank.)*
_____ a few times a week
_____ every day
_____ several times a day

Place an X beside the statements that describe how you use music:

_____ at a fixed time everyday
_____ when my baby is fussy
_____ to stimulate my infant
_____ during diaper changes
_____ during feedings
_____ not at a specific time
other:

My baby responds to music in the following manners:

_____ sleeps
_____ ceases crying
_____ smiles
_____ listens and attends to music
other:

Place an X beside the statement that describes how often you use the CD OF YOUR SINGING.

Since my baby has been home, I have used the CD

_____ not at all *(Do not continue with the next two questions if you check this blank.)*
_____ a few times a week
_____ every day
_____ several times a day

Place an X beside the statements that describe how you use the CD:

_____ at a fixed time everyday
_____ when my baby is fussy
_____ to stimulate my infant
_____ during diaper changes
_____ during feedings
_____ not at a specific time
other:
My baby responds to the CD in the following manners:

_____ sleeps
_____ ceases crying
_____ smiles
_____ listens and attends to music

other:

How often do you sing to your baby?

_____ not at all
_____ a few times a week
_____ every day
_____ several times a day

Please feel free to add any other comments in the space below.
APPENDIX K

List of Song Titles, Including Lullabies, Children’s Songs, and Popular Songs
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<th>ABC Song</th>
<th>Lavender's Blue</th>
</tr>
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<tr>
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<td>Lullaby and Goodnight</td>
</tr>
<tr>
<td>All the Pretty Little Horses</td>
<td>Mary Had a Little Lamb</td>
</tr>
<tr>
<td>All Through the Night</td>
<td>Oh What a Beautiful Morning</td>
</tr>
<tr>
<td>Amazing Grace</td>
<td>Moon River</td>
</tr>
<tr>
<td>Are You Sleeping</td>
<td>My Girl</td>
</tr>
<tr>
<td>The Ants Go Marching</td>
<td>Over the Rainbow</td>
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<tr>
<td>Baby Mine (From Dumbo)</td>
<td>Rainbow Connection</td>
</tr>
<tr>
<td>Beautiful Dreamer</td>
<td>Rock-a-Bye, Baby</td>
</tr>
<tr>
<td>By 'N By</td>
<td>Shenandoah</td>
</tr>
<tr>
<td>Down by the Bay</td>
<td>Shoo Fly</td>
</tr>
<tr>
<td>Eensy Weensy Spider</td>
<td>Skinamarink</td>
</tr>
<tr>
<td>Goodnight Sweetheart</td>
<td>Skip to My Lou</td>
</tr>
<tr>
<td>He's Got the Whole World</td>
<td>Swing Low, Sweet Chariot</td>
</tr>
<tr>
<td>Edelweiss</td>
<td>Teddy Bear</td>
</tr>
<tr>
<td>My Favorite Things</td>
<td>Twinkle, Twinkle, Little Star</td>
</tr>
<tr>
<td>Scarborough Fair</td>
<td>Under the Boardwalk</td>
</tr>
<tr>
<td>Hickory Dickory Dock</td>
<td>What a Wonderful World</td>
</tr>
<tr>
<td>Home on the Range</td>
<td>Wheels on the Bus</td>
</tr>
<tr>
<td>I'm a Little Teapot</td>
<td>You are My Sunshine</td>
</tr>
<tr>
<td>Let Me Call You Sweetheart</td>
<td>Nursery Rhymes</td>
</tr>
</tbody>
</table>

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APPENDIX L

Specialized Lullaby to the Tune of Brahms’s *Lullaby*
Hello __________________.
   (Name)

How are you?

I ______________ you __________ ____________ ____________.
(verb – think, hope, wish)

I really __________ you, your cute/precious ________________.
   (love, adore, etc.) (smile, eyes, etc.)

I love you very, very much.

   _______________ ________________________________.
   (Name)

   _______________ ________________________________.
   (Name)

   _______________ ________________________________.
   (Name)

and I love you very, very much.
APPENDIX M

Comments Made by Full-term Experimental Mothers
Comments Made by Full-term Experimental Mothers at the End of the Survey.

<table>
<thead>
<tr>
<th>Comments About Personalized CD</th>
<th>General Comments About Music</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thank you for making the CD. I sing during the day, but the CD has helped, especially at night when I am too tired to think. I often rock her on my chest while the music plays. My husband even uses the CD while he holds her.</td>
<td>Music is an awesome manner in which a mother can communicate with her child. I used music at night to sleep during pregnancy with my first baby. I think it created a slight interest in music for her now.</td>
</tr>
<tr>
<td>I enjoyed singing and making the CD. I feel that the CD helps me bond with my son because he hears my voice.</td>
<td>Music does not seem to affect this daughter as much as my first daughter.</td>
</tr>
<tr>
<td>Thank you for the CD. This would be an excellent business idea. I’ve told friends about it and they said they would have been willing to pay money for something like this when their infants were born.</td>
<td>I often use Baby Einstein with my infant.</td>
</tr>
<tr>
<td>I think that your coming around in the hospital was a good idea. I really enjoyed making the CD, and I think she will enjoy it in her future.</td>
<td>Music helps to calm my infant, and I think it is very important.</td>
</tr>
<tr>
<td>I think this was a great project and I do feel like this helps with extra bonding between me and my infant.</td>
<td>I use classical music in the car. My baby is often fussy in the car but music soothes my baby within a few minutes</td>
</tr>
<tr>
<td>I used music before my baby was born. I also think it is important for brain growth and development. I use all types of music. I stated a 4 for the CD of singing promoting mother-infant bonding because I think it is also important to use live singing with my baby.</td>
<td>Babies have very good hearing since in the womb, according to specialists’ research. Therefore, I think it is very important to talk or play or sing some music to the baby all of the time, which allows the baby to get used to these sounds. But I think that it is more important to talk or sing for the baby than just to play some music because the baby may know who is talking or the baby may have familiar feelings from the Mommy’s or Daddy’s voices, which may strengthen mother-infant bonding with each other.</td>
</tr>
<tr>
<td>Thank you for taking the time to make the CD with me.</td>
<td></td>
</tr>
<tr>
<td>Thank you for making the CD.</td>
<td></td>
</tr>
<tr>
<td>This was a great idea and a good thing for parents and their babies.</td>
<td></td>
</tr>
<tr>
<td>Other than the first time I used it, sleep deprivation has kept me from using the CD. I will try again.</td>
<td></td>
</tr>
<tr>
<td>Thank you for the experience.</td>
<td></td>
</tr>
<tr>
<td>I enjoy the CD. It’s a great keepsake for when he is older.</td>
<td></td>
</tr>
<tr>
<td>We are really enjoying the CD, even though I initially felt funny singing in my room at the hospital.</td>
<td></td>
</tr>
<tr>
<td>My baby seems to like the songs. The songs we picked I’ve used with my older daughter. I don’t know many songs, but my baby seems to enjoy the ones we sing.</td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX N

Comments Made by Full-term Control Mothers
Comments Made by Full-term Control Mothers at the End of the Survey.

<table>
<thead>
<tr>
<th>Comments About Music</th>
</tr>
</thead>
<tbody>
<tr>
<td>Music helps calm my baby and is beneficial; I use classical and lullabies with my baby.</td>
</tr>
<tr>
<td>Music was a big part of my first son’s life, and he seems to have turned out OK; I hope to have similar results with this one.</td>
</tr>
<tr>
<td>I feel that music helps my baby a lot.</td>
</tr>
<tr>
<td>I am a big proponent of music. I grew up playing in the band. At this time I own a restaurant, and we play live music. My baby was exposed to music during my pregnancy. I bring him to the restaurant and he seems to recognize and relax to the music.</td>
</tr>
<tr>
<td>Music is very soothing. Our 3 year old still listens to music.</td>
</tr>
<tr>
<td>I often use Disney music with my older child; thus, by default the baby also hears music in the car.</td>
</tr>
<tr>
<td>Happy and healthy and in love with my baby.</td>
</tr>
</tbody>
</table>
APPENDIX O

Comments Made by Preterm Experimental Mothers
Keep doing this with other infants and mothers. I put the CD in her baby book for her future. Everything you did in the hospital was great. It put me more at ease to know you were playing the CD when I went back to work. I feel that this helped our mother-infant relationship.

I think this is a great project at the hospital and that it was definitely helpful to him. I would love to know the results of this project.

I appreciate you doing this. It was nice to know that she had my voice when I couldn’t be down there when I was placed on bed rest. I often had to wait for someone in my family to visit me and wheel me down to the second floor to see her.

The nurses said he responded well to the CD. I felt like he had the essence of me when listening to the CD of my singing, and this made me feel better. I could only visit the NICU once a day, and I often worried about him lying there all by himself in the hospital, with no one around.

This is a really great idea. When I wasn’t able to be there, she could still hear my voice.

Thank you so much, and please let me know how your study turns out.
APPENDIX P

Comments Made by Preterm Control Mothers
I sing to my infant, especially during feedings and when she was at the hospital. Is music the best way for me to bond with my infant?

It seems that we have the same feelings and moods; when I’m down, it seems that he is also down.

Overall, he is a very good baby. He only cries at night to tell me he is hungry.

As a 16 year old parent, my world is so much better with him. I spend all of my time with him, not because I have to, but because I enjoy being with him.

I feel that everything is going good. Other than a few moments in which she cried and I could not figure out what to do, she has been a good baby.

I played music during my pregnancy. It almost seems that he now recognizes the songs that I had played.
APPENDIX Q

Full-term Mothers’ Specialized Lullabies to the Tune of Brahms’ Lullaby
Hello Janyiah.
How are you?
I love you, my little angel.
I really cherish you, your precious face.
I love you very, very much.
Jeniah, go to sleep
so mommy can too.
Jeniah, we’re both so tired
and a good night to you.

Hello Dane.
How are you?
I want you to sleep now.
I really love you, your blue eyes.
Your beautiful blue eyes.
Rest you now, go to sleep
and I’ll see you in the morning.
Rest you now, go to sleep
and I’ll see you in the morn.

Hello Ny’keririah.
How are you?
I think of you all the time.
I really love you, your precious smile.
I love you very, very much.
Ny’keririah, you’re so special.
Ny’keririah, you’re so sweet.
Ny’keririah, you’re the best.
and I love you very, very much.

Hello Alex.
How are you?
I wish you were sleeping.
I really love you, your precious eyes.
I love you very, very much.
Alex, close your eyes.
Alex, please go to sleep.
Alex, close your eyes.
and I love you very, very much.

Hello Kimariyahn.
How are you?
I hope you are happy.
I really love you, your precious smile
I love you.
Kimariyahn, I love you.
Kimariyahn, I do.
Kimariyahn, you’re special
and Mommy love you.

Hello Perryuntay.
How are you?
I think you are special.
I really love you, your precious eyes.
I love you very, very much.
Perryuntay, you’re so special.
Perryuntay, you’re so sweet.
Perryuntay, you’re so dear
and I love you very much.

Hello Ja’kyra.
How are you?
I love you very much.
I really adore you, your precious face.
I love you very, very much.
Ja’kyra, I adore you.
Ja’kyra, I love you.
Ja’kyra, you’re so precious
and I love you very much.

Hello Charles.
How are you?
I love you very much.
I really do, you’re precious to me.
I love you very, very much.
Charles, my little angel.
Charles, mommy’s baby.
Charles, God loves you
and I love you too.
Amillha.
I love you
I love you when you smile.
I really love, your precious eyes.
I love you very much.
Amelia, I love you
I love you with your smile.
Amelia, I love you.
I love you very much.

Hello Jailyn.
How are you?
I hope you are sleeping.
I really love you, your precious eyes.
I love you very, very much.
Jailyn, you’re my sweetheart.
Jailyn, you’re so sweet.
Jailyn, I adore you
and I love you very much.

Hello Ashley.
How are you?
I think you are so pretty.
I really love you, your precious smile.
I love you very, very much.
Ashley, you’re so pretty.
Ashley, I really love you.
Ashley, your cute eyes
and I love you very much.

Hello Layla.
How are you?
I’m so happy you’re here.
I really love your precious smile.
I love you very, very much.
Layla Renee
Layla Renee
Layla Renee
I love you very much.

Hello Alexia.
How are you?
I hope you have sweet dreams.
I really love you, your precious smile.
I love you very much.
Alexia, you are beautiful.
Alexia, you are sweet.
Alexia, You are my angel
and I love you very much.

Hello Sierra.
How are you?
I think you are very special.
I really love you, your cute smile.
I love you very much.
Sierra, I love you.
Sierra, you’re the best.
Sierra, I adore you
and I love you very much.

Hello Jayden.
How are you?
I wish you were sleeping
I really love you, your precious smile
I love you very, very much.
Jayden, go to sleep.
Jayden, close your eyes.
Jayden, go to sleep
and I love you very, very much.

Hello Ja Marion.
How are you?
I think you look cute.
I really love you, your precious smile.
I love you very, very much.
Ja Marion, I really love you
Ja Marion, you’re so cute
Ja Marion, I adore you.
And I love you very much
And I love you very much
And I love you very much.
APPENDIX R

Preterm Mothers’ Specialized Lullabies to the Tune of Brahm’s *Lullaby*
Hello Jack.
How are you?
I hope you are sleeping.
I really love you, your precious toes.
I love you very, very much.
Jack, please, go to sleep
‘cause you really need your rest.
We hope you can come home sooner than later.

Hello Nolan.
How are you?
We think of you daily.
We really love you; you’re precious to us.
We love you very, very much.
Nolan, close your eyes
and rest peacefully.
When you wake we can play,
but for now go to sleep.
And we love you very much.

Hello Emma.
How are you?
I pray for you daily.
I really love your precious smile.
I love you very much.
Emma, my darling.
Emma, my dear.
Emma, my sweetheart,
and I love you very much.

Hello Mahki.
How are you?
I hope you have sweet dreams.
I really love you, your precious eyes.
I love you very, very much.
Mahki, go to sleep.
Mahki, close your eyes.
Mahki, I’ll protect you.
because I love you very, very much.

Hello Robby.
How are you?
I hope you are dreaming
I really love you. You’re precious to me
and I love you very, very much.
Little Robby, go to sleep
Little Robby, dreams await.
Little Robby, you’re so sweet
and I love you very, very much.

Hello Kiyarah.
How are you?
I hope you’re sleeping very well.
I really miss you, your cute eyes.
I love you very much.
Kiyarah, go to sleep.
Kiyarah, gain some weight.
Kiyarah, come home soon,
‘cause I love you very much.

Joshua and
Jeremiah,
I hope you are sleeping.
I really love you, your precious smile.
I love you very, very much.
Joshua and Jeremiah,
We want you to come home.
Joshua and Jeremiah
We love you very, very much.
APPENDIX S

Mothers’ Scores for Parental Perception Inventory
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APPENDIX T

Mothers’ Scores for Mother-Infant Bonding Scale
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142
APPENDIX U

Full-term Mothers’ Scores for Value of Music Scale
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APPENDIX V

Experimental Mothers’ Scores for CD Importance Score
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APPENDIX W

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REFERENCES


Campbell, C.L. (2000. Classical music compact discs and books for Georgia’s infants: Use and relationship to infant development one year later as reported by low-income caregivers. Doctoral dissertation. Georgia State University, Atlanta, GA.


Kemper, K; Martin, K; Block, SM; Shoaf, R; & Woods, C (2004). Attitudes and expectations about music therapy for premature infants among staff in a neonatal intensive care unit. *Alternative Therapies in Health and Medicine, 10*(2), 50-54. [Abstract]


BIOGRAPHICAL SKETCH

Name: Andrea Marie Cevasco

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Higher Education:
- The University of Alabama (1999)
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  Major: Music Therapy
  Degree: BM (1999)
- The University of Georgia
  Athens, GA
  Major: Music Education
  Degree: MMEd (2001)
- The Florida State University
  Tallahassee, FL
  Major: Music Education
  Degree: PhD (2006)

Experience:
- Music Therapy Private Practice
  Programmed music therapy for clients with Alzheimer’s disease,
  geriatrics, adults with substance abuse addictions, premature infants,
  children with early intervention needs, children with severe emotional
  and behavioral disorders, children with autism, individual with a cochlear
  implant, and individual with cerebral palsy.
- Clinical Training Director of the Music Therapy Department
  The University of Georgia, School of Music

Publications:
  Lullaby on weight gain of premature infants. *Journal of Music Therapy, 42*, 123-139.
  movement-to-music, rhythm activities, and competitive games on stress
  for eliciting exercise-to-music for clients with Alzheimer’s disease.
  *Journal of Music Therapy, 40*, 41-56.
Cevasco, A.M., & Grant, R.E (accepted). Value of musical instruments used by the therapist to elicit responses from individuals in various stages of Alzheimer’s Disease. *Journal of Music Therapy.*


**Honors:**

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- Florida State University Teaching Assistantship
- Phi Eta Sigma Honor Society
- Gamma Beta Phi Honor Society
- Golden Key National Honor Society
- Pi Kappa Lambda Music Honor Society
- Phi Kappa Phi Honor Society