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The Effect of Parent Training in Music and Multimodal Stimulation on Parent-Neonate Interactions in the Neonatal Intensive Care Unit

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This study examined the effects of parent training in music and multimodal stimulation on the quantity and quality of parent-neonate interactions and the weight gain and length of hospitalization of premature and low birthweight (LBW) infants in a Neonatal Intensive Care Unit (NICU). Twenty sets of parents and premature LBW infants participated in the study. Parents in the experimental group (n = 10) received approximately one hour of instruction in appropriate uses of music, multimodal stimulation including massage techniques, and signs of infant overstimulation and techniques for its avoidance. Parent-neonate interactions, specifically parent actions and responses and infant stress and nonstress behaviors, were observed for subjects in both groups. Infant stress behaviors were significantly fewer and appropriateness of parent actions and responses were significantly greater for experimental infants and parents than for control subjects. Parents in the experimental group also self-reported spending significantly more time visiting in the NICU than did parents of control infants. In addition, length of hospitalization was shorter and average daily weight gain was greater for infants whose parents received training, although these differences were not significant. A one month, postdischarge follow-up showed little difference between experimental and control group parent-infant interactions in the home.

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Introduction

Each year in the United States 11% of all infants are born prematurely with 7.4% of those at low birthweight (LBW) (Centers for Disease Control and Prevention, 1998). Between 1988 and 1991, the infant survival rate was zero at 22 weeks gestation, 15% at 23 weeks, 54% at 24 weeks, and 79% at 25 weeks (Horbar & Lucey, 1995), and has continued to increase with growing numbers of smaller and less mature infants, even those as young as 23 weeks gestation born weighing approximately 14 oz, being treated and expected to survive. Advances in treatment have improved survival rates but not necessarily the developmental outcome of survivors, increasing not only the number of healthy children, but also the number of children with disabilities (Hack, Klein, & Taylor, 1995).

Both psychosocial and biological risk factors can negatively affect developmental outcomes of premature infants. The cognitive effects associated with social or environmental risks, initially obscured by the original biological concerns of LBW infants, become more evident as children age, signaling the need for intervention programs for children born at LBW, especially in low socioeconomic status environments (Osofsky, 1979; Thompson et al., 1997). Consequently, infant enrichment and parent support programs during infancy and early childhood are recommended. Increases in developmental outcome (Rauh, Nurcombe, Achenbach, & Howell, 1987; Riksen-Walraver, Meij, Hubbard, & Zevalkink, 1996), including increased IQ, receptive language, and visual-motor function, have been noted in connection with such programs (Hack et al., 1995). Parent training has also been found to increase both the quality of interactions between parents and their children (Gomes-Pedro et al., 1995) and parent perceptions of interactions (Rauh et al., 1987).

Children need opportunities for interaction and attachment (Kantrowitz, 1997), as interactions between parents and infants in the first months of life form the base for all future learning (Reiner Foundation, n.d.). Osofsky (1976) discovered consistent relationships between infant and maternal behaviors in which the infants appearing to be more alert and responsive had more responsive and sensitive mothers. In responding sensitively to their children's needs, parents form secure, nurturing attachments with their children (Greenberg, 1997), which can also be of benefit during stressful experiences (Gomes-Pedro et al., 1995), allowing lower levels of cortisol to be released (Zeanah, Boris, & Larrieu, 1997).

Literature Review

Preterm and LBW infants are usually placed in a neonatal intensive care unit (NICU) to receive care until they are medically stable and have gained enough weight to be discharged to a home environment (Campbell, 1985). Consequently, infants are exposed to painful medical procedures (Field, 1987) and interruptions to sleep cycles due to caregiving procedures (Oehler, 1993), bright lights (Oehler, 1993; Shogan & Schumann, 1993), and noxious sounds from medical equipment (Mitchell, 1984). Singly or in combination, these aversive stimuli can result in overstimulation and fatigue (Oehler, 1993), decreased oxygen saturation (Shogan & Schumann, 1993), episodes of apnea and bradycardia, an increase in stress hormones which can cause a reduction in the release of growth hormones (Oehler, 1993), and hearing loss (American Academy of Pediatrics, 1997; Bess, Peek, & Chapman, 1979; Mitchell, 1984; Oehler, 1993). Still, the aim of hospitalization is to achieve the most normal neurological outcome possible (Campbell, 1985). Because the premature infant's brain is actively developing, necessary medical procedures often cause pain and distress, resulting in a flood of cortisol to the brain, creating a damaged cell network in which the infant is in a constant hyperalert state. If the aversive environmental conditions persist, the damage may remain. However, this potential debilitation due to the adverse conditions of prematurity can be overcome within 1 to 3 years via the provision of a positive and nurturing environment (Osofsky, 1979).

Given the undesirable conditions, the NICU can be a stressful environment for both parents and infants (Newman, 1981). The birth of a premature or LBW infant is stressful even for the most stable families and the environment and experiences of the NICU to which the infant is admitted adds even greater stress for the family. Parents often feel a sense of guilt and responsibility following premature birth, as well as anxiety and helplessness caused by the uncertainty of the newborn's survival. Parents often agonize over their ability to survive the financial burden of hospitalization, to provide adequate care for their infant after discharge, and to handle the possibility of infant relapse. The noisy and sterile atmosphere of the NICU can add to these feelings of disorientation and prevent feeling at ease and in control. Many parents also experience grief due to the long term deficits with which their child may struggle or the anticipation or possibility of their infant's death (Bachman & Lind, 1997).

The monotony of sensory stimulation in the NICU may negatively affect responsivity of premature infants (Segall, 1972), as a lack of stimulation can interfere with the development of the growing neonate. However, too much handling and overstimulation can cause distress (Brazelton, 1969). Still, supplemental stimulation, to include separate or combined tactile, vestibular, auditory, gustatory, and visual stimulation, has been shown to be beneficial to premature infants (Harrison, 1985). Additionally, it seems that different types of stimulation provide specific benefits. Regardless, the type of stimulation provided may be less important than its promotion of homeostasis (Dieter & Emory, 1997).

In addition to stress reduction and physiological benefits, music listening, swaddling (Oehler, 1993), stroking (Field, 1987), and provision of a pacifier (Field, 1987; Oehler, 1993) can decrease agitation and assist in alleviating infant pain (Oehler, 1993). Music listening by hospitalized premature infants has been found to result in decreased initial weight loss (Caine, 1991), increased weight gain (Malloy, 1979), decreased length of hospitalization (Caine, 1991; Malloy, 1979), more stable oxygen saturation levels (Standley & Moore, 1995), and decreased observed stress behaviors (Caine, 1991). Long term benefits may also exist. Standley (1991a) surveyed the mothers of infants who participated in a study by Caine (1991) six months following the completion of that study, finding that mothers of infants who were exposed to music reported that their infants were calmer and cried less than did mothers of the control infants who did not receive music. In addition, some increased mother-infant bonding was evident in the responses from mothers of infants in the experimental group.

Nonmusic studies providing auditory, tactile, visual, and vestibular stimulation, either alone or in combination, have resulted in increased weight gain (Field, 1995; Kramer & Pierpont, 1976) and head circumferences (Kramer & Pierpont, 1976); developmental enhancement (Field, 1995; Leib, Benfield, & Guidubaldi, 1980); optimal arousal in preparation for feeding (White-Traut, Nelson, Silvestri, Cunningham, & Patel, 1997); lower levels of anxiety and stress hormones; improved overall infant health and immune functioning; more responsive, awake, and active infants, exhibiting less exhaustion, better state regulation, improved muscle tone, and shorter lengths of hospitalization, consequently resulting in decreased medical costs (Field, 1995). Subsequently, Standley (1998) examined the effects of multimodal stimulation, pairing music with

stroking, rocking, and eye-to-eye contact procedures for premature infants in a NICU. The infants, referred for the program on the basis of medical stability and readiness for developmental stimulation, received the multimodal stimulation for 15 to 30 min once or twice each week from the time of referral to discharge. For the infants receiving the treatment, average weight gain per day was greater and, for females, the length of hospitalization was significantly lower, leaving the hospital 11.9 days sooner on average than control females. The male experimental infants, however, were discharged only 1.5 days sooner than male control infants. The goal of the program was pacification while teaching the infants to respond to increasing levels of stimulation. The infants, with females progressing more rapidly, steadily increased in their toleration of the stimulation through the duration of treatment.

While mother's voice is the auditory stimulus most preferred by infants (Standley & Madsen, 1990), music has been shown to be the most physiologically beneficial auditory stimulus (Standley & Moore, 1995). Because of its calming effects, music, especially lullabies sung by parents to infants, can assist in creating positive parent-infant interactions (Polverini-Rey, 1992), tactile stimulation in the form of stroking administered by parents can improve parents' own perceptions of well-being (Field, 1995), and music and other modes of infant stimulation can have positive effects on infant responsiveness and can strengthen parent-infant relationships, promoting better interactions at a critical time for attachment. Development is especially good when appropriate stimulation is continued at home by parents following hospital discharge (Campbell, 1985).

Purpose

The purpose of this study was to determine the effects of parent training in music and multimodal stimulation on the quantity and quality of parent-neonate interactions and the weight gain and length of hospitalization of premature LBW infants in a NICU.

Method

Subjects

Subjects for this study were infants in the NICU of a regional medical center in the Southeastern region of the United States and their parents. Weekly neonatology patient care meetings were at-

TABLE 1
Mann Whitney U *Comparisons of Subject Demographics*

	Obtained *U*	Critical *U*
Maternal age	35	23
Gravita	51	23
Parity	50	23
Birthweight	39	23
Final Apgar ratings	43	23
Corrected gestational age	39.5	23

Note. All $\alpha > .05$.

tended in order to receive referrals and track infant progress. Criteria for inclusion in the study were infant birthweight of 2500 g or less, birth before 37 weeks gestation, and medical staff referral for music therapy services based on clinical stability and readiness for developmental stimulation. When a mother of a referred infant gave signed consent, she and her child were placed, by alternating assignment, in either the experimental or control group, totaling 10 mothers and 10 infants in each group.

There were seven female and three male infants in the experimental group and six female and four male infants in the control group. The maternal subjects ranged from 16 to 39 years of age and, at birth, infant subjects ranged from 630 to 2500 g and 25 to 36 weeks corrected GA based on Dubowitz scores. Using the Mann-Whitney *U* statistical test (Madsen & Moore, 1978) at a .05 level of significance for a two-tailed test, no significant differences in subject demographics were found between the two groups based on maternal age, gravidity (number of pregnancies), parity (number of children), infant birthweight, final Apgar ratings, and corrected GA at birth based on Dubowitz scores (see Table 1).

Design

An experimental/control group design with seven dependent variables was employed. Dependent variables were: (a) observed infant stress and nonstress behaviors, (b) observed parent actions and responses, (c) parent-neonate interaction survey responses, (d) infant weight gain during hospitalization, (e) length of infant hospitalization, (f) infant weight gain at one month following hospital discharge, and (g) parent-neonate follow-up survey responses.

Procedure

Parents in both the control and experimental groups received the usual parent training from the nursing staff and, when deemed necessary, from the occupational and physical therapists. This training includes instruction in the proper methods for picking up, swaddling, holding, and placing the infant in the open crib or isolette, and the techniques for CPR, monitor use, temperature measurement, feeding, bathing and dressing, and, when necessary, signs of overstimulation and care of any special infant needs. In addition, parents of medically stable infants are encouraged to participate in "kangaroo care" in which the infant is placed directly on the mother or father's chest for skin-to-skin contact, promoting breathing and facilitating homeostasis, growth, and parent-infant bonding.

Additionally, members of the experimental group received approximately one hour of parent training through music therapy. Training sessions took place at the mother's convenience, at times when she was already planning to visit her infant. During the first session, usually lasting 15 to 30 min, mothers, and fathers when available, were instructed to:

- keep the infant swaddled, with arms contained in front to limit the opportunity for a startle response.
- keep the infant's head covered when not in the isolette or open crib in order to maintain body temperature.
- hold the infant in a manner to ensure that the head is supported and the airway is unobstructed.
- keep the infant out of the isolette or open crib for limited periods of time.
- be aware of infant preference for mother's voice.
- read to infants and use parentese to assist in language development.
- select a song or songs to hum or sing quietly to their infants during a variety of daily activities and during stressful situations.
- use a slow, smooth, and steady technique when rocking.
- attempt visual stimulation of eye-to-eye contact and recognize the occurrence as a sign of contentment and developing neurological maturity.
- recognize signs of infant overstimulation which can lead to hy-

poxia and cause further agitation and oxygen consumption, culminating in total infant exhaustion.

The signs to which parents were sensitized were commonly accepted and taught by the hospital in which this study was performed and consisted of yawning, hiccoughing, or sneezing; tongue protrusion; finger splay or outstretched arm referred to as "halt hand;" struggling movements; averted or clinched eyes; flushed, blotchy, or pale skin color; grimacing or creasing forehead into a frown; startle reflex response in which infants extend their necks and throw out their arms and legs; hyperalertness as evidenced by a wide-eyed, fixed stare; whimpering, crying, or cry face; spitting or vomiting; irregular heart rate or respiratory rate; oxygen saturation below 86 percent; and limp body and lack of responsiveness. Parents were also instructed to:

- wait approximately 30 s after removing the infant from the isolette or open crib before beginning any stimulation, as stimulation is cumulative.
- add each additional stimulus one at a time, separated by intervals of at least 30 s, allowing the infant to maintain homeostasis.
- provide the most calming environment possible in order to avoid overstimulation.
- pause current stimulation for 15 s if a sign of overstimulation does arise, then resume stimulation, stopping again if the sign returns.

At the second training session, lasting approximately 30 min, parents were instructed on:

- the benefits of nonnutritive sucking to improve oxygen saturation, encourage state organization and behavior patterns resembling those of term infants, increase amounts of quiet sleep, reduce infant stress during painful procedures as well as during nonprocedural moments, facilitate calmer more alert infants, and teach the sucking endurance necessary for feeding.
- the use of tactile stimulation to soothe the infant and teach him or her to better respond to the environment (Standley, 1991b; Standley, 1998).

Tactile stimulation or stroking began at the top of the head and

progressed to the back, neck, arms, abdomen, legs, and face, as infant neurological development is cephalocaudal and proximodistal. Touch is performed with moderate pressure, avoiding light stroking which could tickle and be aversive to infants. Multimodal stimulation should be limited to 15–30 min at a time and no more than 60 min per day because of the premature infant's need for uninterrupted rest.

For the four parents who expressed uncertainty in their ability to appropriately implement the use of music and multimodal stimulation, a third training session was arranged to reinforce the techniques. For members of both groups, times were arranged when the researcher could observe parent-neonate interactions. For members of the experimental group, this observation occurred immediately following the final training session.

Data Collection

During the observed interactions, the researcher recorded observable infant stress and nonstress behaviors and parent actions and responses during 20 s observation and 10 s record intervals for a period of 15 min, totaling 30 observation intervals, with 2 per min, and 90 data points. In cases where both parents interacted with control infants during observations, actions of both parents were recorded. During experimental subject observations, the father's actions and responses were only recorded if he had participated in parent training. Each infant stress behavior observed received two points, minor stress behaviors each received one point, and nonstress behaviors received zero points. Scoring resulted in Infant Prestress Levels identified at the beginning of each observation interval prior to any parent action or response and Infant Poststress Levels identified at the end of each observation interval following any parent action or response, with the two categories together providing 60 of the data points. The final 30 data points resulted from parent actions and responses observed between the beginning and ending infant behaviors in each interval. Parents received an Appropriate Parent Score toward which one point was earned for appropriate behaviors or appropriate use of music and zero points were earned for inappropriate behaviors or inappropriate use of music, with a total of one point possible during each observation interval and 30 possible for the entire observation period. Recorded actions and responses of both parents received

equal weight and were combined to result in the total Appropriate Parent Score for the observation period. Parents using music during the observed interaction also received a Percentage of Appropriate Music Score determined from the ratio of appropriate to inappropriate implementation of music.

Following each observed interaction, parents were asked to complete a Parent-Neonate Interaction Survey regarding their perceptions of the interaction and the effects of music on the quality of their interactions with their infants. Nine questions asked parents to evaluate their perceptions on a Likert scale from 1 (low) to 5 (high). Scores for these questions were totaled with a maximum score possible being 45. Responses to five other open ended questions about parent perceptions are summarized in results.

Follow-Up

At approximately one month following infant hospital discharge, 18 of the 20 parent subjects, nine experimental and nine control, were located and asked to complete a Parent-Neonate Follow-Up Survey regarding the quality of their interactions with their infants and the use and effects of music during interactions. Five questions asked parents to evaluate their perceptions on a Likert scale from 1 (low) to 5 (high). Scores for these questions were totaled with a maximum score possible being 25. Responses to five other open ended questions about parent perceptions are summarized in results. Surveys were completed between 29 and 42 days after discharge with a mean of 33.89 days for experimental infants and between 28 and 42 days after discharge with a mean of 33.33 days for control infants.

Results

Results were analyzed using the Mann-Whitney U statistical test (Madsen & Moore, 1978) at a .05 level of significance for a one-tailed test to compare behavioral observations, survey responses, infant weight gain, and length of infant hospitalization for experimental and control subjects.

Data from the observed parent-neonate interactions showed Infant Pre-Stress (obtained $U = 10.5$, critical $U = 27$) and Infant Post-Stress Levels (obtained $U = 12$, critical $U = 27$) measured at the beginning and ending of each 20 s observation interval, respectively, to be significantly lower for experimental infants than for control

TABLE 2

Decrease in Observed Infant Stress Levels

Group	Total prestress	Total poststress	% of decrease
Experimental	22	11	50
Control	71	65	8

infants ($p < .05$). The amount of stress behaviors of each individual experimental infant either remained the same or decreased from Prestress to Poststress measures after an opportunity for parent response, while four control infants increased in stress levels from the first measure to the second. Both total group experimental and control infant stress levels decreased from Prestress to Poststress after an opportunity for parent response; however, the experimental group decreased stress behaviors by 50% while the control group decreased by only 8% (see Table 2).

Appropriate Parent Scores were significantly higher for the experimental group than for control group parents (obtained $U = 11$, critical $U = 27$, $p < .05$). Five parents in the experimental group and three in the control group were observed using music. All five experimental parents received a 100% score for appropriate use of music, while the mean appropriate use of music percentage for control parents was 88.86.

Data were examined for Total Survey Response Score, and then divided into the five sections of perceptions of interactions for the observed period and for the week, time spent in the NICU, time spent in interaction with infants, amount of music used during the week, and perceptions of music's effects (see Table 3). No signifi-

TABLE 3

Parent-Neonate Interaction Survey Response Score Means and Mann Whitney U *Comparisons*

	Experimental $n = 10$	Control $n = 10$	Obtained U
Survey categories			
Parent perceptions of interactions	$M = 22.5$	$M = 21.8$	51
Total time spent in NICU	$M = 3.6$	$M = 2.4$	26*
Amount of interaction time	$M = 4.3$	$M = 4.7$	39.5
Amount of music used	$M = 3.2$	$M = 2.7$	34.5
Parent perceptions of music's effects	$M = 4.3$	$M = 4.3$	47
Total survey response score	$M = 37.9$	$M = 35.8$	39.5

Note. Critical $U = 27$, * $\alpha < .05$.

TABLE 4

Infant Weight Gain and Length of Hospitalization Means and Mann Whitney U *Comparisons*

	Experimental $n = 10$	Control $n = 10$	Obtained U
Average daily weight gain	M = 11.33 g	$M = 3.44$ g	46
Length of hospitalization	$M = 26.10$ days	$M = 42.20$ days	42

Note. Critical $U = 27$, all $\alpha > .05$.

cant differences were found in survey responses of control and experimental parents for Total Survey Response Score or perceptions of interactions; however, parents in the experimental group had a somewhat higher mean Total Survey Response Score. Parents in the experimental group did report spending significantly more time in the NICU, but slightly less time interacting with their infants, than did the control parents. Although results did not reach significance, experimental parents reported using more music during interactions than did control parents; however, both groups had identical mean scores for their perceptions of music's effects. No subjects reported the use of music to negatively effect their interactions.

No significant differences were found between infant groups in average daily weight gain and length of hospitalization (see Table 4). However, experimental infants gained an average of 7.89 g more per day and left the hospital 16.10 days sooner than control infants.

No significant differences were found between experimental and control group parent responses on the Parent-Neonate Follow-Up Survey at one month following infant hospital discharge (see Table 5) and only minor differences were noted in survey response score

TABLE 5

Parent-Neonate Follow-Up Survey Response Score Means and Mann Whitney U *Comparisons*

	Experimental $n = 9$	Control $n = 9$	Obtained U
Survey categories			
Parent perceptions of interactions	$M = 9.22$	$M = 9.33$	32
Music used and perceptions of effects	$M = 4.33$	$M = 4.44$	38
Total survey response score	$M = 22.11$	$M = 22.44$	34

Note. Critical $U = 21$, all $\alpha > .05$.

TABLE 6

Infant Weight Means and Mann Whitney U *Comparisons at Approximately One Month Following Hospital Discharge*

	Experimental $n = 9$	Control $n = 9$	Obtained U
Weight at follow-up	$M = 3207$ g	$M = 3049$ g	32
Weight gain since discharge	$M = 1067$ g	$M = 878$ g	34
Average daily weight gain since discharge	$M = 31.00$ g	$M = 30.39$ g	39

Note. Critical $U = 21$, all $\alpha > .05$.

means. Once again, no subjects reported the use of music to negatively affect their interactions.

No significant differences were found between experimental and control groups for infant weight, total weight gain since discharge, and average daily weight gain since discharge based on parent report at one month following infant hospital discharge (see Table 6). Although only small differences were noted between the experimental and control group means, all measurement differences favored the experimental group.

In summary, statistical analysis revealed that while in the NICU, infant stress behaviors were significantly fewer, appropriateness of parent actions and responses were significantly greater, and significantly more visitation time was reported for infants and parents who received training in the use of music and multimodal stimulation than for control subjects. In addition, length of hospitalization was shorter and average daily weight gain was greater for infants whose parents received training, although these differences were not significant. Parent training through music therapy was determined to be effective in decreasing infant stress behaviors and increasing parent appropriateness.

Discussion

Shortened length of hospital stay of premature infants is beneficial not only developmentally, but also financially because of the expensive treatments and extended stay required which result in increased medical costs of hospitalization for premature infants. Due to the large spread of data in each group, significant differences were not found between groups in the areas of length of hospitalization and average daily weight gain during hospitalization,

but comparisons of means showed that experimental infants did, on average, gain more weight per day and left the hospital sooner than control infants. As in studies by Caine (1991) and Standley (1998), results of this study once again suggest the cost effectiveness of music therapy with premature and LBW infants, as those receiving music had a mean hospital stay 16.10 days shorter than those infants whose parents did not receive training in music and multimodal stimulation.

The types of parent-neonate interactions observed were dictated by parent subjects, and infant behaviors were assessed based on the specific activity and infant state observed. During observations, parents were permitted to select and move between activities at their leisure. While all experimental and control subjects were observed at a time when the infant was being held, some control subjects were also observed during the necessary daily activities of diapering and feeding. This activity choice may in itself demonstrate that experimental parents were more aware of providing a calm and constant environment for their infants, as they tended to allow a less variable and disruptive environment during observations than did the control parents who moved more frequently from one activity to the next. At the time when the study was introduced to control parents, they were informed of benefits discovered in previous studies involving music and neonatal care and were notified that during observations, the researcher would be recording parent-neonate interactions, including infant stress and nonstress behaviors and parent responses. During training sessions, experimental parents were made aware of the need to provide a peaceful environment for their infants, but were not specifically instructed to limit incidences of diapering and other necessities of infant care to do so. Any such adjustment noted during observations was decided independently by parents, and while the regular assimilation of a stable atmosphere into parent-neonate interactions cannot be determined from one observation, it seems that experimental parents may have been able to apply the general knowledge gained in the training sessions to subsequent interaction without specific direction. Consequently, differences in types of observed interactions were not likely confounding to the observation analysis.

Because the parents who received training used music more appropriately during their observed interactions than those parents who did not receive training, the importance of teaching appro-

priate music techniques and providing recommendations for parents regarding the use of recorded music, musical books, and wind-up stuffed toys, as well as singing and humming, is evident.

The difference in Parent-Neonate Interaction Survey responses in which experimental parents reported spending significantly more time in the NICU than control parents was not likely due to the time spent by experimental parents in meetings with the researcher because those training sessions, like the control and experimental subject observations, were scheduled at the convenience of parents when they were already planning on visiting with their infants. Therefore, this greater quantity of visitation by experimental parents may have been partially due to the increased quality of interactions caused by the more pleasant atmosphere experienced from the existence of music and fewer infant stress behaviors. While experimental parents reported spending slightly less time interacting with their infants than was reported by control parents, this small difference was in response to a survey question regarding the portion of the total time spent in the NICU that was spent in actual interaction with their infants: none, less than half, half, more than half, or all or almost all. Because experimental parents reported spending significantly more total time in the NICU than control parents and the differences in reported interaction time were only slight, it seems that experimental parents likely still spent more time interacting with their infants than did control parents.

Based on narrative survey responses, lack of opportunity for interaction with their infants is a stressor for parents. Parents in both groups spent some time in the NICU in which they were not directly interacting with their infants. The reason cited by three parents for limited amount of interaction was the use of phototherapy, during which parents are not permitted to remove the infants from the isolettes except for short periods of time. Regardless of parent visitation, such circumstances are not controlled by parents and may dictate that, at certain times, the most meaningful activity in which parents can engage is to simply observe the infant without any direct contact or interaction. Situations such as these may account for some of the discrepancy between experimental and control groups in amount of reported total NICU visitation time vs. reported parent-neonate interaction time. Even so, one parent in the experimental group, who was the only maternal subject to have previously given birth to a premature infant, expressed gratitude

for the interaction opportunities that do exist, as she had not been allowed such interaction in another hospital 7 years earlier. Other reported items of stress for parents and infants are medical equipment, bright lights, and noise in the NICU, and bathing, diapering, and feeding the infant. Intermittent music listening is already provided in the NICU in which this study took place, in order to help in masking aversive sounds and improving developmental outcomes. Implications for future studies may include extended parent training to help parents apply the use of music to specific situations, such as bathing and dressing. Support groups for parents in distress may also be warranted.

All experimental and control parent survey responses were favorable at one month following infant hospital discharge, perhaps because the joy experienced by parents of a new baby at home may have been an overriding influence in their perceptions of interactions with their infants at that point in time. This was supported by narrative survey responses in which seven parents were no longer able to identify a stressful activity related to interaction with their infants, noting decreased irritability of infants.

Based on other Parent-Neonate Follow-Up Survey narrative responses, getting up in the middle of the night was listed repeatedly as an item of parent stress and hunger was cited several times as an item of infant stress. Parents still reported enjoying holding their infants and that their infants were most content when being held or sung to. Two parents from the experimental group mentioned continued use of the music and multimodal stimulation techniques and expressed appreciation for being taught a proper method of tactile stimulation.

The concept of this study evolved from simply teaching and encouraging parents to use music and massage with their infants in order to continue the already established benefits after discharge, to additionally focus on the effects of using music therapy techniques to teach parents to recognize and respond to signs of overstimulation in their infants. Based on observation of parent appropriateness, the use of music and multimodal stimulation may have created an opportunity for parents to practice and apply these concepts while engaged in an enjoyable activity with their infants. Given its effectiveness, the implementation of music therapy to teach basic skills of interaction and the signs of overstimulation and its avoidance may also assist nurses, physical therapists, and oc-

cupational therapists by reducing the time required of them in reinforcing these skills. Parents may not have performed the multimodal stimulation procedure as frequently or consistently as would a music therapist serving patients in a NICU, which could account for the lack of significance in weight gain and length of hospitalization data that found significance in Caine (1991) and Standley (1998). Still, the benefit to parent-neonate interactions is clear, supporting parent training as a practice to augment other music therapy services in a NICU.

As stress of new parents appears to pervade age and experience, the need for parent training and education is evident and is especially warranted given the previously discussed psychosocial deficits of premature infants. Since results showed parents in the experimental group to demonstrate significantly more appropriate interaction skills and experimental infants to demonstrate significantly fewer stress behaviors, it may be that these infants also experience less flooding of stress hormones in the brain and could develop more efficiently, especially if the same quality of interactions continue after discharge. Many premature infants leave the hospital for less than desirable home environments, in which case the parent training may offer an opportunity for music to be a continued stabilizing factor and could also result in long-term developmental and social benefits and increased amounts of appropriate parent-infant interactions and secure attachments. Consequently, it could be beneficial to complete a long-term study to assess the effects of music intervention with parent involvement at differing stages of development on the total development of children born prematurely.

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