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NICU music therapy: Post hoc analysis of an early intervention clinical program

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ABSTRACT

The incidence of premature births in the United States is increasing, as are medical costs related to this problem. Research has shown benefits for NICU-MT in small sample size, controlled clinical trials. Such benefits have included significantly earlier discharge dates and a consistent pattern of increases in weight gain that has not been statistically significant. As yet, no clinical analyses of the effects of NICU-MT have been conducted.

The clinical NICU-MT program at TMH has been in effect for over 7 years and includes referrals for multimodal stimulation, Pacifier-Activated-Lullaby (PAL) treatment, and parent training in infant stimulation. We analyzed the medical records of all infants born low birth weight (<2499 g) and born prior to 36 gestation weeks who were treated in the NICU in 2006 ($N = 208$) with differentiation for receipt of NICU-MT or not. We excluded infants not discharged to the home but to another medical site for further treatment. This post hoc analysis of clinical records showed that the smallest, lowest birth-weight infants were more often referred for music therapy. Infants receiving NICU-MT gained more weight/day than did infants not referred for MT. Those born very early (24–28 gestational weeks) were discharged sooner than non-music infants in that age range. Infants born after 30 weeks and receiving MT had longer length of stay than non-music infants but they also were diagnosed with more serious illnesses. In summary, the demographics reveal that MT is primarily referred for premature, low birth-weight infants and those with multiple, serious medical problems.

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Introduction

The incidence of premature birth is rising in the United States and is a costly component of national healthcare. In 2006, 12.8% of births in the U.S. were premature, with fertility treatment of older mothers contributing to the problem. Specialized NICU (Neonatal Intensive Care Unit) medical treatment was developed about 25 years ago. This specialty has reduced mortality, but levels of disability have increased with over 20% of premature infants now having major disabilities. The average length of NICU stay is approx. 90 days. Costs are astronomical, with over 2 billion dollars spent each year (Gilbert, Nesbitt, & Danielson, 2003). About one third of these births are to indigent parents who qualify for Medicaid assistance, thus much of the costs fall to the taxpayer. Over 10 years ago, neonatal length of stay research showed that premature infants (<7% of all births) accounted for over half of all hospital delivery charges (Marbella, Chetty, & Layde, 1998).

Many variables affect length of stay (LOS) in the NICU. Of course, the earlier the gestational age at birth, the longer the stay since discharge is roughly equivalent to the mother's original due date. Infants born as early as 23–24 gestational weeks have a 50% chance of survival while those born earlier than this rarely survive. Low birth weight (defined as less than 2499 g) similarly affects LOS. Other variables affecting LOS include time on the ventilator, the provision of oxygen at 36 gestational weeks or later, and retinopathy of prematurity (damage to the retina caused by the provision of oxygen to infants with immature lung development (Beeby, 2003)).

LOS research has shown that treatment is highly differentiated across NICUs and differences can be attributed primarily to problems with monitoring/treating apnea and poor feeding ability (Eichenwald et al., 2001). Unlike other patients, premature infants must resolve medical complications and attain maturity on critical life skills prior to discharge. This growth process is highly individualized (Eichenwald et al., 2001). About 20% of discharged premature infants have a higher risk than term infants of re-admission two weeks later. This is usually due to abnormal feeding ability which is exacerbated by length of ventilation for breathing assistance (Gilbert et al., 2003).

The incidence of painful medical procedures increases likelihood of longer stays. Earlier this decade it was felt that premature infants were neurologically too immature to sense pain. Now, we know that premature infants feel pain from 25 weeks gestation and that it seems to be a full awareness to pain. Multiple painful procedures are necessary daily in standardized NICU care and such awareness has potential for long-term neurologic damage (Slater

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et al., 2006). Even moderately premature infants are subject to morbidity, re-admission, and longterm disabilities (Escobar et al., 2006). Infants born prematurely have a 50% greater likelihood of developmental disability with cerebral palsy, hyperactivity, and specific learning disabilities being the most common.

NICU research has shown that a number of patient demographics affect length of stay, including admission to a children's hospital from another NICU, need for surgery, and congenital abnormalities (Berry, Shah, Brouillette, & Hellmann, 2008), and moderate vs. severe prematurity (Kirkby, Greenspan, Kornhauser, & Schneiderman, 2007). To facilitate improved patient care outcomes, a broad-based assessment of the complex NICU service is recommended in length of stay analyses (Schulman, 2006).

In 2006, Profit et al. published NICU length of stay data comparing health care systems in California, MA, and the United Kingdom. Subjects in their study were born moderately premature (between 30 and 34 gestational weeks). Results showed average lengths of stay for these infants of 35.9–36.3 days with both sites in the United States being shorter than that in the United Kingdom. The authors attributed differences in length of stay to the more integrated health care approaches in the U.S.

In the United States, NICU current treatment philosophy emphasizes family-centered, developmental care. An evaluative review of literature on such developmental care delineated a variety of approaches but lamented the dearth of literature comparing benefits (Peters, 1999). Others have asserted that family-centered care is critical in the NICU and that families should be involved in infant care throughout the length of stay (Griffin & Abraham, 2006). These authors emphasize the need for parents to be taught to observe their infants carefully to identify individual responses and progress.

A variety of NICU treatments have shortened length of stay, including massage and kinesthetic stimulation (Massaro, Hammad, Jazzo, & Aly, 2009), multidisciplinary guidelines for care (Nankervis et al., 2009), and NIDCAP care (Peters et al., 2009). Research has shown that parental anxiety is reduced when NICU length of stay is lessened (Melnyk et al., 2006).

Music therapy (MT) is used in many NICUs but sometimes is not considered an integrated developmental therapy despite research showing that music positively affects heart rate, respiratory rate, oxygen saturation, behavioral state, and pain responses (Hartling et al., 2009; Standley, 2002, 2003a, 2003b). The clinical NICU-MT program analyzed in this study has been in effect for over 7 years. It is fully integrated in the developmental and family centered care of NICU infants and consists of a variety of MT protocols including listening to recorded lullabies in the high risk nursery. The intermediate care nursery also makes referrals for 2 types of evidence-based treatment (Standley, 2003a, 2003b). Multi-modal stimulation was given as early as 30 gestational weeks to overcome symptoms of overstimulation and research has shown that it shortens length of stay (Standley, 1998). It teaches tolerance to increasing levels of stimulation using lullaby singing to pacify infants and then systematically adds massage, visual, and proprioceptive stimulation one mode at a time while continuing the singing. Infants are observed carefully for signs of overstimulation and all stimuli cease when symptoms appear. Infants usually learn to tolerate all of the combined layers of stimulation in about 3 days with one 15–30 min treatment/day.

Infants from 32 gestational weeks were also referred for use of a pacifier that activates music to reinforce sucking. Research shows that this device increases non-nutritive sucking (Standley, 2000), improves feeding rate at the next nipple feeding, and increases weight gain (Standley, 2003a, 2003b). This device has FDA approval to teach feeding skills to premature infants.

In a few cases in 2006, the music therapists taught NICU parents to observe their child for signs of overstimulation and how to implement the multi-modal procedure as an effective way to nurture their infant. Research has shown that this training helps parents to avoid overstimulation (Whipple, 2000). It has also been shown to increase parental visits. The few infants whose parents were so trained but who did not receive an MT service directly from the NICU-MT were not included in this study.

All of the music therapy clinical services were provided with approval of the infant's nurse caretaker and upon availability of the Board Certified Music Therapists (MT-BCs) trained in NICU-MT. Two MT-BCs provide treatment throughout this 900 bed regional medical center and spend approx. 7 h/week in the NICU.

Clinical NICU-MT experience has demonstrated that individual infants thrive when receiving music therapy as evidenced by weight gain, increased oxygen saturation levels, and development of independent feeding skill. Additionally, a variety of research studies have shown shortened length of stay due to music therapy procedures. Since infants usually thrive better in the home than the NICU, shortened hospital stay improves long term outcomes. We theorized that music listening was functioning to reduce stress by masking aversive auditory stimuli in the NICU; that multimodal stimulation, a systematic, live music, individualized intervention with accumulating layers of stimulation regulated by infant responses was enhancing neurologic development as evidenced by speed of acclimation to stimulation and reduction of episodes of overstimulation; and that use of the PAL reinforced non-nutritive sucking and led to faster nipple feeding status. We theorized that the multiple benefits of music therapy are so effective that length of stay may be differentiated by this intervention. There has been no research on clinical implementation of these procedures, so we were uncertain how patient demographics affected medical referral and provision of NICU-MT protocols.

Purpose

The purpose of this post hoc analysis of clinical records for all NICU infants treated during the year 2006 was to describe patient demographics of gender, weight gain, criticality of diagnoses, and length of stay as differentiated by the provision of music therapy.

Design

This study was a post hoc analysis of NICU medical records at a large non-profit regional medical center with a Level III NICU. Data were obtained from Powerchart, the computerized medical records used at TMH, and from departmental records of the Music Therapy Program. The clinical medical data were collected by research assistants blind to music therapy condition. Later, type of music therapy provision and frequency was obtained separately from departmental records. Since this was post hoc analysis of existing records, informed consent was not needed from individual patients, but IRB approval was obtained with a HIPPA waiver of confidentiality of records.

Methods

Subjects were all infants born at 35 gestational weeks or earlier who were also born low birth weight (<2499 g) and treated in the TMH Level III NICU in the calendar year 2006. A total of 410 infants were identified from the TMH medical records. Records were excluded for infants discharged to another hospital rather than to home or who died during their NICU stay, for those born at 36 gestational weeks or later or who weighed more than 2499 g, and for those whose medical records were incomplete. Final analyses were conducted on 208 infants who were born both premature and low birth weight, 83 of whom received NICU-MT. Table 1 shows the demographics of the population of infants treated with and without

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