

# Music and Mother's Voice as a Therapeutic Intervention for Convalescing Preterm Infants in the NICU

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## Introduction

Infants who require intensive care, as well as their families, are exposed to many unfamiliar sights and sounds. Clinicians employ pharmacologic and non-pharmacologic measures to reduce stress and promote comfort. A growing body of evidence exists for the use of music therapy as an aid to promote comfort in children requiring respiratory assistance; however, less is known about the application of this intervention to convalescing preterm infants in an intensive care nursery environment.

## Objective

The primary objective of this pilot study was to test the feasibility of a music therapy (MT) intervention program and to examine the outcomes of family-centered MT interventions on infants and their parents. The present study 1) compared two audio-recordings (music alone, and music and mother's voice) on infant physiologic responses (heart & respiratory rates) and behaviors (sleep state, non-nutritive sucking (NNS)), 2) examined the effects of MT on heart rate variability (HRV) as a measure of autonomic system balance; and 3) described the perceptions of parents regarding their participation in the MT intervention.

## Methods

Using a within subjects cohort study design, convalescing, stable preterm infants with chronic lung disease (adjusted age of  $\geq 36$  wks) were enrolled. Infants with known or suspected CNS lesion, asphyxia or seizures, or identified as having a congenital anomaly, injury, or viral infection associated with hearing loss were excluded.

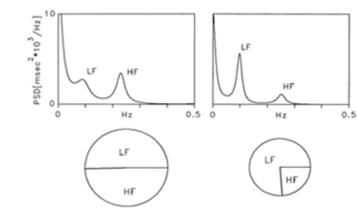
MT intervention was two audio-recordings in random order, consisting of music alone (sedative guitar in simple chord progression) and simultaneous music with mother's voice (singing lullaby) with a silent track in the beginning, between the two audio-recordings, and at the end. Preferred selections were based on parents' preferences for cultural and personal song selection appropriate for the infant's development and adapted musically to reflect properties of sedative music. Each mother sang the lyrics to guitar accompaniment. Audio-recordings were played using a portable MP3 player with attention to infection control and safety standards of volume control with speakers in the crib located on each side of the infant.



A 30-40 min MT intervention trial was delivered weekly (total of 4-5 trials) by a board-certified music therapist following standard nursing care/handling. A NIDCAP observer (inter-rater reliability  $\geq 85\%$ ) recorded physiologic and behavioral responses prior to, during, and after each MT intervention. HRV was obtained weekly before and after each MT intervention.

## Results

Figure 1. HRV Measurement (Sympathovagal Balance)



Adapted from "Heart Rate Variability: Standards of Measurement, Physiological Interpretation and Clinical Use," (1996) HRV Task Force of the European Society of Cardiology.

**Fig 1.** Characteristic HRV spectral frequency power bandwidths with representative Low Frequency (LF) to High Frequency (HF) ratio pie charts. Note: the graphic on the right shows LF predominance with diminished HF (parasympathetic tone) characteristic of the preterm infant.

Fig 2. Effect of Music Therapy on Heart Rate

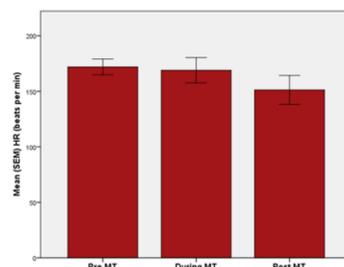
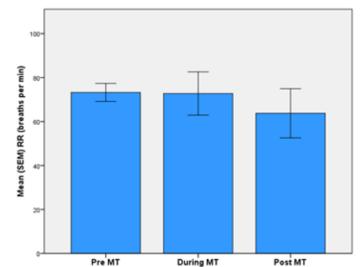
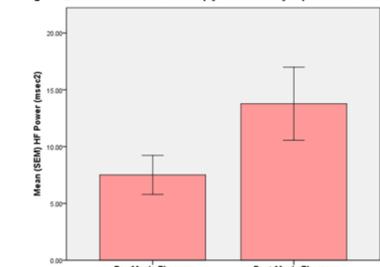


Fig 3. Effect of Music Therapy on Respiratory Rate



- Heart and respiratory rates were lower after the music therapy (**Fig 2 & Fig 3**).
- Heart and respiratory rates were significantly lower during mother's singing as compared to music alone.
- The percentage of sleep and non-nutritive sucking (NNS) during MT was lower for mother's voice as compared to music alone.
- The percentage of waking and moving toward the music source was highest during the mother's voice recordings.

Fig 4. Effect of Music Therapy on Parasympathetic Tone



**Fig 4.** Represents the mean pre and post HF-HRV spectral frequency averaged over 5 MT sessions. The bar graphs show an increased HF-HRV post MT therapy, suggesting higher parasympathetic (vagal) tone and higher stress resiliency.

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## Maternal Perceptions Regarding MT Intervention:

- On a scale of 1 to 4 ("not satisfied" to "very satisfied"), mothers were moderate to very satisfied with the availability of music therapy treatment for calming their babies other than sedatives.
- The ability to have a role in addressing their babies' needs, the ability to choose music that met their preferences, the amount of time required for participation in the study, and the infant's overall response to MT were all rated positively.
- Selected comments: "It was helpful recording the songs with a voice as well as the piano or guitar. Interesting to see "baby's response to my singing" "We appreciated the interest you took towards our child in looking at other ways to help calm her. It seemed to help her a lot"; "...think this is a wonderful program.."

## Conclusions

- The family-centered MT interventions resulted in positive effects on infant's physiologic response systems. Mother's singing was more beneficial compared to music alone, as infants showed lower HR and RR, more alertness, and less need for self-consoling when listening to mother's singing.
- MT had a positive effect on infants' autonomic system balance as HF-HRV, representative of vagal tone, increased from pre- to post-MT, suggesting that MT promotes premature infants' resiliency to stress and environmental stimulation.
- Mothers had positive perceptions regarding the MT intervention and their infants' overall responses to MT.

## Clinical Implications

Parental participation in MT should be encouraged as a means to provide stimulation appropriate for the infant's gestational age and administered in a soothing and protective manner. Future studies should examine the role of MT to enhance feeding and sleep in convalescing preterm infants.

## Selected References

- Dileo, C., & Bradt, J. (2005). Medical music therapy: A meta-analysis and agenda for future research. Cherry Hill, NJ: Jeffrey Books.
- Kemper, K. J. Hamilton, C.A., McLean, T. W., & Lovato, J. (2008). Impact of music therapy on pediatric oncology patients. *Pediatric Research*, 64(1), 105-109.
- Standley, J.M. (2002). A meta-analysis of the efficacy of music therapy for premature infants. *Journal of Pediatric Nursing*, 17, 107-113.
- Walworth, D.D. (2005). Procedural-support music therapy in healthcare settings: A cost-effectiveness analysis. *Journal of Pediatric Nursing*, 20, 276-284.
- Whipple, J. (2000). The effect of parent training in music and multimodal stimulation on parent-neonate interactions in the neonatal intensive care unit. *Journal of Music Therapy*, 37(4), 250-268.
- Wolfe, D.E., & Waldon, E.G. (2009). Music therapy and pediatric medicine. Silver Spring, MD: American Music Therapy Association, Inc.