Music Interventions for Very Preterm Infants in the NICU: A Pilot Study of Safety, Feasibility, and Preliminary Outcomes

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Background

Preterm infants in the NICU experience reduced meaningful auditory exposures during a critical period of brain development[1].

Music-based interventions (MBI) may be beneficial, yet the optimal conditions under which recorded auditory stimuli can be safely offered to high-risk infants in the NICU remain unclear[2].



Music Therapy in the BWH NICU

Aims : To address this gap, we evaluated the feasibility of a recorded MBI administered over a period of several weeks for very preterm infants prior to term-equivalent age (TEA).

Methods

- This **pilot study** included 15 very preterm infants (criteria: born at 24+0 to 32+6 weeks' gestation) in an academic Level III NICU.
- We excluded infants with major congenital anomalies, severe brain injury, or severe clinical illness precluding interventions.
- **Study procedures**
  - Infants were randomized to one of two study arms:
    1) M: Instrumental guitar played by a music therapist
    2) MPV: Parent singing a lullaby with guitar accompaniment.
  - Infants received recorded MBIs via infant-adapted headphones 3-5 times per week, for 10-15 minutes duration, after feeding and care times.



Infant-adapted headphone*

Headphones applied with and without CPAP using a Velcro strap*

* Patient image included with written permission from the infant's parent.

- MBIs duration: From enrollment (32-33 weeks PMA) to TEA
- A protocolized, tailored MBI was provided in two variations (shorter vs longer version for younger vs more mature infants)

Listen via the QR code below.



Results (1)

Fifteen infants were randomized; one patient was unable to receive MBI due to critical illness, and one transferred before study completion. **Thirteen were included in outcome analyses.**

Baseline characteristics

- Mean gestational age at birth was 30.0 ± 2.2 weeks (range 24.9–32.9) and mean birth weight 1356 ± 324 g (650–1900)
- Clinical characteristics and family-social factors did not differ between groups (Table 1).

Duration and Frequency of the MBIs: Infants received MBIs over a median of 35 days (range 12–44), with median frequency of 3.9 sessions per week (IQR 3.2–4.9).

Table 1. Clinical and family-social characteristics

Clinical characteristics	M (n = 6*)	MPV (n = 8*)	*p*-value
Gestational age, weeks (mean ± SD)	29.7 ± 2.9	30.2 ± 1.8	1.000
Male sex, n (%)	4 (66.7)	5 (62.5)	1.000
Multiple gestation, n (%)	1 (16.7)	1 (12.5)	1.000
Cesarean delivery, n (%)	2 (33.3)	7 (87.5)	0.129
Birth weight, g (mean ± SD)	1415.0 ± 418.7	1311.5 ± 253.9	0.477
Head circumference at birth, cm (median[IQR])	27.5 [27.0–28.0]	26.8 [25.2–28.5]	0.696
Length at birth, cm (median[IQR])	40.0 [40.0–42.5]	39.6 [38.0–41.0]	0.649
Small for gestational age, n (%)	0 (0.0)	1 (12.5)	1.000
Days intubated (median[IQR])	1.0 [1.0–61.0]	2.0 [1.0–2.0]	1.000
Days on mechanical ventilation (median[IQR])	29.0 [3.0–45.0]	30.0 [10.0–36.0]	0.830
Oxygen at 36 weeks PMA, n (%)	2 (33.3)	1 (14.3)	0.844
Days of TPN (median[IQR])	10.5 [4.0–180.0]	4.0 [3.0–7.0]	0.249
IVH grade 3 or 4, n (%)	0 (0.0)	0 (0.0)	NA
Positive bacterial blood culture, n (%)	2 (33.3)	1 (14.3)	0.844
Treatment of patent ductus arteriosus, n (%)	0 (0.0)	0 (0.0)	NA
Presence of necrotizing enterocolitis, n (%)	0 (0.0)	0 (0.0)	NA
Postnatal steroids treatment, n (%)	2 (33.3)	0 (0.0)	0.222
Treatment of retinopathy of prematurity, n (%)	1 (16.7)	0 (0.0)	0.720
Length of stay (median[IQR])	60.0 [47.0–78.0]	54.0 [47.0–75.0]	0.943
Family-social factors			
Maternal age, years (mean ± SD)	32.3 ± 4.7	35.5 ± 3.4	0.152
Maternal age < 21 years, n (%)	0 (0.0)	0 (0.0)	NA
Single marital status, n (%)	2 (33.3)	2 (25.0)	0.878
Public or no insurance, n (%)	3 (50.0)	1 (12.5)	0.407
Ethnic minority, n (%)	2 (33.3)	0 (0.0)	0.216
High family-social risk (≥ 2 risk factors), n (%)	3 (50.0)	0 (0.0)	0.078

*Among 15 randomized infants, one was excluded from analyses (n = 14).
Values are mean ± SD or median [IQR] based on skewness; categorical variables as n (%).

Results (2)

Interventions were safe and feasible to implement in the NICU. Sessions were well tolerated with no related physiologic instability or significant events recorded. Families and staff welcomed MBIs. Study interventions were well integrated into clinical flow.

Anderson Behavioral State Scores : Across 33 paired sessions, Infant Behavioral State Scores **evolved in the desired direction in both arms,** specifically: from 4.3 ± 1.5 before to 2.7 ± 1.1 after interventions in Arm 1 (M) , and from 3.5 ± 0.9 to 2.7 ± 1.3 in Arm 2 (MPV).

Test of Infant Motor Performance (TIMP) and Hammersmith Neonatal Neurological Examination (HNNE) scores at TEA were similar in the two groups (Wilcoxon rank-sum: $p = 0.72$ and $p = 0.37$, respectively) (Table 2)

Table 2

	M (n = 6)	MPV (n = 7)	*p*-value
TIMP (n = 13*)			
Gestational age at test, weeks (mean ± SD)	37.3 ± 2.0	37.8 ± 1.2	0.62
TIMP score (mean ± SD)	55.5 ± 4.8	56.3 ± 3.0	0.72
HNNE (n = 12*)			
Gestational age at test, weeks (median [IQR])	38.1 [37.1–38.9]	37.9 [37.6–38.1]	0.70
HNNE total score (max 34, mean ± SD)	30.2 ± 2.4	31.2 ± 1.5	0.37

Discussion

This pilot study demonstrated that
- MBIs were safe and feasible for very preterm infants in a level III NICU, with high adherence and no adverse events noted

- At TEA, early outcomes were similar between groups

- Findings support safety and feasibility of MBIs for preterm infants hospitalized in the NICU before TEA, and provide preliminary data to inform larger randomized trials.

References

1. Tierney AL, Nelson CA 3rd. Brain Development and the Role of Experience in the Early Years. Zero Three. 2009 Nov 1;30(2):9-13.
2. Erdei C. Safety of auditory interventions for vulnerable hospitalized infants: more is not always better. Lancet Child Adolesc Health. 2025;9(9):619–20.