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### Music Therapy for Neurodevelopment in Hospitalised Infants

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Infants with a history of early, prolonged hospitalisation (e.g. due to preterm birth) are widely known to experience adverse neurodevelopmental outcomes. (1) Researchers have suggested that some of these neurodevelopmental outcomes might be attributed to the sensory and linguistic deprivation that characterises time spent in hospital, rather than to the medical conditions and interventions that necessitate hospitalisation. (2–4) Thus there is an increasing interest in non-invasive environmental enrichment therapies in the neonatal intensive care unit (NICU), including music therapy. (4,5) Despite being a developmentally-focussed therapy, there is a surprising paucity of evidence regarding the impact of music therapy on neurodevelopment (as opposed to physiology) in infants. (6)

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In this edition, Emery and colleagues describe the results of a randomised comparative effectiveness study, where they compared two intervention models without a no-treatment control group. Eight sessions of music therapy were delivered in either: 1. Intensive-intermittent (four times a week in a week on, week off format over four weeks) or 2. Spaced mode (twice a week over four weeks). (7) Because music therapy is standard in the NICU where this study was conducted, including a no-treatment control group was not possible. Twenty seven infants between 44 and 66 weeks' post-menstrual age were recruited. Inclusion criteria specified children who: were expected to stay in the NICU for at least four weeks following recruitment; were not intubated or solely on assisted ventilation; had no surgery planned shortly before or during the intervention period; and were not receiving palliative care. Six infants were lost to follow-up: three were unable to complete the study due to changes to their medical status over the study period, and three were discharged before the conclusion of treatment. The latter three infants were still included in the analysis, however, according to the intention-to-treat protocol, resulting in a final analysis set of 24 infants. The study group had a median gestational age at birth of 28.5 weeks, and only three infants had experienced intraventricular haemorrhage. The majority of participants were receiving respiratory support. Specifically, 17% were on continuous positive air pressure, 13% on high flow nasal cannula, and 42% on nasal cannula. The outcome measures were a series of ten items from the standardised Developmental Assessment of Young Children 2<sup>nd</sup> Edition (DAYC-2). Each item was a single age-appropriate milestone, scored on a four-point scale, in the domains of gross motor skills, fine motor skills, cognition, social-emotional skills, and communication. Two composite scores (motor and overall) were also reported.

The authors' primary aim was to compare milestone acquisition between randomly delivered intensive-intermittent versus spaced modes of music therapy. A secondary aim was to evaluate the entire group before and after intervention, to examine changes in the group as a whole, regardless of which therapy was administered. The results demonstrated that there were no significant differences in milestone acquisition between the intensive-intermittent and spaced groups. By contrast, the whole group demonstrated significant changes from pre- to post-intervention on the Gross Motor 2, and Cognitive 2 items; and Composite Motor, and Composite Overall scores; but no changes in Fine Motor, Social-Emotional, or Communication items, or Gross Motor 1 or Cognitive 1 items. The effect sizes for the composite scores were in the medium to large range. A secondary analysis was conducted, using linear regression models, to evaluate the impact of potential co-

variates (race, feeding status, intraventricular haemorrhage, respiratory support, gestational age at birth, post-menstrual age at intervention) upon pre- and post-intervention composite score change, and no effect was found. The authors did not report any correction of p-values for multiple comparisons.

The finding that outcomes did not differ between the intensive-intermittent and spaced treatment groups may have important implications for health resourcing. The option to provide music therapy flexibly would allow hospitals and therapists to adapt their service delivery model to the needs of the service and the population of patients seen. However further work is needed to confirm this finding. Although the authors did not report a hypothesis related to which model was expected to be more effective, they cited a preliminary comparative effectiveness study suggesting that intensive-intermittent physiotherapy may be associated with better outcomes in infants with cerebral palsy than standard therapy spacing. (8) Examination of the data reported in Emery et al.'s study reveals a non-significant trend towards more change in the intensive-intermittent group (score changes were slightly greater in the intensive-intermittent group than the spaced group for seven of the ten items), but given that differences were not significant, a larger sample size, and full, standardised assessment battery would allow a more definitive conclusion to be drawn in a future study.

The differences in pre- and post-intervention scores across the study cohort appeared to be primarily driven by Gross Motor items. This is an interesting result, as it would be reasonable to hypothesise that the developmental areas most likely to change in response to music therapy would have been social-emotional and/or communication skills. The authors reflect that the rhythmicity of a musical intervention may have led to increased rhythmicity of movement in the study group; but that the relatively brief intervention (eight sessions) may have been inadequate to counter the effects of known auditory processing delays and longer term linguistic deprivation for the vulnerable infants in this study group. Another possibility might be that effects on social-emotional and communication domains are subtler and the outcome measurement tools not sensitive enough to change, or that these effects are slower to emerge. Follow-up assessments three or six months post-intervention, controlling for other neurodevelopmental interventions, may help to determine whether there are longer-term effects of music therapy in these domains. This would also help to determine whether the proposed benefits of this intervention are sustained, or whether a brief intervention is only effective in the short-term.

Given that motor milestones appeared to be the primary drivers of significant findings in this paper, it is notable that there was no significant association between pre- and post-intervention motor scores (whereas pre- and post-intervention overall scores were significantly associated). This may suggest that responses to the intervention were variable. For example, there may have been a greater intervention effect upon more severely delayed infants with more room for improvement (perhaps those who experienced more environmental and social deprivation, and/or higher stress levels), whereas more mildly delayed infants might make only small improvements before reaching a threshold dictated by their age. It is also possible that the application of other neurodevelopmental therapies (such as physiotherapy) might have confounded results, as these were not reported. The use of a no-treatment control group, and inclusion of data on the delivery of other neurodevelopmental therapies, should be considered in future studies to account for these factors.

One further consideration, that might also have contributed to the lack of association between pre- and post-intervention motor scores, is the psychometric robustness of the outcome measurement tool. The authors used a subset of items from a standardised assessment tool (DAYC-2), however it is unclear whether this truncated version of the assessment had been adequately validated. Ten milestones is a small assessment set, and may not have provided an accurate or adequate description of each child's level of development. The authors note in their discussion that two items assessed (Fine Motor 2, Social Emotional 2) reached the maximum possible score on average at the baseline assessment. This meant that no change could be detected for these items, and suggests that this tool might not be adequately sensitive. A validated developmental assessment tool (the authors suggest the Bayley Scales of Infant Toddler Development) may provide more useful information in future studies.

The authors reflect that, because music therapy is standard in the NICU where this study was conducted, it was not possible to include a no-treatment control group. Thus a logical next step for researchers would be to extend this study to a location where the recruitment of a no-treatment control group is viable, and conduct an appropriately powered randomised controlled trial using a well-validated developmental assessment. Such a trial would ideally control for other neurodevelopmental therapies, and include follow-up assessments after discharge and into early childhood to determine whether music therapy has promise as an intervention for ameliorating the

lasting neurodevelopmental sequelae of prolonged hospitalisations in infancy. Another fertile area for future investigations, raised by the authors in their discussion, might be whether a parent training approach provides any additional advantages, particularly in conjunction with Kangaroo Care. (9,10) This is particularly relevant given that many of the children included in this study were close to discharge, and so parent training could have facilitated carry-over into the home environment.

This paper provides preliminary results examining the impact of an eight-session music therapy intervention on the neurodevelopment of hospitalised infants, and comparing two service delivery models. It lays the foundation for future research to evaluate whether music therapies, and other linguistic and sensory enrichments in the NICU, are neuroprotective; and what service delivery models are most effective and efficient for these medically and developmentally vulnerable NICU patients.

#### **CONFLICT OF INTERESTS**

The authors have no conflict of interests to declare

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