

The Effect of Maternal Presence on Premature Infant Response to Recorded Music

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ABSTRACT

Objective: To determine the effect of maternal presence on the physiological and behavioral status of the preterm infant when exposed to recorded music versus ambient sound.

Design: Repeated-measures randomized controlled trial.

Setting: Special care nursery (SCN) in a tertiary perinatal center.

Participants: Clinically stable preterm infants (22) born at > 28 weeks gestation and enrolled at > 32 weeks gestation and their mothers.

Methods: Infants were exposed to lullaby music (6 minutes of ambient sound alternating with 2x 6 minutes recorded lullaby music) at a volume within the recommended sound level for the SCN. The mothers in the experimental group were present for the first 12 minutes (baseline and first music period) whereas the mothers in the control group were absent overall.

Results: There was no discernible infant response to music and therefore no significant impact of maternal presence on infant's response to music over time. However during the mothers' presence (first 12 minutes), the infants exhibited significantly higher oxygen saturation than during their absence $p = .024$ and less time spent in quiet sleep after their departure, though this was not significant.

Conclusion: Infants may have been unable to detect the music against the ambient soundscape. Regardless of exposure to music, the infants' physiological and behavioral regulation were affected by the presence and departure of the mothers.

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Each year in Australia approximately 8% of infants are born prematurely, that is in excess of 20,000 infants being born before age 37 weeks gestation (Laws, Li, & Sullivan, 2010). In addition to the inherent medical risks associated with premature birth, being cared for in an atypical environment puts preterm infants at increased risk of potential neuro-developmental problems (Romeo, Cioni, Palermo, Cilauro, & Romeo, 2013) and altered brain structures (Inder, Warfield, Wang, Huppi, & Volpe, 2005). The combination of the absence of the appropriate physical environment and the sudden loss of physiological and psychological support provided by the mother can be devastating to the preterm infant (Aucott, Donohue, Atkins, & Allen, 2002; White-Traut et al., 2009). The family is known to be a protective factor for infant neurodevelopment (Benzies, Magill-

Evans, Hayden, & Ballantyne, 2013; Vanderveen, Bassler, Robertson, & Kirpalani, 2009); however, the mother's typical role within the mother/infant dyad can be altered by weeks of extraordinary experience in the neonatal intensive care unit (NICU) with a notable lack of opportunity for interaction due to the infant's fragility (Aagaard & Hall, 2008). A growing number of researchers are scrutinizing the consequence of hospitalization for the new mother/infant dyad (Korja et al., 2010; Newnham, Milgrom, & Skouteris, 2009) and their experiences in hospital.

Maternal Presence for Preterm Infant

Many hospitals have adopted strategies to ameliorate mother/infant separation (Chesney & Champion, 2008; Melnyk et al., 2006) and minimize

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the potential negative impact on families, particularly on the mother/infant relationship. Most tertiary hospitals in Australia encourage the parents to be present with supportive infrastructure such as comfortable chairs, available food, facilities to express milk, and close-by or onsite accommodation. At the bedside, mothers are supported to be present with strategies such as skin-to-skin contact that allows preterm infants intermittent access to the mother's skin, smell (Schaal, Hummel, & Soussignan, 2004), voice, and touch (Gardner & Goldson, 2011; Konstandy et al., 2008), and promoting stability in the infant's physiological and behavioral status (Ludington-Hoe & Hosseini, 2005; Westrup, Kleberg, & Stjernquist, 2005). Mothers identify such experiences as a way to make a unique contribution to their infants' well-being, promoting a sense of mastery, closeness, and self-confidence in their mothering roles (Davis, Mohay, & Edwards, 2003).

Preterm Infant Response to Music

Recorded and live music are increasingly being used in NICUs and special care nurseries (SCNs) for infant self-regulation based on the evidence in the music therapy and nursing literature for the beneficial effect of music on infant status. Recorded music has been shown to reduce high arousal levels (Cassidy & Standley, 1995; Kaminski & Hall, 1996; Whipple, 2008) stabilize physiological functioning (Caine, 1991; Nagorski Johnson, 2003; Standley, 2003), increase oxygen saturation levels (Cassidy & Standley; Standley & Moore, 1995), reduce heart rate (Butt & Kisilevsky, 2000; Coleman, Pratt, Stoddard, Gerstmann, & Abel, 1997; Keith, Russell, & Weaver, 2009), and facilitate improved sleep (Olishchar, Shoemark, Trudy Holton, Weninger, & Hunt, 2011).

In addition to this however, engagement in music is also being considered as a supportive opportunity for mother and infant. When combined with mother's presence during kangaroo care, music has been shown to significantly improve blood pressure and respiration (Teckenberg-Jansson, Huotilainen, Pölkki, Lipsanen, & Järvenpääf, 2011), levels of quiet sleep (Lai et al., 2006), and reduce parental anxiety (Lai

et al., 2006; Teckenberg-Jansson et al., 2011). The potential of a music intervention to provide an opportunity for the mother to support her infant has only been partially realized through studies which provided parent training (Whipple, 2000), opportunity for maternal singing (Cevasco, 2008; Johnston, Fillion, & Nuyt, 2007; Loewy, Stewart, Dassler, Telsey, & Homel, 2013), and kangaroo care with music (Johnston et al., 2009; Lai, et al., 2006; Teckenberg-Jansson et al., 2011). The further proposition is that mother and infant listening to music together is encompassed into the infant's existing relationship with the mother, and an association with that loving relationship is constructed. Then at times when the mother is unable to be present, the potential of the familiar music to support infant regulation may be enhanced (Shoemark & Dearn, 2008; Shoemark, 1999).

Music in the Ambient Environment of the NICU and SCN

The American Academy of Pediatrics (AAP; 1997) recommended a Leq (the logarithmic equivalent of average sound level over a specific period of time) of 45dBA (A weighted scale) for the ambient sound of the NICU. Studies to measure the environment have repeatedly demonstrated that this is a very conservative sound level and difficult to achieve (Busch-Vishniac, West, Hunter, Orellana, & Chivukula, 2005; Byers, Lowman, & Waugh, 2006; Lasky & Williams, 2009). Alongside this, recommendations for the volume at which recorded music should be played in the NICU have varied from 55dBA (Standley, 2000) to 65dBA (75 dBC) (Standley, 2012), to Philbin's (2000) recommendation that the sound intensity of the music needs to be context driven (incubator or open cot; ventilation or proximity to nursing station). Premature infants do not have the same auditory discrimination ability as term newborns (de Regnier, 2008), and therefore it is reasonable to expect that premature infants would require more sound level intensity to detect music from the ambient sound than adults do (Werner, 2007).

The majority of studies using recorded music with premature infants in a NICU have used a volume level that does not account for the AAP recommendations and do not give important acoustic details for replication such as the sound level response time (slow or fast) or the weighting in the A scale (weighted for human hearing) or the C scale (weighted for environmental measurement). Music has been presented via free field speakers, headphones, and a speaker pillow, and the sound

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