



Mother–infant interaction improves with a developmental intervention for mother–preterm infant dyads



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ABSTRACT

While premature infants have a high need for positive interactions, both infants and their mothers are challenged by the infant's biological immaturity. This randomized clinical trial of 198 premature infants born at 29–34 weeks gestation and their mothers examined the impact of the H-HOPE (Hospital to Home: Optimizing the Infant's Environment) intervention on mother–preterm infant interaction patterns at 6-weeks corrected age (CA). Mothers had at least 2 social environmental risk factors such as minority status or less than high school education. Mother–infant dyads were randomly assigned to the H-HOPE intervention group or an attention control group. H-HOPE is an integrated intervention that included (1) twice-daily infant stimulation using the ATVV (auditory, tactile, visual, and vestibular-rocking stimulation) and (2) four maternal participatory guidance sessions plus two telephone calls by a nurse–community advocate team. Mother–infant interaction was assessed at 6-weeks CA using the Nursing Child Assessment Satellite Training–Feeding Scale (NCAST, 76 items) and the Dyadic Mutuality Code (DMC, 6-item contingency scale during a 5-min play session). NCAST and DMC scores for the Control and H-HOPE groups were compared using *t*-tests, chi-square tests and multivariable analysis. Compared with the Control group ($n = 76$), the H-HOPE group ($n = 66$) had higher overall NCAST scores and higher maternal Social-Emotional Growth Fostering Subscale scores. The H-HOPE group also had significantly higher scores for the overall infant subscale and the Infant Clarity of Cues Subscale ($p < 0.05$). H-HOPE dyads were also more likely to have high responsiveness during play as measured by the DMC (67.6% versus 58.1% of controls). After adjustment for significant maternal and infant characteristics, H-HOPE dyads had marginally higher scores during feeding on overall mother–infant interaction ($\beta = 2.03$, $p = 0.06$) and significantly higher scores on the infant subscale ($\beta = 0.75$, $p = 0.05$) when compared to controls. In the adjusted analysis, H-HOPE dyads had increased odds of high versus low mutual responsiveness during play (OR = 2.37, 95% CI = 0.97, 5.80). Intervening with both mother and infant is a promising approach to help premature infants achieve the social interaction patterns essential for optimal development.

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1. Background

Preterm birth remains a major health concern in the US. Nearly half a million infants are born prematurely each year in the US (Martin et al., 2012). Despite declines in the preterm birth rates among all race and Hispanic origin groups, substantial disparities remain. The preterm birth rate for African-Americans is over 1.5 times the rate for non-Hispanic whites (17.1% vs. 10.8%), and the rate for Hispanics is 11.8%, slightly higher than for non-Hispanic whites (Martin et al., 2012). Although survival rates have increased among all racial and ethnic groups, premature birth places surviving infants at increased biological risk for difficulties in behavioral organization, feeding, social interaction, development and growth (Bendersky & Lewis, 1994; Boyle et al., 2012; Bradley et al., 1994; Burchinal, Roberts, Zeisel, Hennon, & Hooper, 2006; Conley & Bennett, 2000; Cserjesi et al., 2012; Kelly, 2012; Kerstjens et al., 2011; McGauhey, Starfield, Alexander, & Ensminger, 1991; Ruth, Roos, Hildes-Ripstein, & Brownell, 2012; Saigal, Szatmari, Rosenbaum, Campbell, & King, 1991; Williams et al., 2013).

Because preterm infants are at higher risk of social-emotional, language, mental and motor developmental delays, social interaction is especially important in optimizing these outcomes (Forcada-Guex, Pierrehumbert, Borghini, Moessinger, & Muller-Nix, 2006; McGroder, 2000; Smith, Landry, & Swank, 2000). For most infants, interaction with their mothers is the foundation that builds their capacity for presenting clear behavioral cues and responding during social interaction. Building positive mother–infant interaction requires sensitive maternal responses to infant cues, positive affect, maternal pauses during interaction and other maternal behaviors including cognitive and social-emotional growth fostering behaviors. These maternal behaviors have been shown to facilitate infant clarity of cues and responsiveness, leading to engagement and mutual responsiveness (Barnard, 1979, 1997; Barnard, Hammond, Booth, Mitchell, & Spieker, 1989; Cusson, 2003). These types of positive interactions help establish social competency and secure attachment, which are essential for later social, language, and cognitive development (Barnard, 1997; Kelly, Morisset, Barnard, Hammond, & Booth, 1996; Steelman, Assel, Swank, Smith, & Landry, 2002).

While premature infants have a high need for positive interactions, establishing positive interaction patterns is challenging for both infants and their mothers because of the infant's biological immaturity. Premature infants have lower capacity for self-regulation, less alertness, hypersensitivity to stimulation, inefficient oral feeding and unclear behavioral cues that are difficult for parents to interpret (Feldman & Eidelman, 2006; Pickler et al., 2010; White-Traut, Nelson, Silvestri, Cunningham, & Patel, 1997; White-Traut et al., 2002a). Consequently, mothers may experience heightened levels of stress and anxiety related to their infant's prematurity and a lack of knowledge and confidence regarding premature infant care, which can alter their early mothering experience (Brandon et al., 2011; Feldman & Eidelman, 2006; Howland, Pickler, McCain, Glaser, & Lewis, 2011; Miles, Holditch-Davis, & Schwartz, 2007).

Infant immaturity, maternal distress, and lack of knowledge related to the premature infant's capacity for social interaction place the mother–infant dyad at risk for negative interaction patterns (Forcada-Guex, Borghini, Pierrehumbert, Ansermet, & Muller-Nix, 2011; Glascoe & Leew, 2010; Gravener et al., 2012; Holditch-Davis, Schwartz, Black, & Scher, 2007; Lee, Holditch-Davis, & Miles, 2007; McManus & Poehlmann, 2012; Treyvaud et al., 2011). A mother's perceptions of her premature infant may be negatively altered, and these negative perceptions can limit a mother's capacity to respond appropriately, causing disruptions in the development of appropriate mother–infant interaction (Brandon et al., 2011; Coyl, Roggman, & Newland, 2002; Miles et al., 2007; Nicolaou, Rosewell, Marlow, & Glazebrook, 2009; Pridham, Lin, & Brown, 2001). Initially, mothers respond to their preterm infants with overstimulation, resulting in negative infant responses, followed by maternal continued non-contingent overstimulation or decreased stimulation despite increasing infant readiness for social interaction (Forcada-Guex et al., 2006; Holditch-Davis, Miles, & Belyea, 2000; Magill-Evans & Harrison, 2001). Higher levels of maternal anxiety were also associated with premature infants being less facially responsive in interactions with their mothers (Schmucker et al., 2005). Over time, maternal lack of sensitivity and non-contingent behaviors during interactions lead to poorer infant growth and development (Feldman & Eidelman, 2006; Feldman, Keren, Gross-Rozval, & Tyano, 2004; Glascoe & Leew, 2010; Treyvaud et al., 2011; White-Traut & Norr, 2009).

Behavioral and developmental interventions are necessary to address the unique behaviors of premature infants and interactive capacities of the mother–infant dyad. To date, many interventions have addressed the needs of premature infants and mothers separately. Interventions for premature infants have largely concentrated on improving the development of the infant's nervous system and have had positive outcomes including better neurobehavioral functioning, increased alertness, and increased arousal (Als et al., 2004; Burns, Cunningham, White-Traut, Silvestri, & Nelson, 1994; Lekskulchai & Cole, 2001; White-Traut et al., 1997, 2002a). Interventions for mothers of premature infants have focused on reducing maternal distress and improving maternal sensitivity to their premature infant, resulting in reduced maternal anxiety and improved mother–infant interactions (Bakermans-Kranenburg, van Ijzendoorn, & Juffer, 2003; Davis, Edwards, Mohay, & Wollin, 2003; Feeley, Zelkowitz, Westreich, & Dunkley, 2011; Kaarsen, Ronning, Ulvund, & Dahl, 2006; Parker, Zahr, Cole, & Brecht, 1992). Other interventions have been directed to mothers of premature infants with the aim of improving their capacity to recognize and respond to their infant's unique behavioral cues, resulting in improved sensitivity and responsiveness among mothers (Kang et al., 1995; Pridham et al., 2005; Ravn et al., 2011; Schroeder & Pridham, 2006). However, no previous interventions have simultaneously focused on the needs of both mothers and premature infants to improve the quality of their interactions.

Guided by the Transactional Model (Sameroff & MacKenzie, 2003), we developed the H-HOPE intervention (Hospital to Home: Optimizing the Infant's Environment). H-HOPE integrates an infant remediation intervention (the ATVV intervention) with maternal re-education and redefinition offered via participatory guidance by a nurse-community advocate team (NAT) (White-Traut & Norr, 2009). In this study, we targeted clinically stable premature infants born at 29–34 weeks (considered at

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