



Elevated maternal anxiety in the NICU predicts worse fine motor outcome in VLBW infants[☆]



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ABSTRACT

Aim: The literature is sparse with respect to the impact of elevated maternal psychological distress in the neonatal intensive care unit (NICU) on later neurodevelopmental outcome in VLBW infants. The objective of this study is to examine the impact of elevated maternal distress, defined as elevated depression, anxiety and perinatal-specific post-traumatic stress, during the NICU hospitalization on VLBW infant ND outcome at 20 months corrected age (CA).

Methods: This was a prospective study of 69 mothers and their VLBW infants recruited in 2011–2012. Elevated maternal distress was collected by maternal questionnaire in the NICU. Elevated depression was quantified with the Center for Epidemiological Studies-Depression Scale, anxiety with the Spielberger State-Trait Anxiety Inventory and perinatal-specific post-traumatic stress with the Modified Perinatal Posttraumatic Stress Disorder Questionnaire. VLBW infant ND outcome was assessed using the Bayley Scales of Infant & Toddler Development-III at 20 months CA. Regression analyses determined the impact of elevated distress on ND outcome after adjusting for infant medical and maternal sociodemographic variables.

Results: After controlling for infant and maternal covariates, elevated maternal anxiety in the NICU predicted lower fine motor scores at 20 months CA.

Conclusion: Elevated maternal anxiety in the NICU is associated with adverse ND outcome in VLBW infants in the 2nd year of life. NICU-based support services may help mothers' quality of life and VLBW infant outcome.

1. Introduction

Mothers of very low birth weight (VLBW, birth weight < 1500 g) infants hospitalized in the neonatal intensive care unit (NICU) experience acute emotional vulnerability stemming from the unexpected and often traumatic nature of the preterm birth [1], and immediate separation from their critically ill infant. The stress of parenting a critically ill infant during the two to three month NICU hospitalization impacts mothers' emotional well-being as they face uncertainty about their VLBW infants' increased risks for life-long health and neurodevelopmental (ND) difficulties [2]. Relative to mothers of full-term infants in the first three months of the post-partum period,¹ mothers of VLBW infants hospitalized in the NICU demonstrate disproportionately higher rates of elevated maternal psychological distress, typically

defined as elevated symptoms of depression, anxiety and perinatal-specific post-traumatic stress (PPTS) [3–8]. Fourteen to 63% of mothers of VLBW infants hospitalized in the NICU endorse elevated rates of depression, 43–55% endorse elevated rates of anxiety, and 24–25% endorse elevated PPTS. Rates for all three aspects of psychological distress for mothers of full-term infants in the first three months of the post-partum period are significantly lower, with elevated depression endorsed by 10–15%, elevated anxiety endorsed by 43–55% and elevated PPTS by only 3% of mothers.

Although little is known about the effect of elevated maternal distress in the NICU on VLBW infants' ND outcome in early childhood, the negative effect of elevated post-partum depression and, to a lesser extent, PPTS and anxiety, on ND outcome for children who were born full-term is well established [9–13]. Elevated levels of all three aspects of

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¹ In the psychological distress literature, the post-partum period is typically defined as the first 12 months after childbirth [17,18]

distress are hypothesized to impact full-term children's ND outcome by altering mother-child relationships and mothers' ability to engage in sensitive parenting, defined as parenting characterized by emotionally and developmentally synchronized interactions [14–17]. More specifically, altered relationships and insensitive parenting negatively impacts mothers' ability to help their child regulate attention and arousal, participate in contingent play, and engage in scaffolded, structured play, all of which promote ND outcome [11,14–17]. The first three months of the post-partum period is recognized as a critical time for establishing mother-child relationships. Thus, elevated maternal distress occurring within this time frame has the potential to have a stronger negative influence on both the developing mother-child relationship and the child's ND outcome than other periods of development [17,18].

The critical first three-months of the post-partum period coincides with the average length of NICU hospitalization for VLBW infants. It is also the time period in which mothers of VLBW infants experience the highest rates of elevated psychological distress [3–8]. Furthermore, for VLBW infants this same time period also coincides with gestational weeks (24–40) uniquely associated with rapid pre-oligodendroglial, microglial, axonal, subplate neuronal, cortical and cerebellar growth and “enhanced vulnerability” of the brain [19]. To our knowledge, in the past 15 years [20] only Zelkowitz et al. [21] has assessed elevated maternal psychological distress during VLBW infants' NICU hospitalization. This seminal study revealed that elevated maternal anxiety during the NICU period significantly predicted lower composite cognitive and language score in infants at 20 months corrected age (defined as age adjusted for prematurity, CA). Zelkowitz et al. [21] only examined the association between one psychological distress variable (e.g., anxiety) during the NICU hospitalization and ND outcome, not all three variables (e.g., depression and PPTS also).

Given that mother-VLBW infant dyads are at disproportionately higher risk for both elevated maternal psychological distress during the NICU hospitalization and infant ND delay [2], understanding the associations between elevated psychological distress in mothers and their VLBW infants' ND outcome is of great importance. The purpose of this study is to identify the associations between elevated maternal depression, anxiety and PPTS at two time points during the NICU hospitalization (within the first month of the NICU hospitalization and 2 weeks prior to NICU discharge) on ND outcome in the 2nd year of life in a contemporary cohort of VLBW infants. Based on the existing literature of full-term and VLBW infants, we hypothesize that elevated maternal depression, anxiety and PPTS at both NICU time points will be associated with lower scores on ND measures for VLBW infants.

2. Methods

This is a longitudinal, mixed-method (quantitative and qualitative) study of 69 mothers and their VLBW infants recruited from a 57 bed, level IV NICU in an urban academic center, in the United States (US), from 2011 to 2012. Qualitative results have been previously published [22,23]. Eligible mothers were identified and recruited based on their participation in a larger, NIH-funded cohort study. Additional details of the NIH-funded cohort study have been previously published [24]. This sub-study of 69 mothers, identified and recruited from the larger NIH cohort study, examined associations among a series of NICU variables, namely infant medical risk factors, maternal sociodemographic variables, maternal psychological distress levels, maternal visitation rates, and human milk exposure/dose, and, post-NICU discharge VLBW infant ND outcome and maternal psychological distress. The present study reports on NICU-based maternal and infant variables, NICU-based maternal psychological distress, and post-NICU discharge VLBW infant ND outcome.

2.1. Participants

Mothers of VLBW infants were recruited to participate if the mothers were enrolled in the aforementioned larger, NIH-funded cohort study English-speaking, ≥ 18 years of age, and the infants were deemed likely to survive by the attending neonatologist. Of 100 eligible dyads, 72 mothers initially signed consent, 17 refused and/or were not approached given difficulty contacting the mothers, and 11 had immediate plans to transport their infants from the NICU to a hospital closer to the mother's home. Of the 72 mothers, 69 mothers (3 mothers lost due to sudden transfer/infant death) completed the first wave of maternal distress questionnaires (Time 1, T1) and 64 completed the second wave of distress questionnaires (Time 2, T2). The relevant institutional review board (IRB) approved this study. Written informed consent was obtained for all participants. Given privacy requirements of the IRB, no data were available for mothers who did not sign consent for participation.

2.2. Design

Infant and maternal data from the NICU hospitalization were obtained from collaboration with the larger NIH-funded cohort study via medical chart review conducted upon VLBW infant NICU discharge. During the NICU hospitalization, maternal self-report distress questionnaires were administered 2–4 weeks after birth (T1 mean 28.1 days). Questionnaires were repeated on one occasion, approximately 2 weeks prior to discharge (T2 mean 14.8 days prior to discharge). Variability existed for the interim days between T1 and T2 (Mean = 50.6, Median = 49, SD = 26.23, range = 7–101). Mothers with extreme T1 and T2 interim day values (more or < 1.5 SD from the mean) did not have extreme, or outlier (more or < 1.5 SD from mean) distress values. Post-NICU assessment of VLBW ND outcome occurred at routine clinical visits to the Neonatal High Risk Follow-up Clinic, a multidisciplinary clinic that monitors growth, neurologic, and neurodevelopmental status of infants cared for in the NICU.

2.3. Measures

2.3.1. Infant medical variables

The following were collected as a part of the larger NIH project and were accessed by this study: infant birthweight (BW) in grams, gestational age (GA) in weeks, sex, length of time on a mechanical ventilator in the NICU (days), presence of late-onset sepsis (presumed or confirmed), presence of necrotizing enterocolitis (stage 2 or 3) [25], presence of severely abnormal head ultrasound (defined as presence of intraventricular hemorrhage grade III or IV, periventricular leukomalacia, or hydrocephalus requiring shunt), presence of any abnormal head ultrasound (defined as presence of intraventricular hemorrhage grades I–IV, periventricular leukomalacia, or hydrocephalus requiring shunt), average daily dose of human milk (HM) received by infant, receiving any HM at time of NICU discharge, length of hospitalization (days) were gathered from the extensive prospective NIH database.

2.3.2. Maternal sociodemographic, reproductive, psychological history variables

The following were collected as a part of the larger NIH project and were accessed by this study: maternal age, education level, unemployment status, race/ethnicity, relationship status, insurance status, eligibility for Women, Infant and Children (WIC) program (a government subsidized program for families with incomes below state poverty standards), primipara status, history of fetal loss and history of prior preterm delivery.

Psychological history was collected via self-report and medical chart review. Information about mothers' history of psychological diagnosis prior to birth of a preterm infant, history of involvement with the state's Child Protective Services, and history of drug abuse during pregnancy

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