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Maternal Psychological Distress and Visitation to the NICU

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Abstract

Aim—To examine associations between maternal NICU visitation rates, maternal psychological distress (“distress”), and preterm infant outcome post-NICU discharge in a contemporary cohort of very low birth weight (VLBW) infants.

Methods—This was a prospective study of 69 mothers and their VLBW infants. Distress was assessed 1 month post-birth, 2 weeks prior to NICU discharge and after NICU discharge at 4 months corrected age [CA]. Maternal NICU visitation rates were calculated for the first 2 weeks and 1 month post-birth as well as for the entire NICU hospitalization. Regression analyses adjusted for the impact of 1. maternal and infant characteristics and distress on maternal visitation rates and 2. the impact of visitation on long-term maternal distress, and rates of infant clinic attendance and rehospitalization.

Results—Greater number of children in the home, maternal exposure to a greater number of potentially traumatic events prior to childbirth, and lower maternal anxiety consistently predicted lower visitation rate. Lower maternal visitation rate predicted higher maternal depression scores at infants’ 4 month CA visit. Maternal NICU visitation rate did not predict post-NICU discharge infant clinic attendance or rehospitalization.

Conclusion—Distress is an important predictor of visitation. In turn, visitation is associated with long-term maternal distress.

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Conflict of Interest

The authors report no conflict of interest of relevant financial relationships.

Keywords

maternal NICU visitation; maternal psychological distress; NICU follow-up; re-hospitalization

Background

Since 1993, when the Principles for Family Centered Neonatal Care were published, many neonatal intensive care units (NICUs) have implemented policies to support maternal visitation (1,2,3). Recently, many NICUs have transitioned away from traditional open-bay units to single-patient rooms, with the rationale that single-patient rooms provide an environment that will better facilitate maternal visitation (4). Maternal visitation to the NICU is considered important for infant outcomes as it is associated with shorter NICU length of stay, higher rates of NICU follow-up clinic attendance and lower rates of behavioral and emotional problems in preterm infants at school age (5,6,7).

Maternal visitation practices also have important implications for the mother. Mothers of preterm infants experience disproportionately elevated rates of maternal psychological distress (referred to hereafter as “distress”) relative to term infants (8,9,10), and this distress has been known to negatively impact the parent-child relationships (11). Frequent maternal visitation to the NICU has been hypothesized to decrease distress by creating opportunities for mothers to participate in infant caregiving and improve parent-child relationships (4). Despite the implications of the associations between distress and visitation, to date, only one study has directly examined the association between one type of distress, NICU-specific parenting stress, and visitation patterns (12). This study revealed that higher stress specifically related to infants’ appearance and behavior predicted less frequent visitation (12). To our knowledge, no study has directly examined the associations between other types of distress (e.g., depressive, anxious, or post-traumatic stress symptoms) on maternal visitation rate, or, the impact of NICU visitation rate on later maternal distress post-NICU discharge.

The purpose, therefore, of this study was to examine: 1) multiple types of distress predictors of maternal NICU visitation rates and; 2) the relationships between maternal NICU visitation rates and later maternal distress and infant clinic attendance and rehospitalization by four months corrected age (CA).

Methods

Participants

This study was a part of a prospective, longitudinal, mixed-method examination of 69 mothers and their VLBW infants enrolled in a larger NICU-based NIH investigation (NR010009, P. Meier, principal investigator). English-speaking mothers over 18 years of age with infants deemed likely to survive by the neonatologist were eligible for enrollment in this study. Sample characteristics are summarized in Table 1. Mothers of infants were recruited and enrolled into this study from August, 2011 through December, 2012. A registered nurse with expertise as a research coordinator and clinical responsibility in the NICU introduced this study to mothers in person and/or over the telephone. Informed

consent was obtained by this research coordinator, a second trained NICU registered nurse with evening and weekend availability, or the study's primary investigator (MG) with evening and weekend availability. Informed consent was obtained either during mothers' unscheduled visits to the NICU, or during meetings scheduled at a time convenient for mothers.

Qualitative results from the mixed-method study have been reported elsewhere (13, 14). Both studies were approved by the medical center's institutional review board, and written informed consent was acquired from participants. Per existing NICU clinical protocol, mothers identified as experiencing significant distress via unstructured clinical interview completed by all NICU mothers with NICU social workers and/or medical staff concern were referred to mental health professionals.

Recruitment and Study Timeline

Of 100 eligible mothers, 72% initially signed consent, 17% refused and/or were difficult to approach, and 11% were not approached because of immediate plans to transport the infants from the NICU to a hospital closer to the mother's home. Distress questionnaires were administered at the following time points: 28 days post-birth (one month post-birth), 14 days prior to NICU discharge (two weeks prior to discharge) and at infants' four month CA visit. Multiple time points were chosen as previous investigations have demonstrated that distress in this population significantly declines throughout the course of the NICU hospitalization (15) and post-discharge throughout the first year of life (8,16). The first time point of approximately one month after birth was based on the initial time point of a seminal longitudinal investigation of maternal psychologist distress in mothers of VLBW infants (16). Two weeks prior to discharge is consistent with other recent investigations that analyzed distress near time of hospital discharge (9,17). The four month CA time point was chosen because all VLBW infants discharged from the NICU were routinely scheduled for a visit to the Neonatal High-Risk Follow-Up Clinic at this age. All infants were discharged from the NICU by four month CA. Attendance rates were calculated for the follow-up clinic visit, and of those who attended, rehospitalization rates post-NICU discharge were obtained.

Maternal Visitation Measures

Maternal visitation rate was measured using data from the institution's visitation sign-in sheets maintained as part of the hospital's clinical protocol. Per clinical protocol, mothers were required to sign their names and the date of the visit with clerical staff at a NICU reception desk and receive a visitor identification card before entering the locked, open-bay NICU. Per protocol, clerical staff retained photograph identification of mothers to validate the identity of mothers. Mothers were allowed to visit 24 hours a day but did not have sleep accommodations at the bedside. One parent sleep room was available for use by: 1) critically ill infant's parents; 2) parents who were providing "full care" for an infant in preparation for discharge home. The majority of mothers did not document the time they entered and left the unit and as such duration data are not available.

For 30% of the mothers, sign-in data was incomplete (range: 2 days -7 weeks of visitation data) due to human error (most frequent example was a page of the visitation log being

thrown away/shredded by clerical staff prior to patient being discharged). Maternal visitation also is collected by NICU nursing staff documentation in the electronic medical chart. Data missing from sign-in sheets was supplemented via electronic medical chart in these situations. T-tests confirmed that there were no significant differences in infant, maternal or visitation variables for mothers with visitation data that required supplementation via medical chart documentation and those that did not have any missing data via the sign-in sheet ($p > .05$). The sign-in sheet was used as the primary source for data because the photograph identification was thought to ensure better validity of mothers' visitation (versus visitation by another family-approved female visitor).

Visitation was calculated for the following time points: first 14 days (two weeks) post-birth, first 30 days (one month) post-birth, and for the duration of the hospitalization, birth through discharge. These time points were chosen based on previous literature that: 1) documented that the greatest number of visitation hours occur in the first two weeks of the NICU hospitalization (4); 2) studied visitation in, approximately, the first month (i.e., 28 days) of the NICU hospitalization (18), and; 3) studied visitation across the duration of the entire NICU hospitalization (12). The visitation rate for each mother was calculated by recording the total number of days that a mother visited her infant within the time interval and dividing by the total number of days in the respective time interval. One month post-birth and two weeks prior to discharge mothers completed a checklist of barriers to visitation developed by this team of NICU clinician-researchers. Potential barriers included difficulty visiting due to: car problems, hospital parking fees, general commute factors, child care issues, employment, phone/internet problems, and child protective service issues. The cumulative sum of barriers and individual barriers were both entered into study analyses.

Maternal Socio-demographic & Medical and Infant Birth & Medical Variables

The following maternal data were collected from the database for the NIH study and from additional chart review, as needed: age, insurance status, education, race, relationship status, primipara status, number of mothers with other children, total number of children and adults in the home, history of health problem in other children, total number of caretakers available, distance between the home and NICU, diagnosis of preeclampsia, gestational diabetes, and pre-pregnancy diabetes mellitus. Infant data that were collected included: sex, birth weight, gestational age (GA), postmenstrual age at NICU discharge, length of NICU stay, head ultrasound abnormalities, presence of sepsis (both culture proven and suspected), necrotizing enterocolitis (as defined by Bell et al., 19), bronchopulmonary dysplasia (defined as oxygen dependence at 36 weeks postmenstrual age), duration of mechanical ventilation, and need for oxygen therapy or gastrostomy tube at discharge. Methods for collecting these data have been described in previous publications by this research team (20).

Maternal Psychological Distress Measures

Unless otherwise noted below, the following questionnaires were administered one month post-birth, two weeks prior to discharge and at infants' four month CA visit with higher scores indicating more symptomatology/greater distress: 1. The Center for Epidemiological Studies-Depression Scale (CES-D, 21) is a 20-item measure that assesses depressive symptomatology. The CES-D has been used in this study's population with good internal

reliability ($\alpha = .81-.90$; 8, 17). CESD clinical cut-off scores used by previous investigations (CESD > 16; 8, 17) were used to define elevated depressive symptomatology. 2. The Spielberger State-Trait Anxiety Inventory (STAI, 22; Trait administered only at one-month post-birth, State administered across time points) is comprised of a 20-item subscale of “state” or acute/situational anxiety and 20-item subscale of “trait” or generalized anxiety. The STAI has demonstrated good internal consistency among mothers of VLBW infants ($\alpha = .89$; 23). STAI clinical cut-off scores used by previous investigations (State scores > 40-50 considered moderate anxiety, State scores > 60 considered severe anxiety; 9) were used to define elevated symptoms of anxiety. 3. The Modified Perinatal Posttraumatic Stress Disorder Questionnaires (PPQ-M, 24, 25) is a 14-item questionnaire designed to measure perinatal-specific post-traumatic stress (PPTS). It is well-validated for use with mothers with infants in the NICU (25) with good internal consistency ($\alpha = .90$). The PPQ-M’s clinical cut-off score of 19 (25), was used to define elevated PPTS symptomatology (25). 4. The Life Events Checklist (LEC, 26, administered only at one month post-birth) is a 17-item scale that quantifies cumulative lifetime exposure to potentially traumatic events. Documentation of history of previous traumatic events is important in comprehensive models of trauma and post-traumatic stress symptomatology (10). The LEC has temporal stability ranging from .84-.37 and correlates well to other measures of post-traumatic stress (26).

Data Analysis

Pearson, point-biserial and chi-square analyses were calculated to determine bivariate associations between maternal socio-demographic and medical variables, infant birth and medical variables, distress variables, maternal report of barriers to visitation and maternal visitation rates for 2 weeks post-birth, 1 month post-birth and birth through discharge. Variables associated with maternal visitation rates at $p < .05$ in bivariate analyses were entered into hierarchical multiple regression models. Only variables measured and/or considered to exist before respective visitation intervals were entered into regression models (ex. lifetime history of exposure to traumatic events was the only distress variable entered into the two weeks post-birth visitation model). Maternal and infant characteristics were entered into step 1 and distress variables were entered into step 2 of regression models. Variables that had a p value $< .35$ at each step were retained in final models. This same statistical approach was used to investigate maternal visitation rates as a predictor of distress variables at infants’ four month CA visit. Variables associated with distress at infants’ four month CA visit at $p < .05$ in bivariate analyses were entered into hierarchical models. Maternal variables, infant variables, and distress variables from earlier time points were entered into in step 1 and maternal visitation was entered into step 2 of regression models. Point-biserial and chi-square analyses were calculated to determine bivariate associations between maternal visitation rates and infants’ four month CA follow-up attendance and re-hospitalization rate.

Results

Of the 69 mothers initially enrolled, 64 (93%) and 52 (74%) completed questionnaires two weeks prior to discharge and at infants’ four month CA visit, respectively. The only difference between mother-infant dyads who attended the four month CA visit and those that

did not was gestational age (GA). The mean GA of infants who attended the visit at four months CA was significantly lower than that of those who did not attend (27.1 ± 2 weeks vs. 28.7 ± 2 weeks, $t [67] = 2.00$, $p = .049$). Maternal socio-demographic and medical factors and infant birth and medical factors are summarized in Table 1. Mothers were primarily black (54%), with public insurance (66%), and not married (68%).

Maternal visitation rates declined from 70% of days ($SD \pm 27\%$) over the first two weeks post-birth, to 67% of days ($SD \pm 24\%$) over the first month post-birth, to 61% of days ($SD \pm 23\%$) birth through discharge. Mothers did not report a large number of barriers to hospital visitation ($M = 1.37 \pm 1.17$) with the most commonly cited barriers being commute to hospital (52%), car issues (38%), lack of child care (25%), problems with hospital parking (20%) and job/employment (3%). On average, families resided 20.68 miles ($SD = 14.20$) away from the NICU.

Distress data are summarized in Table 2. Mothers had relatively high distress and significant exposure to potentially traumatic events. Rates of elevated anxiety and PPTS symptoms significantly declined from one month post-birth to the four month CA visit (McNemar's test $p = .000$ and $p = .012$, respectively). Rates of elevated depression trended towards a statistically significant decline from one month post-birth to the four month CA visit (McNemar's test $p = .11$).

Predictors of Maternal NICU Visitation Rates (Tables S1-S3)

In final multiple regression models, greater number of children residing in the home and exposure to a greater number of potentially traumatic events predicted lower visitation rates across all time points. Other predictors of lower visitation rates for the first one month post-birth and birth through discharge in final multiple regression models included lower state anxiety one month post-birth, the burden of hospital parking and African-American/Black race.

In addition to the predictors of maternal visitation rate reported above, the following maternal variables significantly related ($p < .05$) to lower visitation rates over the first one month post-birth and/or birth through discharge in bivariate analyses but did not maintain a p -value of $< .35$ in multiple regression analyses and as such were not retained in final regression models: public insurance (one month $r = .37$, $p = .003$; birth-discharge $r = .43$, $p < .001$), relationship status (not cohabitating with or being married to partner birth-discharge $r = .26$, $p = .04$), younger maternal age (birth-discharge $r = .30$, $p = .015$), maternal self-reported difficulty visiting hospital due to car difficulty (one month $r = -.26$, $p = .04$; birth-discharge $r = -.35$, $p = .04$), and maternal self-reported difficulty visiting hospital due to parking problems (birth-discharge $r = -.28$, $p = .024$).

Maternal NICU Visitation Rates as Predictors of Maternal and Infant Outcome at Infants' 4 month CA Visit (Table S4)

In bivariate analyses, the only significant association between maternal visitation rate variables and maternal distress variables at infants' four month CA visit was the association between lower maternal visitation rate in the first two weeks post-birth and higher maternal depression score at infants' four month CA visit ($r = -.42$, $p = .006$).

In the final regression model for maternal depression score at infants' four month CA visit, lower maternal visitation rate over the first two weeks post-birth was the only significant predictor ($p < .05$). In addition to lower visitation rate over the first two weeks post-birth, lower infant GA ($r = -.33$, $p = .03$), greater exposure to a greater number of potentially traumatic events ($r = .48$, $p = .002$) and greater number of reported caretakers for child ($r = .37$, $p = .02$) significantly related to higher maternal depression score at infants' four month CA visit in bivariate analyses, and as such were included in the regression model. These variables did not maintain a p-value of $p < .05$ in the regression model, but did have p-values $< .35$, so they were retained in the final multiple regression model. Additionally, maternal depression score one month post-birth ($r = .23$, $p = .14$) was included in the multiple regression model despite the fact that it did not significantly ($p < .05$) relate to maternal depression score at infants' four month CA visit, in order to control for earlier (baseline) depression levels. Maternal depression score one month post-birth had a p-value $< .35$ in the regression model and as such was retained in the final multiple regression model.

In contrast, maternal NICU visitation rate variables did not significantly relate to either attendance at infants' four month CA appointment or rehospitalization prior to four months CA ($p > .05$) in bivariate analyses and as such, multiple regression analyses were not calculated. In total, 29% of infants who returned for the four month CA visit had been rehospitalized. Respiratory problems and respiratory infection accounted for nearly half (43%) of rehospitalizations. Surgical complications, non-respiratory infections, feeding issues and acute life threatening events each respectively accounted for 14% of the rehospitalizations.

Discussion

To our knowledge, this is the first study to include multiple types of distress and maternal reports of visitation barriers in prediction models of maternal NICU visitation. We found that the most consistent predictors of lower maternal NICU visitation rates were exposure to a greater number of potentially traumatic events, lower maternal anxiety, and the number of other children residing in the home.

The association between exposure to traumatic events and lower visitation rate may be a proxy for socio-demographic disadvantage, which is associated with greater exposure to traumatic events. Consistent with previous investigations (12, 18) we did not, however, find many socio-demographic variables to be significant predictors of maternal visitation rate in bivariate or regression analyses. An alternative hypothesis is that the result attributed to potentially traumatic events is associated with avoidance symptoms of post-traumatic stress. Post-hoc analysis of avoidance symptoms did not significantly relate to visitation rate (bivariate correlation with two weeks $= .04$, $p = .69$; one month $r = .05$, $p = .71$; birth-discharge $r = .04$, $p = .74$). However, this study used a perinatal-specific measure of post-traumatic symptomatology and it is possible that development of a generally avoidant coping style attributable to previous traumatic episodes and not birth and/or NICU hospitalization may help explain this association.

The association between higher maternal anxiety and higher visitation rate may be explained by the premise that anxiety compels more frequent visitation, and that the act of being near

their infant serves to alleviate anxiety (14). The direction of this result is somewhat surprising as the previous investigation that had analyzed the associations between distress, in the form of NICU-specific parenting stress, and visitation revealed that higher stress specific to their infants' appearance and behavior was associated with lower visitation rate (12). Consistent with the possibility above that a general avoidance style and avoidance of perinatal-specific events operate differently, it is possible that characterological state anxiety and NICU-specific parenting stress impact behavior differently. It is possible that characterologically anxious mothers are compelled to visit more frequently but that mothers with stress and anxiety specific to their preterm infant's appearance visit less frequently. Additional research is warranted to better understand the mechanism behind these associations.

The present study marks the first investigation to reveal that higher maternal visitation rate early in the NICU stay predicts significantly lower levels of maternal depressive symptomatology in the first year of an infant's life. It is possible that mothers with higher visitation rates early in the infant's NICU stay visit frequently, in part, because they have a higher level of baseline psychological functioning, and as such, better functioning after discharge. However, the association between maternal visitation rate and maternal depression after discharge persisted even after adjusting for baseline psychological variables. Alternatively, it is possible that establishing a higher visitation rate early in the infants' NICU hospitalization assisted mothers with facilitating their transition to motherhood (14), developing attachment and therefore promoting long-term psychological adjustment to preterm birth. Previous work supports this possibility; among mothers of preterm infants, lower stress surrounding maternal role attainment during the NICU hospitalization has been related to lower depressive scores in the first year of life (8). This would suggest that interventions aimed at improving distress among mothers of preterm infants should attempt to facilitate NICU visitation by identifying mothers with risk factors for infrequent visitation (e.g., other children in the home, exposure to traumatic events).

The significant bivariate association between greater number of child caretakers and higher depression at infants' four month CA visit warrants comment even though the association did not have a significant p-value in the final regression model. While initially counterintuitive, previous investigations of VLBW infants have documented that having more than three caregivers/babysitters in the past three months regularly involved in care is one aspect of less optimal home environment (27). In these contexts it appears that a greater number of child caretakers is less a proxy of greater social support and rather a proxy of chaotic or irregular childcare.

To the author's knowledge, the present study also marks the first to document elevated maternal anxiety and PPTS among mothers of preterm infants at four months CA. The current study's rate of elevated depression at four months CA (12%) may be considered slightly lower than, but broadly consistent with, previous documentation that 16% of VLBW mothers have elevated depression scores on the same measure at eight months CA (8). Elevated maternal anxiety and PPTS both declined significantly from one month-post birth to infants' four month CA visit. This study's documented decline in maternal psychological distress over the first year of life is consistent with previous research that documents that

maternal distress among mothers of VLBW declines over the first year of life so dramatically that no significant differences exist between mothers of VLBW infants and mothers of term infants by eight months CA (16).

In addition to investigating associations between distress and maternal visitation, the present study also analyzed relations between maternal sociodemographic, maternal medical variables, and maternal self-report barriers and visitation. The present investigation's finding that the number of other children residing in the home was one of the most consistent predictors of lower maternal NICU visitation rates is consistent with previous investigations of VLBW (28) or extremely preterm infants (< 27 weeks GA, 12) and/or investigations of longer NICU hospitalization (greater than 4 weeks, 29). The finding that African-American/Black mothers have a lower rate of visitation may be explained by the fact that African-American/Black mothers in this study have higher rates of socio-economic disadvantage (rates of public insurance African-American mothers = 81%, other race mothers = 48%, $p = .006$). Maternal medical variables such as history of preeclampsia, gestational diabetes, and pre-pregnancy history of diabetes mellitus, did not significantly predict visitation in this study. As noted above, for the first time, this study revealed that specific, individual barriers to hospital visitation, namely, difficulty with hospital parking, but not the sum, or cumulative impact of self-reported barriers to visitation, to be related to lower visitation rate. As observed clinically by these authors, patients at this single-center study's hospital complain about both availability and cost of parking at this urban location. This provides helpful information for clinicians and administrations at this, and similar urban locations, to make specific, targeted changes to potentially improve visitation. Interestingly, other variables thought to relate to transportation barriers, such as automobile problems (i.e., unreliable automobiles), lengthy commutes, and longer geographic distance from home to hospital did not relate to lower visitation rate in final regression models. Other investigations of distance from home to hospital as a barrier to visitation of extremely preterm and/or VLBW infants in both the United States (12) and Europe (18) have not found distance from home to hospital to be related to visitation. A previous investigation of preterm infants (<37 weeks GA) did find longer distance from home to hospital to be related to lower visitation rate (29).

In the present investigation, infant medical variables, such as GA, did not significantly predict maternal visitation. This finding is consistent with previous research of visitation of VLBW infants (18). Other previous investigations of preterm infants (infants born <37 weeks GA) have found GA to significantly predict maternal visitation (29). Interestingly, patterns of transportation and infant medical predictors suggest that predictors of maternal visitation for smaller, more premature (i.e., VLBW or GA < 27 weeks), and therefore generally more perinatally complex, infants may be different than predictors of maternal visitation for a group of premature infants (GA < 37 weeks) with greater variability in health status.

Consistent with previous investigations (18), the present study did not reveal significant associations between maternal visitation rate and later healthcare utilization. As proposed by a previous study, it may be that the quality of maternal visitation and/or maternal-child

relationship and not the quantity, or frequency of visitation, predicts attendance at follow-up visits (18).

Limitations of this study include the retrospective review of visitation records, lack of information about the duration of the visit or activities performed during the visit, and the setting of an open-bay unit that did not permit parents to access to sleep overnight at the bedside. Many NICUs are transitioning to single-patient rooms with access to sleep accommodations; however, many open-bay units still exist and thorough study and understanding of open-bay units is necessary as a basis for comparative study of the newer single-patient room setting (4). Selection bias is another weakness. Despite significant efforts made to maximize recruitment and retention, mothers that were unavailable for recruitment may have been those with low visitation rates. Furthermore, use of the CES-D, a general depression questionnaire that does not contain items tailored to the experience of depressive symptoms in post-partum mothers, and the investigator-developed list of barriers to visitation that hasn't been normed on another population of NICU parents, mark two additional limitations. In general, assessment of distress through maternal self-report may be subject to reporting error and is less optimal than assessment through structured clinical interview or a mental health diagnosis by a trained professional. Future investigations would benefit from corroborating self-report data with report from a partner or health care provider, physiological distress data, or structured clinical interview.

In conclusion, the associations between distress and maternal visitation are substantial with apparent lasting associations between visitation and long-term maternal distress. Development of programs to facilitate maternal visitation to the NICU may benefit from targeting mothers with multiple children as well as those previously exposed to potentially traumatic events. Mechanistic study of such programs may investigate if frequent visitation facilitates parent-child relationships and subsequently ameliorates later maternal depression symptoms.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Abbreviations

CA	corrected age
GA	gestational age at birth
NICU	neonatal intensive care unit
PPTS	perinatal-specific post-traumatic stress

VLBW very low birth weight

References

1. Harrison H. The principles for family-centered neonatal care. *Pediatrics*. 1993; 92:643–50. [PubMed: 8414850]
2. Griffin T. A family-centered “visitation” policy in the neonatal intensive care unit that welcomes parents as partners. *J Perinat Neonatal Nurs*. 2013; 27:160–5. [PubMed: 23618937]
3. Moore KA, Coker K, DuBuisson AB, Swett B, Edwards WH. Implementing potentially better practices for improving family-centered care in neonatal intensive care units: Successes and challenges. *Pediatrics*. 2003; 111:450–60.
4. Pineada RG, Stansky KE, Rogers C, Duncan MH, Smith GC, Neil J, et al. The single-patient room in the NICU: Maternal and family effects. *J Perinatol*. 2012; 32:545–51. [PubMed: 22031044]
5. Zeskind PS, Iacino R. Effects of maternal visitation to preterm infants in the neonatal intensive care unit. *Child Dev*. 1984; 55:1887–93. [PubMed: 6510059]
6. Lewis M, Bendersky M, Koons A, Heygi T, Hiatt M, Ostfeld B, Rosenfeld D. Visitation to a neonatal intensive care unit. *Pediatrics*. 1991; 88:795–800. [PubMed: 1896285]
7. Latva R, Lehtonen L, Salmelin RK, Tamminen T. Visiting less than every day: A marker for later behavioral problems in Finnish preterm infants. *Arch Pediatr Adolesc Med*. 2004; 158:1153–7. [PubMed: 15583100]
8. Miles MS, Holditch-Davis D, Schwartz M. Depressive symptoms in mothers of prematurely born infants. *J Dev Behav Pediatr*. 2007; 28:36–44. [PubMed: 17353730]
9. Rogers CE, Kidokoro H, Wallendorf W, Inder TE. Identifying mothers of very preterm infants at-risk for postpartum depression and anxiety prior to discharge. *J Perinatol*. 2013; 33:171–6. [PubMed: 22678144]
10. Vanderbilt D, Bushley T, Young R, Frank DA. Acute posttraumatic stress symptoms among urban mothers with newborns in the Neonatal Intensive Care Unit: A preliminary study. *J Dev Behav Pediatr*. 2009; 30:50–6. [PubMed: 19194322]
11. Muller-Nix C, Forcada-Guex M, Pierrehumbert B, Jaunin L, Borghini A, Ansermet F. Prematurity, maternal stress and mother-child interactions. *Early Hum Dev*. 2004; 79:145–158. [PubMed: 15324994]
12. Gonya J, Nelin LD. Factors associated with maternal visitation and participation in skin-to-skin care in all referral level IIIc NICU. *Acta Paediatr*. 2013; 102:53–6. [PubMed: 23113613]
13. Rossman B, Kratovil AL, Greene MM, Engstrom JL, Meier PP. “I have faith in my milk”: The meaning of milk for mothers of very low birth weight infants hospitalized in the neonatal intensive care unit. *J Hum Lact*. 2013; 29:359–65. [PubMed: 23599267]
14. Rossman B, Greene MM, Meier PP. The role of peer support in the development of maternal identity for “NICU moms.” *J Obstet Gynecol Neonatal Nurs*. 2014 in press.
15. Lefkowitz DS, Baxt C, Evans JR. Prevalence and correlates of posttraumatic stress and postpartum depression in parents of infants in the Neonatal Intensive Care Unit (NICU). *J Clin Psychol Med Settings*. 2010; 17:230–7. [PubMed: 20632076]
16. Singer LT, Salvator A, Guo S, Collin M, Lilien L, Baley J. Maternal psychological distress and parenting stress after the birth of a very-low-birth-weight infant. *JAMA*. 1999; 281:799–805. [PubMed: 10071000]
17. Ballantyne M, Benzies KM, Trute B. Depressive symptoms among immigrant and Canadian born mothers of preterm infants at neonatal intensive care discharge: A cross sectional study. *BMC Pregnancy Childbirth*. 2013; 12:S1–S11.
18. Garten L, Maass E, Schmalisch G, Buhner C. O father, where art thou? Parental NICU visiting patterns during the first 28 days of life of very-low-birth-weight infants. *J Perinat Neonat Nurs*. 2011; 25:342–8.

19. Bell MJ, Ternberg JL, Feigin RD, Keating JP, Marshall R, Barton L, et al. Neonatal necrotizing enterocolitis. Therapeutic decisions based upon clinical staging. *Ann Surg.* 1979; 187:1–7. [PubMed: 413500]
20. Johnson TJ, Patel AL, Bigger HR, Engstrom JL, Meier PP. Economic benefits and costs of human milk feedings: A strategy to reduce the risk of prematurity-related morbidities in very-low-birth-weight infants. *Adv Nutr.* 2014; 1(5):207–12. [PubMed: 24618763]
21. Radloff L. The CES-D Scale: A self-report symptom scale to detect depression in a community sample. *App Psych Meas.* 1977; 1:385–401.
22. Spielberger, CD.; Gorsuch, RL.; Lushene, R.; Vagg, PR.; Jacobs, GA. *Manual for the State-Trait Anxiety Inventory.* Consulting Psychologists Press; Palo Alto, CA: 1983.
23. Zelkowitz P, Na S, Wang T, Bardin C, Papageorgiou A. Early maternal anxiety predicts cognitive and behavioral outcomes of VLBW children at 24 months corrected age. *Acta Paediatr.* 2011; 100:700–4. [PubMed: 21214883]
24. DeMier RL, Hynan MT, Harris HB, Manniello RL. Perinatal stressors as predictors of symptoms of posttraumatic stress in mothers of infants at high risk. *J Perinatol.* 1996; 16:276–280. [PubMed: 8866297]
25. Callahan JL, Borja SE. Psychological outcomes and measurements of maternal posttraumatic stress disorder during the perinatal period. *J Perinat Neonatal Nurs.* 2008; 22:49–59. [PubMed: 18287902]
26. Gray MJ, Litz BT, Hsu JL, Lombardo TW. Psychometric properties of the life events checklist. *Assessment.* 2004; 11:330–341. [PubMed: 15486169]
27. Treyvaud K, Inder TE, Lee KJ, Northam EA, Doyle LW, Anderson PJ. Can the home environment promote resilience for children born very preterm in the context of social and medical risk? *J Exp Child Psychol.* 2012; 112:326–37. [PubMed: 22480454]
28. Franck LS, Spencer C. Parenting visiting and participation in infant caregiving activities in a neonatal unit. *Birth.* 2003; 30:31–5. [PubMed: 12581037]
29. Latva R, Lehtonen L, Salmelin RK, Tamminen T. Visits by the family to the neonatal intensive care unit. *Acta Paediatr.* 2007; 96:215–20. [PubMed: 17429908]

Keynotes

- * Maternal visitation rate to the NICU and distress impact preterm infant outcome, yet little is known about the associations between NICU visitation rate and distress during the NICU hospitalization or post-NICU discharge.
- * Predictors of lower maternal visitation rate include greater number of children in the home, exposure to a greater number of potentially traumatic events, and lower maternal anxiety.
- * Lower maternal visitation rate predicted higher maternal depression scores post-NICU discharge.

Table 1
Maternal Socio-demographic and Medical Data and Infant Birth and Medical Data

Maternal Data	M ± SD, N (%)
Maternal Age (years)	26.99 ± 5.98
Public Insurance	44 (66%)
High School Education Level or Below	32 (48%)
Race: Black	38 (54%)
Non-Hispanic White	18 (26%)
Hispanic-White	12 (17%)
Asian	1 (1%)
Marital Status: Married	20 (32%)
Cohabiting	12 (19%)
Significant Other/not Cohabiting	20 (32%)
Single	10 (16%)
Number of Children in Home	1.91 ± 1.39
Number of Adults in Home	2.30 ± 1.01
First Pregnancy	23 (34%)
Has Older Children in Home	29 (42%)
Number of Caretakers Available	2.23 ± 1.12
History of Health Problems in Other Children	7 (10.14%)
Diagnosis of Preeclampsia	17 (25%)
Diagnosis of Gestational Diabetes	3 (4%)
Pre-Pregnancy Diagnosis of Diabetes Mellitus	2 (3%)
Infant Data	M ± SD, N (%)
Female Sex	35 (51%)
Birth weight (grams)	957 ± 243
Gestational Age (weeks)	27.5 ± 2.2
Severely Abnormal Head Ultrasound	5 (8%)
Sepsis	20 (30%)
Necrotizing Enterocolitis	5 (8%)
Bronchopulmonary Dysplasia	31 (44%)
Discharge Home on Oxygen	3 (5%)
Discharge Home with Gastrostomy Tube	5 (8%)
Duration of Mechanical Ventilation (days)	14.25 ± 20.19
Postmenstrual Age at Discharge (weeks)	39.8 ± 5.2

Table 2
Maternal Psychological Distress

	One month post-birth N=69	Four months CA N=52
Elevated Depression	23 (34%)	5 (12%)
Elevated Anxiety	38 (60%)	4 (9%) **
Elevated PPTS	17 (26%)	3 (6%) *
Total Number of Potentially Traumatic Events Either Experienced or Directly Witnessed	2.75 ± 2.64	
Unexpected Death of Loved One	41 (59%)	
Car Accident	35 (51%)	
Other	25 (36%)	
Life Threatening Illness	18 (26%)	
Violent Death	12 (17%)	
Natural Disaster	12 (17%)	
Fire or Explosion	11 (17%)	
Unwanted Sexual Experience	11 (16%)	
Assault with a Weapon	10 (15%)	
Physical Assault	10 (14%)	
Serious Accident at Work	9 (13%)	
Sexual Assault	8 (12%)	
Serious Bodily Injury	5 (7%)	
Severe Human Suffering	5 (7%)	
Exposure to a Toxic Substance	3 (4%)	
Combat in War	1 (1%)	

*
p<.05

**
p<.01