

## Prevalence and Correlates of Posttraumatic Stress and Postpartum Depression in Parents of Infants in the Neonatal Intensive Care Unit (NICU)

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**Abstract** The purpose of this study was to assess the prevalence and correlates of acute stress disorder (ASD) and posttraumatic stress disorder (PTSD) in mothers and fathers, and postpartum depression (PPD) in mothers, of infants in the Neonatal Intensive Care Unit (NICU). 86 mothers and 41 fathers completed measures of ASD and of parent perception of infant medical severity 3–5 days after the infant's NICU admission (T1), and measures of PTSD and PPD 30 days later (T2). 35% of mothers and 24% of fathers met ASD diagnostic criteria at T1, and 15% of mothers and 8% of fathers met PTSD diagnostic criteria at T2. PTSD symptom severity was correlated with concurrent stressors and family history of anxiety and depression. Rates of ASD/PTSD in parents of hospitalized infants are consistent with rates in other acute illness and injury populations, suggesting relevance of traumatic stress in characterizing parent experience during and after the NICU.

**Keywords** Posttraumatic stress · Postpartum depression · Neonatal intensive care · Infants · Psychosocial screening

There are many factors which contribute to general distress in parents of infants in the neonatal intensive care unit (NICU). The appearance and behavior of a sick infant, the use of complex medical language and technology, threat of potential loss of their child's life, and parents' loss of their

role in their infant's care are a few of the stressors which can compound existing parental distress about their infant's illness. In these circumstances parents have reported a variety of reactions, including sadness, fear, anxiety, grief, and helplessness (Joseph, Mackley, Davis, Spear, & Locke, 2007; Miles & Holditch-Davis, 1997).

While a variety of distressing reactions are normative at this time, significant and prolonged parental distress, including postpartum depression (PPD) and posttraumatic stress disorder (PTSD) are of greater clinical concern. Previous attempts to characterize such distress have focused primarily on maternal PPD (Leonard, 1998; Veddovi, Kenny, Gibson, Bowen, & Starte, 2001) which is estimated to occur in 10–15% of mothers of healthy babies. Though no formal prevalence studies of PPD in the NICU have been previously reported, it is believed that the rates are higher than in mothers of healthy babies (Beck, 2003; O'Hara & Swain, 1996).

Maternal PPD has been linked with a variety of negative infant outcomes, including avoidant attachment, behavioral and emotional difficulties, and cognitive delay (Civic & Holt, 2000; Murray & Cooper, 1997). Infants in the NICU are at particular risk for these outcomes, given their increased developmental vulnerability (prematurity, congenital anomaly, and/or severe medical illness; Aylward, 2002; Taylor, Klein, & Hack, 2000); and factors iatrogenic to the NICU environment, including sensory overstimulation, repeated medical/surgical procedures, pain, and parental separation, all of which can alter central nervous system organization (e.g., Aucott, Donohue, Atkins, & Allen, 2002; Liu et al., 2007).

These multiple and often reciprocal avenues of infant developmental risk in the NICU underscore the importance of understanding severe parental distress. However, using maternal PPD as a primary language to characterize all severe and prolonged distress in the NICU setting does not account for the experience of fathers, and is limiting in its

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primary focus on depressive symptoms. Literature from other acute care and chronic illness populations have found acute stress disorder (ASD) and posttraumatic stress disorder (PTSD) to be useful ways of characterizing the severe distress of parents of critically ill or injured children. Individuals with ASD and PTSD share the experience of intense fear, horror, or helplessness in response to a traumatic event (in this case an infant's NICU admission) and the common symptoms of re-experiencing (intrusive thoughts, dreams, flashbacks), avoidance (avoiding reminders of the trauma, numbing, restricted affect) and physiological arousal (sleep problems, hypervigilance, irritability). ASD diagnosis also requires the presence of dissociative symptoms (numbing, derealization, depersonalization, amnesia). ASD describes the presence of these symptoms in the early post-trauma period (with onset and duration between 2 days and 4 weeks after the traumatic event), whereas PTSD is diagnosed when symptoms persist for at least 1 month (American Psychiatric Association, 1994).

Elevated rates of ASD/PTSD have been found in parents of children in the Pediatric Intensive Care Unit (PICU; Balluffi et al., 2004; Bronner et al., 2010; Bronner, Knoester, Bos, Last, & Grootenhuis, 2008; Colville & Gracey, 2006), after pediatric injury (Winston et al., 2002), and in parents of children with cancer (Kazak & Baxt, 2007; Manne, Du Hamel, Gallelli, Sorgen, & Redd, 1998; Patino-Fernandez et al., 2008), with incidence estimates ranging from one-tenth to one-half of parents, with many additional parents reporting subclinical ASD/PTSD symptoms. In a study which examined the course of parental PTSD after PICU admission (Bronner et al., 2010), rates of PTSD diagnosis were similar at 3 and 6 months post-admission, suggesting that clinically significant symptoms may not be decreasing over time.

In these populations, the incidence of ASD/PTSD has been associated with pre-existing psychopathology, psychosocial stressors, trauma exposure, and demographic characteristics (Bronner et al., 2008, 2009, 2010; Patino-Fernandez et al., 2008). ASD and PTSD have not generally been associated with objective measures of illness/injury severity (e.g., Balluffi et al., 2004; Bronner et al., 2010; Colville & Gracey, 2006; Winston et al., 2002).

Given similar circumstances surrounding the admission of an infant to the NICU (life-threatening illness), it could be hypothesized that ASD/PTSD may be a useful way to characterize severe parental distress in this setting. While multiple recent studies have examined prevalence and correlates of posttraumatic stress symptoms in similar settings (e.g., PICU), only one known study has prospectively examined these symptoms specifically in parents of infants in the NICU. Shaw et al. (2006) assessed correlates of ASD in 40 parents and found that 28% of mothers, but no fathers, met criteria for a diagnosis of ASD. The diagnosis of ASD was associated with family environment (low cohesion and

control) and personal coping style (high emotional restraint). Though limited by its small sample size and its highly educated, affluent parent population, it is an important first examination of the prevalence and correlates of early traumatic stress symptoms in the NICU environment.

The aims of the current study were to (1) explore the applicability of using traumatic stress symptomatology to characterize severe distress in both mothers and fathers of infants in the NICU; (2) understand associations with and potential predictors of posttraumatic stress reactions; and (3) measure the prevalence and correlates of postpartum depression in mothers. It was hypothesized that the prevalence of ASD/PTSD in the NICU would be consistent with documented rates in other populations of ill or injured children. Likewise, in line with findings in other illness populations, it was hypothesized that ASD/PTSD would be associated with parental psychiatric history and current social stressors, but not with objective medical factors.

## Method

### Participants

Eligible participants included mothers and fathers of infants in the NICU of a large northeastern United States Children's Hospital. Typical diagnoses of infants in this NICU include prematurity of <30 weeks gestation, severe complications of prematurity  $\geq 30$  weeks gestation, congenital anomaly, and/or other severe medical illness. A consecutive cohort of parents of infants whose anticipated stay (per physician estimate) in the NICU was 5 days or greater were recruited to participate during day 3 and day 5 of their infant's admission. About half of the population of infants in this NICU have a length-of-stay (LOS) of less than 5 days; these infants were excluded from the study to focus on families of children with extended NICU admissions. Study exclusion criteria included the inability to read English, parent age less than 18, or if the child's death appeared imminent (per physician report). The study was approved by the participating hospital's Institutional Review Board. Written parental informed consent was obtained for this study, which included two time points: the first, at the time of consent, 3–5 days after infant admission (T1), and the second,  $\geq 30$  days later (T2).

A total of 527 infants were admitted to the NICU during the 9-month study period. Of those infants, 271 families (51%) met eligibility criteria. 102 of the eligible families were approached for consent (the remaining 169 were unavailable at times of recruitment, which included business hours and one alternating evening per week). 95% of the approached families (89 mothers and 41 fathers) consented to participate in the study and completed measures at T1.

Three mothers were not included in the analyses because of incomplete data at T1. No significant differences emerged between enrolled families and those who were unavailable at times of recruitment in terms of infant median length of hospital stay (enrolled = 14 days, not enrolled = 15 days). However, those not enrolled were significantly more likely to be of minority ethnicity (minority enrolled = 28%, minority not enrolled = 44%;  $p = .01$ ). Mothers participating in the study (mean age = 29 years) were primarily Caucasian (71%); 24.4% had a college degree. Fathers (mean age = 33 years) were also primarily Caucasian (81%), and 21.4% had a college degree.

Of the initial participants, 60 mothers (70%) and 25 fathers (61%) remained in the study to complete questionnaires at T2, 30 or more days after T1 (median days = 32.5). For the families who remained in the study at T2, 20% of the infants were still hospitalized in the NICU, 16% were on a different unit in the hospital, and 64% of the infants had been discharged to home. There were no significant differences on demographic variables, T1 Acute Stress Disorder score, or infant medical severity between those who were retained at follow-up and those who were not.

## Procedure

At T1, parents completed a questionnaire of Acute Stress Disorder (ASD) and a demographic information form, which included items about social support and family social and psychiatric history, and parental perception of illness severity (see measure descriptions below). At T2, 30 days later, parents completed a questionnaire of Post-traumatic Stress Disorder (PTSD), and mothers completed a survey of Postpartum Depression (PPD). Parents of infants who were no longer hospitalized at T2 were mailed the questionnaires, and follow-up phone calls were placed to encourage T2 measure completion.

## Measures

### Time 1

**Demographic and Family History Information** Parents reported on their own gender, ethnicity, and highest level of education completed. Mothers completed items about their birth and pregnancy histories (history of previous pregnancies, miscarriages, children in NICU; depression or anxiety during pregnancy, depression after childbirth; infant medical problems identified during pregnancy). *Perceived social support* was measured with a checklist where parents indicated on whom they could rely to provide different types of logistical and emotional support. A count of potential sources of support was used, with higher scores indicating higher perceived social support. On the items assessing *concurrent*

*stressors*, participants marked “yes” or “no” to a number of possible social stressors, including change in relationship status, living arrangements, or job status; loss; personal or family health concern; experience of a traumatic event, and legal problems. A count score was used, with more affirmatives indicating a higher number of stressors.

**Acute Stress Disorder Scale (ASDS; Bryant, Moulds, & Guthrie, 2000)** The ASDS is a 19-item self-report questionnaire specifically developed to assess ASD in adults <30 days following a traumatic event. The ASDS can be used to determine the presence or absence of ASD by symptom criteria and also provides a continuous score to indicate symptom severity. Subsyndromal ASD was classified as the presence of  $\geq 1$  symptom in each of four symptom categories (dissociation, re-experiencing, avoidance and arousal), as described in Kassam-Adams and Winston (2004). The ASDS has demonstrated excellent internal consistency, test–retest reliability, and convergent validity with related measures (Bryant et al., 2000).

## Infant Medical Variables

### NICU Medical Severity Rating

A 6-item rating scale of infant physiological risk and intensity of medical intervention was developed based on the extant literature on determinants of infant morbidity and mortality in the NICU. The items were: (1) Was this patient born prematurely? (2) Is this patient on a ventilator? (3) Is this patient on pressors? (4) Is this patient on extracorporeal membrane oxygenation? (5) Does this patient have a major congenital anomaly or chromosomal abnormality? and (6) Does this patient have a severe CNS injury? Physicians responded “yes” or “no” to each item. Yes items were summed for a total score ranging from 0 (least severe) to 5 (most severe).

### Other Infant Medical Variables

Length of stay, and location of infant at T2 (home vs. hospital) were determined by reviewing the patient medical record.

### Parental Perception of Medical Severity

Medical severity from the parent’s perspective was assessed via two separate items rated on a Likert scale of 1 (not at all) to 4 (very much): “How sick is your child?” and “How worried are you that your child might die?”

### Time 2

**PTSD Symptom Checklist (PCL; Weathers & Ford, 1996)** The PCL is a 17-item self-report measure with

items corresponding directly to the DSM-IV diagnostic criteria for PTSD, with an additional item (#18) assessing level of impairment from symptoms. The DSM-IV criteria for PTSD require at least 30 days between the traumatic event and the assessment point. Respondents rate PTSD symptoms in relation to an index event (their infant’s admission to the NICU). Scores on the PCL were interpreted as meeting diagnostic criteria if the respondent reported one or more re-experiencing symptoms, three or more avoidance symptoms, and two or more arousal symptoms over the past month. The measure also yields a continuous score of symptom severity. Subsyndromal PTSD is determined by report of at least one clinically significant symptom in each symptom category of PTSD with moderate level of impairment, as described in Kassam-Adams and Winston (2004). The PCL has demonstrated excellent internal consistency, test–retest reliability, and convergent validity with other measures of PTSD severity (Blanchard, Jones-Alexander, Buckley, & Forneris, 1996).

*Postpartum Depression Screening Scale (PDSS; Beck & Gable, 2000)* Completed by mothers only, the PDSS is a 35-item, Likert-type self-report instrument designed for use in screening for PPD. It is composed of seven dimensions: sleeping/eating disturbances, anxiety/insecurity, emotional lability, cognitive impairment, loss of self, guilt/shame, and contemplating harming oneself. The PDSS has demonstrated excellent internal consistency, construct validity, and convergent validity with other measures of PPD (Beck & Gable, 2000).

**Analyses**

Descriptive statistics were utilized to summarize demographic information and proportions of parents meeting criteria for ASD, PTSD, and PPD. The association between potential predictors of ASD, PTSD and PPD and the relationship between ASD and PTSD, and PTSD and PPD were examined using chi-square analyses for categorical variables and correlation coefficients for the ordinal or continuous predictors. Significant correlations were entered into a linear regression to identify factors which best predicted PTSD diagnosis at T2.

**Results**

**Acute Stress Disorder**

At T1 (3–5 days post-NICU admission), 32% of the 130 participating parents met criteria for a diagnosis of ASD, with rates varying between mothers and fathers (see Table 1). About half of mothers and one-third of fathers

**Table 1** Acute and posttraumatic stress and postpartum depression

	Mothers		Fathers	
	<i>n</i>	%	<i>n</i>	%
Acute stress disorder (ASD)	30	34.9	10	24.4
ASD subsyndromal <sup>a</sup>	14	16.3	4	9.7
ASD symptom categories				
Dissociating	66	76.7	26	63.4
Re-experiencing	62	72.1	23	56.1
Avoidance	67	77.9	29	70.7
Arousal	70	81.4	28	66.7
Posttraumatic stress disorder (PTSD)	9	15	2	8
PTSD subsyndromal <sup>b</sup>	7	11.7	1	4
PTSD symptom categories				
Re-experiencing	27	45	5	20
Avoidance	10	16.7	3	12
Arousal	18	30	7	28
Postpartum depression (PPD)	23	39		
PPD subsyndromal	10	16.9		
Subcategories				
Sleeping/eating disturbances	19	32.2		
Anxiety/insecurity	22	37.3		
Emotional lability	15	25.4		
Mental confusion	16	27.1		
Loss of self	16	27.1		
Guilt/shame	19	32.2		
Suicidal thoughts	19	32.2		

<sup>a</sup> Subsyndromal ASD requires presence of ≥1 symptom in each of 4 symptom categories

<sup>b</sup> Subsyndromal PTSD requires presence of ≥1 symptom in each category, plus moderate level of impairment

endorsed symptoms consistent with subclinical ASD. The majority of mothers and fathers (62–70%; Table 1) endorsed at least one clinically significant symptom across ASD symptom categories (dissociation, re-experiencing, avoidance, and arousal). Total ASDS score was positively associated with maternal report of prepartum depression (symptoms of sadness for ≥2 weeks during pregnancy;  $r = .29, p < .01$ ), family history of depression ( $r = .186, p < .05$ ), and parent reported worry that the child might die ( $r = .212, p < .05$ ; Table 2). Physician- and parent-rated medical severity was not significantly associated with scores on the ASDS.

**Posttraumatic Stress Disorder**

At T2 (≥30 days post-admission), 15% of mothers and 8% of fathers met criteria for a diagnosis of PTSD, with an additional 11.7% of mothers and 4% of fathers endorsing subsyndromal PTSD (Table 1). Compared to scores on the ASDS, the percentage of mothers and fathers reporting

**Table 2** Correlation matrix

	ASDS total score	PCL total score	PDSS total score <sup>‡</sup>	LOS	Parent age	Minority	Family hx depression	Family hx mental illness	Concurrent stressors	Parent-rated medical severity	Physician-rated medical severity
ASDS total score	1										
PCL total score	.62**	1									
PDSS total score <sup>‡</sup>	.65**	.82**	1								
Length of stay	-.21*	-.13	.02	1							
Parent age	-.07	.07	-.17	-.10	1						
Minority	.07	-.17	-.04	.16	-.19*	1					
Family hx depression	.19*	.50**	.49**	.07	.00	-.12	1				
Family hx mental illness	.10	.43**	.23	-.11	.09	-.12	.39**	1			
Total concurrent stressors	.15	.34**	.29*	-.08	-.11	.16	.18*	-.04	1		
Parent-rated medical severity	.01	.13	.02	.19**	.16	-.08	.02	.11	-.16	1	
Physician-rated medical severity	-.05	-.11	.17	.28**	-.12	-.03	-.05	-.19*	-.05	.23*	1

\*  $p \leq .05$ , \*\*  $p \leq .01$ , <sup>‡</sup> mothers only

significant symptoms in at least one of the three symptom categories (avoidance, arousal, and re-experiencing) of PTSD was much lower. Total PTSD score was positively associated with total ASDS score ( $r = .66$ ,  $p < .01$ ), family history of depression ( $r = .50$ ,  $p < .01$ ), family history of anxiety ( $r = .38$ ,  $p < .01$ ), family history of serious mental illness ( $r = .40$ ,  $p < .01$ ), and total number of reported concurrent stressors ( $r = .38$ ,  $p < .01$ ; Table 2). Physician- and parent-rated medical severity was not significantly associated with PTSD scores, nor was infant location at T2 (home vs. still hospitalized;  $t = -1.079$ , ns), infant medical characteristics (diagnosis, whether medical problems were known during pregnancy) nor were demographic characteristics (parent age, ethnicity, level of education). See Table 2 for full correlation matrix.

#### Parent and Physician-Rated Indices of Medical Severity

Parent responses to questions about their perception of the medical severity of their child's illness spanned the full range, with parents most frequently reporting moderate levels of infant illness (mean = 2.73, SD = .86) and low levels of worry that their child might die (mean = 1.89, SD = 1.05). On the physician-completed NICU Medical

Severity Rating Form, scores ranged from 0 to 5 (mean = 1.37, SD = 1.07). Physician-rated medical severity was positively correlated with parent rating of infant illness severity ( $r = .232$ ,  $p = .01$ ) and of worry that infant might die ( $r = .414$ ,  $p < .001$ ).

#### Postpartum Depression

Of the mothers completing the PDSS at T2 ( $n = 60$ ), 39% met criteria for a positive screening for postpartum depression, with an additional 16.9% of mothers endorsing enough symptoms for subsyndromal PPD. A significant minority of mothers endorsed significant problems across each of the PDSS symptom categories (Table 1), with nearly one-third of mothers reporting the presence of suicidal thoughts within the prior 2 weeks (32.2%). Postpartum depression was significantly correlated with both ASD ( $r = .65$ ,  $p \leq .001$ ) and PTSD ( $r = .82$ ,  $p \leq .001$ ). PPD was also associated with maternal report of pre-partum anxiety ( $r = .28$ ,  $p < .05$ ) and depression ( $t = -2.10$ ,  $p < .05$ ), reported concurrent stressors ( $r = .29$ ,  $p < .05$ ), and family history of anxiety ( $t = -2.52$ ,  $p < .05$ ) and depression ( $t = -4.15$ ,  $p < .001$ ). 16% of mothers met criteria for diagnoses of both PTSD and PPD.



## Predicting PTSD

In order to predict the development of PTSD, variables significantly correlated with PTSD were entered into a linear regression model (Table 3). Overall, a model including ASD symptom severity at T1, parent-reported family history of depression and other psychiatric disorders, and number of concurrent stressors accounted for 56% of the variance in PTSD symptom severity, as evidenced by total score on the PCL.

## Discussion

Symptoms of posttraumatic stress are common in parents of infants newly-admitted to the NICU, with many mothers and fathers meeting full criteria for a diagnosis of Acute Stress Disorder, and another group meeting criteria for subsyndromal ASD. Likewise, a significant majority of parents endorsed at least one symptom of ASD, suggesting a high level of parental distress around the time of admission. For most parents, these symptoms abated within the first 4 weeks after admission; however, for a sizable group of parents, posttraumatic stress symptoms persisted beyond 30 days, warranting a diagnosis of PTSD or subsyndromal PTSD. These rates of ASD/PTSD are consistent with those found in other acute illness and injury populations (e.g., oncology, Kazak & Baxt, 2007; pediatric intensive care, Balluffi et al., 2004; Bronner et al., 2010; Colville & Gracey, 2006), suggesting the utility of using the language of posttraumatic stress to characterize the prolonged severe distress of parents of infants in the NICU.

While other researchers have examined ASD and PTSD in similar populations, the current study is the first known to prospectively examine the incidence of both ASD and PTSD in parents of infants in the NICU, allowing for an examination of the course of symptoms from admission until 4 weeks later. In Shaw et al. (2006)'s examination of ASD in parents of infants in the NICU, no fathers met criteria for ASD; in this study, 25% of fathers in this study met full criteria for ASD and another 10% endorsed significant symptoms. Though the rates of ASD/PTSD were

lower for fathers than for mothers, findings suggest the importance of paying attention to the needs of fathers, an oft-neglected population in the NICU.

As hypothesized, factors related to the illness itself, (i.e., parent- or physician-rated medical severity, infant location at follow-up assessment (home or still hospitalized), infant hospital length-of-stay, unexpectedness of admission) were not associated with the severity of parental distress or the incidence of ASD/PTSD. These findings are consistent with clinical observation as well as literature in other illness groups, which have not consistently demonstrated a link between objective medical severity and parental functioning (Kazak, Schneider, & Kassam-Adams, 2009). However, it is important to note that this NICU population represents the most critically ill infants; therefore, the distinctions between illness severity at this level may not be as meaningful as they might be in a more medically diverse patient population.

On the other hand, personal/social factors, including individual/family psychiatric history and number of concurrent stressors, were found to significantly predict the development of PTSD four weeks after admission. In the linear regression model, 56% of the variance in PTSD was accounted for by a combination of ASD diagnosis at Time 1 and these personal/social factors. This is consistent with literature describing correlates of PTSD in similar populations (Balluffi et al., 2004; Bronner et al., 2010) as well as of PPD and PTSD in mothers of healthy newborns (Scrandis, Sheikh, Niazi, Tonelli, & Postolache, 2007; Zaers, Waschke, & Ehlert, 2008). While further research is needed to better understand the individual contributions of these factors, these findings suggest the importance of screening for personal and social variables as part of an overall parental risk assessment.

This study also represented the first known prospective, quantitative evaluation of the rates of postpartum depression (PPD) in mothers of infants in the NICU. Nearly half of mothers in this study met full criteria for PPD diagnosis, with an additional one-fifth experiencing symptoms at a level of subsyndromal PPD, which is much higher than the rates found in mothers of healthy infants. Interestingly, PPD was highly correlated with PTSD in mothers, and 16% of mothers met criteria for both disorders. As little research exists on the interrelationship between PPD and PTSD, it is not well understood. While there may be high levels of comorbidity between PPD and PTSD in mothers of infants in the NICU, the diagnoses of PPD and PTSD share similar criteria and symptom sets, particularly in the area of anxiety and somatic symptoms. As such, a mother exhibiting one disorder is already meeting much of the criteria for another. Further research including those with clinical interview may improve our understanding of the relationship between these two variables.

**Table 3** Summary of linear regression analyses predicting PTSD

Model	Unstandardized B	SE	$\beta$	T	Sig
Total ASDS score	.31	.053	.47	5.92	.000
Family history of depression	6.07	2.21	.23	2.74	.008
Family history of mental illness	12.28	4.27	.24	2.87	.005
# of concurrent stressors	2.56	.86	.23	2.97	.004

The use of self-report measures is typically not as effective in identifying true disorder as are structured diagnostic clinical interviews. It was important in this study, however, to use research methods that might also have clinical utility. The aim of identifying a screening method for parental distress in the NICU required consideration of ongoing available personnel and time resources to ensure implementation, and the use of a more extensive diagnostic procedure would likely be a hindrance to the expedient identification of at-risk parents.

Likewise, while assessing the incidence of ASD/PTSD has been a useful first step to characterizing the extremes of parental distress, we are hesitant to focus too narrowly on the diagnosis of disorder. Given the incidence of at least one symptom of traumatic stress in the majority of parents in this study, it is likely that the experience of being a parent of a child in the NICU can be conceptualized under a broader umbrella of pediatric medical traumatic stress (PMTS; Kazak et al., 2006), which allows for consideration of a wide range of severity of reaction. Further research can be helpful in determining thresholds for clinical concern, prevention, and/or intervention, which may be lower than those of standard diagnostic criteria. Additionally, unlike the traditional ASD/PTSD focus on a sentinel traumatic event, the PMTS model considers the ongoing nature of stressors and parent reactions, which may better capture the experiences of parents of medically ill children.

While this study boasts a high consent rate (95%) as well as a large overall  $n$  (130 at Time 1, 85 completed Time 2), one of the most concerning limitations came from the group of 169 parents who were “missed,” in that they were eligible to participate in the study, but could not be located to approach for consent during recruitment hours (business hours plus one varying evening per week). These “missed” parents were significantly more likely to be of minority ethnicity. A number of tentative hypotheses can be suggested from these findings. Most likely, as we found high levels of distress in parents who were routinely present in the NICU it is possible that even higher levels of distress might be present in those parents who were not routinely visiting, whether because of high level of psychosocial stressors, or because of a high level of distress or avoidance preventing them from coming into the NICU. The inability to locate these parents to include in the study is reflective of general clinical concerns about many of these parents, and we may be neglecting the group that might be at the highest risk.

In providing initial insight into the prevalence of PPD and PTSD in mothers and fathers of infants in the NICU, this study lends credence to the conceptualization of the NICU admission as a traumatic stressor for parents. Limitations of the study include a selective population and reliance on self-report measures. Further research is

recommended to better understand the extent of PPD and PTSD in this vulnerable parent group, and to explore the direct impact of severe parental distress on infant development, and to develop targeted interventions.

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## References

- American Psychiatric Association. (1994). *Diagnostic and statistical manual of mental disorders* (4th ed.). Washington, DC: American Psychiatric Association.
- Aucott, S., Donohue, P. K., Atkins, E., & Allen, M. C. (2002). Neurodevelopmental care in the NICU. *Mental Retardation and Developmental Disabilities Research Review*, 8, 298–308.
- Aylward, G. P. (2002). Cognitive and neuropsychological outcomes: More than IQ scores. *Mental Retardation and Developmental Disabilities Research Review*, 8, 234–240.
- Balluffi, A., Kassam-Adams, N., Kazak, A., Tucker, M., Dominguez, T., & Helfaer, M. (2004). Traumatic stress in parents of children admitted to the pediatric intensive care unit. *Pediatric Critical Care Medicine*, 5, 547–553.
- Beck, C. T. (2003). Recognizing and screening for postpartum depression in mothers of NICU infants. *Advances in Neonatal Care*, 3, 37–46.
- Beck, C. T., & Gable, R. K. (2000). Postpartum Depression Screening Scale: Development and psychometric testing. *Nursing Research*, 49, 272–282.
- Blanchard, E. B., Jones-Alexander, J., Buckley, T. C., & Forneris, C. A. (1996). Psychometric properties of the PTSD Checklist (PCL). *Behaviour Research and Therapy*, 34, 669–673.
- Bronner, M. B., Kayser, A., Knoester, H., Bos, A. P., Last, B. F., & Grootenhuis, M. A. (2009). A pilot study on peritraumatic dissociation and coping styles as risk factors for posttraumatic stress, anxiety and depression in parents after their child’s unexpected admission to a Pediatric Intensive Care Unit. *Child and Adolescent Psychiatry and Mental Health*, 3, 33.
- Bronner, M. B., Knoester, H., Bos, A. P., Last, B. F., & Grootenhuis, M. A. (2008). Follow-up after paediatric intensive care treatment: Parental posttraumatic stress. *Acta Paediatrica*, 97, 181–186.
- Bronner, M. B., Peek, N., Knoester, H., Bos, A. P., Last, B. F., & Grootenhuis, M. A. (2010). Course and predictors of posttraumatic stress disorder in parents after pediatric intensive care treatment of their child. *Journal of Pediatric Psychology*, Advance Access, 1–10.
- Bryant, R. A., Moulds, M. L., & Guthrie, R. M. (2000). Acute Stress Disorder Scale: A self-report measure of acute stress disorder. *Psychological Assessment*, 12, 61–68.
- Civic, D., & Holt, V. L. (2000). Maternal depressive symptoms and child behavior problems in a nationally representative normal birthweight sample. *Maternal Child Health Journal*, 4, 215–221.
- Colville, G. A., & Gracey, D. (2006). Mothers’ recollections of the Paediatric Intensive Care Unit: Associations with psychopathology and views on follow-up. *Intensive and Critical Care Nursing*, 22, 49–55.
- Joseph, R. A., Mackley, A. B., Davis, C. G., Spear, M. L., & Locke, R. G. (2007). Stress in fathers of surgical neonatal intensive care unit babies. *Advances in Neonatal Care*, 7, 321–325.

- Kassam-Adams, N., & Winston, F. K. (2004). Predicting child PTSD: The relationship between acute stress disorder and PTSD in injured children. *Journal of the American Academy of Child and Adolescent Psychiatry*, 43, 403–411.
- Kazak, A. E., & Baxt, C. (2007). Families of infants and young children with cancer: A post-traumatic stress framework. *Pediatric Blood and Cancer*, 49, 1109–1113.
- Kazak, A. E., Kassam-Adams, N., Schneider, S., Zelikovsky, N., Alderfer, M. A., & Rourke, M. (2006). An integrative model of Pediatric Medical Traumatic Stress (PMTS). *Journal of Pediatric Psychology*, 31, 343–355.
- Kazak, A., Schneider, S., & Kassam-Adams, N. (2009). Pediatric medical traumatic stress. In M. Roberts & R. Steele (Eds.), *Handbook of pediatric psychology* (4th ed., pp. 205–215). New York: Guilford.
- Leonard, L. G. (1998). Depression and anxiety disorders during multiple pregnancy and parenthood. *Journal of Obstetric, Gynecologic, and Neonatal Nursing*, 27, 329–337.
- Liu, W. F., Laudert, S., Perkins, B., Macmillan-York, E., Martin, S., & Graven, S. (2007). The development of potentially better practices to support the neurodevelopment of infants in the NICU. *Journal of Perinatology*, 27, S48–S74.
- Manne, S. L., Du Hamel, K., Gallelli, K., Sorgen, K., & Redd, W. H. (1998). Posttraumatic stress disorder among mothers of pediatric cancer survivors: Diagnosis, comorbidity, and utility of the PTSD checklist as a screening instrument. *Journal of Pediatric Psychology*, 23, 357–366.
- Miles, M. S., & Holditch-Davis, D. (1997). Parenting the prematurely born child: Pathways of influence. *Seminars in Perinatology*, 21, 254–266.
- Murray, L., & Cooper, P. (1997). Effects of postnatal depression on infant development. *Archives of Diseases in Children*, 77, 99–101.
- O'Hara, M., & Swain, A. (1996). Rates and risk of postpartum depression—a meta-analysis. *International Review of Psychiatry*, 8, 37–54.
- Patino-Fernandez, A. M., Pai, A. L., Alderfer, M. A., Hwang, W. T., Reilly, A. T., & Kazak, A. E. (2008). Acute stress in parents of children newly-diagnosed with cancer. *Pediatric Blood and Cancer*, 50, 289–292.
- Scrandis, D. A., Sheikh, T. M., Niazi, R., Tonelli, L. H., & Postolache, T. T. (2007). Depression after delivery: Risk factors, diagnostic and therapeutic considerations. *Scientific World Journal*, 7, 1670–1680.
- Shaw, R. J., Deblois, T., Ikuta, L., Ginzburg, K., Fleisher, B., & Koopman, C. (2006). Acute stress disorder among parents of infants in the neonatal intensive care nursery. *Psychosomatics*, 47, 206–212.
- Taylor, H. G., Klein, N., & Hack, M. (2000). School-age consequences of birth weight less than 750 g: A review and update. *Developmental Neuropsychology*, 17, 289–321.
- Veddovi, M., Kenny, D., Gibson, F., Bowen, J., & Starte, D. (2001). The relationship between depressive symptoms following premature birth, mothers' coping style, and knowledge of infant development. *Journal of Reproductive and Infant Psychology*, 19, 313–323.
- Weathers, F., & Ford, J. (1996). Psychometric properties of the PTSD Checklist (PCL-C, PCL-S, PCL-M, PCL-PR). In B. H. Stamm (Ed.), *Measurement of stress, trauma, and adaptation*. Lutherville, MD: Sidran Press.
- Winston, F. K., Kassam-Adams, N., Vivarelli-O'Neill, C., Ford, J., Newman, E., Baxt, C., et al. (2002). Acute stress disorder symptoms in children and their Parents after pediatric traffic injury. *Pediatrics*, 109, e90.
- Zaers, S., Waschke, M., & Ehlert, U. (2008). Depressive symptoms and symptoms of post-traumatic stress disorder in women after childbirth. *Journal of Psychosomatic Obstetrics and Gynecology*, 29, 61–71.