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Neonatal Intensive Care Unit Admission and Maternal Postpartum Depression*

Tara Wyatt, M.A.^a, Karina M. Shreffler, Ph.D.^a, and Lucia Ciciolla, Ph.D.^b

^aHuman Development and Family Science, Oklahoma State University, Tulsa, OK, USA

^bDepartment of Psychology, Oklahoma State University, Stillwater, OK, USA

Abstract

Objective: This study aimed to examine the impact of newborns' Neonatal Intensive Care Unit (NICU) admittance on maternal postpartum depression.

Background: Admittance of newborns into a NICU is a common, though often unexpected, occurrence that is associated with adverse psychological outcomes for parents such as higher anxiety and uncertainty. Because prior research on the parental psychological impacts of a NICU admittance typically includes a hospital sample of parents following birth, the causality of NICU admittance and maternal depressive symptomatology is unclear.

Methods: 127 women across 38 counties in a South Central U.S. state participated in online surveys in their 3rd trimester and approximately six weeks post birth conducted in 2016. Both the pre- and post-birth assessments of depression were measured with the Center for Epidemiologic Studies Depression Scale (CES-D). NICU admittance was asked in the post-birth survey. T-tests and multivariable regression analyses were used to determine predictors of NICU admittance and postnatal depressive symptomatology.

Results: Findings indicate that prenatal depression does not differ significantly between mothers by NICU admission status, but rather that admission of a newborn to a NICU is a significant predictor of postpartum depressive symptomatology.

Conclusions: Having a newborn admitted to the NICU is a risk factor for maternal postpartum depression. These findings have implications for practice; screening mothers of infants admitted to a NICU for depression as a target for intervention has the potential to improve maternal well-being, which in turn should enhance maternal-child attachment and subsequent infant developmental outcomes.

Each year, neonatal intensive care units (NICU) across the United States admit a million and a half newborns (10 - 15 percent of all babies born) (Harrison & Goodman, 2015). NICUs admit most infants within 72 hours of birth, and they have an average stay of 13.2 days

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(March of Dimes, 2016). There are many reasons for NICU admittance. Preterm birth (born before 37 weeks gestation) is common, occurring in 10 percent of all U.S. births, and it is the prevailing reason for NICU admittance (March of Dimes, 2016). Other reasons for admission to the NICU include congenital birth defects, maternal complications of pregnancy, and breathing irregularities and infections (Kochaneck, Murphy, Xu, & Tejada-Vera, 2016). Recently, there has been an increasing trend of admitting newborns suffering neonatal abstinence syndrome passed in utero from opioid addicted mothers (Tolia et al., 2015). Rates of NICU admittance are also increasing among full-term, normal birth weight newborns, though the reason for the increase among all newborns is not yet known (Harrison & Goodman, 2015). Although there are many and diverse reasons that newborns are admitted to the NICU, the parental experience has some shared commonalities.

Parents walking into the NICU for the first time are often unprepared to see their critically-ill newborns. Most parents of infants in the NICU report experiencing new sights, sounds, and nomenclature surrounding the medical care of their children (Bell, 1997). In addition, parents may struggle with maternal postpartum recovery and/or psychological reactions to having their newborns unexpectedly admitted to the NICU. The confluence of these factors can diminish the parents' ability to mentally ascertain significant medical information concerning the welfare of a NICU infant (Boss, Donahue, & Arnold, 2010). Mothers can also suffer from loss of the maternal role (Miles, Funk, & Kasper, 1991), feelings of helplessness and guilt (Trause & Kramer, 1983), inadequacy (Jeffcoate, Humphrey, Lloyd, 1979), worry about the survival of their critically-ill child (Pederson, Bento, Chance, Evans, & Fox, 1987), and a deep sadness due to separation from the newborn (Korja et al., 2009).

The negative psychosocial impacts of a newborn's NICU stay for parents have been documented in previous research (Affleck & Tennen, 1991; Meyer, Coll, Seifer, Ramos, Kilis, Oh, 1995). Erdem (2010) showed that having a baby in the NICU can lead to anxiety and uncertainty for the parents. In many couples, the mother will remain in the NICU and become the primary caregiver (Traustadottir, 1991), while the father is usually the parent who returns to work as both parents often cannot afford the time off from work to care for the baby in the NICU (Hollywood & Hollywood, 2011; Lundqvist, Westas, & Hallström, 2007). This can leave the mother with feelings of isolation (Barry & Singer, 2001), loss or strain on the marital relationship (Manning, 2012), and anticipatory grief (Benfield, Leib, & Reuter, 1976), which can all lead to physical and depressive symptomology (Mayo Clinic, 2016).

This study uses a longitudinal data set of 127 women during their pregnancies and following birth as they transition to motherhood in an effort to determine how NICU admittance affects women's mental health. Because this draws from a community-based sample rather than a NICU-based sample and due to the longitudinal nature of the data set, we are able to overcome past limitations of research on this topic.

Literature Review

White tile floors, task lighting, equipment and alarms beeping, phones ringing, HVAC systems in use, and medical personnel talking and using unknown terms are just a few of the

sensory inputs during a walk to the bedside of a critically-ill or premature infant in a NICU. While these environmental factors may be overwhelming initially (Altimier & White, 2014), it is the appearance and behavior of the newborn coupled with a change in parental role expectations that causes the most anxiety to new parents (Miles et al., 1991). Doering, Dercup, and Moser (1999) found that parents of newborns in the NICU reported that their anxiety, hostility, and depression levels had increased, and mothers reported that the NICU experience to be more stressful than fathers. They argue that parental psychosocial distress should be assessed early to facilitate better outcomes for not only the newborns but for the family units as well.

Prenatal depression can have harmful effects to both the mother and infant. Previous studies have found delayed fetal growth and low birth weight (Diego, Field, Hernandez-Reif, Schanberg, Kuhn, & Gonzalez-Quintero, 2009), increase risk for maternal birth complications such as preeclampsia (Kurki, Hiilesmaa, Raitasalo, Mattila, & Ylikorkala, 2000) and preterm labor (Goldenberg, Culhane, Iams, & Romero, 2008), and behavioral changes in the newborn (Field, Diego, Hernandez-Reif, 2006). Interestingly, prenatal depression is also associated with increased risk for NICU admission (Latendresse, Wong, Dyer, Wilson, Baksh, & Hogue, 2015).

There is also a high risk for developing postpartum depression after prenatal depression. The onset of postpartum depression occurs in approximately 50% of patients that had been diagnosed with depression before giving birth (Josefsson, Berg, Nordin, & Sydsjo, 2001; Yonkers et al., 2001). According to the Diagnostic and Statistical Manual of Mental Disorders, 5th edition (DSM-V), postpartum depression is typically classified as a major depression episode with a postpartum onset (American Psychiatric Association, 2013; Munoz, Agruss, Haegar, & Sivertsen, 2006). Hence, there is no diagnosis of postpartum depression by itself; it is depression and/or anxiety comorbid with “postpartum onset” within a month postpartum (O’Hara, 2009).

Postpartum depression can last from a few weeks up to one year (Munoz et al., 2006). Selix and colleagues (2017) estimate that one in every five to seven women who give birth is affected by postpartum depression. Symptoms for postpartum depression include “tearfulness, despondency, emotional lability, feelings of guilt, loss of appetite, suicidal ideation, and sleep disturbances as well as feelings of inadequacy and inability to cope with the infant, poor concentration and memory, fatigue, and irritability” (Robertson, Grace, Wallington, & Stewart, 2004, p. 290).

Research Questions

Parents of children in the NICU report that it is a highly stressful and isolating experience (Affleck & Tennen, 1991). Yet prior research also indicated that women with prenatal depression are more likely to have their newborns admitted into a NICU (Latendresse et al., 2015). To ascertain whether NICU admittance significantly affects new mothers’ depressive symptoms over and above prenatal symptoms of depression, we utilize a sample of women who self-reported depression symptomology both before birth and approximately 6 weeks after giving birth. This allowed us to examine whether depression rates differ pre- and

postnatally among women with a newborn admitted to the NICU, or whether the NICU admission is uniquely associated with higher postpartum depression.

Methods

Procedures

Data for this paper come from an online survey collected from pregnant women in rural and urban counties in a South Central state in 2016. Institutional Review Board approval was granted before commencing with the study. Participants were asked to complete two online surveys: one prior to birth during the 3rd trimester and an additional online survey approximately one month postpartum. Women were able to withdraw from the survey at any point and were paid up to \$70 for their participation in both waves of the study.

Participants

Pregnant women were recruited from social media groups and community baby shower events for study participation. The criteria for inclusion in the survey were women: 1) between the ages of 18-35 years old, 2) women expecting their first biological child, 3) be in the 3rd trimester of the pregnancy (at least 28 weeks), and 4) be able to read and write in English. Nearly 90% of participants who responded to the first wave of the survey also completed the post-birth survey. Analyses of descriptive statistics did not reveal significant differences between those who participated in both waves of the survey as compared to those who only completed the first wave. The sample for the current study includes the 127 women who participated in both waves of the study. Participants had an average age of 24, most participants (69%) reported non-Hispanic White as race/ethnicity, 72% had at least some college, and 81% were living with a partner in a marriage or cohabiting union.

Measures

Depressive Symptoms.—Both the pre- and post-birth assessments of depression were measured with the Center for Epidemiologic Studies Depression Scale (CES-D). The CES-D scale was developed by Radloff (1977) to measure the general population's depressive symptomology. There are 20 items measuring “depressed mood, feelings of guilt and worthlessness, feelings of helplessness and hopelessness, psychomotor retardation, loss of appetite, and sleep disturbance” (Radloff, 1977, p. 386). Each item has a range of 0-3 for a response, such that 0=Rarely or None of the time, 1= Some or little of the time, 2= Occasionally or a moderate amount of time, and 3=Most or all of the time. For this study, the sum of responses were used to calculate the *prenatal depression* and *postpartum depression* scales ranging from 0-49, with higher scores indicative of more depressive symptomology and frequency of events within the previous week. The Cronbach's alpha for the prenatal depression scale in this sample is .90, and the Cronbach's alpha for the postnatal depression scale in this sample is .91.

Neonatal Intensive Care Unit (NICU) Admission.—The survey instrument included a single question, “Did your baby spend any time in a neonatal unit?” used to measure *NICU admission*, which was coded such that 1=yes and 0=no.

Demographic and Control Variables.—Age was assessed with the question, “How old will you be when your baby is born?” and ranges between 18-36. Education was included in the study as a dichotomous variable where 1 = at least *some college*. Race/ethnicity was queried with the question, “Please choose one or more of the following categories to describe your race or ethnicity.” Answers were based on Census categories of White, Black, Asian/Pacific Islander, Hispanic, Unknown, Native American, or Other. Due to the small sample size, race/ethnicity was coded as 1= Non-Hispanic *White* or 0=other. Relationship status was coded into dummy variables comparing women living *in a union* (1 = married, remarried, or cohabiting) to single (=0).

Analytic Strategy

T-tests were used to compare means of study variables such as prenatal depression or postpartum depression for new mothers depending on whether or not they had a newborn admitted to the NICU following birth. A correlation matrix assessed relationships between study variables. Multivariable linear regression analysis was then used to examine the relationship between NICU admission and postpartum depression.

Results

Descriptive statistics are presented in Table 1 for the full sample and for participants based upon whether or not their newborns were admitted into the NICU. Findings show that 11% of the sample had newborns admitted into the NICU, which is consistent with the national trend (Harrison & Goodman, 2015). Scores of prenatal depression were higher than postpartum depression; a mean prenatal depression score of 16.22 is above the cut-off point (16) that is typically used to indicate high depressive symptoms (Radloff, 1977). In the full sample, depression scores were lower post-birth ($M=14.44$), though the drop in postpartum depression was only observed for the new mothers who did not have their infants admitted into the NICU. the , and postpartum depression were fairly low, with mean item-level scores between “Rarely or Never” and “Sometimes.”

Results of the t-test analysis comparing new mothers on study variables based upon NICU admission status reveals no significant differences on any variables except for postpartum depression. Although NICU mothers scored higher on prenatal depression ($M=19.47$) as compared to non-NICU mothers ($M=15.57$), this difference was not statistically significant. Postpartum depression scores did differ significantly between NICU and non-NICU mothers, with NICU mothers reporting higher levels of depressive symptoms postpartum, $t = -2.53$, $p < .05$. Interestingly, NICU mothers maintained nearly identical levels of depression as they reported prenatally ($M=20.00$), whereas non-NICU mothers reported lower postpartum depressive symptoms than they reported prenatally ($M=13.57$).

Table 2 presents the correlation matrix of study variables. NICU admission was significantly correlated with postnatal depression (Pearson’s $R=.22$; $p < .05$), and prenatal depression was correlated with postnatal depression ($R=.22$; $p < .05$). Interestingly, prenatal depression, but not postnatal depression, was correlated with demographic variables of age ($R=-.28$; $p < .01$), education ($R=-.26$; $p < .01$), and living in a union ($R=-.35$; $p < .01$).

Table 3 presents the results of the multivariable linear regression. In the first model with no additional variables, NICU admittance was significantly associated with higher depression scores postpartum ($b=6.03$; $p<.05$). This finding held in Model 2 with the inclusion of demographic control variables, ($b=5.99$; $p<.05$). Prenatal depression was added to the analysis in Model 3. Consistent with prior research, prenatal depression scores were significantly associated with higher postpartum depression scores ($b=0.22$; $p<.05$). Still, even with the inclusion of prenatal depression score, NICU admittance was significantly associated with higher depression scores postpartum, although the association was slightly attenuated ($b=5.16$; $p<.05$).

Discussion

The findings from the current study suggest that NICU admittance had a unique association with postpartum depressive symptoms, over and above prenatal depressive symptoms. This finding supports prior research indicating mental health risks to mothers with infants admitted to the NICU compared to mothers of healthy babies (Korja et al., 2009). However, much of the research on depression and the NICU, even prospective studies, do not report prenatal symptomatology, preventing a complete understanding about the onset and maintenance of depressive symptoms in these mothers.

Importantly, there were no significant prenatal differences between mothers with and without a NICU admission, and differences between the groups emerged with a decline in symptoms for mothers without a NICU admission. This decline is consistent with data reporting that, for most mothers, and especially for mothers with high prenatal depressive symptoms, there is a decline in depressive symptoms over the first 6 weeks postpartum (Fredriksen et al., 2017). Further, our results suggest that mothers whose infants were admitted to the NICU did not follow this pattern of declining symptoms, but rather *maintained* fairly high prenatal levels of depressive symptoms up to 6 weeks postpartum. This suggests that the NICU admission delays or presents a barrier to the typical decline in symptoms postpartum, perhaps due to the uncertainty and stress experienced from having a baby in the NICU (Erdem, 2010).

This potentially normative decline in symptoms may also be associated with methodological factors. For example, several of items on the CES-D may be capturing third trimester pregnancy symptoms and labor worries as much as or more than depressive symptoms, which then resolve following delivery and discharge from the hospital. Some examples include, “I was bothered by things that don’t usually bother me;” “I felt that everything I did was an effort;” “I did not feel like eating; my appetite was poor;” “I felt fearful;” “My sleep was restless;” and “I had crying spells.” Supporting this is a finding that a minority group of women report an increase of depressive symptoms throughout pregnancy which then rapidly drop during the post-partum period (Fredriksen et al., 2017). If this is the case, following a NICU admittance, these symptoms may remain elevated for additional time because the delivery experience itself took longer to resolve, and there are likely continuing concerns about the infant’s health which would reasonably maintain symptoms. Thus, it may be helpful to examine responses at the item-level to better understand the experience and needs

of these new mothers, and suggests the need for measurement scales that more carefully differentiate between normative pregnancy symptoms and symptoms of depression.

Limitations, Strengths, and Conclusions

There are important limitations of this study. First, though the sample drew participants from 38 counties across the state, generalizability of the findings may be limited. Overall, participants in this sample were more likely to have some college education, married, and to be non-Hispanic White, than women of childbearing ages in the general population of the state. This is a common challenge for contemporary survey research (Groves, 2011). Second, the small sample size may have suppressed some results that may have been significant in a larger sample. For example, the nonsignificant differences in prenatal depression scores, which were higher among mothers who had infants admitted to the NICU, may be due to low power. Previous research has acknowledged the contribution of prenatal depressive symptoms for NICU admission (Latendresse et al., 2015). Although we examined NICU admission as a predictor of postpartum depression rather than as an outcome, there is a possibility that NICU admission is a mediator of the relationship between prenatal and postnatal depression. Further, there may be additional factors associated with both NICU admission and depression that were not assessed in the study, such as opiate addiction. In addition, the timing of the pre- and post-birth surveys may affect depression scores. More time points during both the prenatal and postnatal periods would provide more insight into fluctuations of depressive symptoms. Further, the post-birth survey that took place at approximately six weeks postpartum may have excluded some of the mothers with infants still in the NICU. Most stays for the newborn in the NICU do not last more than a few weeks; however, mothers with infants still in the NICU may not have opted to participate in the post-birth wave of the study. Still, we argue that these limitations would lead to conservative estimates of the impact of NICU admittance on new mothers' mental health. The prospective ability to evaluate change in depression scores provides important insights into maternal mental health across the transition to motherhood.

This study has important implications medical practices regarding maternal mental health at admittance to and discharge from the NICU for the newborn child; each mother should be screened for postpartum depression at entry to and discharge from the NICU with resources provided for mothers suffering from clinical risk for depression. Both time points have significant implications for maternal mental health interventions (Melnik, Crean, Feinstein, & Fairbank, 2008), maternal-child attachment (Johnson, 2008; Wigert et al., 2006), family-centered care (Cooper, Gooding, Gallagher, Sternesky, Ledsky, & Berns, 2007), infant developmental outcomes (Parfitt, Pike, Ayers, 2014), and the ability to provide a safe and secure home environment for the NICU graduate (McLennan & Kotelchuck, 2000). Further, there can be a delay in the onset of depression postpartum of 6-12 months following birth (Miller, 2002; Munoz et al., 2006), so informing new mothers about depression that can occur later and resources near them could enhance maternal and infant well-being.

In accordance with the 1987 call by then Surgeon General C. Everett Koop, NICUs are encouraged to develop an intervention program for "family-centered, community-based care for children with special health care needs and their families" (U.S. Department of Health

and Human Services, 1987). Enhancing maternal well-being enables better care for infants (Börjesson, Paperin & Lindell, 2004), which might be especially important for the higher-risk newborns that spent time in a NICU. In the future, providing screenings for women before giving birth would allow women's health care providers to give patients resources to utilize after the birth of the newborn. NICUs should provide a treatment venue for mothers during the infant's NICU stay to utilize mental health care resources on site rather than within the community. Keeping the mother and child well both physically and mentally increases the likelihood that both will experience a smoother transition home following a NICU stay.

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Table 1.
Means and standard deviations of study variables by NICU admission experience (N=127).

<i>Variables</i>	<u>Full sample</u>		<u>NICU (N=14)</u>		<u>No NICU (N=113)</u>		<i>Range</i>	<i>t</i>	<i>p</i>
	<i>M</i>	<i>or %</i>	<i>SD</i>	<i>M</i>	<i>or %</i>	<i>SD</i>			
NICU admission	11%		.32				0-1		
Prenatal depression	16.22		10.17	19.47	11.10	15.57	9.84	0-49	-1.41
Postnatal depression	14.44		9.57	20.00	11.20	13.57	9.02	0-47	-2.53 *
Demographic variables									
Age	24.25		4.21	24.43	4.43	24.28	4.19	18-36	-.13
Some college or more	72%		.45	73%	.46	71%	.45	0-1	-.16
White	69%		.46	73%	.46	69%	.46	0-1	-.32
Living in union	81%		.39	80%	.41	81%	.39	0-1	.11

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p<.05.

Table 2.

Correlation matrix of study variables (N=127).

	1	2	3	4	5	6
1. NICU admission	--					
2. Prenatal depression	.13	--				
3. Postnatal depression	.22 [*]	.34 ^{**}	--			
4. Age	.01	-.28 ^{**}	-.15	--		
5. Some college or more	.01	-.26 ^{**}	-.13	.47 ^{**}	--	
6. White	.03	-.02	-.04	.20 [*]	.14	
7. Living in union	-.01	-.35 ^{**}	-.12	.29 ^{**}	.29 ^{**}	.26 ^{**}

* p<.05

** p<.01

*** p<.001.

Table 3.

Multivariable linear regression analysis of postnatal depression by NICU admittance, demographic characteristics, and prenatal depression (N=127).

<i>Variables</i>	Model 1		Model 2		Model 3	
	<i>b</i>	<i>SE</i>	<i>b</i>	<i>SE</i>	<i>b</i>	<i>SE</i>
NICU admission	6.03 *	2.54	5.99 *	2.55	5.16 *	2.52
Demographic variables						
Age			-.12	.23	-.05	.22
Some college or more			-1.33	2.14	-.66	2.11
White			-.30	1.87	-.80	1.84
Living in union			-2.61	2.40	-.92	2.45
Prenatal depression					.22 *	.09
Constant	13.33 ***	.87	19.51 ***	5.08	13.12 *	5.64
Adj. R2	.04		.04		.08	

*
p<.05

**

p<.01

p<.001.