Maternal Mental Health and Neonatal Intensive Care Unit Discharge Readiness in Mothers of Preterm Infants

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Objective To evaluate associations between maternal mental health disorders (MHDs) and discharge readiness for mothers of infants born preterm (<37 weeks). We hypothesized that mothers with a history of MHDs would report decreased perceptions of neonatal intensive care unit (NICU) discharge readiness compared with mothers without a history.

Study design Mothers of infants born preterm in the NICU >5 days between 2012 and 2015 and participating in a transition home program completed a discharge readiness questionnaire measuring perceptions of staff support, infant well-being (medical stability), maternal well-being (emotional readiness/competency), and maternal comfort (worry about infant). Greater scores are more optimal (range 0-100). Social workers obtained a history of MHDs. Group comparisons and regression analyses were run to predict decreased scores and maternal discharge readiness.

Results A total of 37% (315/850) of mothers reported a MHD. They were more likely to be white (64% vs 55% $P = .05$), single (64% vs 45% $P \leq .001$), on Medicaid (61% vs 50% $P = .002$), and less likely to be non-English speaking (10% vs 22%, $P \leq .001$). Mothers with MHD perceived less NICU support (92 ± 13 vs 94 ± 12, $P = .005$), less emotional readiness for discharge (78 ± 17 vs 81 ± 14, $P = .04$), and lower family cohesion (81 ± 24 vs 86 ± 19, $P = .02$) compared with mothers without MHD. Regression modeling (OR; CI) indicated that maternal history of MHDs predicted mother's decreased perception of infant well-being (1.56; 1.05-2.33) and her own well-being (1.99; 1.45-2.8) at discharge.

Conclusion One-third of mothers reported a history of MHDs. This vulnerable group perceive themselves as less ready for discharge home with their infant, indicating an unmet need for provision of enhanced transition services. *(J Pediatr 2017;184:68-74).*

More than 450 000 babies are born preterm in the US.[1] With increased rates of survival, more parents are exposed to extensive medical and nursing interventions. After their infants are discharged from the neonatal intensive care unit (NICU), parents are expected to transition to full-time caregiver responsibilities, so it is not surprising they become anxious when bringing their infant home.[2] Discharge readiness has been defined as parental emotional comfort and confidence with infant care, in addition to attainment of technical skills and knowledge.[3] Therefore, parent mental well-being is critical to parenting readiness.

Time spent in the NICU exposes both infant and parent to stressors.[4] Parental anxiety has been associated with infant appearance, sights and sounds of the technical NICU environment, alterations in parental role,[5] concern for developmental outcomes[6-8] and anticipated financial burdens.[5,9-12] Mothers of infants born preterm are at increased risk for poor postpartum functioning, including depression,[13] anxiety,[14] and posttraumatic distress.[15] The impact of maternal mental health and postpartum psychological distress on the mother-infant dyad is now recognized as a public health priority,[16] because poor maternal mental health adversely affects child cognitive, language, social-emotional, and behavioral development.[17-23] Thus, it is not surprising that parental mental wellness is recognized as a cornerstone of infant wellness.

Stressful life events, poor social support, and prenatal history of psychiatric illness are all strong predictors of postpartum mental illness.[24] Prenatal depression has been cited as the strongest predictor for postpartum depression.[25] Perceptions of decreased readiness at discharge have been associated with postdischarge depressive symptoms.[26] Recent recommendations of recognizing and supporting maternal mental health during the NICU discharge transition have been published[27]; however, discharge assessment data examining different constructs of maternal perceptions

CSW	Clinical social worker
FIPRE	Fragile Infant Parent Readiness Evaluation
FRS	Family resource specialist
MHD	Mental health disorder
NICU	Neonatal intensive care unit
THP	Transition home program
WIH	Women and Infants Hospital

of emotional readiness and factors affecting this readiness are lacking. The objective of this paper was to explore the association between maternal mental health disorders (MHDs) and the perception of discharge readiness in mothers of infants born preterm. It was hypothesized that mothers with a history of MHDs would report decreased discharge readiness compared with mothers without a history of MHDs.

Methods

This prospective, cohort study recruited all infants < 37 weeks' gestation between October 2012 and September 2015 hospitalized in the Women and Infants Hospital (WIH) NICU greater than 5 days. Subjects were part of a larger education and support intervention, Partnering with Parents, the Medical Home and Community Providers to Improve Transition Services for High Risk Preterm Infants in Rhode Island (transition home program [THP]). The institutional review board of WIH approved the study. Excluded were mothers unable to read English or Spanish and infants or mothers with a terminal diagnosis. Families were approached, asked for their consent, and enrolled when infants no longer required acute care and were in the discharge preparation phase.

WIH NICU is an 80-bed, single family room level III/IV NICU. Multidisciplinary rounds involve medicine, nursing, nutrition, case managers, respiratory therapists, and social workers. Parents are encouraged to attend daily multidisciplinary rounds and provide basic infant care of diapering, bathing, feeding, skin to skin, and breastfeeding when developmentally and medically appropriate.

Parents enrolled in THP received the standard discharge process, which included nursing review and a demonstration for parents of infant care, viewing formula mixing videos, and cardiopulmonary resuscitation classes. Discharge planners reviewed follow-up appointments and home equipment details. In addition, parents enrolled in THP received enhanced education and support services, which included educational binders (containing information on infant safety topics, infection control, formula recipes, and community resources), parent mental health support, predischarge home assessment, and community referrals as needed. Former NICU parents were hired and trained to serve as family resource specialists (FRS). Families enrolled in THP were matched with a FRS. The FRS reviewed the educational binder, administered study questionnaires, and served as a peer mentor. English-, Spanish-, and/or Portuguese-speaking FRS were available. Study clinical social workers (CSWs) supervised the FRS, offered mental health counseling, and facilitated referrals to community providers. Study CSWs worked in conjunction with NICU staff social workers, however, with an emphasis on transition and the home environment.

Maternal characteristics, including age, race, gravida, marital status, education, insurance, involvement with child protective services, domestic violence, and substance abuse were abstracted from the medical record. Infant characteristics included birth weight, gestational age, sex, intraventricular hemorrhage (grade 3-4), necrotizing enterocolitis (>Bell stage 2), sepsis (culture positive), bronchopulmonary dysplasia (oxygen at 34 weeks' postmenstrual age), breast milk use, oxygen at discharge, and length of stay. Socioeconomic questionnaires were completed at enrollment.

At enrollment, the study CSW obtained a history of MHDs by maternal report and medical record review. Mothers were interviewed and assigned a history of MHDs if they: (1) reported or had a documented diagnosis of anxiety, depression, bipolar disorder, post-traumatic stress disorder, obsessive compulsive disorder, or other diagnosis of the *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition*, and or (2) received mental health treatment, either psychotherapy or medication, for any of the aforementioned disorders before enrollment (including prenatal or antenatal). Medical record review included admission notes, social work assessments, and psychiatry consultations.

At discharge, mothers completed the Fragile Infant Parent Readiness Evaluation (FIPRE), which was developed by Health ActCHQ as a quality measure of NICU parent outcomes.[28] This discharge tool measures how the parent feels about the NICU care provided to herself and her infant and how emotionally prepared the parent feels to care for her infant at home. It consists of 4 core multi-item Likert-type scales. NICU support reflects how included and informed the parent felt during the NICU stay. Infant well-being reflects how positive a parent feels about infant's current health status and survival. Maternal well-being represents mother's feeling of self-competency and emotional confidence to care for self and infant. Maternal comfort reflects the degree of worry/anxiety the mother is experiencing regarding her infant's current and future health, growth, and development. Response options are "not at all," "a little," "some," and "a lot." Family cohesion (response choices ranging from "excellent" to "poor" on a 5-point scale) and anticipated personal time limitations (response choices ranging from "a lot of time" to "no time" on a 4-point scale) were each single-item scales. For all scales (except time limitation scale) scores are transformed to a standard 0-100 metric. Greater scores are more favorable responses and indicate greater discharge readiness. Mean and median scores are reported. Scores < 75 were evaluated for each scale, to identify responses in the lower three-quarters range of possible scores. Cronbach alpha for each scale was performed to measure internal reliability and ranged from 0.73 to 0.87. Six demographic questions also are asked.

Maternal and infant outcomes for those with and without a history of MHDs were compared with t tests and Wilcoxon tests for continuous variables and χ^2 tests for categorical variables. Infant variables were analyzed by the use of random effects models (continuous) or generalized estimating equations (categorical) methods to adjust for multiple births within mothers.

Regression models estimated the effect of MHDs on FIPRE scores while we controlled for independent variables of early preterm, days in NICU, gravida >1, nonwhite, non-English speaking, and Medicaid. A social risk variable comprised a count of selected risk factors, including less than high school education, single, child protective services involvement, and domestic and substance abuse. Statistical analyses were conducted with SAS 9.1 (SAS Institute, Cary, North Carolina).

Results

A total of 1504 infants born preterm were eligible for enrollment in THP and 1105 infants (73.5%) were enrolled. This cohort consisted of 934 mothers. The FIPRE response rate was 91% (850/934) and, of those, 315 (37%) mothers reported a history of MHDs. The number of in-person NICU contacts between mothers and FRS did not differ between those with and without MHDs (mean 4.1 ± 3.6 SD vs 3.8 ± 3.2). Maternal characteristics are presented in **Table I**. Mothers with a history of MHDs vs none were more likely white (64% vs 55%, $P = .05$), whereas rates of history of MHDs among each race were as follows: 40% among all white mothers, 30% among all black mothers, and 38% among all Hispanic mothers. Mothers with a history of MHDs were more likely to be single (64% vs 45% $P \leq .001$), receive Medicaid (61% vs 50% $P = .002$), and were less likely to be non-English speaking (10% vs 22%, $P \leq .001$). More mothers with a history of MHDs reported social risks including child protective services involvement (20% vs 5%), domestic abuse (19% vs 3%), and substance abuse (25% vs 4%) compared with mothers without a history. **Table II** depicts infant characteristics; the only difference between groups was infants of mothers with a history of MHDs were less likely to receive breast milk at discharge (60% vs 74% $P \leq .001$).

At discharge, the majority of mothers reported a positive NICU experience (**Table III**), but those with a history of MHDs were more likely to report negatively (9% vs 5%, $P = .01$). In both groups, 18%-19% of mothers expressed elevated concern (scores < 75) regarding their infant's care or survival. Mothers with a history of MHDs reported overall less favorable self-competence/emotional confidence (maternal well-being) compared with mothers without a history of MHDs (78 ± 17 vs 81 ± 14, $P = .04$) and had significantly more scores < 75 (35% vs 26%, $P = .004$). Of all FIPRE scales, the lowest mean scores

for both groups were maternal comfort/anxiety items pertaining to infant health and development (75 ± 24 vs 73 ± 45, $P = .2$), with approximately 39%-42% of all mothers having scores < 75, reflecting greater levels of anxiety about infant outcomes. Perceptions of family cohesion were lower for mothers with a history of MHDs (81 ± 24 vs 86 ± 19, $P = .02$). Impact on personal time was similar between both groups.

Regression analyses run to predict FIPRE scores < 75 are shown in **Table IV**. A history of MHDs predicted lower FIPRE infant well-being (OR 1.56; 95% CI 1.05-2.33) and maternal well-being scores (OR 1.99; 95% CI 1.45-2.8). Nonwhite and non-English speaking predicted lower infant well-being scores (OR 1.82; 95% CI 1.17-2.84 and 2.57; 1.59-4.16). Days spent in NICU and non-English speaking predicted lower maternal well-being scores (OR 1.01; 95% CI 1.003-1.02, and 2.1; 1.31-3.33).

Discussion

Study findings supported our hypothesis that a history of MHDs is associated with maternal perception of decreased

Table II. Infant characteristics* by history of MHDs

Characteristics	MHD, n = 367	No MHD, n = 636	P[†]
Birth weight, g	1905.4 ± 668	1848.7 ± 643	.45
Gestation, wk	32.3 ± 3	32.1 ± 3	.95
Male	188 (51)	346 (54)	.51
Intraventricular hemorrhage (III-IV)	3 (1)	16 (3)	.09
Necrotizing enterocolitis	7 (2)	15 (2)	.64
Sepsis	12 (3)	19 (3)	.80
Bronchopulmonary dysplasia	33 (9)	69 (11)	.61
Breast milk at discharge	218 (60)	467 (74)	<.001
Oxygen at discharge	16 (4)	31 (5)	.76
Days in hospital	34.2 ± 37	35.8 ± 35	.93

Values are expressed as n (%) or mean ± SD.
*Based on number of children.
†P values adjusted for multiple births within mothers.

Table I. Maternal characteristics* by history of MHDs

Characteristics	MHD, n = 315	No MHD, n = 535	P
Age, y	28.8 ± 6	29.9 ± 6	.01
Group			
Early preterm (<32 wk), n = 266	95 (30)	171 (32)	.12
Moderate preterm (32-33 wk), n = 188	60 (19)	128 (24)	
Late preterm (34-36 wk), n = 396	160 (51)	236 (44)	
Gravida > 1	235 (75)	341 (64)	.001
Race/ethnicity			
White, n = 496	201 (64)	295 (55)	.05
Black, n = 92	28 (9)	64 (12)	
Hispanic, n = 184	65 (21)	119 (23)	
Mixed/other, n = 78	21 (7)	57 (11)	
Not married	198 (64)	239 (45)	<.001
Non-English speaking	31 (10)	118 (22)	<.001
Less than high school education	48 (16)	66 (13)	.14
Medicaid	191 (61)	266 (50)	.002
Child protective services involvement	62 (20)	25 (5)	<.001
Domestic abuse	58 (19)	14 (3)	<.001
Substance abuse	79 (25)	24 (4)	<.001

Values are expressed as n (%) or mean ± SD.
*Based on number of mothers.

Table III. FIPRE scales by maternal history of MHDs

Scales	MHD, n = 315	No MHD, n = 535	P*
NICU support[†]	91.8 ± 13 (100)	94.0 ± 12 (100)	.005
Score < 75	28 (9)	25 (5)	.01
Infant well-being[†]	84.8 ± 23 (100)	86.7 ± 22 (100)	.18
Score < 75	61/313 (19)	95 (18)	.53
Maternal well-being[†]	78.2 ± 17 (81.8)	81.3 ± 14 (84.8)	.04
Score < 75	111/314 (35)	138/533 (26)	.004
Maternal comfort[†]	74.7 ± 24 (81)	72.8 ± 24 (81.0)	.24
Score < 75	123/312 (39)	223/531 (42)	.46
Family cohesion[†]	81.2 ± 24 (85)	85.7 ± 19 (85)	.02
Score < 75	74/310 (24)	97/531 (18)	.05
Time impact	(n = 312)	(n = 530)	
A lot	76 (24)	112 (21)	.62[‡]
Some	73 (23)	121 (23)	
A little	100 (32)	174 (33)	
None	63 (20)	123 (23)	

Values are expressed as mean ± SD (median) or n (%).
*Wilcoxon test.
†Scores 0-100, with greater scores more favorable scores averaged within mother for multiple births
‡χ^2 test.

Table IV. Logistic regressions for FIPRE scores <75

Characteristics	NICU support OR (95% CI)	Infant well-being OR (95% CI)	Maternal well-being OR (95% CI)	Maternal comfort OR (95% CI)	Family cohesion OR (95% CI)
MHD	1.63 (0.88-2.99)	1.56 (1.05-2.33)	1.99 (1.45-2.8)	1.05 (0.77-1.43)	1.29 (0.89-1.89)
Early preterm	1.17 (0.43-3.17)	0.79 (0.43-1.43)	0.86 (0.52-1.43)	1.24 (0.78-1.96)	1.05 (0.61-1.81)
Days NICU (per day)	0.99 (0.97-1.01)	1.005 (0.99-1.01)	1.01 (1.003-1.02)	1.003 (0.99-1.01)	1.008 (1.001-1.02)
Gravida > 1	0.64 (0.35-1.16)	0.91 (0.62-1.36)	0.81 (0.58-1.13)	0.78 (0.58-1.05)	0.98 (0.67-1.43)
Nonwhite	0.85 (.44-1.65)	1.82 (1.17-2.84)	1.18 (0.81-1.73)	0.96 (0.68-1.34)	1.15 (0.76-1.73)
Non-English speaking	0.62 (0.23-1.64)	2.57 (1.59-4.16)	2.1 (1.31-3.33)	1.7 (1.1-2.60)	1.220 (0.72-1.97)
Medicaid	1.82 (0.88-3.78)	1.31 (0.83-2.10)	0.55 (0.36-0.80)	0.59 (0.41-0.85)	1.39 (0.9-2.16)
Social risk	1.19 (0.91-1.59)	.82 (.66-1.00)	0.97 (0.81-1.14)	0.97 (0.83-1.13)	1.12 (0.43-1.35)

Social risks are less than high school education, single, child protective services involvement, domestic abuse, and substance abuse.

readiness for discharge compared with mothers without a history of MHDs. Although differences were observed between the 2 groups in perception of NICU support, maternal well-being, and family cohesion, there were no differences in perceptions of infant well-being, maternal comfort, and time impact.

NICU discharge is a balance of patient and caregiver readiness, based on infant physiologic stability, family capability, confidence, and the home environment. Our findings support the recommendation from the American Academy of Pediatrics of assessing social risk factors and parental mental illness before a newborn is discharged,[29] as well as recently published NICU recommendations endorsing multidisciplinary, layered parent psychosocial support from NICU admission through discharge and beyond.[30]

Mothers with a history of MHDs were more likely to be single, multiparous, and on public insurance. This finding is similar to other studies, as single mothers report increased use of mental health services, and along with multiparous mothers, greater rates of depression and anxiety.[31-35] Although our mothers were predominantly white, which reflects our local population, rates of MHD history were 40% among white, 36% among Hispanic, and 30% among black mothers. Data on the associations between mental illness and race/ethnicity are conflicting. In general, depression appears to be greater in black or Hispanic mothers[36-38]; however, barriers to access of healthcare[39] and cultural differences[40,41] may lead to underreporting and/or underdiagnosis. Some studies on maternal depression and anxiety have found no racial/ethnic differences,[42] as well as postulating protective effects of race/ethnicity.[43] Discrepancies likely are confounded by economic and social adversities. Our mothers with mental health difficulties were more likely to have a history of child protective services involvement, domestic abuse, and substance abuse, associations that are well documented in literature.[44-46]

Mothers with a history of MHDs were less likely to provide breast milk at discharge, which has important clinical implications. In addition to protective effects on infant morbidities, maternal benefits are well documented.[47,48] Breastfeeding has been reported to decrease postpartum anxiety and depression.[49] It has been reported that women with elevated levels of prepartum anxiety or depression who stop breastfeeding early have disproportionately greater rates of postpartum

anxiety/depression, compared with those without prepartum psychological distress.[50]

Overall, both groups of mothers had a positive NICU experience. The majority of mothers felt included in their infant's care and perceived staff to be responsive and accessible. It has been documented that patients deemed "ready" for discharge have greater hospital and provider satisfaction.[51] It is likely the single family room NICU environment played a role, as studies have shown that this environment increases parent satisfaction.[52] Stevens et al[53] reported parents in single family room NICUs perceived better staff communication, attention, and respect compared with an open-bay unit. Despite our high NICU satisfaction rate, 9% percent of mothers with a history of MHDs had a less favorable experience compared with 5% of mothers without MHD. This finding may reflect a subtle but important point for staff, that psychologically unwell mothers may need additional bedside communication and support throughout their infant's hospitalization.

We recently reported that mothers with negative perceptions of self during the discharge process were at increased risk for symptoms of depression 1 month after their infant's discharge from the NICU.[26] In the current study, a history of MHDs was an independent risk factor for mother's poor perception of self and infant. Specifically, regression analysis revealed that mothers with a history of MHDs were 1.5 times more likely to be more fearful of their infant not surviving (infant well-being scale) and were twice as likely to have a lower perception of self confidence/competence (maternal well-being scale) during the critical transitioning-of-caregiver discharge period. FIPRE maternal well-being scale asks the mother to reflect on her emotional state, such as feeling "overwhelmed by all that has happened" or "uncertain about what to do once the baby is home." These feelings are in concordance with the construct of maternal self-efficacy, which is mother's belief in her ability to parent.[54] Low maternal self-efficacy has been correlated with maternal depression, anxiety, and stress.[55,56] Infant well-being scale captures feelings of worry about survival, even though infants are typically clinically stable when nearing discharge. Our results likely include mothers with clinical anxiety and depression diagnoses but also may be capturing those with subclinical symptoms. Nonetheless, mothers with poor mental health are beginning the discharge transition in a more vulnerable position. And, importantly, a lower (less favorable) score

could identify those who would most benefit from targeted, timely psychosocial assessment and intervention.

Although no group differences were seen in questions pertaining to concern with infant's sleeping, eating, growth patterns, or future developmental potential (maternal comfort scale), mean scores were overall low, with nearly one-half of all mothers scoring < 75. These topics are common concerns for parents of infants requiring NICU care[57] and have important long-term implications. We previously reported low scores in this scale to be associated with postdischarge depression symptoms.[26] Our finding suggests that despite THP-enhanced efforts in anticipatory education, the infant's medical and developmental needs continue to be distressing for mothers. Ongoing educational focus and support of infant future health needs and development should remain a priority.

Family cohesion responses allow a glimpse into the social dynamics of the home. This single-question scale rates a family's "ability to get along" and should be interpreted cautiously. Low social support has been shown to be a predictor of anxiety and depression in postpartum families.[58-60] Poorer functioning has been reported in families with infants born preterm,[19] and family relationships/cohesion have been linked to infant developmental outcomes.[61] Within our cohort, 18%-24% of all mothers reported less favorable responses, and this item could serve as a prompt to discuss family support networks.

Non–English-speaking mothers were less likely to report a history of MHDs, yet non-English speaking was an independent risk factor for several FIPRE scales. Independent of mental health, we show that language barriers affect multiple components of the discharge process. Raffray et al[62] support this finding, as non-native speaking families were found to have prolonged NICU discharges. Effective language accommodation in healthcare is challenging, and non–English-speaking parents report feelings of discrimination and difficulty establishing trust with medical personnel.[63] Not wanting to be a burden often leads to parents communicating enough to "get by,"[64] potentially resulting in misinterpretation of information. Despite THP providing culturally sensitive Spanish- and Portuguese-speaking FRS, decreased readiness persisted.

Our regression analyses also revealed that a mother on Medicaid was more likely to report feeling positive about her well-being and confident in her ability to care for herself and child. We hypothesize that this confidence may reflect a perception of Medicaid as a "safety net" after adjusting for other social and economic adversities. An alternative hypothesis is that mothers receiving Medicaid may not want to place themselves in a more vulnerable or socially undesirable situation, and thus report bias should also be considered.[65,66]

Strengths of our study include evaluation of a discharge readiness assessment tool for high-risk infants born preterm, large heterogeneous cohort of mothers, and assessment of impact of maternal mental health, psychosocial, and infant factors on discharge. Discharge readiness assessments often are derived from instruments used for healthy infants born at term, are nurse-based assessments, and/or only briefly address psychological preparedness.[67-70] Our study explores in detail the emotional factors that contribute to discharge readiness. A limitation is that MHD was based on maternal report or medical records and not direct assessment, although our study intent was not to diagnose MHDs. Our reporting of scores <75 allowed us to evaluate the lower range of scores; however, future use of the FIPRE in conjunction with standardized mental health assessments could aid in accurately defining and targeting mothers with current depression and/or anxiety, while supporting the clinical relevance of scores. All mothers in this study received the same THP discharge support services and both groups received the same number of personal contacts with their FRS or CSW. We postulate that mothers with MHDs need increased support, and this discharge readiness tool, used in conjunction with mental health support teams, can help guide more effective discharge preparation. To further explore outcomes of mothers and infants relative to discharge readiness, study participants are being followed for postdischarge outcomes, including use of the emergency department and rehospitalization.

In conclusion, a history of MHDs was reported in one-third of mothers of infants born preterm. Mothers with poor mental health perceive themselves to be less ready for NICU discharge, particularly pertaining to feelings of self well-being. Gaining insight to where parents may be struggling presents opportunities to tailor and improve NICU discharge readiness protocols. Further investigation of maternal perception of "readiness" to transition home, especially those mothers with poor mental health, and postdischarge mother/infant dyad support and outcomes is needed. ■

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