# Effects of an Infant-Focused Relationship-Based Hospital and Home Visiting Intervention on Reducing Symptoms of Postpartum Maternal Depression

# Effects of an Infant-focused Relationship-based Hospital and Home Visiting Intervention on Reducing Symptoms of Postpartum Maternal Depression: A Pilot Study

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## Abstract

Relationship-based interventions are an effective means for reducing postpartum depression (PPD), but few cost-effective tools that can be administered efficiently in medical and home settings are available or well-studied. This study examines the efficacy of the Newborn Behavioral Observations (NBO), an infant-centered relationship-based intervention, in reducing levels of postnatal maternal depression. First-time mothers and their infants were recruited in the postpartum units of two New England hospitals and randomized into intervention and control groups. A total of 106 mothers participated in this study, which used a randomized controlled trial design. At one-month postpartum, symptoms of postpartum depression (PPD) were assessed using the Edinburgh Postnatal Depression Scale (EPDS). Ten of the 106 mothers reported elevated levels of depressive symptoms (EPDS > 12), with 4% in the intervention group and 16% in the control group. Results indicated that the NBO was associated with lowering the odds of depressive symptomatology by approximately 75%. These findings suggest that the NBO conducted in hospital and home settings may be an efficient, cost-effective, relationship-based method for reducing the likelihood of PPD symptoms.

# The Effects of an Infant-focused Family-centered Hospital and Home Visiting Intervention on Preventing Postpartum Maternal Depression: A Pilot Study

Postpartum depression (PPD) is a common psychological condition among women in the U.S., with a prevalence of 11 to 20 percent among new mothers (Beeghly et al., 2002; Seyfried & Marcus, 2003; Wisner et al., 2013). Moreover, approximately one in eleven infants are exposed to maternal depression within their first year of life (Center on the Developing Child at Harvard University, 2009). The prevalence of PPD is concerning in light of mounting evidence that it may severely compromise parenting quality and place infants at risk for psychopathology in childhood and adolescence (Brennan et al., 2000; Brennan, Hammen Katz, & Le Brocque, 2002; National Research Council and Institute of Medicine, 2009). Too often, personal, program-level, and system-level barriers prevent primaparous women from attaining help early enough to support the development of healthy relationships with their newborn babies.

Women with clinically significant levels of depressive symptoms generally have fewer emotional, intellectual, and physical resources they can summon to soothe and care for their babies in comparison to their non-depressed counterparts (Laurent & Ablow, 2012). Compared to mother who are not depressed, depressed mothers tend to be affectively unresponsive and emotionally unavailable, provide limited language and cognitive stimulation for their children, and display covert hostility, such as anger and criticism (Chapin & Altenhofen, 2010; Downey & Coyne, 1990; Van Doesum, Hosman, & Riksen-Walraven, 2005). Moreover, maternal depression may lead to dysfunctional patterns of family functioning, including family conflict, poor quality interactions between fathers and their offspring, psychologically controlling parenting behavior (Rafferty, Griffin, & Robokos, 2010), and child abuse and neglect (Conron, Beardslee, Koenen, Buka, & Gortmaker. 2009). The newborn period is a time of particular

vulnerability for both mothers and their infants, as PPD can impair a mother's ability to respond contingently to her infant's cues and to engage in sensitive and responsive interactions with her infant, essential aspects of mother-infant relationships for the establishment of secure attachments and healthy development in children (Laurent, Ablow, 2012; Mertesaker, Bade, & Kowalenko, 2004; Musser, Ablow, & Measelle, 2012; Weinberg & Tronick, 1998). In fact, the deleterious effects of postnatal depression, especially when severe and long-lasting, may undermine infant brain development and lead to enduring physical and mental health problems over the life span (Center on the Developing Child at Harvard University, 2009).

**Impact of Postpartum Depression (PPD) on Infants**

Maternal depression has both direct and indirect effects on infants (Connell AM, Goodman , 2002; Laurent et al., 2013) and may result in a wide range of internalizing and externalizing problems in children (Goodman et al., 2011). The genetic and environmental mechanisms of transmission are not yet clear, but studies reveal detrimental effects of maternal depression on infant behavioral, physiological, and biochemical regulation after birth. In turn, children may present difficulties with social and object engagement and in regulating their affective states (Diego et al., 2004; Field, Hernandez-Reif, & Freedman, 2004; Tronick & Rec, 2009). For example, PPD is associated with higher levels of salivary cortisol in infants (Brennan et al., 2008; Diego et al., 2004; Field, 1992), an indicator of neuroregulatory dysfunction, as well as suboptimal scores on the Neonatal Behavioral Assessment Scale (NBAS), a widely used index of newborn abilities in medical settings (Field, Hernandez-Reif, & Freedman, 2004; Hernandez-Reif, Field, Diego, & Ruddock, 2006).

Other negative sequelae found in children of depressed mothers include insecure attachment (Campbell et al., 2004), physical ailments (Goodwin, Wickramaratne, Nomura, &

Weissman, 2007), social, emotional, and behavioral problems (Halligan, Murray, Martins, & Cooper, 2007; National Research Council and Institute of Medicine, 2009), cognition and attention problems (Batenburg-Eddes, 2013; Hay, Pawlby, Waters, & Sharp, 2008), poor academic functioning (Downey & Coyne, 1990), anxiety and depression (Bureau, Easterbrooks, & Lyons-Ruth, 2009; Hay, Pawlby, Angold, Harold, & Sharp, 2003), and substance abuse (Brennan, Hammen, Katz, & Le Brocque, 2002). These poor child outcomes may occur regardless of whether a mother's depressive symptoms recur in subsequent developmental periods (Hay, Pawlby, Sharp, Asten, Mills, & Kumar, 2001), and ultimately, whether by way of biological or environmental vulnerability (or both), children born to depressed mothers are at risk for functioning deficits that exceed the impairment exhibited by their parents (Hammen & Brennan, 2003). Given the potential for long-lasting harmful effects, efforts to prevent and treat PPD as early in a child's life as possible are essential (National Research Council and Institute of Medicine, 2009).

**Prevention and Treatment**

PPD remains underdiagnosed and untreated, especially among postpartum women (Vesga-Lopez, 2008), and there is a growing demand for early interventions to reduce PPD (Hendrick, 2003; Lyons-Ruth, Wolfe, & Lyubchik; Van Doesum, Hosman, & Riksen-Walraven, 2005). The results of interventions aimed at preventing maternal postnatal depression have been somewhat disappointing, with many utilizing expensive, time-consuming approaches that are not feasible for most families (Austin, 2004; Brockington, 2004; Dennis, 2005; Ogrodniczuk & Piper, 2003). An emerging consensus suggests that promoting the emerging mother-child relationship increases the likelihood of resilient trajectories for both mothers and babies (Als et al., 2003; Beeghly et al., 1995; Browne & Talmi, 2005; Nugent & Brazelton, 1995). While

individual psychotherapy and psychotropic medications have been used effectively to address PPD (National Research Council and Institute of Medicine, 2009), treatments that focus on improving the mother-infant relationship may have greater potential to reduce symptoms (Paris, Bolton, & Spielman, 2011; Forman et al., 2007; Murray, Cooper, Wilson, & Romaniuk, 2003; Nylen, & Moran, Franklin, & O'Hara, 2006).

A number of programs have been designed to treat PPD. Some cognitive-behavioral therapy (CBT), psycho-educational programs, mother-infant psychotherapy, and various family-based interventions have been shown to be fairly efficacious (Cooper, Murray, Wilson, & Romaniuk, 2003; Dennis, 2004; Paris et al., 2011). Antidepressant medication is commonly used in general practice for treating PPD, yet many mothers are reluctant to take this medication during this period, especially if breast-feeding (Chabrol, Walburg, Teissedre, Armitage, & Santrisse, 2004). In addition, seriously depressed mothers may be emotionally unavailable to the more classic “mother-centered” therapeutic approaches, especially during the first month postpartum (Ballestrem, Strauss, & Kaechele, 2005; Carter et al., 2003; Milgrom & Beatrice, 2005; Stevens, Ammerman, Putnam, & Van Ginkel, 2002). In a study of the effects of different treatments, Murray and Cooper (1997) concluded that “mother-centered” interventions, or interventions designed to lift the mother’s mood states, were not effective in influencing mother-infant interaction, perhaps because they were initiated too late (8 weeks).

Relationship-based preventive methods of reducing PPD perhaps are more promising. Hay and colleagues (2003) advocate the development of interventions that focus on the child’s temperament and self-regulation, as well as on the nature of the mother’s depression, as an effective way to prevent maladaptive child outcomes. Weinberg and Tronick (1998) argue that the infant is “the forgotten patient” in interventions for depressed mothers and propose a focus

on promoting the mother-infant relationship. Similarly, Paris, Bolton, and Speilman (2011) conclude that the presence of the baby in the intervention provides a powerful stimulus and opportunity for in vivo focus on maternal feelings, doubts, meaning-making, and responsivity. These interventions must be efficient, cost-effective, and feasible to deliver around the time of birth to have maximum utility for providers and families. The Mother's Assessment of the Behavior of Her Infant (MABI; Field, Dempsey, Hallock, & Schuman, 1978), a simplified version of the NBAS (Brazelton & Nugent, 1995, 2011) for mothers to use with their infants, for example, has been found to impart some benefits to infants of depressed mothers (Hart, Field, & Nearing, 1998). The MABI, however, primarily serves as an assessment tool. In contrast, the NBO (Nugent et al., 2007) offers a means for using the infant's behavior as vehicle for improving the infant-parent relationship and building maternal competence and confidence.

**The Newborn Behavioral Observations (NBO) System**

Based on over twenty-five years of research and clinical work with the Neonatal Behavioral Assessment Scale (NBAS; Brazelton & Nugent, 1995; 2011), and in an effort to extend its clinical application, Nugent, Keefer, Minear, Johnson, and Blanchard (2007) developed the Newborn Behavioral Observations (NBO) system. The NBO provides clinicians with a short, flexible, cost-effective scale designed to sensitize mothers to their infant**'**s competencies, to promote positive interactions between mothers and their new infant, and thus to contribute to the development of a positive mother–infant relationship.

The NBO consists of 18 neurobehavioral observations (see Figure 1), which yield a profile of the infant's behavioral repertoire along four dimensions—autonomic, motor, state organization and attentional-interactional. It takes approximately 8-10 minutes to administer and is appropriate for use with infants from birth to three months in hospital, outpatient, or home

settings. Items include observations of the infant in sleep, awake, and crying states, and the overall quality of the infant's state regulation. Specifically, the NBO yields information on the baby's capacity to habituate, reflexes such as rooting and sucking, motor behavior, the infant's communication cues, threshold for stimulation, signs of autonomic stress, amount of crying and capacity for consolability, and quality of visual and auditory responsivity and social interactive behavior.

The NBO session begins with the administration of light and sound stimuli to observe the infant's capacity for habituation. The clinician then elicits motor behaviors such as hand-grasp, sucking and rooting and crawling reflexes, motor tone and activity level, followed by observations of the infant's capacity to respond to animate and inanimate visual and auditory stimuli. If the infant cries, the amount of crying and the ease or difficulty of consolability is recorded, while the infant's overall state regulation and response to stress is examined. Since the NBO is an interactive tool, the mother's own observations are integrated into the session, and mothers are invited to elicit infant behaviors. For example, the clinician asks mothers to elicit the baby's response to their voice, or to identify the best way to soothe the infant when upset. The goal of the NBO is to create an individualized profile of the infant's behavior so that the clinician and mothers can discuss the implications of the baby's responses for the management of sleep, feeding, crying, in addition to identifying the kind of interaction that is best suited to the infant's behavioral threshold and style. The clinician maintains a collaborative stance towards the mothers throughout the session and ends with the clinician and mothers developing a joint infant caregiving plan by identifying techniques most likely to foster positive mother-infant interaction.

The NBO is associated with enhanced mother-infant engagement in first time mothers

(Sanders & Buckner, 2006) mother's positive perceptions of their interactions with their high-risk infants in Early Intervention settings (McManus & Nugent, 2012) positive changes in pediatric residents' interactions with mothers (McQuiston, Kloczko, Johnson, O'Brien, & Nugent, 2006) and higher perceived confidence among service providers in working with low- and high-risk newborns and their families (McManus & Nugent, 2011). Prior to this study, however, the NBO has never been tested as an intervention to reduce PPD symptoms. Given prior evidence that mothers' perceptions of their infants is linked to maternal mental health (Field et al., 1985; Leerkes & Crockenberg, 2003; McGrath, Records, & Rice, 2008; Nugent & Blanchard, 2005), it is plausible that a relationship-enriching intervention, such as the NBO, when administered during an optimal moment to support parent-child bonding—the postpartum period (Nugent & Blanchard, 2005)—might improve mothers' assessments of their infants and of their parental efficacy, in turn enhancing maternal mood.

**The Present Study**

This pilot study explores the impact of the NBO on maternal depressive symptoms during the postnatal period. Because the NBO focuses on the infant and his or her communication patterns, we hypothesized that the tool would positively influence the quality of mothers' interactions with their infants and enhance a mother's own sense of competence in recognizing her infant's communication cues and meeting her infant's needs, ultimately improving maternal mood and decreasing depressive symptoms. Specifically, we predicted that administration of the NBO at a mother's hospital bedside following birth, and again at home one month later, would be associated with a lower incidence of clinically significant PPD symptoms among intervention mothers in the intervention group compared to mothers in the control group.

## Methods

**Sample and Procedures**

Participants were recruited December - January 2001 from postpartum units of two New England hospitals, a large urban teaching hospital averaging 4,250 births per year, and a community hospital averaging 500 births per year. Researchers contacted the nurse-in-charge of the postpartum unit twice-weekly to identify eligible mothers: first-time parent cohabitating with the father of the baby, vaginal delivery of an infant between 36 and 42 weeks gestational age, Apgar scores not less than 7 (at 5 and 15 minutes), no congenital anomalies, and no use of Neonatal Intensive Care Unit. Mothers were excluded if their infant had been circumcised that day or if they lived far from the hospital. A total of 139 mothers were eligible during the course of the study; 112 gave consent and were enrolled. Reasons for declining related to inconvenience of study participation on the day of delivery. A coin toss was used to randomly allocate mothers to the intervention group ($n$ = 57) and control group ($n$ = 55).

Control group mothers received the routine hospital care and a short attention-control home visit to administer the EPDS. Intervention group mothers received routine care plus the NBO in the hospital at mothers' bedside within two days post-delivery, and again at a one-month postpartum home visit. Mothers completed study questionnaires during the home visit. One of four clinicians administered the NBO—three psychologists and one nurse; each completed training and certification in reliably administrating the NBO. After meeting mothers and describing session goals, the clinician administered the 18 neurobehavioral items, assigning a value from one to three for each item (see Figure 1). Throughout each session, the clinician encouraged mothers to consider the knowledge they possessed about their infants and to make further observations and predictions as they reviewed the infant's responses in the 18 neurobehavioral areas. This process shaped the clinician's anticipatory guidance for future

caregiving. Session length varied from 12 to 25 minutes, depending on the baby's state behavior and social availability. All study procedures were approved by the participating Institutional Review Boards.

Of 118 mothers enrolled in the study, 108 completed a home visit (39 from the community hospital, 69 from the urban teaching hospital). Ten mothers (three intervention, seven control) could not be located for the home visit and four mothers were excluded from the study due to missing EPDS scores (1 intervention/1 control) and missing data on mother's education (1 intervention/1 control), resulting in a total study sample of 104 mothers.

Depression symptom scores were similar between hospitals (community hospital 6.3 ± 4.1, urban hospital 5.7 ± 3.8; $p = 0.43$; see Measures for description of tool). Demographic characteristics of mothers and infants were generally comparable between intervention and control groups (Table 1), except for baby's gender and mother's educational level. The control group had a higher proportion of boys than the intervention group (59% versus 33%, $p < 0.01$ Pearson's $\chi^2$ test) and a higher proportion of mothers with college or higher education (64% versus 37%, $p < 0.01$ Pearson's $\chi^2$ test).

**Measures**

**Maternal and infant demographic information.** Demographic information on infants and their mothers (maternal age, maternal education, mode of delivery, feeding, baby gender) were obtained from hospital records.

**Postpartum Depression (PPD).** The Edinburgh Postnatal Depression Scale (EPDS; Cox, Holden, & Sagovsky, 1987), which is among the mostly widely used screening tools for depression, was administered to all mothers at the one-month home visit to assess maternal depressive symptom level. This 10-item self-report questionnaire assesses symptoms during the

previous week and includes questions concerning mood, anxiety and suicidal ideation. To calculate a total score (0 to 30), we summed the 10 responses (each on a 0-3 continuum). Using a threshold of 12, Cox et al. (1987) reported a sensitivity of 86% in identifying major postnatal depression and Harris, Thomas, Johns, & Fung (1989) reported a sensitivity of 95%. Murray and Carothers (1990) reported a threshold score of 12.5 and correctly identified over 80% of mothers with major depression and 50% with minor depression. Based on previous studies on PPD (Felice, Saliba, Grech, & Cox, 2004; Guedeney, Fermanian, Guelfi, & Kumar, 2000; Morris-Rush, Freda, & Bernstein, 2003), we used an EPDS score of >12 to indicate elevated depressive symptomatology warranting professional attention.

**Statistical Analyses**

We used two-sample t-tests, Pearson's $\chi^2$ tests and Fisher's exact tests to determine differences in demographic variables between the two groups. Fisher's exact test compared the proportion of mothers with elevated depressive symptomatology (EPDS > 12), including 95% confidence intervals (*CI*s) for odds ratios (*ORs*). We performed multiple logistic regression to examine the effect of the NBO on PPD, adjusting for hospital, infant gender, and mother's education. To check the applicability of the asymptotic results for the moderate sample size, we performed robust stratified analyses (stratified by all covariates adjusted in the multiple logistic regression) and calculated the corresponding *ORs* and *CIs*.

Sample size was determined by the number of mothers that could be recruited for the duration of the study. Assuming 60 mothers per group and 15%PPD in the control group, a two-sided Fisher's exact test with 5% significance level would have 48% power to detect an intervention-to-control *OR* of 0.2, which corresponds to 3% PPD (or 80% reduction) in the intervention group. All analyses were performed with SAS 9.2 (SAS Institute, Cary, NC),

except stratified analyses, which were performed with STATXACT-6 (Cytel Studio, Cambridge, MA). The alpha was set to $p < .05$ for all analyses.

## Results

Ten (9%) mothers had elevated PPD scores (EPDS > 12) at the one-month home visit. Significantly fewer mothers had elevated depression scores in the intervention group (*OR* = 0.20, *95% CI* = 0.02 - 1.11; $p = 0.05$, Table 2). After adjusting for hospital, infant's gender, and mother's education, the adjusted *OR* for elevated postpartum depressive symptoms was 0.24 (*95% CI* = 0.04 - 1.32; $p = 0.07$, Table 3), similar to the crude *OR*, suggesting that the use of NBO was associated with a reduction in the risk of major depression by over 75% during the first month after birth. These results were comparable to those obtained in the more robust stratified analysis (*OR* = 0.25; *95% CI* = 0.02 - 1.50; $p = 0.15$). Baby's gender, mother's education, and hospital were not significantly associated with depression. The unadjusted *R* of the association between intervention and elevated depressive symptoms was 0.23 (*95% CI* = 0.05 - 1.14; $p = 0.09$); 4% of mothers in the intervention group and 16% of mothers in the control group reported elevated depression symptoms at one month postpartum. The adjusted *OR* was 0.26 (*95% CI* = 0.05 - 1.41; $p = 0.09$).

## Discussion

This study represents the first clinical trial assessing the effect of the Newborn Behavioral Observations (NBO) system on postpartum depressive symptomatology in first-time mothers. It also extends our previous work using the Neonatal Behavioral Assessment Scale (Brazelton & Nugent, 1995; 2011; Nugent & Brazelton, 2000; Nugent, 1985, 2010) and the work of others' using individualized family-centered approaches (Als et al., 2003; Browne & Talmi, 2005) with high-risk newborns. Because short-term interactional difficulties are associated with

long-term consequences for children (Murray, Cooper, Wilson, & Romaniuk, 2003; Singer et al., 2003; Milgrom, Westley, Gemmill, 2004) the NBO was administered at a formative moment in the development of mother-infant relationship and at a time when mothers may be at significant risk for depression (Murray & Cooper, 1997). We predicted that the NBO would enhance mother's sense of competence by increasing their knowledge of their infants and how to respond to and interact with them, by improving their perceptions of their babies, and by supporting the mother's efforts to read her baby's cues and engage in mutually rewarding interactions, in turn decreasing PPD symptoms. Our findings are in line with previous research showing an association between mothers' mental health and the quality of interactions with and perceptions of their infants (Field et al., 1985; Leerkes & Crockenberg, 2003), offering potential support for this theory. While the results of this study are preliminary, they do suggest that the NBO was related to lower depressive symptomatology among intervention mothers.

For several reasons, findings from this study must be interpreted with caution. First, we lacked a baseline assessment of PPD symptoms. This decision was made in light of Cox and colleagues' assertion that up to 75% of new mothers undergo "baby blues" immediate postpartum (transient emotional disturbance) (Cox, Holden, & Sagovsky, 1987; Misra, Guyer, & Allston, 2003) a condition qualitatively different from PPD, which has more potential to harm to both mother and baby. Second, the study sample size was small, limited by the number of families that could be recruited at two hospitals during the study period. We did not expect to have substantial power to detect the NBO's impact on PPD, but rather to provide an estimate of effect size for future research. Third, the intervention and control groups differed for baby's gender and mother's education, with control mothers having higher education levels. However, risk of PPD was consistently lower in the intervention group whether or not we controlled for

these characteristics, indicating that the observed effect was unlikely to be due exclusively to confounding. Finally, while mothers' depressive symptoms were significantly lower in the intervention group compared to the control group, when we adjusted for hospital, gender and mother's education, the difference approached but did not reach significance ($p = .07$). This finding was not altogether surprising given the small sample size, but further investigation will be needed in order to make true inferences about salutogenic effects of the NBO on the mental health of new mothers.

Despite some limitations, study findings raise important issues relating to the importance of preventive approaches to the clinical management of PPD, especially in the light of mothers' reluctance to take antidepressants while breastfeeding. The NBO could be an effective intervention tool in preventing PPD in first-time mothers. Because it is short, cost-effective and easily integrated routine postnatal care, the NBO could be a valuable clinical method for clinicians working with mothers in the newborn period. The NBO is administered at an opportune time when children are particularly vulnerable to depression and mothers may be especially motivated to make positive changes to assure their offspring's well-being (Misra, Guyer, &Allston, 2003). Moreover, in light of the international trend to decrease postpartum hospital stays, the NBO has a particular advantage in that it can be administered within a day or two of a child's birth. Further research to replicate these results, to determine whether positive effects hold up over time, and to explore underlying mechanisms of the NBO's effect on PPD will be important to establishing the NBO's effectiveness in reducing PPD systems. In addition, study of the NBO and its impact on other primary caregivers (e.g., fathers) and the family as a whole, would be useful for understanding whether it has the potential to impact an infant's entire caregiving system.

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Table 1

Demographic characteristics by treatment group.

| | Control ($n$ = 51) | Intervention ($n$ = 55) | *p-value** |
|---|---|---|---|
| Mother's age, Mean (SD) | 27 ± 6 | 29 ± 7 | 0.18 |
| Mother's education, *n* (%)† | | | <0.01 |
| High school or lower degree | 19 (36) | 35 (63) | |
| College or higher degree | 32 (64) | 20 (37) | |
| Baby's gender, *n* (%) | | | < 0.01 |
| Boys | 30 (59) | 18 (33) | |
| Girls | 21 (41) | 37 (67) | |
| Feeding, *n* (%) | | | |
| Bottle | 11 (22) | 14 (25) | 0.77 |
| Breast | 37 (73) | 36 (65) | |
| Both | 3 (6) | 5 (9) | |
| Mode of delivery, *n* (%) | | | 0.96 |
| C-section | 10 (20) | 11 (20) | |
| Vaginal | 41 (80) | 44 (80) | |
| Hospital, *n* (%) | | | 0.19 |
| 1 (urban) | 22 (43) | 17 (31) | |
| 2 (community) | 29 (57) | 38 (69) | |
| Clinician, *n* (%) | | | <0.01 |
| 1 | 7 (14) | 6 (11) | |
| 2 | 41 (80) | 28 (51) | |

| | | |
|---|---|---|
| 3 | 0 (0) | 19 (35) |
| 4 | 3 (6) | 2 (4) |

* Based on two-sample *t-tests* for continuous variables and Pearson's $\chi^2$ test for categorical variables, except for Clinician and Feeding where Fisher's exact test was used.

† Mother's education was not available for two mothers (1 intervention / 1 control).

Table 2

Postpartum depression and EPDS score by group*.

| | Control ($n$ = 51) | Intervention ($n$ = 55) | *p-value*† |
|---|---|---|---|
| Depression (EPDS > 12), n (%) | 8 (16) | 2 (4) | 0.05 |
| EPDS score, Mean ± SD | 6.5 ± 4.3 | 5.4 ± 3.5 | 0.14 |

* Based on 106 subjects. Two subjects (1 intervention/1 control) were excluded due to missing EPDS scores.

† Based on Fisher exact test for postpartum depression and two-sample t-test for EPDS score.

Table 3

Logistic regression predicting postpartum maternal depression (EPDS > 12) for intervention and control groups, controlling for demographic variables ($n$ = 104)*

| Covariate | *OR* | *95% CI* | *p-value*† |
|---|---|---|---|
| Treatment | | | |
| Control | 1.00 | -- | -- |
| Intervention | 0.24 | (0.04 − 1.32) | 0.07 |
| Hospital | | | |
| 1 (urban) | 1.00 | -- | -- |
| 2 (community) | 0.71 | (0.18 − 2.76) | 0.62 |
| Baby's gender | | | |
| Girls | 1.00 | -- | -- |
| Boys | 0.97 | (0.24 − 3.87) | 0.96 |
| Mother's education | | | |
| High school or lower degree | 1.00 | -- | -- |
| College or higher degree | 1.74 | (0.39 − 7.74) | 0.49 |

* Four subjects were excluded from the analysis due to missing EPDS.

† Based on likelihood ratio tests.

Figure 1. Newborn Behavioral Observations (NBO) system

**Newborn Behavioral Observations (NBO) system**

(Nugent, Keefer, O'Brien, Johnson & Blanchard, 2005)

Practitioner's name_____ Date____/____/_____

Setting_____

Baby's name_____ Gender_____

Date of Birth____/____/_____ Weight_____

Gestational Age_____ APGAR_____ Parity_____

Type of Feeding_____

| **BEHAVIOR** | **OBSERVATION RECORD** | | | **ANTICIPATORY GUIDANCE** |
|---|---|---|---|---|
| | **3** | **2** | **1** | |
| 1. Habituation to light | *Habituates* with ease | some difficulty | great difficulty | ___Sleep regulation |
| 2. Habituation to sound | *Habituates* with ease | some difficulty | great difficulty | ___Sleep regulation |
| 3. Tone: Arms and Legs | **3** strong | **2** fairly strong | **1** weak | ___Tone |
| 4. Rooting | strong | fairly strong | weak | ___Feeding |
| 5. Sucking | strong | fairly strong | weak | ___Feeding |
| 6. Hand grasp | strong | fairly strong | weak | ___Strength/ Contact |
| 7. Shoulder and neck tone | strong | fairly strong | weak | ___Robustness |
| 8. Crawl | strong | fairly strong | weak | ___Sleep positioning |
| | **3** | **2** | **1** | |
| 9. Response to face and voice | very responsive | moderate | not responsive | ___Social interaction |
| 10. Visual response (to face) | very responsive | moderate | not responsive | ___Social readiness |
| 11. Orientation to voice | very responsive | moderate | not responsive | ___Voice recognition |

| | | | | |
|---|---|---|---|---|
| 12. Orientation to sound | very responsive | moderate | not responsive | ___Hearing & attention |
| 13. Visual Tracking | very responsive | moderate | not responsive | ___Vision/stimulation |
| 14. Crying | **3** very little | **2** moderate amount | **1** a lot | ___Crying |
| 15. Soothability | easily consoled | moderate | with difficulty | ___Soothability |
| 16. State regulation | **3** well-organized | **2** moderate | **1** not organized | ___Temperament |
| 17. Response to stress: color, tremors, startles | well-organized | moderate | very stressed | ___Stimulation threshold |
| 18. Activity level | well modulated | mixed | very high/ very low | ___Need for support |

***Behavioral Profile*** *(Strengths and Challenges)*

***Anticipatory Guidance*** *(Key Points)*