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BIRTH-RELATED, PSYCHOSOCIAL, AND EMOTIONAL CORRELATES OF POSITIVE MATERNAL-INFANT BONDING IN A COHORT OF FIRST-TIME MOTHERS

Cara Bicking Kinsey, MS, RNC-NIC,

Doctoral Candidate, College of Nursing, MPH Candidate, College of Medicine, The Pennsylvania State University

Kesha Baptiste-Roberts, PhD, MPH,

Assistant Professor, College of Nursing, College of Medicine, Department of Public Health Sciences, The Pennsylvania State University

Junjia Zhu, PhD, and

Assistant Professor, College of Medicine, Department of Public Health Sciences, The Pennsylvania State University

Kristen H. Kjerulff, PhD, MA

Professor, College of Medicine, Department of Public Health Sciences and Department of Obstetrics and Gynecology, The Pennsylvania State University

Abstract

Objective—to describe the development of a shortened 10-item version of the Postpartum Bonding Questionnaire (S-PBQ) and examine the relationship between birth-related, psychosocial, and emotional factors and maternal-infant bonding.

Design—cross-sectional interview study.

Setting—women having their first baby in Pennsylvania, USA.

Participants—We interviewed 3005 women in their third trimester and at 1 month postpartum who were enrolled in the First Baby Study.

Measurements and Findings—For the S-PBQ, we completed factor analysis and examined instrument properties. We examined the relationship between birth-related, psychosocial, and emotional factors and maternal-infant bonding using adjusted linear regression models. The S-PBQ demonstrated acceptable internal reliability (Cronbach's $\alpha=0.67$). Analysis revealed a

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Correspondence to: Cara Bicking Kinsey, MS, RNC-NIC, The Pennsylvania State University College of Nursing, 90 Hope Drive, 1300 ASB/A110, Hershey, PA 17033, cxb935@psu.edu, (p) 717-531-4211, (f) 717-531-5339.

Conflict of Interest Statement:

The authors have no relevant conflicts of interest to disclose.

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socioeconomic bias such that women who were older, more educated, not living in poverty, and married reported lower bonding scores. Maternal-infant bonding was significantly negatively correlated with maternal stress, maternal pain, and postpartum depression, and positively correlated with partner support with the baby, and social support.

Key Conclusions and Implications for Practice—For researchers who wish to measure maternal-infant bonding but are in need of a relatively short scale, the 10 item S-PBQ may be a useful alternative to the original version. However, it is important that researchers measuring maternal-infant bonding also investigate socioeconomic bias in their studies and adjust for this effect as needed. Our results also indicate that clinicians should be aware of life stressors that may impact the maternal-infant relationship, in order that intervention may be provided to improved health outcomes for mothers, infants, and families.

Keywords

Maternal-infant bonding; Postpartum Bonding Questionnaire; postpartum; reliability; validity

Introduction

A woman's transition to the role of mother is one of the most significant developmental processes in the human experience (Brockington, 1996). Although most women successfully develop a healthy relationship with their infants, a minority show difficulty with the process. These impairments in maternal-infant bonding are associated with depressive symptoms (Reck et al., 2006) and can lead to long-term complications for mother and baby, including abuse and neglect (Brockington, 1996).

The original focus of bonding theory, as described by Klaus and Kennell in 1976, was to promote early physical contact between a mother and her newborn infant. The theory was later revised to suggest that although close physical contact is desired after birth, it is not necessary for the development of a health bond (Klaus and Kennell, 1982; Kennell and Klaus, 1998). In fact, difficulty with maternal-infant bonding may stem from either physical separation or a lack of emotional availability of the mother (Bicking Kinsey and Hupcey, 2013). Although there is research supporting the idea that birth circumstances may have a positive or negative impact on maternal-infant bonding, much of the research findings are contradictory (Bicking Kinsey and Hupcey, 2013).

Furthermore, the psychosocial and emotional factors that may impact a woman's ability to form a healthy bond with her infant have been examined only to a limited extent. More research is needed to identify risk factors for impaired maternal-infant bonding beyond the obstetric circumstances at birth. Furthermore, measurement of a complex concept such as maternal-infant bonding can present challenges, and there are many inconsistencies in the way bonding is currently measured. A recent concept analysis defined maternal-infant bonding as "an affective state of the mother; maternal feelings and emotions toward the infant are the primary indicator of maternal-infant bonding" (Bicking Kinsey and Hupcey, 2013). Although behavioural observation is sometimes used to examine maternal-infant bonding, Bicking Kinsey and Hupcey's (2013) concept analysis concluded that limited observation of maternal behaviour with the infant did not distinguish the state of a mother's

bond with her infant from other related concepts such as maternal confidence. Therefore, the authors suggested that maternal-infant bonding should be measured using maternal self-report of emotions regarding her infant (Bicking Kinsey and Hupcey, 2013).

Instruments that examine a mother's emotional response to her infant via self-report are available. Most notable is the Postpartum Bonding Questionnaire (PBQ), developed by Brockington and colleagues. The PBQ is a 25-item screening questionnaire designed to identify women who are at risk for mother-infant relationship disorders (Brockington et al., 2006) and has been validated in both clinical and research settings (Brockington et al., 2006; Wittkowski et al., 2007; van Bussel et al., 2010; Wittkowski et al., 2010). A cut-off score was established for each validated factor to optimize identification of women at risk for bonding impairment (Brockington et al., 2006). A shortened 22-item version was also developed by Wittkowski and colleagues (2010) with a three factor solution while Reck and colleagues (2006) developed a 16-item shortened version in the German language.

Another available instrument for measuring the maternal emotional response to the infant is the Mother-to-Infant Bonding Scale (MIBS) developed by Taylor and colleagues (2005). The MIBS is an 8-item questionnaire that asks women to rate their feelings for their infant in response to statements of simple emotions (i.e. loving; protective). The MIBS was deemed suitable for use in the general population; however, the authors suggest that certain statements (i.e. dislike, resentment) may not uniquely measure maternal-infant bonding.

Although these instruments for measurement of maternal-infant bonding exist, some practical issues still remain. As a 25-item or 22-item questionnaire, the PBQ was deemed too long to include as a part of our large research study, and the 16-item version was not developed in the English language. Furthermore, the MIBS, although short, may be an overly simplified measure of maternal emotion, as it correlated highly with maternal mood (Taylor et al., 2005). We therefore sought to develop an instrument that would adequately measure variation in maternal-infant bonding in the general population while remaining short enough for practical inclusion in a large survey research study.

The aim of our report was to describe the use of a shortened 10-item version of the PBQ (S-PBQ), which was administered as part of our large, longitudinal cohort study. We also aimed to examine the relationship between birth-related factors, psychosocial factors, and emotional factors and maternal-infant bonding in our population of women having their first baby.

Methods

Participants and procedure

The present study is a large prospective cohort study, the First Baby Study (FBS). The FBS was designed to investigate the association between mode of first birth and subsequent childbearing. Women ages 18–35 who were expecting their first, singleton birth, spoke English or Spanish, and were residents of Pennsylvania, USA were enrolled. Recruitment included both active and passive methods with the majority of participants recruited through childbirth education classes (42%), hospital-based advertising such as hospital tours, website

posting, and flyers (21%) and low-income clinics or community centers (14%). Enrollment occurred between January 2009 and April 2011. The study was approved by the Institutional Review Board at participating study hospitals and written informed consent was obtained from each participant. After completing telephone interviews at two time points: prior to first birth (at 30 weeks gestation or later) and 1 month after birth, 3006 women were enrolled in the study. Further information about the FBS recruitment and sampling can be found elsewhere (Kjerulff et al., 2013).

Measures

Sociodemographic variables were measured during the baseline interview including education, poverty status, marital status, maternal age, race, and ethnicity. Poverty was measured using the US Census Bureau classification system to categorize participants based on household income and family composition – poverty, near poverty and not poverty. Those with household incomes 200% above the threshold are classified as “not poverty”, those with household incomes that are 100% to 200% of the poverty threshold are “near poverty”, and those with household incomes < 100% of the poverty threshold are classified as “poverty”. For 205 women, regression methods were used to impute missing income values and create a poverty status category.

Additional variables including mode of birth, newborn birth complications, amount of time the baby roomed-in during the postpartum hospital stay, maternal-report of infant colic, breastfeeding status, quality of the relationship with the partner or significant other, and maternal report of physical pain, were measured during the 1-month postpartum interview. Newborn birth complications included signs of respiratory distress or airway obstruction, fever or treatment with antibiotics, pneumothorax, meconium stained amniotic fluid, preterm birth, infection, nuchal cord, hypothermia, bruising, broken clavicle, shoulder dystocia, hip dysplasia, hypoxic-ischemic encephalopathy (HIE), hematoma, or hypoglycemia. The quality of the woman’s relationship with her partner was measured by asking, “Please indicate the degree of happiness, all things considered, of your relationship with your partner” and responses ranged from “Extremely unhappy” to “Perfect”. The variable was then categorized into three types: women who reported they were “Extremely happy” or “Perfect”, those who were “Very happy” to “Extremely unhappy”, and those who reported that they did not have a partner or significant other.

At the 1 month postpartum interview participants were administered several scales including:

The *Psychosocial Hassles Scale* (Misra et al., 2001), is an 11-item instrument which measures perceived maternal stress (from “no stress” to “severe stress”) due to common stressors, such as “money worries like paying bills”. In response to pilot testing results, we modified several items to be more appropriate for the study population and added an item, “Problems with the baby”, for a total of 12 items. Internal reliability was acceptable with a Cronbach’s alpha of 0.73. Higher scores indicate higher levels of maternal stress.

The *Edinburgh Postnatal Depression Scale* (EPDS) (Cox et al., 1987) is a 10-item screening questionnaire with established validity and reliability. We modified one of the original

items: “The thought of harming myself has occurred to me” was changed to “The thought of harming myself or others has occurred to me”. Cronbach’s alpha for this scale was 0.81. A total score was used with higher scores indicating increased probability of depression.

The *MOS Social Support Survey* (Sherbourne and Stewart, 1991) was originally an 18 item instrument. We used 5 items from the original instrument and added 4 items specifically concerning social support that a new mother would need, including “Someone to teach you what you need to know about taking care of a new baby”, “Someone to give you advice about breastfeeding if you needed it”, “Someone to help you take care of the baby”, and “Someone to give you a break taking care of the baby so you can get some rest”. The scale demonstrated high internal reliability (Cronbach’s alpha=0.88). Higher scores indicate more available social support.

Partner baby support was measured using a 6-item scale developed by the FBS investigators. It included questions such as, “In terms of your husband or partner and the new baby, how much of the time does your partner take care of the baby?” and “How much of the time is your partner interested in the baby?” This scale demonstrated acceptable internal reliability (Cronbach’s alpha= 0.70) and higher scores indicated more partner support with the baby.

The S-PBQ is a 10-item shortened version of the original PBQ developed by Brockington and colleagues (2001). Shortening of the instrument was necessary in order to include a measure of maternal-infant bonding in our large telephone interview survey. We chose statements from each of the three original PBQ factors deemed adequate in sensitivity and specificity: Factor 1, impaired bonding, Factor 2, rejection and anger, and Factor 3, maternal confidence (Brockington et al., 2006). We used six items directly from the original PBQ (Items 1–4, 7, 9) and slightly modified the wording of four items (5, 6, 8, 10) to more adequately fit the study population (See Appendix I). For example, the original PBQ item “I love my baby to bits” was changed to “I love my baby with all my heart” in order to avoid ambiguity and the original PBQ item of “I feel happy when my baby smiles or laughs” was modified to “I feel happy when my baby looks at me” in order to reflect the developmental capabilities of infants at one month old. Items 1, 4, 6, 8, and 10 were reverse coded in order that a higher score would indicate high maternal-infant bonding. The S-PBQ scale has a potential range of scores of 10–50. Before commencement of the FBS, this scale was reviewed along with the rest of the 1-month interview by a small number of postpartum women who indicated that they found it acceptable and easy to understand.

Data analysis

Data analysis was completed using SPSS (v21). The relationships between the S-PBQ scores and sociodemographic characteristics were summarized using descriptive statistics and then tested using one-way ANOVA models. Exploratory factor analysis was completed using principal components extraction with Varimax rotation and Kaiser normalization. Cronbach’s alpha reliability coefficient, alpha if item is deleted, and corrected item-total correlations were calculated for the full scale. Finally, multiple linear regression models were created to determine the association between birth-related factors, psychosocial factors,

and emotional factors and S-PBQ score with adjustment for sociodemographic factors maternal age, marital status, poverty status, and education.

Findings

Sample

Of the 3006 women enrolled in the FBS, one woman did not answer any of the S-PBQ questions and was excluded from the present study, resulting in a final sample size of 3005 women. The mean age of participants at the one-month postpartum interview was 27.4 years (SD=4.4), range 18–36 years. The majority of participants had completed a 4-year college degree or greater, did not live in poverty, identified themselves as Non-Hispanic White, and were married (Table 1).

Properties of the Shortened 10-item PBQ (S-PBQ)

Women in our study reported a mean S-PBQ score of 47.65 (SD 2.59) at 1-month postpartum and scores ranged from 24 - 50.

Factor Analysis—Exploratory factor analysis revealed a two-factor solution. The number of factors was determined by eigenvalues >1 and Scree plot analysis (data not shown). All items obtained factor loadings > 0.32 however, two items loaded poorly and two were complex items that loaded highly on both factors. Cronbach's alpha for the resulting subscales were 0.59 and 0.55. Although the resulting two-factor structure was interpretable, the unclear delineation of factors and low internal consistency for each subscale led us to decide that the S-PBQ is best utilized in its entirety. Henceforth, only a total 10-item scale will be discussed.

Reliability analysis—Cronbach's alpha for the total S-PBQ scale at 1 month postpartum was 0.67, indicating acceptable internal reliability. For one item (item 10) the corrected item-total correlation was less than 0.3, however, the removal of this item from the scale would not have improved the overall Cronbach's alpha, and it was therefore maintained as part of the scale (Table 2).

Birth Factors, Psychosocial Factors, and Emotional Correlates of Maternal-Infant Bonding Significant associations were found between the S-PBQ scores and all sociodemographic variables listed in Table 1. Maternal age was significantly negatively associated with the S-PBQ score, as was educational level, indicating that older women and those with higher levels of education had lower maternal-infant bonding scores compared to their younger, less educated counterparts. Furthermore, we found significant associations for S-PBQ scores with respect to marital status and poverty status. Examination of mean S-PBQ scores revealed that women who were married had lower S-PBQ scores than women who were unmarried, while women reporting household incomes near or below the poverty level had higher scores than women not near poverty. We found no significant difference in S-PBQ scores for women near poverty versus in poverty.

The majority of obstetric and neonatal constructs examined were significantly associated with the S-PBQ scores in univariate analysis (results not shown); however, after adjustment

for maternal age, marital status, poverty status, and education level, some were no longer significantly associated with bonding scores (Table 3). Rooming-in with the baby was significantly associated with the S-PBQ after adjustment. The found the highest adjusted mean scores in women who roomed-in with their baby all of the time or none of the time, while scores were significantly less for women whose babies roomed-in most of the time or some of the time. Women who reported their babies had colic at 1 month of age had significantly lower S-PBQ scores than those women who did not report infant colic. Women who reported physical pain at 1 month postpartum also had significantly lower bonding scores than those who did not report physical pain. Women who reported that they had no partner or significant other had the highest bonding scores, and those who reported they were “very happy” to “extremely unhappy” with their relationship had the lowest bonding scores compared to women who reported that their relationships were “extremely happy” or “perfect”. After adjustment for significant confounders, neither a woman’s race/ethnicity, mode of birth, newborn birth complications, nor breastfeeding status at 1 month postpartum were significantly associated with S-PBQ scores (Table 3).

We found significant moderate negative correlations between maternal stress and maternal postpartum depression and S-PBQ scores (Table 3), indicating that as stress or depressive symptoms increased, maternal-infant bonding quality decreased. We also found statistically significant moderate positive correlations between social support and partner baby support with S-PBQ scores, indicating that more support, whether it be in general or support provided by the woman’s partner to care for the baby, is associated with positive maternal-infant bonding.

Discussion

We investigated the psychometric properties of a shortened version of the Postpartum Bonding Questionnaire, the S-PBQ, and its relationship with various factors affecting women having their first baby. Overall the S-PBQ exhibited adequate reliability and validity. Many of the factors were significantly associated with maternal-infant bonding in the expected direction. These findings support the idea that a woman’s emotional state may have a significant impact on her ability to form a healthy bond with her newborn infant. We believe ours is the first study to examine psychosocial factors such as stress and social support as correlates of maternal-infant bonding.

The internal reliability of the S-PBQ, measured via Cronbach’s alpha, was lower than that reported in the literature for the 25-item scale. Brockington and colleagues (2001, 2006) did not originally report Cronbach’s alpha as measures of internal reliability for the PBQ, however, authors subsequently using the PBQ reported a range of Cronbach’s alpha of 0.78–0.87 for translations in various languages (Moehler et al., 2006; Reck et al., 2006; van Bussel et al., 2010; Wittkowski et al., 2010; Edhborg et al., 2011) and 0.76 for one study using the PBQ in English (Wittkowski et al., 2007). Although the internal reliability of the S-PBQ is not strong, we feel this is to be expected from a shortened instrument of only ten items.

In our study, we found that lower S-PBQ scores were associated with higher age, more education, not living in or near poverty, and being married. Although several studies have found no difference between bonding scores for these variables (Moehler et al., 2006; Figueiredo et al., 2009; Edhborg et al., 2011), others reported agreement with our findings for age (Reck et al., 2006; Kokubu et al., 2012), and education (Reck et al., 2006; van Bussel et al., 2010). Since the sociodemographic variables reported here are highly correlated (i.e. older women were more likely to be married and have higher levels of education), we believe that our findings may be related to the likelihood that older women or those with more education may be more inclined to answer honestly about their relationship with their baby. This idea was originally discussed by Reck and colleagues (2006). To further clarify this, one study of postpartum bonding also included a measure of social desirability, the tendency to respond in a socially desirable manner (van Bussel et al., 2010). In that study, researchers found that women who were more inclined to respond in a socially desirable manner also reported better bonding than mothers with less inclination towards social desirability (van Bussel et al., 2010). This supports our suggestion that mothers in our study who are older, married, more educated, or do not live in poverty, may not necessarily have worse relationships with their infants. Instead, they may be more inclined to report the negative thoughts or feelings they do have. We believe the inverse-socioeconomic social desirability bias that we found in our study is likely to be present in other studies using similar instruments designed to measure parent-child relationships because there is strong disapproval in our culture of parents who feel negatively toward their children, perhaps stronger disapproval among women who are younger or less educated. It is important that researchers look for this type of bias when measuring maternal-child bonding and adjust for socioeconomic differences where noted.

In our study, women who reported that their babies had colic had lower mean bonding scores than women who did not. This concurs with Figueiredo and colleagues (2009) who found that mothers of infants with “neonatal problems” had decreased bonding. Furthermore, recent studies have reported that baby characteristics, such as having a difficult temperament, and health or sleep problems, can also make bonding more difficult (Brockington, 2004; Broedsgaard and Wagner, 2005; Figueiredo et al., 2007; Bienfait et al., 2011; Hairston et al., 2011).

One of the major outcomes of the wide dissemination of the tenets of bonding theory as originally described by Klaus and Kennel in 1976 was the institution of rooming-in policies in most hospitals (Klaus and Kennell, 1983). Klaus and Kennell wrote that close physical proximity between newborn and parent promoted an optimal parent-infant relationship (Klaus and Kennell, 1976; Klaus and Kennell, 1982; Kennell and Klaus, 1998). Our results indicated that mothers who roomed-in with their babies “all the time” had higher mean scores on the S-PBQ than those who roomed in most or some of the time. This supports the idea that physical proximity promotes bonding. However, in our study, women who reported they roomed-in with their baby “none of the time” also had high scores on the S-PBQ, comparable to women who roomed in most or all of the time. Usually when women do not room-in with their baby at all, they are either doing so out of personal preference or it may be indicative of health problems for the mother or baby. It is possible that these mothers may have desired, expected, or at least more readily accepted, the need for physical separation

between themselves and their baby. These women may then feel less emotionally separated from their babies than women who were able to room-in “some of the time”. It is possible that the emotional state of the mother may override the effects of physical separation on maternal-infant bonding. Those mothers who roomed-in at the frequency with which they were comfortable may have achieved stronger bonding.

In the postpartum period, maternal social environment and maternal emotional availability may be related to the ability of a mother to develop a strong relationship with her infant (Brockington, 1996; Brockington, 2004; Sevil and Coban, 2005; Bicking Kinsey and Hupcey, 2013). Therefore, we tested several social and emotional variables, which we found to correlate with S-PBQ scores in the expected direction. These included maternal stress, presence of maternal pain at 1 month postpartum, social support, and support from the partner with respect to the baby. These findings provide evidence for the theoretically-based hypothesis that positive maternal emotional health and social environment promote bonding.

The strongest evidence for a relationship between maternal emotional health and maternal-infant bonding comes from the examination of postpartum depression and bonding. In several studies from 2 weeks to 14 months postpartum, researchers have found that postpartum depression is correlated with maternal-infant bonding (Edhborg and Lundh, 2005; Taylor et al., 2005; Moehler et al., 2006; Reck et al., 2006; Noorlander et al., 2008; Figueiredo et al., 2009; van Bussel et al., 2010; Edhborg et al., 2011; Kokubu et al., 2012). Our results concur with these studies, as we found that higher postpartum depression scores, indicating more depressive symptoms, were associated with decreased S-PBQ scores.

Although some evidence exists to show that non-vaginal or traumatic birth can also make bonding between mother and infant difficult (Sharan et al., 2001; Karacam and Eroglu, 2003; Madrid et al., 2006; Cevasco, 2008; Giustardi et al., 2011), the women in our study did not differ significantly in maternal-infant bonding by mode of birth. Figueiredo and colleagues (2009) and Edborg and Lundh (2005) also found no association between bonding scores and mode of birth, suggesting that the part of the experience of birth related to maternal-infant bonding may be more complex than simply identifying the birth mode.

We also found no significant relationship between breastfeeding at 1 month postpartum and S-PBQ scores. This contrasts with the hypotheses of Kennell and Klaus who wrote that oxytocin release during breastfeeding may facilitate bonding (1998). The research-based findings in this area are contradictory (Else-Quest et al., 2003; Edhborg and Lundh, 2005), and we offer two possible explanations for these findings. First, it is possible that complications associated with breastfeeding, such as mastitis or abscess, which are most common in the first six weeks postpartum (Inch and von Xylander, 2000), have a negative impact on maternal-infant bonding, as the experience of breastfeeding early in the postpartum period may become frustrating in the presence of complications. A second possibility is that the complexity of the breastfeeding relationship and its effect on maternal-infant bonding may not be measured simply by asking about the presence of breastfeeding.

Finally, in the postpartum period, maternal social environment and maternal emotional availability are postulated to be related to the ability of a mother to develop a strong

relationship with her infant (Brockington, 1996; Brockington, 2004; Sevil and Coban, 2005; Bicking Kinsey and Hupcey, 2013), but little objective research has been completed to examine this assertion. Therefore, we tested several social and emotional variables, including quality of the mother's relationship with her partner, presence of maternal pain at 1 month postpartum, maternal stress, social support, and support from the partner with respect to the baby. We found that women with no partner or significant other reported the highest bonding scores, even after adjustment for socioeconomic confounders, followed by mother who reported an "extremely happy" or "perfect" relationship with their partners. The group of women who reported they were "very happy" to "extremely unhappy" with their relationship had the lowest bonding scores. Although we did not find any existing literature that studied this exact relationship, this finding provides support for the idea that a mother's ability to bond with her infant may be affected by her emotional health. Experiencing problems in the relationship with her partner may negatively affect a mother's emotional availability and thus her ability to bond with her infant. Conversely, a mother who does not have a significant other is perhaps more emotionally available, as she is able to focus on her infant and develop a relationship with her infant as the primary relationship in her life. We also found that women who reported physical pain at 1 month postpartum had significantly lower bonding scores than women who did not report any pain. This again may be explained by the emotional impact that physical pain may have on a woman's ability to develop a strong bond with her infant. We also found that maternal stress, social support, and support from the partner with respect to the baby each correlate with S-PBQ scores in the expected direction, providing evidence for the theoretically-based hypothesis that positive maternal emotional health and social environment promote bonding.

Limitations

There are several limitations to our study that deserve comment. First, the sample of women in the FBS is not a representative sample of women experiencing their first birth in Pennsylvania. Our study participants were older, more likely to be non-Hispanic White, more educated, and had a higher household income than the overall population (Kjerulff et al., 2013). This type of selection bias, where participants differ from the general population, is common in studies like ours where recruitment depends on voluntary active participation over a long time period. Although our sample size was large and relatively diverse, the results of the study may not be generalizable to the entire population. Our study design also did not allow the examination of a cause and effect relationship between psychosocial or emotional factors and maternal-infant bonding, as most of the variables were measured in a cross-sectional nature at 1 month postpartum. Our sample also did not specifically target women seeking treatment for maternal-infant bonding disorders, which would have allowed us to further investigate the validity of the S-PBQ and perhaps evaluate it against a clinical diagnosis. Consequently, our sample included women who, on average, reported high bonding scores, and thus conclusions cannot be made about the risk for bonding disorders based on the results of this study.

Conclusions and Practice Implications

For researchers who wish to measure maternal-infant bonding but are in need of a relatively short scale, the 10 item S-PBQ may be a useful alternative to the standard 25 item version.

However, in this study we found strong evidence that the S- PBQ may be subject to socioeconomic bias such that more educated and higher income women tend to score lower on this scale. Previous studies have reported that socioeconomic bias may be present in other instruments measuring maternal-infant bonding and further research is warranted to investigate why this type of bias occurs. It is important that researchers measuring maternal-infant bonding also investigate socioeconomic bias in their studies and adjust for this effect as needed.

Our study offers objective support for the theoretically-based idea that the stress a woman experiences in her everyday life, as well as the social support she receives, such as help with household chores or help with the care of the newborn, are significantly correlated with maternal-infant bonding. It is important for clinicians to be aware of life stressors that may impact the maternal-infant relationship, in order that they may provide intervention where possible to reduce stress and increase support. In order to further examine the relationship between these psychosocial factors and maternal-infant bonding, future research studies should be designed to prospectively examine changes in stress and/or support over time, as well as changes in maternal-infant bonding quality. A more complete understanding of the factors that impact maternal-infant bonding may lead to improved health outcomes for mothers, infants, and families through identification of at-risk women and the provision of high-quality targeted interventions.

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Appendix I: Shortened 10-item PBQ (S-PBQ)

Please indicate whether the following are true for you, using the answers: all of the time, most of the time, some of the time, a little of the time, and none of the time. There are no right or wrong answers, just choose the answer which seems right for you, based on your recent experience.

Table 4

		All of the time	Most of the time	Some of the time	A little of the time	None of the time
1	I feel close to my baby	1	2	3	4	5
2	I wish the old days when I had no baby would come back	1	2	3	4	5
3	I feel distant from my baby	1	2	3	4	5
4	I love to cuddle my baby	1	2	3	4	5
5	I wish that I had never had this baby	1	2	3	4	5
6	I feel happy when my baby looks at me	1	2	3	4	5
7	My baby cries too much	1	2	3	4	5
8	I love my baby with all my heart	1	2	3	4	5
9	My baby annoys me	1	2	3	4	5
10	I feel confident when changing my baby's diapers	1	2	3	4	5

Table 1

Comparison of study population S-PBQ scores at 1 month postpartum by selected sociodemographic characteristics.

	Number (percent)	Mean (SD) S-PBQ Score	F-value	P-value
Maternal Age (n=3005)			18.26	<0.001
26 years	1135 (37.8)	48.0 (2.4)		
27–30 years	1090 (36.3)	47.5 (2.5)		
31 years	780 (25.9)	47.3 (3.0)		
Marital Status (n=3002)			46.78	<0.001
Married	2116 (70.5)	47.4 (2.7)		
Not Married	886 (29.5)	48.2 (2.3)		
Poverty (n=2996)			8.07	<0.001
Poverty	253 (8.4)	47.9 (2.5)		
Near Poverty	340 (11.3)	48.1 (2.3)		
Non-poverty	2403 (80.0)	47.6 (2.6)		
Education (n=3005)			30.91	<0.001
High School or less	501 (16.7)	48.2 (2.2)		
Some college or vocational school	803 (26.7)	48.0 (2.3)		
Completed 4 year degree or greater	1701 (56.6)	47.3 (2.8)		

Table 2

Reliability analysis results for the S-PBQ at 1 month postpartum.

Item	Scale Statement	Corrected item total correlation	α if item deleted
1	I feel close to my baby	0.499	0.612
2	I wish the old days when I had no baby would come back	0.420	0.625
3	I feel distant from my baby	0.401	0.631
4	I love to cuddle my baby	0.432	0.626
5	I wish that I had never had this baby	0.308	0.653
6	I feel happy when my baby looks at me	0.303	0.656
7	My baby cries too much	0.313	0.674
8	I love my baby with all my heart	0.341	0.653
9	My baby annoys me	0.454	0.612
10	I feel confident when changing my baby's diapers	0.175	0.666

Table 3

Association between S-PBQ total scores at 1 month postpartum and other psychosocial and emotional variables. Linear regression models (n=2995) adjusted for maternal age, marital status, poverty status, and education.

Variable	N (%)	Adjusted mean (SD) S-PBQ score	p-value
Race/Ethnicity ^a			
Non-Hispanic White	2498 (83.5)	47.6 (0.39)	Ref
Non-Hispanic Black	216 (7.2)	48.0 (0.30)	0.262
Hispanic	164 (5.5)	48.1 (0.41)	0.832
Other	115 (3.8)	47.0 (0.44)	0.004
Mode of Birth			
Normal vaginal	1873 (62.5)	47.7 (0.41)	Ref
Vaginal assisted [†]	260 (8.7)	47.7 (0.40)	0.613
C-section planned	155 (5.2)	47.5 (0.40)	0.340
C-section unplanned	707 (23.6)	47.5 (0.40)	0.068
Newborn Birth Complications			
Yes	380 (12.7)	47.4 (0.41)	0.042
No	2615 (87.3)	47.7 (0.40)	Ref
Extent of Rooming-in with Baby			
All of the time	1051 (35.1)	47.9 (0.39)	Ref
Most of the time	1551 (51.8)	47.6 (0.38)	0.007
Some of the time	257 (8.6)	47.1 (0.40)	<0.001
None of the time	136 (4.5)	47.7 (0.40)	0.479
Infant Colic ^b			
Yes	349 (11.7)	46.2 (0.42)	<0.001
No	2639 (88.3)	47.8 (0.41)	Ref
Breastfeeding at 1 month ^c			
Yes	2088 (76.0)	47.5 (0.36)	0.799
No	658 (24.0)	47.8 (0.41)	Ref
Maternal Pain at 1 month			
Pain	1074 (35.9)	47.2 (0.38)	<0.001
No Pain	1921 (64.1)	47.9 (0.39)	Ref
Relationship Quality			
Perfect or extremely happy	1878 (62.7)	47.9 (0.45)	Ref
Very happy to extremely unhappy	956 (31.9)	47.1 (0.51)	<0.001
No partner or significant other	161 (5.4)	48.0 (0.22)	0.003
Maternal Stress			
		-0.281 [‡]	<0.001
Postpartum Depression ^d			
		-0.326 [‡]	<0.001
Social Support			
		0.138 [‡]	<0.001
Partner baby support ^e			
		0.340 [‡]	<0.001

^a n=2993;

^b_{n=2988;}

^c_{n=2746;}

^d_{n=2992;}

^e_{n=2831}

[†] Vaginal assisted birth is defined by the use of forceps or vacuum extraction

[‡] Beta coefficient reported for continuous variables