

Impact of postpartum depressive and anxiety symptoms on mothers' emotional tie to their infants 2–3 months postpartum: a population-based study from rural Bangladesh

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Abstract The purpose of this study was to investigate the impact of depressive and anxiety symptoms on maternal bonding to the infant 2–3 months postpartum and the influence of the mother's bonding to the infant during pregnancy and to her own caregiver during her childhood on maternal bonding 2–3 months postpartum. This study originated from a community-based cohort study carried out in rural Bangladesh. Trained staff collected data and administered the questionnaires during the third trimester of pregnancy, at childbirth and 2–3 months postpartum. Maternal depressive and anxiety symptoms were assessed with the Edinburgh Postnatal Depression Scale and the State Anxiety Inventory and the mother's emotional bonding to the infant with the Postpartum Bonding Questionnaire. The results showed that 11% of the women reported depressive symptoms, 35% anxiety symptoms, 3.4% both depressive and anxiety symptoms and 51% neither depressive nor anxiety symptoms. Mothers with depressive symptoms were older, were poorer, fewer were literate, reported more intimate partner violence and showed lower emotional bonding to their infants 2–3 months postpartum compared to mentally well and anxious mothers. Approximately 11% of the mothers reported mild bonding disturbances and nearly one third of them showed depressive symptoms. Depressive symptoms and giving birth to a girl

were negatively associated to a mother's emotional bonding to her infant, while maternal anxiety symptoms and high bonding to the foetus during pregnancy were positively associated to the mother's emotional bonding to the infant 2–3 months postpartum.

Keywords Postpartum depressive symptoms · Postpartum anxiety symptoms · Postpartum maternal bonding

Introduction

According to the attachment theory, a child is born with an 'attachment behavioural system' in order to be able to seek proximity and contact with somebody better able to cope with the environment and to maximise physical and psychological protection and security (Cassidy 2008). To make the attachment system effective, the caregivers are, in turn, provided with a 'caregiving system', which makes the caregivers sensitive to the infant's signs and cues and able to provide the infant protection, comfort and care (Georg and Solomon 2008). Attachment refers to a tie from the infant to his/her caregiver; an emotional bond which is persistent, not transitory, involves a specific person and is aimed at maintaining proximity or contact (Ainsworth et al. 1978). Conversely, bonding refers to the tie from the caregiver to the infant and is defined as a unique relationship between two people that is specific and endures through time (Klaus et al. 1995). Brockington (2004) argues that the development of the relationship between a caregiver and an infant is the most significant process after birth and, according to Bowlby (1997), is of crucial importance for the child's development. The bonding process often starts during pregnancy. Research

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by Siddique and Hägglöf (2000) indicates that a mother's emotional attachment during pregnancy influences her engagement with and feelings for the infant after the delivery. In addition, mothers who experience emotional warmth from their own mothers during their childhood are able to establish a more affectionate relationship with their unborn babies than mothers without such experience (Siddiqui et al. 2000). Mc Farland et al. (1978) reported that 41% of new mothers felt love for their children during pregnancy, 24% at birth and 27% during the first week. Eight percent felt affection for their newborns after the first week postpartum. Moreover, Robson and Kumar (1980) found that 40% of primiparous mothers described indifference upon first holding their children. Similarly, Wittkowski et al. (2007) found that 25% of women expressed feelings of disappointment or indifference towards the infant 2 days postpartum. However, maternal affection improved, and 4 days postpartum, only 9% of the women admitted some disappointment or slight indifference towards the infants. In a Swedish study, 8% of 106 new mothers showed impaired bonding to their children 1 week postpartum (Edhborg et al. 2005). Similarly, Reck et al. (2006) found 7% of impaired bonding 2 weeks postpartum in a German sample of mother–infant pairs.

Depressive and anxiety symptoms in women have shown adverse impact on the woman's relationship with the foetus (DiPietro et al. 2002), the newborn baby (Field et al. 2004) and, later, with the child (Van den Bergh and Marcoen 2004). Kumar (1997) described that some women with depressive symptoms have prolonged problems in developing a loving relationship to their infants and expressed absence of affection, rejection, neglect and impulses to harm the infants. Indeed, Brockington et al. (2001) found a rate of 29% bonding impairment in his sample of mothers diagnosed with postpartum depression. In addition, several studies have shown that children of depressed mothers are more likely to have cognitive, attention and emotional problems throughout their development compared to children of non-depressed mothers (Hay et al. 2001; Murray et al. 1996), which might be due to disturbances in the early mother–infant relationship (Murray et al. 2003; Campbell et al. 1995).

Depressed mothers are often described as either passive and withdrawn or unresponsive and intrusive (Field 1995). They also express more negative feelings or antagonism than non-depressed women towards their children (Reck et al. 2004). Such lack of sensitivity in parental behaviours in the early mother–infant interaction has been suggested to increase the risk for the child to develop an insecure attachment to the parent in the second year of life (Murray 1992; Teti et al. 1995). The adverse effects of postpartum anxiety on the mother's emotional involvement with the infant are not as obvious in the

literature as the impact of depression (Figueireda and Costa 2009). However, Feldman et al. (1997) reported that high anxiety both before and after childbirth seem to interfere with the woman's ability to bond and invest in the child emotionally. In contrast, other studies have reported that high cortisol hormone levels in the mothers, which usually are associated with stress and anxiety, also resulted in elevated maternal emotional feelings for the newborns (Giardino et al. 2008; Fleming et al. 1997).

Postnatal depressive symptoms have been paid some research attention in South Asia (Patel et al. 2002; Rahman et al. 2003; Gausia et al. 2009). Gausia et al. (2009) found the point prevalence of depressive symptoms postpartum to be 22% in a southern area of Bangladesh. The associated factors were reported to be previous depression, depression during pregnancy, perinatal death and bad relationship with the mother-in-law or husband. However, anxiety symptoms postpartum have been overlooked in research in South Asia. In addition, research on maternal emotional bonding to the infant is not as common as research about infants' attachment to their caregivers even in high-income countries. In South Asia, no research on maternal emotional bonding to the infant related to postpartum depressive and/or anxiety symptoms has been conducted to our knowledge. Thus, the aim of this study is to investigate the impact of depressive and anxiety symptoms on the maternal emotional bonding to the infant 2–3 months postpartum. In addition, we explore the influence of the mother's bonding to the infant during pregnancy and to her caregiver during her own childhood on maternal bonding 2–3 months postpartum.

Materials and methods

Study design and setting

Data used in this study originated from a community-based, longitudinal cohort study about the impact of maternal, perinatal depressive and anxiety symptoms on infant health and development in rural Bangladesh. This study used data during the third trimester of pregnancy, at childbirth and 2–3 months postpartum. The study was carried out in two rural sub-districts of Mymensingh district (120 km north of the capital city Dhaka). As in other rural areas of Bangladesh, the majority of the women are poor and are mostly involved in housework and childcare.

Sampling strategy and sample

As depressive symptoms were one of the main measurements used in the study, the sample size estimation was

based on the expected prevalence of 20% maternal depressive symptoms postpartum which was reported in India (Patel et al. 2002) and Pakistan (Rahman et al. 2003). Considering this prevalence of maternal depression, a significance level of 0.05, a power of 0.80 and an effect size of 0.40, 500 women in their third trimester of pregnancy were needed to detect differences between women with and without depressive symptoms. Taking into account dropouts and non-responses over multiple data collection phases, a sample size of 720 women was selected at baseline, i.e. during the third trimester of pregnancy. Two women died during childbirth, 26 children died intrauterine or were stillborn and six children died within the first 4 days postpartum. Mothers of these children were excluded from the study. Fourteen mothers dropped out due to migration from the study areas. Thus, 672 (93%) of the women and their infants remained in the study until 2–3 months postpartum.

Data collection

Data were collected from July 2007 to August 2008. Trained female staff collected demographic information and administered the questionnaires at the respondents' homes during the third trimester of pregnancy. Information was collected on maternal age and socio-economic status, which included literacy, mean years of education, land ownership by household and daily expenditure on food in the respondent's household. Obstetric and child data included parity, number of children, sex of the child, mean pregnancy weeks and mean birth weight. Family characteristics included family structure (nucleus or extended family) and relationship with husband and mother-in-law. Intimate partner violence encompassed being a victim of physical violence ever, violence during current pregnancy and forced sex ever. In addition, the woman's emotional bonding to the foetus and attachment to her own caregiver during her own childhood was collected during pregnancy. Within 48 h after birth, data about length of the pregnancy period and the child's birth weight and sex were collected. At 2–3 months postpartum, information about maternal depressive and anxiety symptoms and the mother's emotional relationship and bonding to the child was obtained.

Questionnaires

The *Edinburgh Postnatal Depression Scale* (EPDS; Cox et al. 1987) was used to screen for depressive symptoms 2–3 months postpartum. EPDS is a 10-item questionnaire, rated 0–3 on each item and ranging between 0 and 30. A higher score indicates more depressive symptoms. The instrument has been validated for screening of depression in

many countries and is also validated in Bangladesh by Gausia et al. (2007) for postpartum women, which showed a sensitivity of 89%, specificity of 87% at the cutoff of 9 out of 10. Thus, this cutoff score was used in this study to categorise mothers with depressive symptoms (10 or more on the EPDS) and without depressive symptoms (<10 on the EPDS). The scale demonstrates a relatively good reliability with a Cronbach's alpha of 0.70.

The *State Anxiety Inventory* (STAI-S; Spielberger 1983) was used to screen for anxiety 2–3 months postpartum. The STAI-S consists of 20 items, rated 1–4 on each item and thus ranging from 20 to 80. A higher score indicates more anxiety symptoms. This has been found to be a reliable and valid instrument that can be used in both the clinical and general population. For the STAI-S, a cutoff score of 45 out of 46 was used to categorise anxious (46 and more) or non-anxious (<46) states. The STAI was translated from English into Bangla and then back to English again by two bilingual persons. Cronbach's alpha was 0.91 at 2–3 months postpartum.

The *Postpartum Bonding Questionnaire* (PBQ; Brockington et al. 2001) was used to screen for the mother–infant bonding 2–3 months postpartum. The PBQ is a 25-item scale reflecting a mother's feelings and attitudes to her infant and shall be rated on a scale from 0 to 5. High scores indicate more bonding disturbances. Four sub-scales are included, which reflect *impaired bonding* (12 items), *rejection and anger* (7 items), *anxiety about care* (4 items) and *risk of abuse* (2 items). To identify mild bonding disturbances, Brockington et al. (2001) suggest a cutoff of 11 out of 12 on the sub-scale *impaired bonding* and 16 out of 17 on the sub-scale *rejection and anger* to identify severe bonding disturbances. In a re-validation study, the sub-scale *rejection and anger* was revised and a cutoff of 12 out of 13 identified women with *threatened rejection* and a cutoff of 16 out of 17 identified women with *established rejection* (Brockington et al. 2006). The PBQ was translated into Bangla according to the same procedure as STAI-S.

The *Prenatal Attachment Inventory* (PAI; Müller 1993) was used to assess the mother's feelings, thoughts and relationship to her foetus during the third trimester of the pregnancy. The PAI consists of 21 items rated from 1 to 4, and a high score indicated high emotional feelings and relationship to the foetus. PAI was translated from English into Bangla according to the same procedure as STAI-S and PBQ. The Cronbach's alpha for the total scale was 0.70.

The *Parental Bonding Instrument* (PBI; Parker et al. 1979) was used to measure the woman's own bonding to her caregiver during childhood. The measure is retrospective and measures the parental style as the adult women remember

their caregivers during the first 16 years of life. The PBI consists of 25 items rated on a four-point scale from 0 to 3 and include two sub-scales, *care* (12 items) and *overprotection* (13 items). A high score on the sub-scale *care* indicates affectionate, warm and caring relation to the woman's own caregiver and high scores on the sub-scale *overprotection* indicates a dominant and overprotective caregiver as remembered by the woman. The PBI has been found to have good reliability and validity based on several studies from different countries. This scale was also translated into Bangla according to previously described procedure. Cronbach's alpha was 0.69 for the sub-scale *care* and 0.45 on the sub-scale *overprotection*.

Statistical analysis

The data were coded and analysed using SPSS version 16 (SPSS Inc., Chicago, IL, USA). Four groups were constructed according to the scoring of depressive and anxiety symptoms of the sample. Group 1 consisted of women scoring <10 on the EPDS and <46 on the STAI-S, i.e. *mentally well women*; group 2 consisted of women scoring 10 or more on the EPDS and 46 and more on the STAI-S, i.e. showing *both depressive and anxiety symptoms*; group 3 consisted of women scoring 10 or more on the EPDS and <46 on STAI-S, i.e., showing *only depressive symptoms*; and group 4 consisted of women scoring <10 on EPDS and 46 or more on the STAI-S, i.e., showing *only anxiety symptoms*. Descriptive analysis was performed to report the prevalence of depressive and anxiety symptoms. One-way analysis of variance was used to compare means between groups with Scheffe's post hoc test. Bivariate measures (chi-squared test and Fisher's two-sided exact p) were calculated between potentially associated variables. Correlations between variables were examined using the Pearson correlation coefficients. A factor analysis of the PBQ was carried out and Cronbach's alpha values were done for comparisons of the internal reliabilities of the PBQ and its sub-scales, PAI, PBI and sub-scales. Finally, linear regression analysis was conducted with parental bonding as the dependent variable.

Ethical consideration

This is a collaborative project between BRAC, BRAC School of Public Health, BRAC University and Karolinska Institute (KI), Stockholm, Sweden. The Bangladesh Medical Research Council, Dhaka and the Regional Ethical Committee at KI, Stockholm approved the study. Informed consent was taken from the participants prior to the interviews. Respondents scoring 16 or more on EPDS were referred to a nearby medical college hospital.

Results

Depressive and anxiety symptoms 2–3 months postpartum

Of the 672 women who participated in the study, the majority (51%) reported neither depressive nor anxiety symptoms at 2–3 months postpartum and 3.4% reported both depressive and anxiety symptoms. Almost 11% reported only depressive symptoms and 35% only anxiety symptoms 2–3 months postpartum. The mean scores (standard deviations [SD]) according to the EPDS and STAI-S in the four groups are shown in Table 1. Those women who had both depressive and anxiety symptoms had the highest mean scores on both EPDS and STAI-S.

Depressive and anxiety symptoms related to socio-economic, family characteristics, obstetrics and child factors 2–3 months postpartum

Mothers with both depressive and anxiety symptoms, as well as those with only depressive symptoms, differed from mothers who reported only anxiety symptoms and mentally well mothers on a number of factors (Table 2). The first two groups, in comparison to the latter two, were older, fewer were literate, fewer lived in extended families, more reported poor relationship with mother-in-law and husband and more had experienced physical intimate partner violence, forced sex ever and violence during the current pregnancy. As also seen in Table 2, mothers with depressive symptoms were poorer, according to the amount of landholding by their households ($p=0.04$) and daily household expenditure on food compared to anxious women ($p=0.001$), and they also reported significantly lower daily household expenditure on food compared to mentally well women ($p=0.001$). It is apparent that mothers with depressive symptoms had a vulnerable socio-economic situation, while mothers with only anxiety symptoms did not differ in this respect from the mentally well mothers. In

Table 1 Mean scores (SD) of maternal depressive and anxiety symptoms 2–3 months postpartum

	Maternal depressive symptoms (EPDS)	Maternal anxiety symptoms (STAI-S)
All ($N=674$)	5.7 (3.2)	43.9 (5.0)
Both depressive and anxiety symptoms ($N=23$ [3.4%])	12.1 (2.1)	49.3 (2.5)
Only depressive symptoms ($N=72$ [10.7%])	12.0 (2.0)	40.1 (4.2)
Only anxiety symptoms ($N=235$ [34.9%])	4.6 (1.9)	48.5 (1.8)
Neither depressive nor anxiety symptoms ($N=344$ [51%])	4.7 (2.0)	41.2 (4.2)

Table 2 Socio-economic, family characteristics, obstetrics and child data of the sample according to depressive and anxiety symptoms

	All, N=671	Depression and anxiety, N=23	Depressed, N=72	Anxiety, N=234	Mentally well, N=342	p value
Mean age (SD)	24.6 (6.1)	26.4 (7.4)	26.9 (6.6)	24.5 (6.3)	24.1 (5.6)	0.003
Mean years in school (SD)	3.7 (3.5)	2.4 (4.0)	2.1 (2.8)	3.8 (3.5)	4.1 (3.5)	<0.001
Literate, N (%)	396 (59)	7 (30.4)	28 (38.9)	140 (59.8)	221 (64.5)	<0.001
Amount of land ^a in household [mean (SD)]	83.3 (139.9)	71.5 (175.9)	49.2 (141.2)	103.5 (150.5)	77.4 (127.6)	0.007
Daily per capita household expenditure on food ^b [mean (SD)]	33.1 (13.5)	30.2 (13.5)	27.1 (10.3)	35.4 (15.1)	33.0 (13.3)	0.001
Live in extended family, N (%)	545 (81.2)	15 (65.2)	53 (73.6)	190 (81.2)	287 (83.9)	0.042
Poor relationship with partner, N (%)	160 (23.9)	11 (50.0)	25 (34.7)	51 (21.8)	73 (21.3)	0.002
Poor relationship with mother-in-law, N (%)	275 (47.5)	10 (58.8)	36 (59)	72 (36.7)	157 (51.5)	0.002
Ever experienced physical partner violence, N (%)	464 (69.2)	19 (82.6)	63 (87.5)	155 (66.2)	227 (66.4)	0.001
Experienced physical partner violence during pregnancy, N (%)	121 (18.0)	7 (30.4)	23 (31.9)	41 (17.5)	50 (14.6)	0.002
Experienced forced sex by partner, N (%)	533 (79.4)	18 (78.3)	61 (84.7)	184 (78.6)	270 (78.9)	0.707
Parity—primipara, N (%)	178 (26.5)	3 (13)	9 (12.5)	64 (27.4)	102 (29.8)	0.011
Number of children [mean (SD)]	2.0 (1.9)	2.3 (1.8)	2.8 (2.2)	2.1 (2.0)	1.7 (1.7)	<0.001
Sex of the child—girl, N (%)	336 (50.8)	10 (43.5)	34 (51.5)	119 (51.3)	173 (50.9)	0.912
Mean pregnancy weeks (SD)	39.3 (2.2)	40.2 (1.5)	39.1 (2.6)	39.1 (2.6)	39.5 (2.1)	0.051
Mean birth weight (SD)	2.9 (0.4)	3.0 (0.5)	2.7 (0.5)	2.9 (0.4)	2.9 (0.4)	0.001

^a Landholding in decimals, 100 decimals=1 acre

^b Expenditure in taka, USD 1=BDT 70.00

terms of obstetric characteristics, mothers with depressive symptoms had more children and fewer were first-time mothers. The mean birth weight of infants born to mothers with depressive symptoms was significantly lower than that of mothers in the other groups. Surprisingly, the birth weight of infants of anxious mothers was significantly higher compared to those of mothers who were mentally well ($p=0.03$; Table 2).

Factor analysis of the Postpartum Bonding Questionnaire

To our knowledge, the PBQ has not been used in low-income countries. Therefore, a principal component analysis of the PBQ data was carried out in order to assess whether the original four scales of Brockington et al. (2001) could be used in our sample. We retained four components with the eigenvalue ≥ 1 . The first factor accounted for 23% of the total variance and the four factors together accounted for 47% of the total variance compared to the 51% of Brockington et al. (2001). The factor loading did not exactly support either the original structure reported by Brockington et al. (2001) or the German version of the PBQ (Reck et al. 2006). In comparison with the original scale of Brockington et al., one item did not meaningfully load (<0.4) into any of the components, i.e. item 20: 'I am afraid for my baby', and some of the items did not load meaningfully in the same components. However, to be able to use the sub-scales *impaired bonding* and *rejection and*

anger suggested by Brockington et al. (2001, 2006) to differ between mothers with mild and severe bonding disturbances, we chose to use the original scales. The Cronbach's alpha (0.84) for the total PBQ was satisfactory. Taking away item 20 did not show any difference in the internal consistency and was thus not retained. Cronbach's alpha of the PBQ factor *impaired bonding* was 0.63, *rejection and anger* 0.65 and *anxiety about care* 0.51. Cronbach's alpha of the fourth factor, *risk of abuse*, was only 0.06 and thus not used in the analysis.

Correlations of maternal depressive and anxiety symptoms and the mother's bonding to the foetus, infant and own caregiver

Correlation analysis examining the relationship between depressive symptoms (EPDS) and anxiety symptoms (STAI-S) at 2–3 months postpartum and the mothers' bonding to their infants 2–3 months postpartum revealed coefficients of $R=0.339$ ($p=0.01$) and $R=0.404$ ($p=0.01$), respectively. The mothers' bonding to their infants 2–3 months postpartum showed low, but significant correlations with the mothers' bonding to their foetuses during the pregnancy ($R=-0.171$; $p=0.01$). However, within the mothers' own relationships to their caregivers during childhood, the sub-scales *care* and *overprotection* were not significantly correlated to their bonding with their infants.

Differences between mothers according to depressive and anxiety symptoms and their bonding to the foetus, own caregiver during childhood and bonding to the infant 2–3 months postpartum

As seen in Table 3, there was a significant difference between the four groups according to the mother's bonding to the foetus during the third trimester of the pregnancy ($F_{(3,667)}=4.993$, $p>0.002$). Women with depressive symptoms showed poorer bonding to their foetuses during pregnancy than anxious ($p=0.003$) and mentally well mothers ($p=0.009$). In addition, women with depressive symptoms reported significantly less warm and caring relationships to their own caregivers ($p=0.006$) than mothers in the other groups ($F_{(3,667)}=4.516$, $p=0.004$). Regarding the sub-scale *overprotection* by caregivers during their own childhood, anxious mothers rated their caregiver as more dominant and overprotective ($p=0.001$) than mothers in the other groups ($F_{(3,667)}=5.926$, $p=0.001$; Table 3).

As also shown in Table 3, women with depressive symptoms scored higher on the maternal bonding scale, indicating lower bonding to their infants compared to mentally well mothers. The same was found according to the sub-scales *impaired bonding*, *rejection and anger* and

anxiety about care. On the contrary, women who showed anxiety symptoms reported better bonding, i.e. more emotional feelings and care for the infant 2–3 months postpartum, on both the maternal bonding total scale and on the three sub-scales than all other groups of mothers.

Thus, 75 (11.3%) of the mothers reported *impaired bonding*, e.g. mild bonding disturbances, to their infants 2–3 months postpartum. Of these mothers, 19 (28.8%) showed depressive symptoms, 2 (8.7%) both depressive and anxiety symptoms, 9 (3.9%) only anxiety symptoms and 45 (13.2%) showed neither depressive nor anxiety symptoms ($\chi^2=34.34$, $p=0.001$). One woman with depressive symptoms showed *established rejection* and 13 (2%) showed *threatened rejection* according to the second validation study by Brockington et al. (2006). Six of these mothers, i.e. nearly half, showed depressive symptoms, one showed anxiety symptoms and six were mentally well mothers according to our definitions ($\chi^2=30.04$, $p<0.001$).

Predictors of maternal bonding (PBQ)

A linear regression was performed with maternal bonding (PBQ) as the dependent variable. Twenty variables described in the background were entered in five steps: (1) socio-

Table 3 Maternal bonding to the foetus, to the mothers' own caregivers and to the infant at 2–3 months postpartum

	All, N=663	(1) Depression and anxiety, N=23	(2) Depressed, N=66	(3) Anxiety, N=233	(4) Mentally well, N=341	p value	Significant difference between
Mother–infant attachment during pregnancy (PAI) [mean (SD)]	39.7(6.2)	40.5 (8.0)	37.2 (6.4)	40.3 (5.8)	39.9 (6.3)	0.002	4 vs 2** 2 vs 3**
Mother's bonding to own caregiver (PBI) sub-scale—care [mean (SD)]	15.6 (2.0)	15.5 (2.0)	14.9 (2.9)	15.5(2.0)	15.9 (1.8)	0.004	4 vs 2**
Mother's bonding to own caregiver (PBI) sub-scale—overprotection [mean (SD)]	16.6 (3.1)	16.7 (3.1)	17.0 (3.5)	17.3 (2.5)	16.2 (3.3)	0.001	4 vs 3***
Maternal bonding with infant postpartum (PBQ) [mean (SD)]	14.4 (8.4)	14.3 (7.2)	20.4 (10.4)	10.0 (6.7)	16.3 (7.8)	0.001	4 vs 2** 4 vs 3*** 1 vs 2* 2 vs 3***
PBQ sub-scale 1—impaired bonding [mean (SD)]	6.8 (3.8)	7.3 (3.3)	9.42 (4.82)	5.28 (3.17)	7.2 (3.62)	0.001	4 vs 2*** 4 vs 3*** 2 vs 3***
PBQ sub-scale 2—rejection and anger [mean (SD)]	4.49 (3.4)	3.6 (2.7)	6.5 (4.0)	2.7 (2.6)	5.4 (3.2)	0.001	4 vs 3*** 1 vs 2** 2 vs 3***
PBQ sub-scale 3—anxious about the child [mean (SD)]	3.0 (2.1)	3.3 (2.8)	4.1 (2.4)	1.9 (1.8)	3.6 (1.9)	0.001	4 vs 3*** 1 vs 3* 2 vs 3***

* $p<0.05$; ** $p<0.01$; *** $p<0.001$

economic characteristics; (2) obstetrics and child data; (3) family characteristics, including intimate partner violence; (4) maternal bonding to the foetus during pregnancy and to the woman's own caregiver during childhood; and (5) maternal depressive and anxiety symptoms. In the final model, four variables that were significantly associated with maternal bonding at 2–3 months postpartum explained 27% of the variance. Maternal depressive symptoms and sex of the child showed a direct association with the mother's emotional bonding to the infant, indicating negative impact on maternal bonding to the infant if the mother shows depressive symptoms 2–3 months postpartum and if she gave birth to a girl. On the other hand, maternal anxiety symptoms and maternal emotional bonding to the foetus during pregnancy were inversely associated to maternal emotional bonding to the child 2–3 months postpartum, indicating a positive impact on the maternal bonding to the child (Table 4).

Discussion and conclusion

The main result of this study was that maternal depressive symptoms 2–3 months postpartum showed a negative

impact on the mother's emotional bonding to the infant. Surprisingly, anxiety symptoms amongst mothers showed a positive impact on their bonding to their infants. Maternal postnatal depressive symptoms and giving birth to a girl were independently and negatively associated to a mother's emotional bonding to her infant postpartum, while maternal anxiety symptoms and high bonding to the foetus during the pregnancy were positively associated to the mother's emotional bonding to the infant 2–3 months postpartum. Thus, the results provide further evidence of the early antenatal roots of the mother-to-infant bond postpartum as that has been demonstrated in previous studies (Müller 1996; Damato 2004; Siddique and Hägglöf 2000; van Bussel et al. 2010).

Mothers with depressive symptoms postpartum had a more vulnerable situation than anxious and mentally well mothers. More amongst this group were poor, had low education, were exposed to violence and reported poor relationships with their partners. There were no differences between anxious and mentally well mothers in these respects. The frequency of depressive symptoms was lower in our sample, 14.1%, 2–3 months postpartum than the 22% reported in another study in Bangladesh (Gausia et al. 2009)

Table 4 Linear regression analysis on maternal bonding (PBQ) with infant at 2–3 months postpartum and its associated factors

	<i>B</i>	Standard error	β	<i>t</i>	<i>p</i> value
Block 1 ($R=0.251$; $R^2=0.063$)					
Mother's age	0.03	0.08	0.02	0.37	0.715
Mother's schooling	0.01	0.01	0.00	0.06	0.951
Amount of land by the household	−0.00	0.00	−0.04	−1.05	0.296
Household expenditure on food	−0.00	0.00	−0.05	1.31	0.191
Block 2 ($R=0.305$; $R^2=0.093$)					
Parity (1=primipara; 2=multipara)	0.97	0.87	0.05	1.12	0.264
Number of children	0.17	0.28	0.04	0.63	0.530
Birth weight of the child	−1.00	0.69	−0.05	−1.44	0.148
Length of pregnancy	0.11	0.13	0.03	0.82	0.412
Sex of the child (girl=1, boy=0)	1.37	0.57	0.08	2.33	0.017
Block 3 ($R=0.310$; $R^2=0.096$)					
Joint family (1=no; 0=yes)	−0.06	0.75	−0.00	−0.07	0.941
Relationship with husband	−0.04	0.09	−0.02	−0.50	0.621
Relationship with mother-in-law	−0.00	0.01	−0.00	−0.09	0.928
Physical violence/ever (1=yes)	−0.13	0.72	−0.01	−0.18	0.861
Forced sex/ever (1=yes)	−0.51	0.67	−0.03	−0.76	0.446
Physical violence/pregnancy (1=yes)	1.11	0.79	0.05	1.41	0.159
Block 4 ($R=0.336$; $R^2=0.113$)					
Maternal bonding during pregnancy (PAI)	−0.12	0.05	−0.09	−2.35	0.019
Maternal bonding (PBI—care)	0.09	0.09	0.04	1.02	0.311
Maternal bonding (PBI—overprotection)	−0.09	0.09	−0.34	−1.00	0.320
Block 5 ($R=0.546$; $R^2=0.298$)					
Maternal depressive symptoms (EPDS) 2–3 months postpartum	0.70	0.10	0.27	7.32	<0.001
Maternal anxiety symptoms (STAI-S) 2–3 months postpartum	−0.59	0.06	−0.35	−11.00	<0.001

6–8 weeks postpartum. Different assessment periods could partly explain the difference in the prevalence. On the contrary, the prevalence of 34.7% maternal anxiety at 2–3 months postpartum is higher than that shown in high-income countries. For example, Britton (2005) reported a prevalence of 25% and Heron et al. (2004) reported a prevalence of 13% during the postpartum period. The prevalence of anxiety symptoms postpartum differs between studies, as well as between measures and cutoff scores. Concerns have been expressed that rating scales with different categorisation might lead to over-pathologising particularly during pregnancy (Oates 2002). However, Adewuya et al. (2006) compared the prevalence of anxiety during pregnancy among Nigerian women to non-pregnant women and used clinical diagnoses according to DSM-V anxiety disorders and found a prevalence of 39% among pregnant women and 16.3% among non-pregnant women. This difference was explained as pregnancy to be a period of heightened level of emotion. However, even early postpartum could be indicative of a period of heightened emotion and thus our prevalence of 34.7% is plausible.

A relatively high percentage of mothers reported mild bonding problems at 2–3 months postpartum: 11.3% in our study compared to studies from high-income countries (Righetti-Veltema et al. 2002; Edhborg et al. 2005; Reck et al. 2004; Wittkowski et al. 2007), which indicated a quick recovery of the maternal bonding rather soon after birth. Mothers with depressive symptoms had the highest prevalence of impaired bonding (28.8%) compared to mentally well mothers (13.2%) and anxious mothers (3.9%). This result was consistent with Brockington et al. (2001) who found a rate of 29% of impaired bonding in their sample of mothers with diagnosed postpartum depression. Moehler et al. (2006) found that maternal depressive symptoms in the first 4 months predicted impaired bonding at 14 months, and depressive symptoms 6 weeks postpartum showed the most significant impact. The mean values of PBQ total score in non-depressed Bangladeshi women were higher than that reported by Reck et al. (2004) from Germany regarding non-depressed women ($M=16.41$ vs $M=9.07$), as well as women with depressive symptoms ($M=20.35$ vs $M=12.13$). As the women in this study were poor, lived in hardship and, in addition, the number of stillborn and child deaths within 48 h after birth ($N=27$) were much higher than in high-income countries, the delayed and low bonding at 2–3 months postpartum could be due to the mothers' vulnerable and difficult economic situation and perhaps a fear to bond to the infant before it is relatively certain that the infant will survive. The estimated neonatal mortality was 36 out of 1,000 live births in Bangladesh in 2004 compared to the global neonatal mortality, which is approximately 45 out of 1,000 live births, and to a high-income country such as Sweden with 2 out of 1,000 live births (UNICEF 2009).

The impact of maternal anxiety early postpartum on the mother–infant relation is not as well researched as maternal depression. Britton (2005) found that anxious mothers were less sensitive, less responsive and showed less competence in the parenting role. However, this was not confirmed in our study. Rather, maternal anxiety symptoms 2–3 months postpartum seemed to lead to higher maternal bonding to the infant. Despite this positive result, it is difficult to draw conclusions in a longer perspective. Higher degrees of early mother-to-infant bonding are no guarantee for future healthy mother–infant relationships (Raphael-Leff 2005; Winnicott 1956). Winnicott (1956) indicates that mothers' heightened state of what he called 'primary maternal preoccupation' at the end of the pregnancy and a few weeks postpartum may be adaptive to meet the infant needs in the early infancy, but could be problematic if the mother does not drop this identification with the infant and regain her self-interests again. Indeed, studies have reported that maternal anxiety symptoms both antepartum and postpartum have been associated with behaviour problems in children up to 8–9 years of age (Luoma et al. 2001) and increased risk of hyperactivity in preschool children (O'Connor et al. 2002). Maternal anxiety during pregnancy has also been associated with higher rates of infant temperament difficulties and difficulties in infants' regulations of feelings (Austin et al. 2005; Huizink et al. 2003). Thus, the finding about mothers with anxiety symptoms must be interpreted with caution. However, the different impacts of depressive and anxiety symptoms on the maternal emotional bonding shows that it is important to differentiate between depressive and anxiety symptoms clinically.

Although poverty and adverse social situation, including violence and poor support, did not directly affect the maternal bonding negatively, poverty, low education and intimate partner violence were all factors strongly associated to the mothers' depressive symptoms and thus indirectly associated to the mothers' ability to bond with their infants. Mothers with anxiety did not seem to have a more vulnerable situation than well mothers, but they reported more overprotection from their own caregivers during their childhoods. This result could indicate a vicious circle where own childhood experiences might lead to overprotection of their own children. This may be healthy for small children, but not when the children become older. The gender preference in favour of boys is deeply ingrained in the Bangladeshi society (Gausia et al. 2009), as well as in other Asian countries. Many studies have found an association between infants' gender and maternal postpartum depression (Klainin and Arthur 2009) and this has also been reported from Bangladesh by Gausia et al. (2009). Our finding that the sex of the infant is predictive for impaired bonding may be explained by the fact that having a girl is perceived to be a financial drain on the family (Klainin and Arthur 2009).

Limitations of the study

Limitations of the study are the use of self-reported questionnaires for measuring maternal depressive and anxiety symptoms instead of clinical diagnoses and the assessment of maternal bonding by the women's own perceptions instead of objective observations. It is known that depressed mothers often rate themselves as worse parents than they really are (Frankel and Harmon 1996) due to symptoms such as low self-esteem and negative thoughts of themselves (Hornstein et al. 2006). The PBQ is a relatively new questionnaire to measure mother–infant relationship and the mother's bonding to the child and it has been questioned and consequently re-validated (Reck et al. 2006; Wittkowski et al. 2007). Recently, a Dutch study compared the validity and reliability on three different scales measuring maternal bonding. One of these scales was the PBQ. All the three scales were found to be reliable and valid to give an indication of the early emotional ties between a woman and her newborn infant (van Bussel et al. 2010). The other two scales used to measure women's prenatal attachment to the foetus (PAI) and to assess women's emotional attachment to their own caregivers (PBI) are well-known instruments which have been used in many countries. However, since, to our knowledge, it has not been used in Bangladesh before, the results should to be interpreted with caution.

Conclusion

The results show that maternal depressive symptoms negatively impact the mother's emotional bonding to her infant 2–3 months postpartum. Thus, it is important to pay attention to the high prevalence of depressive symptoms found in Bangladesh and to include assessment of the mothers' mental health during the perinatal period. Cost-effective, non-pharmacological interventions may be included in maternal and child health programmes in Bangladesh to prevent the infant from having an adverse development and insecure attachment as a result of impaired bonding early in life. As maternal emotional bonding starts already during pregnancy, it is important to assess for depressive symptoms already during pregnancy. Although anxiety symptoms showed a positive impact on maternal bonding, more knowledge about anxiety symptoms and the interaction between depressive and anxiety symptoms is needed, as these two mood states with different biochemical profiles seem to have opposite effects on bonding between mother and child. In addition, our result confirms the conclusion of Field et al. (2010) that comorbidity between depressive and anxiety symptoms is not always the worst condition and did often not have a more negative impact than depressive symptoms alone.

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References

- Adewuya AO, Ola BA, Aloba OO, Mapayi BM (2006) Anxiety disorders among Nigerian women in late pregnancy: a controlled study. *Arch Womens' Ment Health* 9:325–328
- Ainsworth MD, Blehar MC, Waters E, Wall S (1978) Patterns of attachment. A psychological study of the strange situation. Erlbaum, Hilldale
- Austin MP, Hadzi-Pavlovic D, Leader L, Saint K, Parker G (2005) Maternal trait anxiety, depression and life event stress in pregnancy: relationship with infant temperament. *Early Hum Dev* 81(2):183–190
- Bowlby J (1997) Attachment and loss, volume 1. Pimlico, London (original work published 1969)
- Britton J (2005) Pre-discharge anxiety among mothers of well newborns: prevalence and correlates. *Acta Paediatr* 94(12):1771–1776
- Brockington IF (2004) Postpartum psychiatric disorders. *Lancet* 364:303–310
- Brockington IF, Oates J, George S, Turner D, Vostanis M, Murdoch C (2001) A screening questionnaire for mother–infant bonding disorders. *Arch Womens' Ment Health* 3:133–140
- Brockington IF, Fraser C, Wilson D (2006) The postpartum bonding questionnaire: a validation. *Arch Womens' Ment Health* 9:233–242
- Campbell S, Cohn JF, Meyers T (1995) Depression in first-time mothers: mother–infant interaction and depression chronicity. *Dev Psychol* 31(3):349–357
- Cassidy J (2008) The nature of the child's ties. In: Cassidy J, Shaver PR (eds) *Handbook of attachment: theory, research and clinical applications*, 2nd edn. Guilford, New York, pp 3–23
- Cox JL, Holden JM, Sagovsky R (1987) Detection of postnatal depression. Development of the 10-item Edinburgh Postnatal Depression Scale. *Br J Psychiatry* 150:782–786
- Damato EG (2004) Prenatal attachment and other correlates of postnatal maternal attachment in twins. *Adv Neonatal Care* 4:274–291
- DiPietro JA, Hilton SC, Hawkins M (2002) Maternal stress and affect influence fetal neurobehavioral development. *Dev Psychol* 38(5):659–668
- Edborg M, Mathiesen A-S, Lundh W, Widström A-M (2005) Some early indicators for depressive symptoms and bonding 2 months postpartum—a study of new mothers and fathers. *Arch Womens' Ment Health* 8(4):221–231
- Feldman R, Greenbaum CW, Mayes LC, Erlich HS (1997) Change in mother–infant interactive behavior: relations to change in the mother, the infant, and social context. *J Child Psychol Psychiatry* 20:153–165
- Field T (1995) Infants of depressed mothers. *Infant Behav Dev* 18:1–13
- Field T, Diego M, Dieter J (2004) Prenatal depression effects on the foetus and neonate. *Infant Behav Dev* 27:216–229
- Field T, Diego M, Hernandez-Reiff M, Figueiredo B, Deeds O, Ascencio A et al (2010) Comorbid depression and anxiety effects on pregnancy and neonatal outcome. *Infant Behav Dev* 33:23–29

- Figueireda B, Costa R (2009) Mother's stress, mood and emotional involvement with the infant 3 months before and 3 months after childbirth. *Arch Womens' Ment Health* 12:143–153
- Fleming AS, Ruble D, Krieger H (1997) Hormonal and experiential correlates of maternal responsiveness during pregnancy and puerperium in human mothers. *Horm Behav* 31(2):145–158
- Frankel KA, Harmon RJ (1996) Depressed mothers: they don't always look as bad as they feel. *J Acad Child Adolesc Psychiatry* 35(3):289–298
- Gausia K, Hamadani JD, Islam MM, Ali M, Algin S, Yunus M, Fisher C, Oosthuizen J (2007) Bangla translation, adaptation and piloting of Edinburgh Postnatal Depression Scale. *Bangladesh Med Res Counc Bull* 33(3):81–87
- Gausia K, Fisher C, Ali M, Oosthuizen J (2009) Magnitude and contributory factors of postnatal depression: a community-based cohort study from a rural sub district of Bangladesh. *Psychol Med* 39:999–1007. doi:10.1017/S00033291708004455
- Georg C, Solomon J (2008) Handbook of attachment: theory, research and clinical applications. In: Cassidy J, Shaver PR (eds) Handbook of attachment: theory, research and clinical applications, 2nd edn. Guilford, New York, pp 833–856
- Giardino J, Gonzales A, Steiner M, Fleming AS (2008) Effects of motherhood on physiological and subjective responses to infant cries in teenage mothers: a comparison with non-mothers and adult mothers. *Horm Behav* 53(1):149–158
- Hay FH, Pawlby S, Sharp D, Asten P, Mills A, Kumar R (2001) Intellectual problems shown by 11-year-old children whose mothers had postnatal depression. *J Child Psychol Psychiatry* 42(7):871–889
- Heron J, O'Connor TG, Evans J, Golding J, Glover V, ALSPAC Study Team (2004) The course of anxiety and depression through pregnancy and the postpartum in a community sample. *J Affect Disord* 80:65–73
- Hornstein CH, Trautman-Villaba P, Hohn E, Rave E, Wortmann-Fleischer S, Schwarz M (2006) Maternal bond and mother-child interaction in severe postpartum psychiatric disorders: is there a link? *Arch Womens' Ment Health* 9:279–284
- Huizink AC, Robles de Medina PG, Mulder EJH, Visser GHA, Buitelaar JK (2003) Stress during pregnancy is associated with developmental outcome in infancy. *J Child Psychol Psychiatry* 44(6):810–818
- Klainin P, Arthur DG (2009) Postpartum depression in Asian cultures: a literature review. *Int J Nurs Stud* 46:1355–1373
- Klaus MH, Kennell JH, Klaus PH (1995) Bonding: building the foundations of secure attachment and independence. Addison-Wesley, New York
- Kumar RC (1997) Anybody's child: severe disorders of mother-to-infant bonding. *Br J Psychiatry* 171:175–181
- Luoma I, Tamminen T, Kaukonen P et al (2001) Longitudinal study of maternal depressive symptoms and child well-being. *J Am Child Adolesc Psych* 40(12):1367–1374
- Mc Farland JA, Smith DM, Garrow DH (1978) The relationship between mother and neonate. In: Kitzinger S, Davis JA (eds) The place of birth. Oxford University Press, New York
- Moehler E, Brunner R, Wiebel A, Reck C, Resch F (2006) Maternal depressive symptoms in the postnatal period are associated with long-term impairment of mother-child bonding. *Arch Womens' Ment Health* 9:273–278
- Müller ME (1993) Development of the prenatal attachment inventory. *West J Nursing Res* 15(2):199–215
- Müller ME (1996) Prenatal and postnatal attachment: a modest correlation. *J Obstet Gynecol Neonatal Nurs* 25:161–166
- Murray L (1992) The impact of postnatal depression on infant development. *J Child Psychol Psychiatry* 33(3):543–561
- Murray L, Fiori-Cowley A, Hooper R, Cooper P (1996) The impact of postnatal depression on early mother-infant interaction and later infant outcome. *Child Dev* 67(5):2512–2526
- Murray L, Cooper P, Hipwell A (2003) Mental health of parents caring for infants. *Arch Womens' Ment Health*. doi:10.1007/s00737-003-0007-7
- O'Connor TG, Heron J, Glover V, the Alspac study team (2002) Antenatal anxiety predicts child behavioural/emotional problems independently of postnatal depression. *J Am Acad Child Adolesc Psychiatry* 41(12):1470–1477
- Oates MR (2002) Adverse effects of maternal anxiety on children: causal effect or developmental continuum? *Br J Psychiatry* 180:478–479
- Parker G, Tupling H, Brown LB (1979) A parental bonding instrument. *Br J Med Psychol* 52:1–10
- Patel V, Rodrigues M, DeSouza N (2002) Gender, poverty, and postnatal depression: a study of mothers in Goa, India. *Am J Psychiatry* 159:43–47
- Rahman A, Iqbal Z, Harrington R (2003) Life events, social support and depression in childbirth: perspectives from a rural community in the developing world. *Psychol Med* 23:1161–1167
- Raphael-Leff J (2005) Psychological processes of childbearing. Centre for Psychoanalytic Studies, Colchester
- Reck C, Hunt A, Fuchs T, Weiss R, Noon A, Moehler E, Downing G, Tronick EZ, Mundt C (2004) Interactive regulation of affect in postpartum depressed mothers and their infants: an overview. *Psychopathology* 37:272–280
- Reck C, Klier CM, Pabst K, Stehle E, Steffenelli U, Struben K, Backenstrass M (2006) The German version of the Postpartum Bonding Instrument: psychometric properties and association with postpartum depression. *Arch Womens' Ment Health* 9:265–271
- Righetti-Veltama M, Conne-Perréard E, Bousquet A, Manzano J (2002) Postpartum depression and mother-infant relationship at 3 months old. *J Affect Disord* 70:291–306
- Robson KS, Kumar R (1980) Delayed onset of maternal affection after childbirth. *Br J Psychiatry* 136:347–353
- Siddique A, Hägglöf B (2000) Does maternal prenatal attachment predict postnatal mother-infant interaction? *Early Hum Dev* 59:13–25
- Siddiqui A, Hägglöf B, Eisemann M (2000) Own memories of upbringing as a determinant of prenatal attachment in expectant women. *J Reprod Infant Psychol* 18(1):67–74
- Spielberger CD (1983) Manual for the state-trait anxiety inventory. Consulting Psychologists Press, Palo Alto
- Teti DM, Gelfand DM, Isabella R (1995) Maternal depression and the quality of early attachment: an examination of infants, preschoolers, and their mothers. *Dev Psychol* 31:53–61
- UNICEF (2009) The state of the world's children. Special edition. Available at http://www.unicef.org/rightsite/sowc/pdfs/statistics/SOWC_Spec_Ed_CRC_TABLE%201.%20BASIC%20INDICATORS_EN_111309.pdf. Accessed on 11 December 2010
- van Bussel JCH, Spitz B, Demyttenaere K (2010) Three self-report questionnaires of the early mother-to-infant bond: reliability and validity of the Dutch version of the MPAS, PBQ and MIBS. *Arch Womens Ment Health*. doi:10.1007/s00737-009-0140
- Van den Bergh BRH, Marcoen A (2004) High antenatal maternal anxiety is related to ADHD symptoms, externalizing problems and anxiety in 8/9-year-olds. *Child Dev* 75:1085–1097
- Winnicott DW (1956) Through pediatrics to psycho-analysis. Hogarth, London
- Witkowski A, Wieck A, Mann S (2007) An evaluation of two bonding questionnaires: a comparison of the Mother-to-Infant Bonding Scale with the Postpartum Bonding Questionnaire in a sample of primiparous mothers. *Arch Womens' Ment Health* 10:171–175