

Three self-report questionnaires of the early mother-to-infant bond: reliability and validity of the Dutch version of the MPAS, PBQ and MIBS

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Abstract In this study, we investigated the reliability and validity of three self-report questionnaires measuring the early emotional bond between a mother and her newborn infant: the Maternal Postpartum Attachment Scale (MPAS), the Postpartum Bonding Questionnaire (PBQ) and the Mother-to-Infant Bonding Scale (MIBS). In a monocentric prospective observational cohort study, 263 mothers completed the MPAS, the PBQ and the MIBS at 8–12 and at 20–25 weeks postpartum. The participants also completed measures of mental health and, during their pregnancy, measures of recalled parental bonding, adult romantic attachment, antenatal attachment and social desirability. In our study, the internal reliabilities of the PBQ and the MPAS were high at 8–12 weeks postpartum but dropped significantly at 20–25 weeks postpartum. Moderately strong correlations between the scales of the PBQ, the MPAS and the MIBS supported their construct validity. Further, weak correlations were found with social desirability and adult attachment representations, whereas moderate correlations were found with antenatal feelings of attachment and antenatal attitudes to motherhood. Finally, maternal feelings of bonding were also moderately

associated with maternal mood. Overall, our findings suggest that the MPAS, the PBQ and the MIBS provide a reliable and valid indication of the early emotional tie between a woman and her newborn infant.

Keywords Mother–infant relationship · Bonding · Attachment · Postpartum · Self-report questionnaires · Reliability · Validity

Introduction

Since the late 1960s, many researchers have investigated the emotional tie between a mother and her newborn infant. A wealth of information about the determinants, pathologies and influences of the mother–infant relationship has emerged from qualitative research using interviews, inpatient nursing observations and home observations (for an excellent review, see: Brockington 1996, pp. 327–347). Some of these qualitative research methods have also been used for clinical diagnostic purposes, particularly in specialised care settings like Mother and Baby Units. Practitioners in obstetric, paediatric or primary-care units, however, mostly lack the time, facilities and training for such diagnostic instruments. For these reasons, several instruments have been developed to assist obstetricians, paediatricians and primary-care professionals in detecting disorders in the early emotional bond between a mother and her newborn infant (Brockington et al. 2001; Condon and Corkindale 1998; Fleming et al. 1988; Kumar and Hipwell 1996; Leifer 1977; Müller 1994; Nagata et al. 2000; Salariya and Cater 1984; Taylor et al. 2005). Three of the most recent and most cited self-report questionnaires are the Maternal Postpartum Attachment Scale (MPAS: Condon and Corkindale 1998), the Postpartum

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Bonding Questionnaire (PBQ: Brockington et al. 2001) and the Mother-to-Infant Bonding Scale (MIBS: Taylor et al. 2005). Interestingly, while these three instruments have been developed to measure the same phenomenon, they differ significantly in developmental process, content and design. One of the differences, for instance, concerns the use of either “attachment” or “bonding” to address the emotional response of a mother towards her newborn infant. Since these terms are associated with the names of the self-report questionnaires, it is somewhat difficult to use one of these terms as a standard. In this study, we preferred to use “mother-to-infant bond(ing)” as much as possible.

The first measure described here, the Maternal Postpartum Attachment Scale, is the postpartum counterpart of Condon’s (1993) Maternal Antenatal Attachment Scale (MAAS). Both the MAAS and MPAS share the same theoretical framework: a hierarchical model of adult attachment (Condon 1993). Within this model, the love of a mother for her infant is considered to be the core experience of the mother-to-infant bond. This core experience, according to Condon and Corkindale (1998), underpins several maternal dispositions towards the infant (pleasure in proximity, tolerance, need gratification and knowledge acquisition), which in turn mediate between the core bonding experience and overt maternal behaviours such as proximity seeking, protecting and pleasing. Items for the MPAS were derived from ten unstructured interviews and tested in a random sample of 65 non-clinical postpartum women (Condon and Corkindale 1998). Nineteen items were retained from the original 31-item questionnaire, resulting in strong internal consistency and a good spread of responses. Using a factor analysis, Condon and Corkindale (1998) also found a three-factor structure referring to (1) the desire for proximity and interaction with the infant, (2) the lack of resentment and negative feelings towards the infant and (3) a sense of confidence and satisfaction in being a mother. While several studies support the reliability and validity of the MPAS, doubt exists about its factor structure (Scopesi et al. 2004).

The Postpartum Bonding Questionnaire (Brockington et al. 2001) is the result of the collaboration between the Department of Psychiatry at the University of Birmingham and the Open University School of Education. Both research groups had independently developed a questionnaire examining the characteristics mothers attributed to their infants. The original Birmingham questionnaire (40 items) was developed in a clinical setting, whereas the original Open University questionnaire (44 items) was based on the responses of a group of healthy mothers. The two instruments were combined and administered as a single instrument in a group of 104 mothers, including mothers

without a psychiatric disorder, mothers with a depressive disorder but with a normal mother–infant relationship and mothers with a bonding disorder (Brockington et al. 2001). Twenty-five items were retained from the combined 84-item questionnaire using a principal component analysis. Also, four factors were identified, reflecting (1) impaired bonding, (2) rejection and pathological anger, (3) anxiety about the infant and (4) incipient infant abuse (Brockington et al. 2001). Later research, however, questioned the original PBQ factor structure and the reliability and validity of the factors “incipient infant abuse” and “infant-focussed anxiety” (Brockington et al. 2001; 2006; Reck et al. 2006; Wittkowski et al. 2007). Reck et al. (2006), for example, suggest one main impaired bonding scale based on 16 items from the original 25-item PBQ. On the other hand, high sensitivity coefficients for severe bonding disorders were reported for the original PBQ and its subscales “impaired bonding” and “rejection” (Brockington et al. 2001, 2006).

The most recent maternal bonding questionnaire is Taylor et al.’s (2005) Mother-to-Infant Bonding Scale. The content of this short questionnaire was derived from previous research on a group of mentally ill postpartum women with impaired bonding towards one of their infants (Kumar 1997). Eight adjectives were derived from these women’s writing assignments and from their responses to a series of questions about how they felt towards their infants (Taylor et al. 2005). While reasonable internal consistency was found in the original study, significantly lower coefficients were found in Wittkowski et al.’s study (2007). The latter study also reported moderate correlations with the PBQ, suggesting an appropriate convergent validity (Wittkowski et al. 2007).

Given the increasing use of self-reporting measures of the early mother-to-infant bond and the need for information about the reliability and validity of these measures, we aimed to examine the psychometric quality of these three measures within a non-clinical population of postpartum women. More specifically, we examined the distribution of the responses on the three measures, their reliability coefficients and the degree of convergence. Further, we investigated whether the responses on the MPAS, BPQ and MIBS were determined by the participants’ sociodemographic characteristics, by their current adult romantic attachment styles or by the care and protection they received from their own parents. In addition, we investigated whether the responses on the three measures were determined by maternal antenatal feelings of attachment or by the maternal antenatal views of the infant and motherhood. Finally, we examined the relationship between the MPAS, PBQ and MIBS and concurrent indicators of maternal mental health.

Methods

The present study is part of a larger monocentric longitudinal research project on maternal antenatal and postpartum mental health. Ethical approval for this study was received from the Medical Ethics Committee of the University Hospital Gasthuisberg, Leuven (July 7, 2005). Recruitment of participants, their background data and data collection used in this study were described in detail elsewhere (van Bussel et al. 2009a, b, c) and are briefly summarised here.

Participants

At a routine antenatal clinical at the University Hospital Gasthuisberg, Leuven (Belgium), pregnant women between 8 and 15 gestational weeks were invited to participate in this study. Four hundred and three pregnant women agreed to participate and gave their written consent. The sample of the current study consisted of the 263 participants (65.25% of the original sample) who completed the three measures of mother-to-infant bonding at 8–12 weeks postpartum. Two hundred and two of them (76.80% of the current sample, 50.12% of the original sample) also completed these measures at 20–25 weeks postpartum.

Procedure

The participants were asked to complete a booklet of questionnaires at five points in time: between 8 and 15 (T1), between 20 and 26 (T2) and between 30 and 36 (T3) gestational weeks and between 8–12 (T4) and 20–25 weeks (T5) postpartum. The first booklet was given at the hospital; the following booklets were posted to the participants' home addresses.

Measures of the early mother-to-infant bond

For this study, the MPAS, the BPQ and the MIBS were translated into Dutch and back-translated into English by the first author and an independent female scientific translator.

The Maternal Postpartum Attachment Scale

The MPAS (Condon and Corkindale 1998) consists of 19 statements. Each item has a two-, four- or five-point scale response option. To ensure equal weighting of all questions, all response options were recoded to represent a score of 1 (low attachment) to 5 (high attachment; Corkindale 2005; personal communication). The sum of the 19 items forms the total MPAS scale, with low scores indicating a

problematic mother-to-infant bond. In addition, the 19 items were also divided over three subscales indicating confidence and satisfaction in the interaction with the infant (further called 'Quality subscale': nine items, e.g. "Over the last two weeks I would describe my feelings for the baby as: dislike (1)–intense affection (5)"), the absence of hostility towards the infant (five items, e.g. "When I am caring for the baby, I get feelings of annoyance or irritation: very frequently (1)–never (5)") and pleasure in the interaction with the infant (five items, e.g. "When I have to leave the baby: I usually feel rather sad (5)–I usually feel rather relieved (1)"). Thus, the theoretical minimum and maximum values for the total MPAS and its subscales are, respectively, 19 and 95 for the total MPAS, 9 and 45 for the quality subscale and 5 and 25 for both the pleasure subscale and the hostility subscale. Participants completed the MPAS at T4 and at T5.

The Postpartum Bonding Questionnaire

The PBQ (Brockington et al. 2001) consists of 25 statements, each followed by a six-point Likert scale ranging from "Always" (0) to "Never" (5). When the statement reflects a negative emotion or attitude, the scoring is reversed. Thus, high scores reflect a problematic mother-to-infant bond. The sum of the 25 items forms the total PBQ scale. In addition, the 25 items are also divided over four subscales indicating impaired bonding (12 items, e.g. "The baby does not seem to be mine"), rejection and anger (seven items, e.g. "I feel distant from my baby"), anxiety about care (four items, e.g. "My baby makes me feel anxious") and the risk of abuse (two items, e.g. "I have done harmful things to my baby"). The lowest possible score on all scales is 0, whereas the highest possible score is 125 for the total PBQ, 60 for the impaired bonding subscale, 35 for the rejection subscale, 20 for the anxiety subscale and 10 for the abuse subscale. In an additional analysis, we used the thresholds suggested by Brockington et al. (2001, 2006) to identify probable cases of bonding disorders (see Table 4). Participants completed the PBQ at T4 and at T5.

The Mother-to-Infant Bonding Scale

The MIBS (Taylor et al. 2005) consists of eight adjectives (loving, resentful, neutral or felt nothing, joyful, dislike, protective, disappointed and aggressive), each followed by a four-point Likert scale ranging from "Very much" (0) to "Not at all" (5). When the adjective reflects a negative emotional response, the scoring is reversed. Thus, possible scores on the MIBS range between 0 and 24, with high scores indicating a problematic mother-to-infant bond. Participants completed the MIBS at T4 and at T5.

Additional measures

The participants' tendency to respond in a socially desirable manner was measured with the short Dutch version (Hermans 1967) of the Marlowe-Crowne Social Desirability Scale (MCSDS-10; Crowne and Marlowe 1960; Strahan and Gerbasi 1972). The ten items are scored with "true" or "not true". A high score reflects the tendency to respond in a socially desirable manner. Participants completed the MCSDS-10 in the second pregnancy trimester.

The Dutch version (Verschueren and Marcoen 1993) of the Parental Bonding Inventory (PBI; Parker et al. 1979) was used to collect retrospective data about the parent-child relation in participants' childhood. The PBI has a maternal and paternal version with each having two subscales: "caring" (12 items) and "overprotection" (13 items). Each item is rated on a four-point scale: high scores reflect, respectively, a more affectionate, warm and caring parent-child interaction and a more dominant and overprotective parent. The PBI has a satisfactory construct and convergent validity (Parker 1989). Participants completed the PBI in the first pregnancy trimester.

The Dutch version (Lowyck et al. 2003) of the Relationship Questionnaire (RQ; Bartholomew and Horowitz 1991) was used to determine the participants' attachment patterns in close adult relationships. The RQ consists of four short paragraphs describing, respectively, a secure, fearful, preoccupied and dismissing attachment pattern. Participants rated their degree of correspondence to each attachment pattern on a seven-point scale. Participants completed the RQ in the first pregnancy trimester.

The emotional tie between the participants and their unborn infants was assessed with the Maternal Antenatal Attachment Scale (MAAS; Condon 1993). The MAAS consists of 19 items divided over two subscales: "quality of attachment" (11 items) and "time spent in attachment mode" (eight items). All items are scored on a five-point scale: high scores reflect a positive quality of attachment and a high intensity of preoccupation with the foetus. For this study, we used the total MAAS scores collected at T1, T2 and T3.

The participant's antenatal orientation on motherhood was determined using the revised facilitator scale and regulator scale of the Placental Paradigm Questionnaire (PPQ; Raphael-Leff 2005; van Bussel et al. 2009c). Both scales consist of five items with responses rated on a four-point scale. A high score on either the regulator scale or the facilitator scale reflected the respondent's tendency to that maternal orientation. The participants completed the facilitator scale and the regulator scale in the third trimester of their pregnancies (T3).

Depressive symptomatology was measured with the Dutch version (Pop et al. 1992) of the Edinburgh Postnatal

Depression Scale (EPDS; Cox et al. 1987), a widely used measure with good reliability and validity in both a pregnant and postpartum population (Cox et al. 1987; Murray and Cox 1990). The responses on the ten items are rated with a four-point (0 to 3) response category. For this analysis, we used the EPDS scores collected at T4 and T5.

The anxiety subscale of the Dutch version (Spinoven et al. 1997) of the Hospital Anxiety and Depression Scale (HADS-A; Zigmond and Snaith 1983) was used to detect general anxiety symptoms. The HADS-A consists of seven items, and responses are rated on a four-point (0–3) response category. The HADS-A has demonstrated good reliability and validity (Herrmann 1997). For this analysis, we used the HADS-A scores of the participants at T4 and T5.

The Maternal Separation Anxiety Scale (MSAS; Hock et al. 1989) was used to measure anxiety and feelings of guilt about leaving the child. It consists of 35 items divided over three subscales: separation anxiety (21 items), perception of separation effects on the child (seven items), and employment-related separation concerns (seven items). Responses are rated on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). For this study, we used only the MSAS total scores. Participants completed the MSAS between 20 and 25 weeks postpartum (T5).

Data analysis

The SAS 9.1 software package was used for statistical analysis (SAS Institute Inc. 2002). Descriptive statistics are presented in means and standard deviations, modes, medians, absolute numbers and percentages. There was no imputation of missing data. If there were more than two missing values on a (sub)scale, no total for that scale was computed. Attrition analyses comparing differences in means of the MPAS, PBQ and MIBS total scales at T4 for those who participated at both postpartum time points of the study and those who dropped out were performed with independent *t* tests or non-parametric Wilcoxon–Mann Whitney *U* tests (*U*). Paired *t* tests were used to observe differences in means of repeated measures when the responses were fairly normally distributed; otherwise, Wilcoxon signed ranks tests (*S*) were used. Linear mixed-model analyses were performed to observe differences in means of repeated MPAS, PBQ and MIBS measurements when the total group of participants was divided by the sociodemographic variables. Cronbach's alpha coefficients were calculated to estimate the internal consistency of the MPAS, the PBQ and the MIBS. Relations between the study variables were investigated using Pearson (*r*) and Spearman (ρ , non-parametric) correlations. Bonferroni post hoc tests were used to reduce the risk of type 1 errors.

Results

Descriptive statistics

The mean age of the participants of the current analysis was 30.41 years (*SD* 4.14). Most participants in this study were Belgian women (*n*=246, 93.54%), were married or lived as a couple (*n*=243, 92.40%), had completed tertiary education (*n*=197, 74.90%) and were employed (*n*=241, 91.63%). One hundred twenty-five participants (47.53%) were primigravida, 59 (22.43%) had had a previous miscarriage, and 26 (9.88%) had conceived after fertility treatment.

The means, standard deviations, medians, modes and minimum and maximum values of the MPAS, the PBQ and the MIBS are displayed in Table 1. Histograms (not provided here) of the total MPAS at T4 and T5 displayed fairly normal Gaussian distributions. The distribution of the hostility subscale was fairly normal at T4 but slightly leptokurtic at T5. The distribution of the responses on both the pleasure subscale and the quality subscale was negatively skewed at T4 and T5. Histograms of the total PBQ and its subscale impaired bonding displayed moderate positively skewed distributions at T4 and T5. Nevertheless, a fairly good spread of responses was observed. In contrast, the responses on the subscales infant-focussed anxiety, incipient infant abuse and rejection were highly concentrated at the lower end of their theoretical ranges. Finally, the histograms of the MIBS also provided cliff-like distributions at T4 and T5 with the responses concentrated at the lower end of the possible range.

Attrition effect

No significant differences were found for the T4 responses on the total MPAS ($t=-0.20, p=0.84$), the total PBQ ($t=0.67, p=0.51$) or the MIBS ($U=-0.54, p=0.65$) between women who participated at both T4 and T5 and those who dropped out at T5.

The course of the MPAS, the PBQ and the MIBS

The responses on the total PBQ ($t=7.24, p<0.0001$) and the MIBS ($S=-1,577.5, p<0.0001$) at T5 were significantly lower compared to the responses at T4. No significant difference was found for the total MPAS ($t=0.16, p=0.87$). Further, moderate-to-strong correlations were found between the T4 and T5 scores of the total MPAS ($r=0.57, p<0.0001$), the total PBQ ($r=0.62, p<0.0001$) and the MIBS ($\rho=0.47, p<0.0001$).

Reliability

Internal consistency

The Cronbach’s alphas for the MPAS, the PBQ and MIBS scales are displayed in Table 2. With regard to the internal consistency of the total scales, high Cronbach’s alphas were found for the PBQ. The internal consistencies found for the two other measures, especially the MIBS, were considerably lower. Further, the internal consistencies of the subscales of the MPAS and the PBQ were moderate or low, except for the PBQ subscales impaired bonding and

Table 1 Means, standard deviations, medians, modes, minimum values and maximum values of the MPAS, the PBQ and the MIBS

	T4 (8-12weeks postpartum)						T5 (20-25weeks postpartum)					
	<i>M</i>	<i>SD</i>	<i>Md</i>	<i>Mo</i>	<i>Min</i>	<i>Max</i>	<i>M</i>	<i>SD</i>	<i>Md</i>	<i>Mo</i>	<i>Min</i>	<i>Max</i>
MPAS												
Total	78.31	4.61	79	80	53.6	88	78.32	4.22	79	82	62	87
Absence of hostility	17.97	1.52	18	18	13	22	18.14	1.65	18	19	12	22
Pleasure in interaction	22.19	2.24	23	23	12	25	21.72	2.27	22	23	13	25
Quality of attachment	38.15	2.42	39	39	27.6	41	38.45	2.02	39	40	28	41
PBQ												
Total	10.72	8.50	9	6	0	87	7.67	5.44	7	5	0	33
Impaired bonding	6.52	4.94	6	6	0	52	4.80	3.43	4	3	0	17
Rejection and anger	1.80	2.86	1	0	0	33	1.27	1.88	1	0	0	13
Infant-focussed anxiety	2.19	1.90	2	1	0	10	1.50	1.19	1	1	0	7
Infant abuse	0.22	0.54	0	0	0	4	0.10	0.35	0	0	0	2
MIBS												
Total	1.59	1.97	1	0	0	13	1.36	1.47	1	1	0	10

M means, *SD* standard deviations, *Md* medians, *Mo* modes, *Min* minimum values, *Max* maximum values

Table 2 Internal consistency (Cronbach's alphas) of the MPAS, the PBQ and the MIBS

	T4	T5
MPAS		
Total	0.75	0.68
Absence of hostility	0.50	0.44
Pleasure in interaction	0.50	0.52
Quality of attachment	0.69	0.57
PBQ		
Total	0.87	0.78
Impaired bonding	0.77	0.69
Rejection and anger	0.75	0.58
Infant-focussed anxiety	0.58	0.38
Infant abuse	0.36	0.35
MIBS		
Total	0.67	0.58

rejection at T4. Overall, the internal consistency of the three measures at T5 was considerably lower compared to T4.

Correlations between the MPAS, the PBQ and the MIBS scales

Only small positive correlations ($\rho < 0.31$) were found between the MPAS subscales hostility, pleasure and quality (Table 3). Of the four PBQ subscales, strong positive correlations were found only between the impaired bonding subscale and the rejection subscale ($\rho > 0.68$). Moderate positive correlations were found between the impaired bonding subscale and the infant-focussed anxiety subscale and between the rejection subscale and the infant-focussed anxiety subscale.

As for the total scales of the three mother-to-infant bonding measures, strong negative correlations were found between the total MPAS and the total PBQ (Table 3). Slightly less strong correlations were found between the total PBQ and the MIBS and between the total MPAS and the MIBS in, respectively, a positive and a negative direction.

Spearman correlations were also computed between the subscales of the MPAS and those of the PBQ (Table 3). Moderately strong negative correlations (ρ between -0.43 and -0.55) were found between the impaired bonding subscale of the PBQ and the three subscales of the MPAS (hostility, pleasure and quality). Further, moderately strong negative correlations (ρ between -0.40 and -0.48) were found between the quality subscale of the MPAS on the one hand and the infant-focussed anxiety subscale and the rejection subscale of the PBQ on the other. In addition, strong positive correlations ($\rho > 0.52$) were found between the MIBS and the impaired bonding subscale and the

rejection subscale of the PBQ (Table 3). Slightly less strong correlations (ρ between -0.40 and -0.48) were found between the MIBS and the quality subscale of the MPAS.

Social desirability

Significant but small correlations were found between the MCSDS-10 and the total scale of the MPAS, the PBQ and the MIBS (except at T5; Table 5). As for the subscales, consistent small correlations were found between the hostility subscale of the MPAS and the impaired bonding and rejection subscales of the PBQ.

Evaluation of the PBQ thresholds

We used the PBQ thresholds previously described by Brockington et al. (2001, 2006) to differentiate between participants with normal PBQ scores and those with high PBQ scores (Table 4). Of the 257 women who participated at T4, 22 women were identified with a probable disordered mother–infant relationship. One woman was identified as a probable case of rejection of her infant, while another probably had an infant-focussed anxiety problem. Finally, nine women were identified as probable cases of incipient infant abuse. As for the total PBQ, two women probably had a severe mother–infant bonding disorder. Further, only three of the eight women identified with a probable bonding disorder at T5 had the same classification at T4. The three women identified at T5 as probable cases of incipient infant abuse had the same classification at T4.

Predictors of the early mother-to-infant bond

Primiparous women and women without a tertiary degree had higher scores on the total MPAS ($t_{\text{primi}} = 3.83$, $p < 0.0001$; $t_{\text{degree}} = -2.21$, $p = 0.02$) and lower scores on the total PBQ ($t_{\text{primi}} = -1.99$, $p = 0.03$; $t_{\text{degree}} = 2.03$, $p = 0.04$) compared to, respectively, multiparous women and women who completed tertiary education. Women with a previous miscarriage reported lower scores on the total MPAS ($t = 2.40$, $p = 0.02$).

Spearman correlations were calculated between the scales of the PBI and the RQ, on the one hand, and the three measures of the early mother-to-infant bond on the other (Table 5). Overall, only weak correlations (all $\rho < 0.23$) with low significance levels ($p < 0.05$) were found.

Consistent moderately strong correlations (ρ between -0.23 and 0.49) were found between the three MAAS measurements and the total MPAS, the total PBQ and the MIBS (Table 5). More specifically, the responses on the MAAS (T1–T3) correlated positively with the pleasure and quality subscales of the MPAS and negatively with the impaired bonding and rejection subscales of the PBQ.

Table 3 Correlations (Spearman) between the three postpartum measures of the mother–infant relationship (MPAS, PBQ, MIBS)

	MPAS						PBQ						MIBS						
	Hostility		Pleasure		Quality		Total		Impaired bonding		Infant abuse		Infant-focussed anxiety		Rejection and anger		Total		
	T4	T5	T4	T5	T4	T5	T4	T5	T4	T5	T4	T5	T4	T5	T4	T5	T4	T5	
MPAS																			
Total	0.60***	0.62***	0.68***	0.70***	0.76***	0.75***	-0.67***	-0.63***	-0.66***	-0.64***	-0.17	-0.10	-0.37***	-0.26***	-0.59***	-0.55***	-0.50***	-0.45***	
Absence of hostility		0.21***	0.18*		0.26***	0.31***	-0.53***	-0.45***	-0.55***	-0.45***	-0.12	-0.10	-0.31***	-0.29***	-0.38***	-0.31***	-0.34***	-0.23**	
Pleasure in interaction				0.25***	0.28***	0.28***	-0.42***	-0.36***	-0.44***	-0.43***	-0.01	-0.03	-0.11	0.08	-0.44***	-0.36***	-0.36***	-0.27***	
Quality of attachment							-0.51***	-0.56***	-0.45***	-0.49***	-0.21	-0.11	-0.40***	-0.40***	-0.44***	-0.48***	-0.40***	-0.48***	
PBQ																			
Total							0.94***	0.93***	0.41***	0.28***	0.65***	0.85***	0.81***	0.56***	0.85***	0.81***	0.60***	0.56***	
Impaired bonding								0.30***	0.19***	0.44***	0.33***	0.74***	0.68***	0.35***	0.74***	0.68***	0.55***	0.52***	
Infant abuse										0.30***	0.20**	0.35***	0.20**	0.42***	0.35***	0.20**	0.24***	0.22**	
Infant-focussed anxiety																			
Rejection and anger																			

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$ (after Bonferroni correction)

The facilitator scale was positively correlated with the total MPAS and negatively with the total PBQ and MIBS (Table 5). The correlations, however, were rather weak (ρ between -0.17 and 0.31). Conversely, the regulator scale was negatively correlated with the total MPAS and positively correlated with the total PBQ and MIBS. The strength of these correlations was rather moderate (ρ between -0.24 and 0.38). As for the subscales, the facilitator scale was positively correlated with the pleasure subscale and quality subscale (MPAS) at T4 and T5 and negatively correlated with the PBQ subscales impaired bonding and rejection, both at T4 and T5. The regulator scale, on the other hand, was negatively associated with the quality subscale (MPAS) and positively associated with the impaired bonding, infant-focussed anxiety and rejection subscales of the PBQ.

Associations with maternal mental health

Moderately strong correlations (ρ between 0.16 and 0.44) were found between the EPDS and the HADS-A on the one hand and the total scales of the MPAS, the PBQ and the MIBS on the other (Table 5). As for the bonding subscales, negative correlations were found between the EPDS and the HADS-A and the hostility and quality subscales of the MPAS, both at T4 and T5. In addition, consistent positive correlations were found with the impaired bonding, infant-focussed anxiety and rejection subscales of the PBQ. Further, a strong positive correlation was found between the MSAS and the quality subscale of the MPAS.

Discussion

Psychometric qualities of the MPAS, PBQ and MIBS

In this study, high internal consistency was found for the total PBQ while lower values were found for the other two measures, especially for the MIBS. The internal consistency of the PBQ subscales impaired bonding and rejection was also high, but only at 8–12 weeks postpartum. Interestingly, the internal consistencies of all measures dropped at the second point of measurement (20–25 weeks postpartum). Further research needs to elucidate (the causes of) this finding. A plausible explanation is that the current factor structures are not the most optimal ones. As for the MPAS, the questionnaire would probably benefit from a more standardised response format (Scopesi et al. 2004).

While responses on the total MPAS were stable between 8–12 and 20–25 postpartum weeks, the responses on the total PBQ and the MIBS slightly decreased. Previous studies reported similar findings for the total MPAS (Condon and Corkindale 1998), the total PBQ (Wittkowski

Table 4 Number of participants scoring under or above the previously published thresholds of the total PBQ and its subscales at T4 and T5

	Normal				High					
	T4		T5		T4		T5		T4 and T5 ^c	
	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%	<i>N</i>	% ^d
Total PBQ (25/26) ^a	248	96.12	195	98.48	10	3.88	3	1.52	0	0.00
Total PBQ (39/40) ^a	256	99.22	198	100.00	2	0.78	0	0.00	0	0.00
Impaired bonding (11/12) ^b	236	91.47	190	95.96	22	8.53	8	4.04	3	13.64
Rejection and anger (12/13) ^b	256	99.22	197	99.49	2	0.78	1	0.50	1	50.00
Rejection and anger (16/17) ^b	257	99.61	198	100.00	1	0.39	0	0.00	0	0.00
Infant-focussed anxiety (9/10) ^b	257	99.61	198	100.00	1	0.39	0	0.00	0	0.00
Infant abuse (1/2) ^a	249	96.51	195	98.48	9	3.49	3	1.52	3	33.33
Infant abuse (2/3) ^b	256	99.22	198	100.00	2	0.78	0	0.00	0	0.00

^a Threshold reported in Brockington et al. (2006)

^b Threshold reported in Brockington et al. (2001)

^c Participants scoring above the threshold both at T4 and T5

^d Percentage based on the number of participants labelled “high” at T4

et al. 2007) and the MIBS (Taylor et al. 2005; Wittkowski et al. 2007). When the total PBQ and its subscales were divided into normal and high scores, the number of probable impaired mother–infant relationships also seemed to decrease. As for the impaired bonding subscale, however, five of the eight probable cases identified at 20–25 weeks postpartum were not identified as such at 8–12 weeks postpartum.

Research and clinical practice on the early mother-to-infant bond mostly focusses on the lack of positive, warm and caring maternal feelings towards the infant. Indeed, consensus exists about the beneficial effect of a positive mother-to-infant bond on the short- and long-term child outcomes (Ranson and Urichuk 2008). However, higher degrees of early mother-to-infant bonding, both in quality and quantity, are no guarantee for a future healthy mother–infant relationship, nor for a healthy development of the child (Raphael-Leff 2005; Sjögren et al. 2004; Winnicott 1956). Indeed, the heightened state of primary maternal preoccupation may be particularly adaptive to the needs of early infancy but becomes problematic if the mother goes on to identify herself with the child and if she does not regain her own self-interest (Raphael-Leff 2005; Scher 2001; Winnicott 1968).

To our knowledge, the tendency to respond in a socially desirable manner has been investigated in association with measures of the mother–foetus relationship (Hjelmstedt et al. 2006; Sjögren et al. 2004; van Bussel et al. 2009d), but not with measures of the early mother-to-infant bond. In our study, mothers who were generally more reluctant to admit unpopular beliefs or behaviours reported a slightly stronger bond with their infants, whether that bond was measured with the MPAS, the PBQ or the MIBS. The

importance of this relationship, however, has been questioned by Condon and Corkindale (1998). They argued that the discriminatory power of a measure is more important than the absolute value of the responses on that measure. Thresholds for a disordered mother–infant bond, on the other hand, are unreliable if the measure is too vulnerable to social desirability.

A substantial overlap was found between the responses on the MPAS and those on the PBQ (between 40% and 45% on the total scales), suggesting that both questionnaires largely measure the same construct. The least overlap was found between the total MPAS and the MIBS (between 20% and 25%). Further support for the construct validity of the MPAS and the PBQ was provided by the correlations between the subscales of both questionnaires. Women with an impaired bond with their infant (PBQ) were more hostile and felt less enjoyment and less satisfaction in interacting with their infants. The MIBS, on the other hand, was found to be a good indicator of an impaired mother–infant relationship and the rejection of the infant by the mother. As for the latter, similar findings were reported by Wittkowski et al. (2007). Therefore, the MIBS might be considered as an interesting screening instrument for an impaired mother-to-infant bond, especially in the first postpartum days (because of its brevity) or among a population of low-literate women (no sentences but only eight adjectives).

Determinants of the mother-to-infant bond

In our study, multiparous women and highly educated women reported lower feelings of bonding with their

newborn infants. As for the educational level, a similar finding was reported by Reck et al. (2006). According to them, this finding reflects the fact that more highly educated women “answer more honestly and in a less socially desirable manner” (Reck et al. 2006). Another explanation could be that higher educated women and multiparae are more realistic and concerned about the changes that come with a new infant and that they attribute less value to motherhood in terms of role fulfilment (Damato 2004; van Bussel et al. 2009d). We hereby highlight the fact that similar results were reported in our previous study on maternal antenatal attachment (van Bussel et al. 2009d).

The intergenerational transmission of attachment styles is a central assumption of attachment theory (van IJzendoorn 1995). The adult attachment styles of new mothers and those of their own mothers have been found to be concordant (Benoit and Parker 1994). To our knowledge, however, no study previously investigated the relationship between the feelings of a mother for her newborn infant and the care and protection received from her own parents during childhood. In our study, no such relationship was found. This concurs with most studies focussing on the emotional ties between pregnant women and their foetuses (Condon and Corkindale 1997; Priel and Besser 2000; Schwerdtfeger and Goff 2007).

In this study, we also investigated whether the bond between a mother and her newborn infant was determined by her current adult attachment style. Overall, the correlations found in our study were only weak. One explanation could be that the Relationship Questionnaire examines more covert aspects of the attachment relationship whereas the MPAS, PBQ and MIBS examine more overt behaviours of the mother-to-infant relationship. Despite the weakness, our findings fit with current attachment theory and previous research. For example, women who were more securely attached in their adult close relationships were also less anxious and more emotionally involved in interacting with their newborns. Conversely, more fearfully attached women reported more anxiety, less emotional involvement and less satisfaction in the relationship with their infants.

Our study provided further evidence of the early antenatal roots of the postpartum mother-to-infant bond. Women with more antenatal feelings of closeness and tenderness towards their foetuses reported more feelings of pleasure and affiliation in the relationship with their newborn infants. As for our findings, we recall the fact that the MAAS and MPAS were developed by the same researcher and share the same theoretical framework. Nevertheless, the strength of the correlations found with the other two mother-to-infant bonding questionnaires was comparable. Furthermore, the strength of the correlations found in our study is comparable with the

correlation found in Müller’s (1996) study using the Prenatal Attachment Inventory and the Maternal Attachment Inventory ($r=0.41$).

In our study, women tending to the regulator orientation during their pregnancies were more prone to impaired bonding or detachment as compared to pregnant women tending to the facilitator orientation. Indeed, in Raphael-Leff’s (2005) work, regulators are characterised by dissociation, rigidity and avoidance of fantasising about the infant and the maternal role, a state Raphael-Leff referred to as “maternal primary persecution”. Facilitators, on the other hand, are characterised by feelings of closeness, selfless nurturance and spontaneous adaptation towards the world of the infant, a state she referred to as Winnicott’s (1956) “primary maternal preoccupation.” With regard to our findings, we again highlight the fact that the modest relation between the maternal antenatal orientations and the mother-to-infant bond was supported using both the longer MPAS and PBQ as well as with the shorter MIBS. Furthermore, our findings concur with previous results about the relationship between the maternal orientations described by Raphael-Leff and maternal feelings of attachment during pregnancy (van Bussel et al. 2009d).

The mother–infant relationship and maternal mental health

As a final part of this psychometric study, we investigated the relation of the MPAS, the PBQ and the MIBS with concurrent symptoms of depression and anxiety. Overall, women with more or stronger depressive or anxiety symptoms reported lower feelings of bonding with their infants. More specifically, these women reported more feelings of hostility, rejection, anxiety and dissatisfaction in the relationship with their newborn infants. Thus, our findings support those of previous studies using either the MPAS (Condon and Corkindale 1998; Scopesi et al. 2004), the PBQ (Moehler et al. 2006; Wittkowski et al. 2007) or the MIBS (Figueiredo et al. 2008; Taylor et al. 2005; Wittkowski et al. 2007) as measures of the early affectionate mother–infant relationship. However, since these correlations are rather moderate, one might suggest that the loss of positive feelings towards the infant is not just an inherent part of the postpartum depressive syndrome but a specific phenomenon on its own (Brockington 1996).

Limitations

Several limitations of this study need to be addressed. First, no clinical interview was used as a gold standard for the diagnosis of a disordered mother–infant relationship. Therefore, further research focussing on the validity of the MPAS, PBQ and the MIBS will benefit from a multitrait–multimethod design (Campbell and Fiske 1959) including a

structured diagnostic interview (for example, the Birmingham Interview for Maternal Mental Health: Brockington 1996), video observations of maternal behaviour (Pajulo et al. 2004), measures of child abuse and neglect (Pollock and Percy 1999) and biochemical (cfr. oxytocin: Gimpl and Fahrenholz 2001) or neurological analyses (Bartels and Zeki 2004). Secondly, the data for this study are taken from responses to questionnaires. Although most of them are well validated, reporting bias is difficult to prevent or estimate. Thirdly, no data about the infant were collected in this study. While the bonding process during pregnancy is of course largely independent from the characteristics and behaviours of the infant (except from, for example, the quickening: Damato 2004; Heidrich and Cranley 1989; Lerum and LoBiondo-Wood 1989; Rubin 1984), their influence on the emotional response of the mother towards her newborn is significant (Brockington 1996). Fourthly, this study relied on the elective enrolment of the participants. Selection bias is possible given that the participants in this study were rather well educated and employed. On the other hand, our study population was fairly representative of both the population of women visiting the antenatal clinic of the UZ Gasthuisberg and of the women living in the region of the hospital. In line with the previous limitation, our population consisted of healthy participants. Therefore, further research should include both healthy participants and participants from, for example, a mother and baby unit.

Conclusions

Since our results are consistent and in line with previous research, we believe that our study contributes to the ongoing validation of the MPAS, the PBQ and the MIBS. In addition, we provided data on the frequency of bonding disorders in a population sample of mothers and confirmed that these disorders can be detected already during the pregnancy. We further provided evidence that women who experienced no or little maternal love during their own childhood are not determined to fail in the bonding with their own infants. Finally, our study confirmed that the failure of a mother to bond with her infant can be regarded as a specific phenomenon on its own instead as simply a feature of maternal anxiety or depression.

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