

RESEARCH ARTICLE

Prenatal expectations and other psycho-social factors as risk factors of postnatal bonding disturbance

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Abstract

The mother's bond to her baby starts to develop during pregnancy, and it is related to the baby's attachment. We study how the mother's prenatal expectations of her unborn baby, the mother's adult relationships, and postnatal psycho-social factors (stress, depression, and anxiety) are related to the risk of bonding disturbance. The study comprised 1398 mothers and their unborn babies assessed both during pregnancy and when the babies were 3 months old (47.7% girls). The mother's risk of bonding disturbance was investigated using Brockington's Postpartum Bonding Questionnaire. According to the results, 71 (5.1%) of all the mothers in the study had a risk of a bonding disturbance. In a final adjusted logistic regression model, the most important risk factors were the mother's inability to form positive expectations about relationships with the baby during the third trimester of pregnancy ($AOR = 7.78, p \leq .001$), maternal postnatal stress ($AOR = 4.95, p \leq .001$) and maternal postnatal depression ($AOR = 3.46, p \leq .01$). The results challenge healthcare professionals to screen pregnant mothers to identify at-risk groups for post-partum bonding disturbances. Intervention programs to prevent the development of bonding disturbances, and thus their possible serious consequences for children's development, should be considered.

KEYWORDS

postnatal bonding, postnatal depression, postnatal stress, Postpartum Bonding Questionnaire (PBQ), prenatal expectations

1 | INTRODUCTION

A mother's bond to her child represents the parent's emotional relationship with her child (Brockington et al.,

2006). The development of this bond prepares mother to her maternal role (Stern, 1995). The bond already begins to evolve during pregnancy (Bunescu, 2020; Canella, 2004; Smorti et al., 2020; Vedova et al., 2008) when mothers

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Key Findings

- 5.1% of mothers had an enhanced risk of bonding disturbance when the baby was 3-month old
- The risk of bonding disturbance was predicted by:
 - a lack of positive expectations about the relationship with the baby
 - maternal postnatal depression
 - maternal postnatal stress

Implications

- the importance of screening pregnant mothers to identify risk groups for postpartum bonding disturbance
- the importance of developing intervention programs in order to prevent a development of bonding disturbance

start developing mental representations and expectations of the baby and herself as a caregiver to prepare psychologically the role as a mother (Barlow, 2016; Stern, 1995; Vreeswijk et al., 2015). Serious disturbances in the mother–child relationship can lead to various developmental problems for the child, such as insecure attachment, and to disturbances of stress-regulation system, as well as disturbances to emotional regulation in later childhood and adulthood (Bowlby, 1969; Schore, 2001a, 2001b). Empirical studies on the topic have been summarized in a review by Le Bas et al. (2019). In this article, we study how prenatal expectations of the unborn baby, experiences in relationships and postnatal psycho-social factors predict bonding disturbances of the mother in relation to the newborn baby.

In a research context, the concepts of attachment and prenatal attachment (i.e., prenatal bonding) have different meanings. In the attachment theory, *attachment* refers to the child's emotional behavior towards a parent (i.e., infant–mother), thus it refers to the child's *inside attach-*

ment model constructed by the relationship with the parent or significant other (Bowlby, 1969; Walsh, 2010). On the other hand, the terms *prenatal attachment* and *maternal–infant or foetal attachment* (e.g., Barlow, 2016), have been used to denote *prenatal bonding* (mother–unborn baby) to refer to the mother's emotional bond to the unborn child (Bouchard, 2011; Condon, 1993). In order to avoid conceptual confusion, in this article, we use the term *bonding* when referring to the mother's emotional bond and her behavior towards the child (e.g., de Cock et al., 2016; Rossen et al., 2016). We use this term also when we refer to studies where the authors have used the term prenatal attachment. Thus, in this article prenatal bonding refers to a mother's emotional bond to the unborn baby and *postnatal bonding* refers to a mother's emotional bond to the newborn baby. Additionally, we use the concept *bonding disturbance* when referring to a negative relationship from the mother's side towards the baby after birth (Brockington et al., 2006).

Previous studies have shown that prenatal bonding is connected with postnatal bonding and child development. Poorer prenatal bonding recorded at any trimester of pregnancy, as well as negative prenatal expectations about the unborn baby in mothers have been found to relate significantly to weaker postnatal bonding (Pearce & Ayers, 2005; Rossen et al., 2016) or to a child's developmental delays (Alhusen et al., 2013). Better prenatal bonding has been found to create a better ground for postnatal mothering. For example, Siddiqui and Häggelöf (2000) reported that mothers with higher prenatal bonding scores were more involved and active during interaction with their infant, which in turn correlated positively with attentive behavior in the infant. Prenatal bonding has also been found to associate with better postnatal maternal sensitivity (Shin et al., 2006), which in turn has been associated with better developmental outcomes in early childhood, such as better communication, motor, problem-solving and personal-social skills (Alhusen et al., 2013). Prenatal bonding is also related to secure attachment and further with better social, emotional, cognitive, and behavioral development (Sroufe, 2005). Finally, balanced prenatal representations in the mother, including both positive and negative attributes of the baby or the mother–baby relationship, have been found to relate to a secure child attachment model at the age of 12 months (Benoit et al., 1997). Weaker prenatal bonding, in turn, has been found to predict delays in early childhood development (Alhusen et al., 2013).

Previous studies in general population samples as well as in psychiatric clinical samples, have shown that bonding disturbances are related to pre- and postpartum depression (Flykt et al., 2010; Garcia-Esteve et al., 2016; Kerstis et al., 2016; Ohoka et al., 2014). Compared to non-depressed mothers, depressed mothers more often have a

Statement of Relevance

- Recognizing mothers at risk of bonding disturbances is important in order to prevent unfavorable psychological sequelae of bonding disturbances.

hostile or withdrawn relationship with the baby; they also have less vocal and visual communication with their baby (Lefkovic et al., 2014), and they are more often unresponsive (Flykt et al., 2010), pejorative (Hornstein et al., 2006) or less sensitive (Bernard et al., 2018). It has also been shown that they interrupt an infant's play more often (Hornstein et al., 2006).

Hornstein et al. (2006) have found depression to be an even more serious deteriorating factor for bonding than psychotic disorders (Hornstein et al., 2006). The intensity and the timing of the depression also make a difference. Continuous depression (i.e., during both antenatal and postpartum periods) is more detrimental for the mother–baby bond than shorter periods of depression or the lack of it altogether (Ohoka et al., 2014). Moreover, Flykt et al. (2010) reported that the effect of prenatal depression is more strongly associated with the mother's unresponsiveness than postpartum depression.

Prenatally experienced anxiety symptoms in the mother also associate with poorer bonding with the baby till the age of 6 to 24 months (de Cock et al., 2016; Pearce & Ayers, 2005). Postnatal anxiety, in turn has been shown to predict impaired bonding in a clinical sample (Tietz et al., 2014). General stress has also been found to associate negatively with maternal postnatal bonding (Bicking Kinsey et al., 2014). Moreover, de Cock et al. (2016) reported that postnatal parenting stress (at 24 months) was related to poorer postnatal bonding. Stress is also related to poorer parenting skills during the first year of life. For example, according to McCurdy (2005) the mother's stress and a lack of support for her increased her risk of physical abusing the child in its first year of life.

In their meta-analysis, Lefkovic et al. (2014) summarized that a mother's stress, anxiety, and depression are related to both less favorable physical (e.g., lower birth weight) and psychological (e.g., cognitive and psychomotor) development in children.

A lower number of supportive persons predicted more problems in bonding (and the risk of depression) both pre- and postnatally (i.e., before 25 weeks and at 1 months of age), while dissatisfaction with received support did not (Ohara et al., 2017). According to de Cock et al. (2016), a low level of social support at 6 and 25 months received by the mother was also associated with poorer postnatal bonding. Bicking Kinsey et al. (2014), in turn, found in their study that mother–baby bonding correlated positively both with partner support and social support (e.g., getting advice, help or time with the baby). Kerstis et al. (2016) reported an association between impaired postnatal maternal bonding and the experience of deteriorating marital relationship at 6 months. Partner- and social-support are also related to parenting skills. According to McCurdy (2005) partner-support and a larger informal net-

work reduced the mother's risk of physically abusing the child in its first year of life.

Our understanding of the development of bonding is based on the attachment theory and the assumption is that motherhood requires mental work. In this process, the mother's *internal working models* (i.e., attachment models formed in childhood) will be updated and change in life-changing situations such as childbirth (Bowlby, 1969, p. 82). These internal attachment models, both those which concern a relationship with a child and those with an adult affect all human relationships (Bowlby, 1969, pp. 376–378). Empirical evidence on the connection between a mother's attachment model and postnatal bonding has been provided, for example, by Nonnenmacher et al. (2016), and Hairston et al. (2018). According to Alhusen et al. (2013), the mother's secure attachment model also provides more positive mother–child bonding and better development of the child (Alhusen et al., 2013). According to attachment-theory, the bond with the mother influences the development of a child's attachment model. This forms the basis which a child as an adult can build new relationships on (Bowlby, 1969, p. 378).

Bonding disturbances on the mother's side include problematic behavior and various emotions, ranging from more severe forms—such as psychological abuse, anger, aggression, infant-focused anxiety, or even rejection of the newborn—to milder forms, such as withdrawal (i.e., an increase in negative behavior towards the baby), a lack of affection, and reduced ability to respond sensitively to the infant's needs (Klier, 2006; Lefkovic et al., 2014; Matsunaga et al., 2017; Parfitt & Ayers, 2009). Furthermore, the mother may be irritated by the child's demands and see the baby as a burden.

Correspondingly, a mother's negative interaction has a negative effect on the child's behavior towards the mother. It has been shown that children whose mothers are withdrawn or emotionally unavailable resign and adapt to very little care and interaction (Dubois-Comtois et al., 2011; Tietz et al., 2014). Furthermore, repeated negativity on the mother's side in the relationship may lead to “mutually coercive interaction patterns” (Lefkovic et al., 2014, p. 359). If continuous, this kind of relationship can lead to insecure attachment, which in turn is connected to different kinds of negative psychosocial developments (Belden et al., 2007; Dykas et al., 2008; Kerns et al., 2007; Sroufe, 2005).

As the above has made evident, a large number of research findings show that there is a need to recognize risk groups for bonding disturbances as early as possible. The mother's behavior (i.e., her sensitivity and responsiveness) towards the baby predicts the baby's ability to cope with frustrations, and it also influences the development of the attachment model that the baby acquires

(Bowlby, 1969, pp. 345–346). Schore (2001b) has demonstrated that insecure attachment (of the child to the parent) influences the infant's brain development and its mental health (Schore, 2001b). Furthermore, both negative parenting (Bradley & Corway, 2007) and insecure attachment have a lasting impact (Weinfield et al., 2004) and thus have a negative impact later in childhood (Dallaire & Weinraub, 2005).

In this study, on the basis of Bowlby's (1969) and Schore's, (2001a, 2001b) theories, we assume that both poor parenting and the child's negative attachment models later in life are difficult to repair because poor parenting, insecure attachment, and negative brain development are related to each other. However, it is possible to improve parenting if available interventions are implemented in the prenatal phase (e.g., Olds et al., 1995).

According to previous studies, good maternal mental health and a socially supportive environment contribute to the good development of good bonding (e.g., Bicking Kinsey et al., 2014; de Cock et al., 2016; Kerstis et al., 2016; Ohara et al., 2017). However, there is a lack of studies that have analyzed the joint effect of several psycho-social factors together and on how such factors jointly relate to the process of bonding with a new-born.

This longitudinal study adds to previous studies in this regard by studying how several psychosocial factors are related to the risk of self-reported postpartum bonding disturbances when the child is 3 months of age. The research questions we posed were:

1. How do the mother's prenatal expectations of her relationship with her baby predict the risk of postpartum bonding disturbance?
2. How do factors influencing the mother's mental health (i.e., postnatal stress, anxiety and depression, and prenatal adverse life events) predict the risk of postpartum bonding disturbance?
3. How do the mother's prenatal relationships with other adults and the postnatal family atmosphere predict the risk of postpartum bonding disturbance?
4. How do all the above psycho-social factors together predict the risk of postpartum bonding disturbance?

Based on previous studies, our hypothesis is that negative expectations about the unborn baby (Pearce & Ayers, 2005) and psychological risk factors—such as stress (Bicking Kinsey et al., 2014; Parfitt & Ayers, 2009), anxiety (de Cock et al., 2016), depression (Flykt et al., 2010; Garcia-Esteve et al., 2016; Ohoka et al., 2014), adverse life events, and poor relationships inside the family and with other adults (Bicking Kinsey et al., 2014; Flykt et al., 2010; Kerstis et al., 2016; Ohara et al., 2017)—all increase the risk of mother–baby postpartum bonding disturbances.

2 | METHODS

2.1 | Sample

The study is a part of the wider CHILD-SLEEP cohort, which is a longitudinal study aiming to study children's sleep quality, development, and health (Paavonen et al., 2017). The general population sample was collected in maternity clinics in central Finland during the third trimester of pregnancy and when the baby was 3, 8, 18, and 24 months old. The study was presented to the mothers/fathers during their regular visits to the well-baby clinics during pregnancy, at about the 32nd pregnancy week. All mothers were eligible for the study except for those who did not have sufficient skills to fill in the questionnaires in Finnish, which is the major language in Finland. All the maternity clinics ($N = 63$) in the target area in participated the study. The mothers who were willing to participate in the study were given the prenatal questionnaires, agreement forms, and prepaid envelopes to return them to the researchers. By signing an agreement form, the participants gave their personal consent. Families were informed of their right to terminate their participation in the study whenever they wished. Those who had given their written consent were eligible for the study. The local ethical committee (R11032/9.3.2011) accepted the study protocol.

This study is based on the first and the second time points of the longitudinal data set. The mothers answered the first questionnaire before delivery and the second questionnaire when the baby was 3 months old. The cohort comprised 1673 families, from which 1398 (83.6%) mothers returned both the pre- and postnatal questionnaires. The data on the babies contained data on girls (47.7%, $n = 667$) and boys (52.3%, $n = 731$).

2.2 | Questionnaires

The questionnaires were distributed to the mothers at maternity clinics. The *prenatal questionnaire* included measures of the mothers' expectations about their unborn babies, and the mothers' relations with other adults (including her partner). Both the prenatal and postnatal questionnaires included measures of adverse life events, health factors (e.g., illnesses, height, weight, medication, alcohol usage), and demographics (e.g., the mother's age, education, income, parity), as well as measures of psychological problems (e.g., depression, anxiety, stress) and social factors (e.g., family atmosphere). In addition, the *postnatal questionnaire* had also contained measures of the mother's risk of a bonding disturbance with her newborn.

TABLE 1 A description of the sample

	<i>N</i>	%
The age of the mothers (years)		
17–25	158	11.4
26–35	1036	74.8
36–48	191	13.8
The disposable income of the mothers (euros)		
Less than 2000	1013	72.5
2000–3000	299	21.9
More than 3000	55	4.0
Parity during pregnancy		
Zero	551	46.0
One or two	607	50.7
Three or more	40	3.3
Vocational degree		
University (master's degree or higher)	478	34.2
University of applied sciences	524	37.5
Lower vocational education	281	20.1
Vocational course(s)	17	1.2
No vocational education	67	4.8
Something else	30	2.1
Educational status (basic and vocational education)		
1. Comprehensive school + lower vocational education (maximum)	219	16.0
2. Comprehensive school + higher vocational education or + a degree from a university of applied sciences, or a high-school diploma + lower vocational education (maximum)	240	17.6
3. High-school diploma + higher vocational education or + a degree from a university of applied sciences	431	31.5
4. Comprehensive school diploma or high-school diploma + graduated from a university (master's degree or higher)	477	34.9

2.3 | Prenatal measures

We measured mothers' expectations of their unborn babies using the Representations of Unborn Baby-scale developed by Kangaspunta et al. (2005). This is a 12-item self-reported questionnaire. *The parents are questioned: "What kind of expectations do you have for your future baby?" The twelve statements are rated on a five point Likert type scale with response options ranging from "Not at all" to "I cannot say" to "Very much". For example, one of the statements is: "I imagine that my future baby will be satisfied and happy".* The items are short and easily interpreted, which according to Hammond (1995) increases the content validity.

According to Stern's (1995) theory, such representations about "an imaginary baby" contain imaginary pictures about the baby and the relations surrounding the baby. These pictures also refer to the unborn baby because the representations of the baby formed during pregnancy have

been found to be quite stable up to a year at least (e.g., de Cock et al., 2016; Pearce & Ayers, 2005; Siddiqui & Hägglöf, 2000; Theran et al., 2005).

Based on a maximum likelihood factor analysis, we extracted three factors: positive expectations about the relationship with the baby ($\alpha = .71$), negative expectations about taking care of the baby ($\alpha = .61$), and positive expectations about the baby's regularity ($\alpha = .47$), as reported previously (Rusanen et al., 2018). The factor scores were then dichotomized at the 10th or 90th percentile to indicate more problematic views (Tables 2–3). Mothers' with high levels of positive expectations concerning their relationship with their baby (scores > -1.39 , $n = 1244$) belonged to the comparison group, while mothers with lower levels of positive expectations concerning their relationship with their baby belonged to the risk group (scores ≤ -1.39 , $n = 140$). The negative expectations about taking care of the baby scale was dichotomized at 1.18. The comparison group

TABLE 2 The mean (M), standard deviation (SD), the range, limits for risk groups and the Cronbach's alpha (α) of independent and dependent variables

	N	Mean	SD	Min-Max	Cut off for the risk group	α
Prenatal variables						
Positive expectations about the relationship with the baby	1384	-.12	.92	-6.91-.82	≤ -1.39	N/A
Negative expectations about taking care of the baby	1384	.01	.83	-1.5-3.4	≥ 1.18	N/A
Positive expectations about the baby's regularity	1384	-.00	.75	-2.0-2.2	$\leq -.93$	N/A
The absence of expectations	1396	1.85	2.11	.0-12.0	≥ 5.0	.73
Closeness in adult relationships	1397	4.06	.60	1.80-5.0	≤ 3.20	.70
Confidence in adult relationships	1397	3.77	.77	1.00-5.0	≤ 2.67	.86
Anxiety in adult relationships	1397	1.72	.68	1.0-4.6	≥ 2.80	.75
Adverse life events	1390	.64	1.09	.0-11.0	≥ 2	.73
Depression	1413	5.07	3.50	.0-23.0	N/A	.79
Postnatal variables						
Postnatal risk of bonding disturbance (PBQ)	1393	4.74	3.62	.0-26.0	> 11	.76
Depression	1392	4.60	3.76	.0-24.0	≥ 10	.81
STAI anxiety	1390	9.02	2.51	6.0-23.0	≥ 12	.81
Stressfulness	1390	5.90	3.18	.0-19.0	≥ 11	.76
Family atmosphere	1389	42.22	5.75	15.0-49.0	< 35	.86

TABLE 3 The descriptive statistics of the study variables in the comparison group and the risk group (independent samples *t*-test)

	Comparison group			Risk group			<i>t</i> ¹
	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	
Prenatal variables							
Positive expectations about the relationship with the baby, cut off ≤ -1.39	1244	.22	.55	140	-2.03	1.09	23.98***
Negative expectations about taking care of the baby, cut off ≥ 1.18	1242	-.16	.68	142	1.50	.39	-43.96***
Positive expectations about the baby's regularity, cut off: $\leq -.93$	1241	.14	.66	143	-1.21	.25	47.99***
The absence of expectations, cut off ≥ 5	1244	1.28	1.28	152	6.52	1.68	-37.09***
Closeness in adult relationships (AAS), cut off ≤ 3.20	1243	4.20	.47	154	2.93	.30	46.22***
Confidence in adult relationships (AAS), cut off ≤ 2.67	1248	3.95	.60	149	2.30	.37	47.25***
Anxiety in adult relationships (AAS), cut off ≥ 2.80	1256	1.55	.48	141	3.19	.42	-42.97***
Adverse life events, ≥ 2	1204	.33	.47	186	2.65	1.66	-18.88***
Postnatal variables							
Postnatal risk of bonding disturbance (PBQ), > 11	1322	4.22	2.83	71	14.42	2.93	-29.52***
Depression (CES-D), cut off ≥ 10	1249	3.64	2.44	143	12.91	2.88	-42.19***
Anxiety (STAI), cut off ≥ 12	1175	8.17	1.43	215	13.66	2.05	-37.65***
Stressfulness (COHEN), cut off ≥ 11	1264	5.21	2.36	126	12.79	1.83	-43.09***
Family atmosphere, cut off < 35	1257	43.61	3.75	132	28.99	4.53	35.83***

1 ****p* < .001.

(scores < 1.18, *n* = 1242) included mothers with low levels of negative expectations concerning taking care of the baby, and the risk group (scores ≥ 1.18 , *n* = 142) included mothers with a high level of negative expectations concerning taking care of the baby. The groups with positive expectations of the baby's regularity were based on a cut-off score of $-.93$. A comparison group (scores > $-.93$, *n* = 1241)

included mothers with positive expectations concerning the child's regularity and the risk group (scores $\leq -.93$, *n* = 143) included mothers with low levels of positive expectations concerning regularity.

The absence of expectations about the baby was calculated based on the original 12-item scale for the mother's representations of her unborn baby ($\alpha = .73$, Table 2), so

that frequency of “I cannot say” responses was summarized as suggested in Kangaspunta et al., 2005. The higher the score, the fewer expectations of the baby a mother had. By dichotomizing the summary score with a cut-off score of 5 (according to Kangaspunta et al., 2005), we got two groups: the comparison group (score < 5, $n = 1244$) includes mothers with no risk or a low risk of suffering from problems regarding their relationship with their baby and the risk group (scores ≥ 5 , $n = 152$) representing mothers with an elevated risk regarding their relationship with their baby (Table 3).

The mother's attachment style within adult relationships was assessed with the adult attachment scale (AAS) reported by Collins and Read (1990). This is an 18-item self-reported questionnaire, using a 1–5 scale. We used the three standardized subscales (closeness, confidence, anxiety) for this measure reported by Collins and Reed. We excluded one variable from the closeness and anxiety subscales to achieve better internal consistency. By excluding variable of “I am comfortable having others depend on me” the reliability (Cronbach's alpha) of closeness increased from .61 to .70, and by excluding the variable of “I want to merge completely with another person” the reliability of the AAS-anxiety item increased from .65 to .75. Then we calculated the summary scores as originally reported (excluding the two above-mentioned items). This way we were able to calculate the three subscale scores: (1) closeness, with five items ($\alpha = .70$), for example, “I find it relatively easy to get close to others”, (2) confidence (i.e., dependence), with six items ($\alpha = .86$), for example, “I am comfortable depending on others”, and (3) anxiety, with five items ($\alpha = .75$), for example, “I often worry that my partner does not really love me” (Table 2).

The three AAS subscale scores were dichotomized at the 10th or 90th percentile to indicate more problems in relationships. The AAS *closeness* scale was dichotomized at 3.20 (the 10th percentile). The risk group (scores ≤ 3.20 , $n = 154$) included mothers with low levels of closeness, while the comparison group (scores > 3.20, $n = 1243$) included mothers with high levels of closeness in adult relationships. The AAS *confidence* scale was dichotomized at 2.67 (the 10th percentile). The risk group (scores ≤ 2.67 , $n = 149$) included mothers with low levels of confidence in adult relationships, and the comparison group (scores > 2.67, $n = 1248$) included mothers with more confidence in adult relationships. The AAS *anxiety* scale was dichotomized at 2.80 (the 90th percentile). The comparison group (scores < 2.80, $n = 1256$) included mothers with low levels of anxiety in adult relationships, and the risk group (scores ≥ 2.80 , $n = 141$) included mothers with a high level of anxiety in adult (Table 3).

Adverse life events were measured by using the List of Threatening Experiences (LTE). This scale lists 11 poten-

tially distressing life events (Brugha & Cragg, 1990). If there were no distressing events, the items were recoded using 0, while distressing events were recoded using 1. A summary score was calculated to indicate the number of adverse events during the past 6 months ($\alpha = .73$). As reported in Table 3, two groups were created with a cut-off of ≥ 2 (indicating 1204 mothers with 0–1 adverse life events in the comparison group vs. 186 mothers with 2 or more adverse life events in the risk group).

2.4 | Postnatal measures

The mother–baby bonding disturbance was measured with Brockington's Postpartum Bonding Questionnaire (PBQ). This is a validated and widely-used scale with good psychometric properties (Brockington et al., 2006; Wittkowski et al., 2007). Bonding disturbances or risk of bonding disturbances in our study refer to Brockington's general factor (one of the four PBQ subscales), which describes “some kind of problem in the mother–infant relationship” (Brockington et al., 2006, p. 237). The general factor of the PBQ comprises 12 items with six response options (from 0–5). A summary score is calculated, and its maximum score is 60. The reliability of the total score was $\alpha = .76$ (Table 2). The higher the score, the greater the risk of disturbance in the mother's bonding to the baby. The cut off score to define mothers at risk of bonding disturbances is > 11 (Brockington et al., 2006, pp. 236–237) and it has been found to have an acceptable degree of reliability and reasonable validity (Wittkowski et al., 2007). With a cut-off score > 11, we classified the women into two groups: those with a low risk of a bonding disturbance ($n = 1322$) and those with an elevated risk of a bonding disturbance ($n = 71$, Table 3). In comparison with other instruments (i.e., the Maternal Postpartum Attachment Scale [MPAS] and the Mother-to-Infant Bonding Scale [MIBS]), the PBQ has been found to be reliable and valid (Bussell et al., 2010). Even though the original four-factor solution has not always been fully replicated, the first factor (measuring impaired bonding) used in this study has been replicated, at least partly (Garcia-Esteve et al., 2016; Wittkowski et al., 2007). Four items were reverse scored to calculate the total scores according to Brockington et al. (2006).

Depression was measured using the short version of the Center for Epidemiological Studies Depression Scale (CES-D; Irwin et al., 1999; Radloff, 1977). This contains 10 items with a scale from 0 to 3 (0 = rarely or not at all or less than once a week, 3 = all the time or 5–7 days per week) leading to a final score ranging from 0 to 30. Its reliability was acceptable at both timepoints (prenatal: $\alpha = .79$, postnatal $\alpha = .81$, see Table 2). The mothers were divided into two groups using 10 as the cut off. The

comparison group included mothers with a low level of depression or no depression (< 10 , $n = 1249$), while the risk group included mothers with elevated depression scores (≥ 10 , $n = 143$). Prenatal depression was used in the logistic regression analysis as a confounding factor (Table 5, Model 2).

Anxiety was measured using the short version of the Spielberger's State-Trait Anxiety Scale (STAI, Bieling et al., 1998). The scale is a shortened version of the original inventory and contains six items with options ranging from 1 to 4 (1 = almost never, 4 = almost always, $\alpha = .81$, Table 2). With a cut-off score of ≥ 12 (the 90th percentile), two groups were created indicating the most anxious mothers. The comparison group included mothers with low levels of anxiety (< 12 , $n = 1175$), while the risk group comprised mothers with high levels of anxiety (≥ 12 , $n = 215$) (Table 3).

Stress was measured using Global Measure of Perceived Stress (GMPS, Cohen et al., 1983). This measure is the five-item scale with options ranging from 0 to 4 (0 = not even once, 4 = very often, $\alpha = .76$, Table 2). The items are tapping how unpredictable, uncontrollable, and overloaded the respondents find their lives. Two groups were created by using a cut-off score of ≥ 11 (the 90th percentile). The comparison group included mothers with low levels of perceived stress (< 11 , $n = 1264$), while the risk group comprised mothers with high levels of perceived stress (≥ 11 , $n = 126$) (Table 3).

Family atmosphere was evaluated using seven items rated on a seven-point semantic differential scale, for example, cohesive (= 1) to tense (= 7), approving (= 1) to disapproving (= 7), tense (= 1) to relaxed (= 7), safe (= 1) to insecure (= 7), and quarrelsome (= 1) to harmonious (= 7). In a factor analysis, the items have been shown to load on one factor, indicating the one-dimensionality of the measure (Paavonen et al., 2017). Three of the items were reverse coded and a summary score was calculated (range: 15–49, $\alpha = .86$, Table 2), with lower values indicating a more negative family atmosphere. The summary score was dichotomized with a score < 35 (the 10th percentile). The comparison group included mothers with positive atmosphere in the family (≥ 35 , $n = 1257$), while the risk group comprised mothers with negative family atmosphere (< 35 , $n = 132$) (see Table 3).

Demographic factors (i.e., the mother's age, educational status, income, and parity) are reported in Table 1.

2.5 | Statistical analyses

To study the associations between the explanatory psychological factors (adverse prenatal life events, postnatal stress, anxiety, depression) and social factors (expectations about the unborn baby, prenatal relations with adults, post-

natal family atmosphere), and the dependent variable (risk of bonding disturbances, measured by PBQ) a correlation analysis was made first. We found that most of the Pearson's correlation coefficients were statistically significant at $p < .01$ (see supplement table). For the final analyses, the explanatory variables were dichotomized as reported above. We first used cross-tabulation and X^2 tests to study how the explanatory and demographic factors were related to the bonding disturbances at the age of 3 months. Next, we used a binary logistic regression analysis to analyze each explanatory variable's direct effect on the bonding disturbances without adjusting for the demographic factors. After this we constructed adjusted binary logistic regression models to study the associations between the explanatory variables, each studied in a separate model, while demographic factors (i.e., the mother's age, education, income, and parity) and prenatal depression were controlled statistically. Finally, all the explanatory variables were studied together to evaluate their joint effect on bonding disturbances at the age of 3 months while adjusting for the demographic factors. All statistical analyses were made using IBM SPSS Statistics 25.

3 | RESULTS

3.1 | A description of the sample

The sample is based on a representative birth cohort recruited during pregnancy. However, those with a lower education seem to be underrepresented in the sample, as are single mothers. The mothers' mean age was 30.7 years old, which is almost the same as the mothers' mean age of delivered women in the official statistics. According to official statistics, the mean age is 30.9 years old (OSF, 2017). The participating mothers had a higher level of education than the population in general: 71.7% of the mothers in our data had a university degree or a degree in applied sciences, while for women in general the percentage is 25%–40%, depending on the residential district (OSF, 2012; Table 1). In total, 71 mothers out of 1,393 (5.10%) exceeded Brockington's limit for the risk of bonding disturbance (Table 2-3).

3.2 | The mother's prenatal expectations as predictors of bonding disturbances

In the crude analyses, we found that 'Low levels of positive expectations about their relationship with their baby' were significantly related to the risk of bonding disturbance (Table 4). As many as 21.4% of the mothers with a low level of positive expectations about their relationship with their baby had an elevated risk of bonding disturbance

TABLE 4 Distributions (% , f, n) of mothers with a risk of bonding disorders (PBQ score > 11) in the risk and comparison groups of explanatory variables and demographic factors

Explanatory variable	The risk of bonding disturbance							95% CI for the OR	p	
	Comparison group			Risk group ¹						
	%	f	n	%	f	n	OR			
PRENATAL FACTORS										
No positive expectations about the relationship with the baby, cut off ≤ -1.39	3.2	40	1239	21.4	30	140	8.18	4.90–13.64	<.001	
Negative expectations about taking care of the baby, cut off ≥ 1.18	4.8	60	1238	7.1	10	141	1.50	.75–3.00	.253	
No positive expectations about the baby’s regularity, cut off $\leq -.93$	4.9	61	1245	6.3	9	143	1.29	.63–2.66	.485	
The absence of expectations, cut off ≥ 5	4.9	61	1240	6.6	10	151	1.37	.69–2.74	.371	
Low closeness in adult relationships, cut off ≤ 3.20	4.3	53	1239	11.8	10	153	2.98	1.70–5.24	<.001	
Low confidence in adult relationships, cut off ≤ 2.67	3.9	48	1243	15.4	23	149	4.54	2.68–7.72	<.001	
Anxiety in adult relationships, cut off ≥ 2.80	4.4	55	1251	11.3	16	141	2.78	1.55–5.00	.001	
Adverse life events, cut off ≥ 2	4.8	58	1200	6.5	12	185	1.37	.72–2.60	.341	
POSTNATAL FACTORS										
Depression, cut off, ≥ 10	2.8	35	1247	25.4	36	142	11.76	7.09–19.50	<.001	
STAI anxiety, cut off ≥ 12	2.9	34	1174	17.4	37	213	7.05	4.31–11.53	<.001	
Stressfulness, cut off ≥ 11	2.9	36	1262	28.0	35	125	13.24	7.94–22.10	<.001	
Negative family atmosphere, cut off < 35	3.7	46	1254	18.9	25	132	6.14	3.63–1.38	<.001	
DEMOGRAPHIC FACTORS										
Educational status, higher vs. lowest	5.0	45	905	5.0	23	457	.99	.59–1.65	.961	
The mother’s income, $\geq 2000\text{€}$ vs. $<2000\text{€}$	4.2	15	353	5.2	53	1010	.80	.45–1.44	.459	
The mother’s age, >25 years vs. ≤ 25 years	4.9	60	1223	6.4	10	157	.76	.38–1.51	.433	
Parity during pregnancy, one or more vs. zero	4.0	26	645	5.8	32	548	.68	.40–1.15	.150	

%: the percentage of the mothers with an elevated risk of bonding disturbance (PBQ score > 11) in comparison and the risk groups according to explanatory variables and demographic factors.

f: the frequency of mothers with an elevated risk of bonding disturbances in comparison and risk groups according to explanatory variables and demographic factors.

n: the total number of mothers in groups in comparison and risk groups according to explanatory variables and demographics.

compared to only 3.2% of the other mothers ($OR = 8.18$, $p < .001$). According to the adjusted logistic regression analysis (Table 5), the mothers with low levels of positive expectations about their relationship with their baby had an 8.50 times higher risk of bonding disturbances than other women ($p \leq .001$). The results remained significant when controlling for prenatal depression. Other predictors (i.e., negative expectations about taking care of the baby, no positive expectations about the baby's regularity and the absence of expectations) were not related to the risk of postpartum bonding disturbances.

3.3 | The mother's relationships as predictors

As reported in Table 4, we found that 11.8% of the mothers with low levels of closeness in prenatal adult rela-

tionships had a risk of bonding disturbance compared to 4.3% of the other mothers ($OR = 2.98$, $p < .001$). The corresponding figures regarding confidence in prenatal adult relationships were 15.4% for low confidence versus 3.9% for high confidence ($OR = 4.54$, $p < .001$). Anxiety in adult relationships was also related to bonding disturbances; 11.3% of mothers reporting high anxiety in prenatal adult relationships (versus 4.4% for low anxiety) had an elevated risk of bonding disturbances ($OR = 2.78$, $p = .001$). Finally, a negative family atmosphere versus a more positive atmosphere resulted in 18.9% versus 3.7% risk of a bonding disturbance ($OR = 6.14$, $p < .001$). All these associations remained significant after demographic factors were adjusted. When adjusted for prenatal depression the associations remained significant for closeness, for confidence and family atmosphere but not for anxiety (Table 5).

TABLE 5 Adjusted binary logistic regression models to predict the risk of bonding disturbances (PBQ score > 11) at the child's age of 3 months

Explanatory variables	MODEL 1				MODEL 2			
	β (S.E.)	Wald	AOR	95% CI	β	Wald	AOR	95% CI
No positive expectations about the relationship with the baby	2.14 (.29)	55.04	8.50[‡]	4.83–14.97	1.89 (.30)	39.26	6.60[‡]	3.66–11.90
Negative expectations about taking care of the baby	.54 (.36)	2.19	1.71	.84–3.47	.53 (.49)	1.99	1.69	.82–3.51
No positive expectations about the baby's regularity	.35 (.46)	.77	1.42	.65–3.08	.13 (.41)	.10	1.14	.51–2.57
Absence of expectations	.38 (.36)	1.10	1.46	.72–2.95	.47 (.37)	1.66	1.61	.78–3.29
Low closeness	1.12 (.31)	12.80	3.06[‡]	1.66–5.64	.72 (.34)	4.65	2.06[‡]	1.07–3.99
Low confidence	1.54 (.29)	27.26	4.64[‡]	2.61–8.25	1.00 (.34)	8.98	2.73[#]	1.42–5.26
AAS anxiety	1.07 (.33)	10.40	2.92[*]	1.52–5.61	.40 (.38)	1.11	1.49	.71–3.10
Negative family atmosphere	1.94 (.30)	42.34	6.99[‡]	3.89–12.55	1.50 (.33)	20.64	4.50[‡]	2.35–8.61
Stress	2.75 (.29)	90.34	15.71[‡]	8.90–27.72	2.49 (.31)	62.76	12.06[‡]	6.52–22.34
Depression	2.68 (.29)	84.17	14.52[‡]	8.20–25.73	2.44 (.36)	55.21	11.43[‡]	6.01–21.73
STAI anxiety	2.05 (.27)	56.31	7.77[‡]	4.55–13.26	1.75 (.30)	34.05	5.75[‡]	3.20–10.34
Adverse life events	.43 (.34)	1.62	1.54	.79–2.98	.08 (.36)	.06	1.09	.54–2.20

Model 1: The explanatory variables studied in separate models and controlled by demographic factors (maternal education, income, age, and parity).

Model 2: The explanatory variables studied in separate models and controlled by demographic factors (maternal education, income, age, and parity) and the mother's prenatal depression.

Bold denotes statistical significance at $p < .05$.

[#] $p < .05$, ^{*} $p < .01$, [‡] $p < .001$.

3.4 | The mother's mental health-related postnatal factors as predictors

Most of the mothers' postnatal mental health factors were related to the risk of bonding disturbance. A cross-tabulation showed that 28.0% of the mothers with high levels of stress had an elevated risk of bonding disturbances compared to the non-stressed mothers, of whom only 2.9% had a PBQ score above the cut-off value ($OR = 13.24$, $p < .001$). Of the depressed mothers, 25.4% had a risk of bonding disturbances while only 2.8% of non-depressed mothers had an elevated risk ($OR = 11.76$, $p < .001$). The corresponding figures for mothers with anxiety were 17.4% versus 2.9% ($OR 7.05$, $p < .001$). All these factors remained statistically significant in the adjusted logistic regression models (Table 5). Adverse life events were not related to bonding disturbances (Table 4).

3.5 | All factors as predictors: A final model

In the final model we analyzed the effects of all the explanatory variables with a binary logistic regression analysis while controlling for the demographic factors (Table 6). The most powerful predictors of a risk of bonding disturbances were the mother's prenatal lack of positive expectations for her relationship with her baby ($AOR = 7.78$, $p < .001$), the mother's postnatal stress ($AOR = 4.95$, $p < .001$) and the mother's postnatal depression ($AOR = 3.46$, $p < .01$).

3.6 | Demographic factors as predictors

Of the demographic factors (i.e., age, education, income, parity) only parity was related to a risk of disturbances in mother-baby bonding. In the adjusted final model, mothers with their first child had a greater risk of a bonding disturbance than the mothers who had already had one or two children ($p = < .01$, Table 6). The results regarding the other demographic factors (i.e., education, income, and age) were non-significant (Table 6).

4 | DISCUSSION

Our aim was to study how the mother's prenatal representations of the baby and several psycho-social factors are jointly related to mother-baby bonding disturbances at 3 months. We found that the prevalence of bonding disturbances was relatively low in our sample and that a lack of positive expectations about the relationship with

the unborn baby, postnatal stress, and depression were the strongest factors predicting bonding disturbances at the age of 3 months when demographics were statistically controlled for. In the next paragraphs we compare our results to those of previous studies and review our results theoretically.

According to our findings, 5.10% of mothers exceeded Brockington's limit for the risk of bonding disturbances, which is clearly less than reported in the previous results. For example, Parfitt and Ayers (2009) and Matsunaga et al. (2017) reported that 23% and 21% of the mothers in their respective studies had an elevated risk of bonding disturbances. Moreover, in psychiatric samples, bonding disturbances have been diagnosed in up to 41% of the mothers (Chandra et al., 2015). The mothers in our study were more educated than the overall population, which could affect the results. Previous research findings on the link between education and bonding have been conflicting. In some studies, high education is weakly associated with better bonding, while in others the opposite has been found (Tichelman, 2019). In our study, education was controlled for and it was not associated with bonding disorder.

Our main finding was that a lack of positive prenatal expectations about the relationship with the unborn baby increased the mother's risk of bonding disturbance strongly even when the mother's pre- and postnatal depression and other psychosocial factors were controlled for. According to previous studies, maternal-fetal bonding is related to postpartum bonding (Alhusen et al., 2013; Dubber et al., 2015; Rossen et al., 2016), and therefore our findings are consistent with the previous literature. Our results are also consistent with Pearce and Ayers's (2005) results, according to which the mother's prenatal expectations concerning some of difficult infant characteristics predict a poorer mother-baby postpartum bond. However, Pearce and Ayers (2005) did not find any association between the mother's expectations about the baby's fussiness and unpredictability, and the mother-baby bond. This is also consistent with our results as neither prenatal positive expectations about the baby's regularity nor negative expectations about taking care of the baby were associated with the risk of bonding disturbances. Thoughts about baby's care or the baby's regularity may not be relevant during pregnancy. Instead, thoughts about the relationship with the baby are more topical. A lack of positive thoughts about the relationship with the baby supports the results reported by Schmidt (2017), according to which repeated negative thinking impairs bonding and mother-infant relationship and increases anxiety. Mothers who had high overall level of repetitive negative thoughts pre- and postnatally reported being less satisfied with having the baby and less close to the baby.

TABLE 6 Full logistic regression model to predict risk for bonding disturbances (PBQ score > 11) at the child's age of 3 months

	β (S.E.)	Wald	AOR	95% CI
No positive expectations about the relationship with the baby (prenatal)	2.05 (.36)	32.98	7.78[‡]	3.86–15.66
Negative expectations about taking care of the baby (prenatal)	.56 (.49)	1.28	1.75	.67–4.58
No positive expectations about the baby's regularity (prenatal)	−.32 (.49)	.42	.73	.28–1.90
Absence of expectations (prenatal)	.13 (.49)	.67	1.14	.44–2.96
Low closeness (prenatal)	.06 (.43)	.02	1.07	.46–2.46
Low confidence (prenatal)	.59 (.41)	2.09	1.81	.81–4.02
AAS anxiety (prenatal)	−.85 (.48)	3.12	.43	.17–1.10
Negative family atmosphere (postnatal)	.56 (.40)	1.94	1.75	.80–3.84
Stress (postnatal)	1.60 (.42)	14.77	4.95[‡]	2.19–11.19
Depression (postnatal)	1.24 (.45)	7.53	3.46[*]	1.43–8.41
STAI anxiety (postnatal)	.59 (.43)	1.83	1.80	.77–4.20
Adverse life events (prenatal)	−.10 (.43)	.06	.90	.39–2.10
Educational status				
1. Lowest (see Table 1)		1.57		
2. (see Table 1)	.38 (.58)	.44	1.47	.47–4.57
3. (see Table 1)	.67 (.56)	1.45	1.95	.66–5.81
4. Highest (see Table 1)	.61 (.58)	1.10	1.83	.59–5.69
Income				
< 2000€ per month		4.43		
2000–3000€ per month	−.66 (.44)	2.28	.52	.22–1.22
> 3000€ per month	.80 (.70)	1.29	2.23	.56–8.87
Mother's age				
17–25 years		2.43		
26–35 years	.08 (.49)	.03	1.09	.42–2.85
≥36 years	−.85 (.74)	1.31	.43	.10–1.84
Parity during pregnancy				
zero child		9.53		
.75 (mean)	−.29 (.53)	.30	.75	.27–2.11
1 children	−1.00 (.38)	6.78	.37 [*]	.17–.78
2 children	−1.37 (.68)	4.05	.26 [#]	.07–.96
3 children	−1.44 (1.23)	1.38	.24	.02–2.61
4 or more		.00	.00	---

1 All the explanatory variables studied together and controlled by demographic factors. $R^2 = .116$ (Cox & Snell R Square), $R^2 = .357$ (Nagelkerke R Square).

Bold denotes statistical significance at $p < .05$.

[#] $p < .05$, ^{*} $p < .01$, [‡] $p < .001$.

The mother's **interpersonal** relationships with other adults, both inside and outside the family (i.e., adult attachment and family atmosphere), were also strongly related to difficulties in postpartum bonding. The mothers who had low confidence or low closeness in adult relationships and the mothers with a negative family atmosphere had an increased risk of postpartum bonding disturbance even when prenatal depression was taken into account. However these results did not remain significant in the final model. Therefore the ability to trust other adults may be a significant mediating factor for the mother's capability to create a bond with her baby. The results are in

line with previous results, according to which partner and social support are associated with higher bonding (Bicking Kinsey et al., 2014).

Our findings further demonstrated that **postnatal stress** was associated with the risk of bonding disturbances even when controlling for pre- and postnatal depression and other psychosocial factors. Previous studies support our findings on stress as deteriorating factors of bonding by showing that stress (Bicking Kinsey et al., 2014) and post-traumatic stress-disorder (Parfitt & Ayers, 2009) are negatively associated with bonding and increase the risk of physical abuse of the baby (McCurdy, 2005).

Postnatal depression was strongly associated with bonding disturbances at the age of 3 months even when prenatal depression was controlled for in the final model. This is in line with many previous results showing that mother's prenatal depression (Flykt et al., 2010; Rossen et al., 2016) and postnatal depression usually associate with the postnatal mother–baby relationship (Flykt et al., 2010; Garcia-Esteve et al., 2016; Hornstein et al., 2006; Tietz et al., 2014).

In our study, depression and other psychological factors were investigated together with interpersonal factors (maternal adult relationships, family relationships, and expectations of the unborn baby), whereas other studies investigated depression in combination with socio-demographic factors (Garcia-Esteve et al., 2016), various anxiety disorders (Tietz et al., 2014), clinical symptoms, and social and occupational factors (Hornstein et al., 2006). It should be noted that our data refer to the normal population, whereas some of the studies mentioned above are psychopathological (Garcia-Esteve et al., 2016; Hornstein et al., 2006). Similarly, according to our results, postnatal anxiety was also strongly associated with bonding disturbances at the age of 3 months, before and after controlling for prenatal depression. Its significance vanished in the final full model where stress and depression were the predictors of bonding disturbances. Our findings regarding anxiety in the full model were not consistent with those results which reported that postnatal anxiety, together (Tietz et al., 2014) or separately (Dubber et al., 2015) with postnatal depressive symptoms, predict lower maternal bonding. The reason for the different results might lie in the different kinds of study design (as explained above).

5 | LIMITATIONS

Compared to other studies that assessed the risk factors for bonding disturbances, our analysis aimed to study the joint effect of multiple known (i.e., 12) risk factors. In many previous studies with same research design as ours either psychological or social factors have been selected or weighted differently or selected in different combinations than ours, or just a few explanatory factors have been selected (e.g., Alhusen et al., 2013; Barlow, 2016; Bicking Kinsey et al., 2014; Dayton et al., 2010; Dubber et al., 2015; Flykt et al., 2010; Garcia-Esteve et al., 2016; Hornstein et al., 2006; Kerstis et al., 2016; Ohara et al., 2017; Ohoka et al., 2014; Pearce & Ayers, 2005; Rossen et al., 2016; Siddiqui & Hägglöf, 2000; Tietz et al., 2014), or the babies ages have been different from ours (de Cock et al., 2016), or research design has differed from ours (Huth-Bocks et al., 2011).

Several factors included in the same model cause competition between the factors, with the consequence that the strongest factors override the others, and we can see the most powerful factors which predict the postnatal bonding. When the factors were analyzed alone and controlled by demographics and prenatal depression, our results closely mirrored the previous studies listed above. We could see that most of the 12 explainers (i.e., no positive expectations about the relationship with the baby, low closeness and low confidence in adult relationships, negative family atmosphere, stress, depression and STAI anxiety) related to bonding disturbances. However, in the full model only stress, depression, and positive expectations about the relationship with the unborn baby from the 12 explainers in the model predict postnatal bonding disturbances.

A few factors in our study remind us to be cautious concerning the results. Despite the large amount of data, the absolute number of mothers at risk of bonding disturbance was quite small. An elevated risk of bonding disturbance was found in 71 mothers out of 1,393 (5.1%). Also, the number of mothers with no prenatal positive expectations or low prenatal positive expectations about their relationship with their baby was relatively small ($N = 140$), and in this group, an elevated risk of bonding disturbance was only found for 30 mothers. This means that further studies should aim to gather even larger data sets than we did.

Additionally, the range of the bonding disturbance (PBQ) in our data was relatively small (0–26 out of the full PBQ scale of 0–60; Brockington et al., 2006), referring to a somewhat homogeneous population. Indeed, our sample was collected from a normal population, not from clinical patients, and thus mothers with more severe clinical depression or anxiety may not have participated in the study. The range of depression in our sample was 0–24 out of the full CES-D scale of 0–30 and the range of stress was 0–19 out of the full Cohen-scale of 0–20.

We also recommend caution in the interpretations of our analyses because the correlations between some explanatory variables were strong; for example, the correlation between depression and stress was .73. Thus, the disappearance of statistical significance of anxiety in the final model may have been due to them being overridden by stress.

Unlike in previous results (Bicking Kinsey et al., 2014; Dubber et al., 2015), according to our results, a higher education was not associated with postnatal bonding, but it is notable that lower educated mothers were underrepresented in our sample. However, it should be noted that from 71.7% of highly educated mothers, not all, but only 1/3 had a science university degree and the rest had an upper secondary level of education (universities of applied science degree or vocational education). The education was

also adjusted for in the analyses, which improved the generalization of results.

6 | CONCLUSIONS

Our research-design included 12 explanatory psychosocial factors, in contrast to several previous studies with included only a few. Of those 12 factors in the final analysis, only postnatal stress, postnatal depression, and prenatal lack of positive expectations about the relationships with the unborn baby predicted postnatal bonding impairment. Finally, according to our results from the demographic factors only first-time mothering increased the risk of bonding disturbances. This finding is reasonable because motherhood is a developmental process (Mercer & Ferketisch, 1995). Mothers with one or two children are more experienced compared to mothers having their first baby.

In practice, our results challenge healthcare professionals to pay attention to mothers when they report a lack of happiness about the unborn baby, especially if the baby is the firstborn, or if the mother reports loneliness or an inability to trust anyone or is suffering from stress disorders or is depressed. Our results are in line with Brockington et al.'s (2006) recommendation that pregnant mothers should be interviewed to screen for the mother's negative feelings towards the baby and also to recognize psychiatric symptoms. If there are such negative feelings, interventions in order to support the mother-baby relationship should be considered.

The mother's ability to be sensitive and responsive to her newborn is a key element regarding the baby's ability to attach securely to the mother, which in turn gives a better basis for the child's developmental outcomes (e.g., Alhusen et al., 2013; Bowlby, 1969; Feng et al., 2007; Flykt et al., 2010). It is highly important to implement and improve suitable intervention programs (such as home-visiting programs, Kitzman et al., 1997; Olds et al., 2010) for mothers who are at risk of developing a bonding disturbance.

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