Journal Pre-proof

Validation of the Postpartum Bonding Questionnaire: a
cross-sectional study among Flemish mothers

Bleijenbergh Roxanne , Van den Branden Laura , van Gils Yannic ,
Van de Craen Natacha , Yvonne J Kuipers

Please cite this article as: Bleijenbergh Roxanne , Van den Branden Laura , van Gils Yannic ,
 Van de Craen Natacha , Yvonne J Kuipers , Validation of the Postpartum Bonding Ques-
tionnaire: a cross-sectional study among Flemish mothers, *Midwifery* (2022), doi:
https://doi.org/10.1016/j.midw.2022.103280

This is a PDF file of an article that has undergone enhancements after acceptance, such as the addition
of a cover page and metadata, and formatting for readability, but it is not yet the definitive version of
record. This version will undergo additional copyediting, typesetting and review before it is published
in its final form, but we are providing this version to give early visibility of the article. Please note that,
during the production process, errors may be discovered which could affect the content, and all legal
disclaimers that apply to the journal pertain.

Validation of the Postpartum Bonding Questionnaire: a cross-sectional study among Flemish mothers

Title

Validation of the Postpartum Bonding Questionnaire: a cross-sectional study among Flemish mothers

Wordcount

Abstract + manuscript + references = 309 + 3782 + 1456 = 5547

Author names and affiliations

(Last name, first name)

Bleijenbergh Roxanne[1,2] (PhD student)
- ORCID 0000-0001-6534-7169
- roxanne.bleijenbergh@ap.be

Van den Branden Laura[1,2] (PhD student)
- ORCID 0000-0001-6956-5593
- laura.vandenbranden@ap.be

van Gils Yannic[1,2] (Psychologist, PhD student)
- ORCID 0000-00001-7917-4684
- yannic.vangils@ap.be

Van de Craen Natacha[1] (MSc)
- natacha.vandecraen@ap.be

Prof. dr. Kuipers Yvonne J[1,2] (PhD)
- ORCID 0000-0002-4200-0522
- yvonne.fontein-kuipers@ap.be

1. Bachelor in Midwifery, Department of Health and Social Work, AP University Antwerp, Noorderplaats 2, 2000 Antwerp, Belgium
2. Centre for Research and Innovation in Care, University Antwerp, Universiteitsplein 1, 2610 Antwerp, Belgium

Corresponding author

Roxanne Bleijenbergh
Bachelor in Midwifery, Department of Health and Social Work, AP University Antwerp, Noorderplaats 2, 2000 Antwerp, Belgium
roxanne.bleijenbergh@ap.be

+32 4 78 61 33 98

Abstract

Objective

Becoming a mother is a process of transition that is subject to constant change and may last for over one year postpartum. Bonding is an important component of this transition to motherhood and can be measured with the Postpartum Bonding Questionnaire (PBQ). Most often, the PBQ is used among mothers up to 12 weeks postpartum. However, the transition to motherhood – and thus bonding – takes much longer and usually continues until 12 months postpartum.

Design

Validation study to test the PBQ for validity and reliability for use among mothers up to one year postpartum. Internal consistency and construct validity were established using Cronbach's Alpha, exploratory factor analysis (EFA) and subsequent confirmatory factor analysis (CFA).

Setting – mothers living in Flanders, Belgium

Participants

The sample was composed of 254 Flemish mothers who had given birth to healthy neonates up to one year earlier.

Findings

The EFA (principal component analysis) resulted in a uni-dimensional factor, "Impaired Bonding", consisting of 21 items. Four items were excluded because of a low factor load. This uni-dimensional version of the PBQ was checked with CFA, resulting in an acceptable model-of-fit: significant X2 (p < 0.001), CMIN/df = 2.61, CFI = 0.85, RMSEA = 0.08. The internal consistency of the 21-item version showed a Cronbach's alpha of 0.89.

Key conclusion

The 21-item version of the PBQ is a valid and reliable tool to identify bonding in a general population of Flemish mothers up to one year postpartum. Further research is of merit.

Implications for practice

After testing the Postpartum Bonding Questionnaire among a population of Flemish mothers up to one year postpartum, one dimension remained: "Impaired bonding", implying to play an important role during transition to motherhood. Measuring in this period emphasizes that in addition to monitoring the mother-infant bonding during pregnancy and early postpartum, it is of importance to extend the period of monitoring, that is, up to 12 months postpartum.

Keywords:

Introduction

Motherhood is recognized as a dynamic, life altering, and ongoing process of transition for its impact on the woman's life balance (Emmanuel et al., 2011; Fontein-Kuipers et al., 2019; George, 2011; Mercer, 2004; Rousseau et al., 2011). Transition theories assume that specific events such as motherhood or parenthood result in changed relationships, routines, assumptions, and roles (Meleis, 2010; Schlossberg et al., 1995). A substantial number of new mothers are struggling with the process of becoming and/or being a mother or parent, for finding an equilibrium in new or renewed motherhood can be a challenge (Emmanuel et al., 2011; Mercer, 2004; Milgrom et al., 2011). An important aspect of functional transition to motherhood is the bonding process between mother and child (Mercer, 2004; van Beeck et al., 2019).

Bonding refers to how the mother feels towards her child and the development of her feelings towards motherhood (Taylor et al., 2005; Wittkowski et al., 2007b). The bond between a mother and her child is the extent to which the mother offers her child protection, comfort and care. This bond is expected to be characterized by positive feelings and thoughts, warmth and affection (Taylor et al., 2005). Therefore, mother-infant bonding is a unidirectional mechanism from mother to child (Bicking Kinsey and Hupcey, 2013; de Cock et al., 2016). An imbalance in motherhood or experiencing problems in mastering the mother or parent role influences and/or is likely to disrupt mother-infant bonding (Aber et al., 2013; Mercer, 2004; Nelson, 2003; Rousseau et al., 2011; Rubin, 1967).

The association between postpartum bonding and emotional well-being cannot be ignored (Cuijlits et al., 2019; Garcia-Esteve et al., 2016; Milgrom et al., 2011; Tsivos et al., 2011; Wiguna and Ismail, 2019). The prevalence of impaired bonding between mother and child one year after childbirth varies between 5% and 11%, which may have a significant impact on maternal, family and public health (Tichelman et al., 2019). Several studies have reported that the mother-child bond has a major effect on children's long-term development. For example, a healthy mother bond supports the health and well-being of babies, effectuating in affirmative cognitive, neurobehavioral and socio-emotional development, physical and emotional health and interpersonal relationships of toddlers, children and teenagers. In contrast, impaired bonding negatively affects all these developmental aspects (Ainsworth and Bell, 1972; Tichelman et al., 2019; Wiguna and Ismail, 2019). The strategies to prevent impaired bonding and its consequences are needed. One of these strategies is measuring bonding during the postpartum period.

There are various instruments that measure bonding; MAI[1], MIAS[2], MABISC[3], MPAS[4], PBQ[5], MIBS[6], MIRFS[7], MORS-SR[8], of which only the PBQ, MIBS and MPAS have been translated into Dutch (van Bussel et al., 2010; Wittkowski et al., 2020). Wittkowski et al. (2020) investigated their psychometric properties and clinical utility. Only the "Postpartum Bonding Questionnaire" (PBQ) was found to demonstrate sufficient evidence for structural validity, internal consistency, and reliability, showing high quality of evidence. The PBQ was also the most frequently adapted tool which is indicative of its perceived relevance and popularity in this field. Brockington et al. (2001) developed the "Postpartum Bonding Questionnaire". This is a self-reporting questionnaire to measure the mother-infant bonding from the woman's perspective. The PBQ is a self-reporting questionnaire that is easy to administer. This measure is one of the most frequently and widely used questionnaires by obstetricians, midwives and other primary care providers as a screening tool to detect mothers at risk of impaired bonding (Kaneko and Honjo, 2014; van Bussel et al., 2010; Wittkowski et al., 2020). The PBQ is also regularly used in scientific research (Kaneko and Honjo, 2014; Ohashi et al., 2016; Reck et al., 2006; Suetsugu et al., 2015; van Bussel et al., 2009; Wittkowski et al., 2007a, b).

Most often, the PBQ has been administered among populations of mothers up to 12 weeks postpartum. However, the transition to motherhood – and thus bonding – takes much longer. The bonding process usually continues until 12 months, sometimes even to two years after birth (Bell, 2001; Delmore-Ko et al., 2000; Mercer, 2004; Miller, 2003).

As there is no instrument that measures mother-child bonding up to one year postpartum, it makes sense to validate the PBQ for a longer period than the questionnaire intends to measure.

To our knowledge, little is known about mother-child bonding among mothers in Flanders (the Dutch-speaking part of Belgium). In Flanders, the PBQ has once been used at 8-12 weeks and 20-25 weeks postpartum, showing a reliable and valid indication of the early emotional tie between women and their children (van Bussel et al., 2010).

Using the PBQ up to one year postpartum will not only provide insight into what goes on between mother and child but will also provide an indication to further explore the mother's emotional state of mind, as negative correlations were found between maternal postpartum emotional well-being and the total scores of the PBQ (van Bussel et al., 2009, 2010). To advocate its use among the general population of Flemish mothers, validation of the PBQ among a heterogeneous sample of mothers up to one year postpartum is necessary. In this study we investigated whether the PBQ is reliable and valid for use among a population of Flemish mothers up to one year postpartum.

---

[1] The Maternal Attachment Inventory
[2] The Mother Infant Attachment Scale
[3] The Mother and Baby Interaction Scale
[4] The Maternal Postnatal Attachment Scale
[5] The Postpartum Bonding Questionnaire
[6] The Mother- to-Infant Bonding Scale
[7] The Mother- to-Infant Relations and Feelings Scale
[8] The Mothers' Object Relations Scales-Short Form

Methods

Participants and sampling

We included Flemish women with a good comprehension of the Dutch language, 18 years or older, who had given birth at least six weeks but not longer than one year ago of a healthy baby. We excluded pregnant women, participants with children with congenital anomalies, severe pathology or life-threatening diseases requiring NICU, neonatology or pediatric admission. Participants who had recently given birth (up to six weeks postpartum) were excluded to avoid confounds with postpartum blues (Graham et al., 2002). We excluded mothers of an adopted child, as transition to motherhood in these cases is characterized by other unique emotions (Fontenot, 2007; Olsson et al., 2008).

We combined convenience and purposive sampling. Nurseries, primary schools, hospitals, playgrounds and breastfeeding cafés were informed about the study by e-mail and telephone and posters/flyers (including the link to study) were distributed to inform mothers about the study. Mothers were also directly approached in parks and indoor playgrounds and were invited to fill in the questionnaire, using tablets that were provided by the researchers. In addition, the announcement of the study and the invitation to participate, were distributed via social media platforms such as Facebook® and Instagram®, allowing snowballing. Data was collected from September 2018 to January 2019, using the Limesurvey® online survey tool.

The sample size was calculated using the subject-to-variable ratio of minimum 10:1 (Arrindell and J., 1985; Field, 2013; Kunce et al., 1975; Marascuilo and Levin, 1983; Nunnally, 1978; Velicer and Fava, 1998; Zhao, 2009). This calculation showed that we needed a sample of a minimum of 250 participants (10 x 25 PBQ items), to allow meaningful statistical inferences.

Instrument: Postpartum Bonding Questionnaire (PBQ)

The PBQ is designed to provide an indication of mother–infant relationship problems (Brockinton et al., 2001), containing 25 items, divided into four constructs: *"impaired bonding"*, *"rejecting & anger"*, *"anxiety about care"* and *"risk of abuse"*. We have used the Dutch version of the PBQ (originally in English), translated and validated by van Bussel et al. (2010). The items were scored on a 6-point Likert scale, ranging from 0 (always) to 5 (never). The cut-off value of impaired bonding is a total score of 26 or higher (46). The Dutch PBQ has shown good internal consistency on two separate occasions (8-12 weeks postpartum α=0.87, 20-25 weeks postpartum α=0.78) (van Bussel et al., 2010).

Analysis

We reversed the negative formulated questions (items 2-3-5-6-7-8-12-13-14-15-17-18-19-20-21-23-24). We calculated the total PBQ scores and identified the high scores using the cut-off value of ≥26. We used descriptive statistics. Normality of distribution was assessed using visual interpretation of histograms and Q-Q plots. The internal consistency of the unidimensional scale was calculated using Cronbach's alpha (α). A value of α≥0.70 was considered acceptable (Field, 2013). Exploratory factor analysis (EFA) was performed to validate the PBQ. The sample size was tested with the Kaiser-Meyer-Olkin (KMO) and the Barlett's test of sphericity. A KMO of ≥0.80 and a Barlett's test with a significance level of p<0.05 were considered acceptable (Field, 2013). EFA was performed using principal component analysis (PCA) with a varimax rotation. Unidimensional factor extraction was performed based on the Scree plot and Eigenvalues (Field, 2013). The factor loading of each item had to be at least 0.40 (Costello and Osborne, 2005; Field, 2013). Confirmatory factor analysis (CFA) was performed to determine the goodness-of-fit of the unidimensional factor obtained with the EFA (Köberich and Farin, 2015). The model-of-fit was determined based on the Chi-square (X^2), Root Mean Square Error of Approximation (RMSEA), Comparative Fit Index (CFI) and the Akaike Information Criterion (AIC). We regarded CMIN/*df*≤3,00, RMSEA≤0,08, CFI≥0,90 as an acceptable fit (Byrne, 2010; Schermelleh-Engell et al., 2003; van Geel and Verboon, 2015). The goodness-of-fit has been optimized by Modification Indices (MI). If the MI was >20.00, covariances were applied (van Geel and Verboon, 2015). All statistical analyses were performed in SPSS version 25.0 and AMOS version 26.0.

Ethics

The study was approved by the Ethical Advisory Committee on Social and Human Sciences of the University of Antwerp (EA SHW_17_40_03). The questionnaire included a privacy note explaining confidentiality, anonymity and data handling. Participation was voluntary and informed consent was obtained via box ticking before the questionnaire could be completed.

Findings

Participants

A total of 254 Flemish mothers were included in our analysis. There were no missing data. Most of our participants were born in Belgium, were in a relationship, had fairly high levels of education and 6% reported psychological problems. Sociodemographic details are presented in table 1.

Table 1: Sociodemographic details

	Mean	SD (±)	Range
Age mother (year)	29.67	3.87	21-43
	N	**%**	
Nullipara	143	56.30	
Multipara	111	44.70	
Ethnicity			
Belgian	238	93.70	
Western European	14	5.51	
Other	2	0.79	
Marital status			
Single/living apart together	16	6.30	
Living together	54	21.26	
Married	184	72.44	
Education level*			
Low	12	4.72	
Moderate	56	22.05	
High	122	48.03	
Academic	64	25.20	
Annual gross family income			
≤ 33700 euro per annum	55	21.65	
> 33700 per annum	135	53.15	
Unknown	64	25.20	
Current psychological problems			
No	238	93.70	
Yes	16	6.30	
Use of psychopharmaceuticals**	8/16	50.00	
Current physical problems			
No	209	82.28	
Yes	45	17.72	
PBQ scores			
PBQ scores above cut-off/ impaired bonding	13	5.12	

*Low: elementary, pre-vocational secondary education; Moderate: secondary education preparing for higher education; High: Bachelor equivalent; Academic: master and university level

** This is 8/16 or 50% of the population who answered 'yes' to the question of having psychological problems.

Validation PBQ

Construct validity

First, EFA was performed. The KMO was 0.86 and the Bartlett's test was statistically significant (p<0.001). PCA and varimax rotation showed six factors with an Eigenvalue of ≥1.00, with a total cumulative explanatory variance of 60.09% (table 2). The Eigenvalues are presented in figure 1, using a Scree plot. Despite the fact that six factors have an eigenvalue ≥1.00, the inflection of the curve is observed at factor 2, showing a unidimensional factor that predominates the factor loadings. The one factor that was extracted, accounted for 30,12% of the total variance. Table 3 shows the factor load for each item for this unidimensional factor "Impaired bonding". Only items with a factor load of ≥0.40 were included. After removing four items (Q17-Q18-Q20-Q24), a subsequent PCA was performed with the 21-item version of the PBQ. The unidimensional factor "Impaired Bonding" had an Eigenvalue of 7.22 and explained 34.37% of the total variance.

Table 2: Factor matrix of PBQ

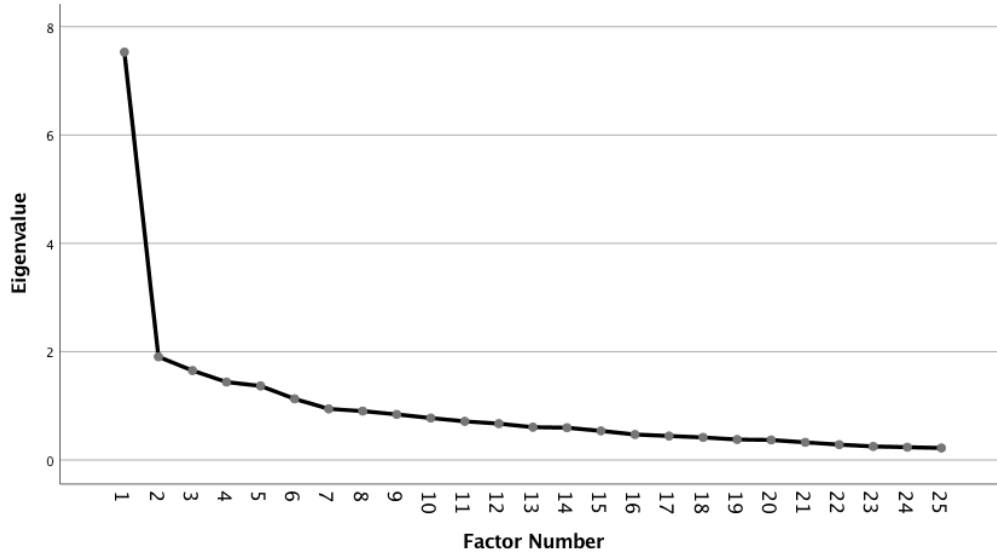|	Factor load					
	I	II	III	IV	V	VI
Eigenvalue (% of variance)	7.53 (30.12%)	1.91 (7.62%)	1.65 (6.60%)	1.44 (5.76%)	1.37 (5.47%)	1.13 (4.51%)
I feel close to my baby	**0.721**					
I wish the old days when I had no baby would come back	**0.610**					
I feel distant from my baby	**0.737**					
I love to cuddle my baby	**0.545**					
I regret having this baby	**0.658**					
The baby does not seem to be mine	**0.662**					
My baby winds me up	**0.614**					
My baby irritates me	**0.620**					
I feel happy when my baby smiles or laughs	**0.584**					
I love my baby to bits	**0.586**					
I enjoy playing with my baby	**0.619**					
My baby cries too much	0.460				**-0.600**	
I feel trapped as a mother	**0.616**					
I feel angry with my baby	**0.578**					
I resent my baby	**0.559**					
My baby is the most beautiful baby in the world	**0.608**					
I wish my baby would somehow go away	0.341			**-0.451**		
I have done harmful things to my baby	0.050					**0.497**
My baby makes me anxious	**0.498**					
I am afraid of my baby	0.378	**0.620**				
My baby annoys me	**0.450**					
I feel confident when changing my baby	**0.446**					
I feel the only solution is for someone else to look after my baby	**0.526**					
I feel like hurting my baby	0.350		**0.478**			
My baby is easily comforted	**0.427**					

Figure 1: Scree plot

Table 3: Factor load after extraction one factor "Impaired bonding"

N°	Item	Unidimensional factor "Impaired Bonding"
Q1	I feel close to my baby	0.721
Q2	I wish the old days when I had no baby would come back	0.610
Q3	I feel distant from my baby	0.737
Q4	I love to cuddle my baby	0.545
Q5	I regret having this baby	0.658
Q6	The baby does not seem to be mine	0.662
Q7	My baby winds me up	0.614
Q8	My baby irritates me	0.620
Q9	I feel happy when my baby smiles or laughs	0.584
Q10	I love my baby to bits	0.586
Q11	I enjoy playing with my baby	0.619
Q12	My baby cries too much	0.460
Q13	I feel trapped as a mother	0.616
Q14	I feel angry with my baby	0.578
Q15	I resent my baby	0.559
Q16	My baby is the most beautiful baby in the world	0.608
Q17	I wish my baby would somehow go away	0.341*
Q18	I have done harmful things to my baby	0.050*
Q19	My baby makes me anxious	0.498
Q20	I am afraid of my baby	0.378*
Q21	My baby annoys me	0.450
Q22	I feel confident when changing my baby	0.446
Q23	I feel the only solution is for someone else to look after my baby	0.526
Q24	I feel like hurting my baby	0.350*
Q25	My baby is easily comforted	0.427

Eigenvalue is 7.22, accounting for 34.37% of the total variance

* Items with a factor load of <0.40 were excluded in the 21-item version of the PBQ

Second, CFA of the unidimensional 21-item version of the PBQ showed a model-of-fit representing a significant X^2(p<0.001), CMIN/*df*=3.92, CFI=0.72, RMSEA=0.11 and AIC=824.07. Modification indices showed covariance between the error terms. After adjusting this covariance, an improved acceptable model-of-fit was obtained: X^2(p<0.001), CMIN/*df*=2.61, CFI=0.85, RMSEA=0.08 and AIC=73.29 (figure 2).
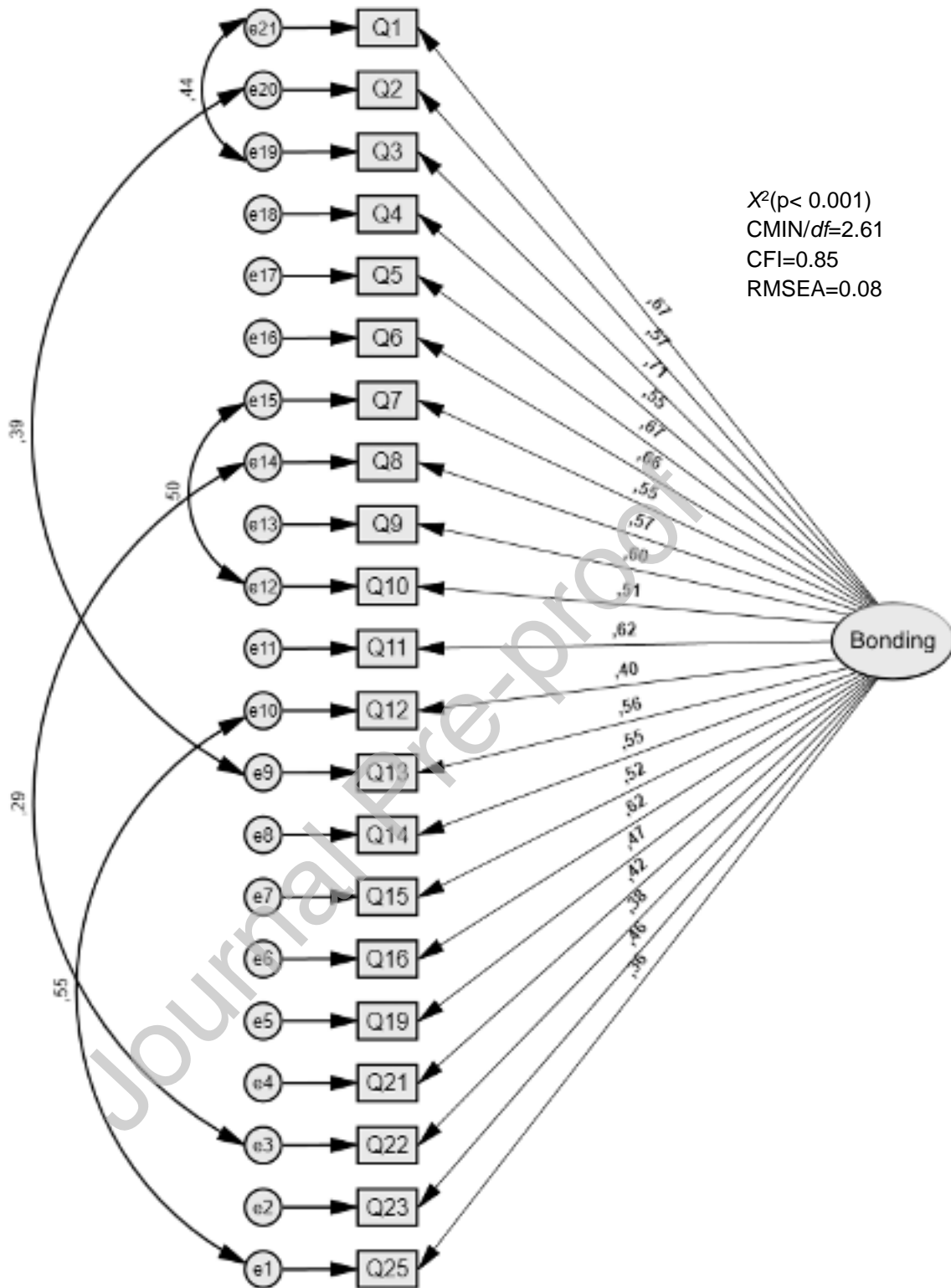
Figure 2: Model-of-fit using CFA

Internal consistency

The internal consistency for the original 25-item version was α=0.886 and for the original four factors: "impaired bonding" α=0.822; "rejecting and anger" α=0.757; "anxiety about care" α=0.464; "risk of abuse" α=0.363. The internal consistency for the original 25-item version was α=0.886. Our proposed one-factor model, consisted of 21 items, showed a good internal consistency (α=0.887).

Discussion

The current study represents the first Flemish investigation of mother–infant bonding based on a sample of postpartum women up to 12 months postpartum. The aim of this study was to examine the Flemish version of the PBQ. Our abbreviated 21-item PBQ showed acceptable validity and reliability in a population of Flemish mothers up to one year postpartum.

In our study one major factor remained: impaired bonding. This is not consistent with previous research among postpartum women where one, three or four factors were found (Kaneko and Honjo, 2014; Ohashi et al., 2016; Reck et al., 2006; Suetsugu et al., 2015; Wittkowski et al., 2010). A possible explanation for the differences in structure between our study and other studies might be the population characteristics. A number of studies included mothers with psychiatric morbidity (Brockinton et al., 2001; Wittkowski et al., 2007a), in contrast to this study, where only few women report to experiencing psychological problems.

In our study, only one factor "*impaired bonding*" remained while the other dimensions (*"impaired bonding"*, *"rejecting & angel"*, *"anxiety about care"* and *"risk of abuse")* disappeared as constructs of bonding. The other dimensions of the original PBQ are more present in the early postpartum and seem more characteristic for the period of four to 12 weeks postpartum (Brockington et al., 2001). This suggests that feelings of anger, hostility and rejection become less prevalent when the process of (renewed) motherhood progresses during the first year after birth (van Bussel et al., 2009). This can be explained by the fact that emotions of anger and hostility are often associated with the physical condition and pain after birth (Graham et al., 2002). Moreover, at six or seven months of age, infants make active attempts to maintain contact with their parent and at one year of age the parent is a child's base to turn to when it is hurt or sad - this mother-infant interaction are likely to positively influence maternal perceptions of bonding (Schroeder and Gordon, 2002; Waters and Cummings, 2000).

Mother-to-infant bonding is a continuous process that develops during pregnancy and can continue up to 12 months after birth for the process to be completed (Bell, 2001; Delmore-Ko et al., 2000; Mercer, 2004; Miller, 2003). An optimal bond between mother and child is essential for healthy development of the child.

We assumed an association between bonding and maternal emotional well-being during the first year postpartum (Cuijlits et al., 2019; Garcia-Esteve et al., 2016; Milgrom et al., 2011; van Bussel et al., 2009, 2010). In our study, 6% of the women self-reported psychological problems, considerably lower than the Flemish average of 20% (Kind & Gezin, 2018). Our findings suggest a possible underreport of reduced emotional well-being and thus impaired bonding. Because we based psychological problems on a single item, for future research, it is recommended to replace this self-report single item by a validated psychometric measure to establish more valid answers.

Previous studies have shown that mother-to-infant bonding is a process that starts during pregnancy and continues after birth (Bicking Kinsey and Hupcey, 2013; de Cock et al., 2016; O'Higgins et al., 2013; Rossen et al., 2019; Tichelman et al., 2019), underscoring the importance of fostering a healthy mother–infant bond as part of perinatal care supported by maternity healthcare professionals (Tichelman et al., 2019). Measuring in this period emphasizes that in addition to monitoring the mother-infant bonding during pregnancy and early postpartum, it is of importance to extend the period of monitoring, that is, up to 12 months postpartum. It would therefore be of interest to administer the PBQ in a longitudinal study using the 25-item PBQ early postpartum and, the 21-item PBQ at one year postpartum. This would provide the opportunity to better understand the process and progress of bonding within the timeframe of transition to motherhood, using the same construct.

A weak point of this study is the use of the word "baby" in the PBQ. In a population of mothers with children up to one year old, this could possibly result in questionnaire bias. By replacing the word "baby" with "child", respondents might better recognize themselves in the PBQ items at a later stage during the postpartum period and a better model-of-fit in further research may be obtained.

We are aware that our sampling techniques might have introduced sampling and selection bias. The sample consists mainly of highly educated women, in paid employment and in a relationship. Although these characteristics reflect the general Flemish female population, our sample contains fewer people with a migration background and very likely underrepresented women with emotional health and well-being problems (Kind & Gezin, 2018; Van den Branden, 2019). Our sample contained a rather equal division of primi and multiparous women. It is known that multiparous women are more likely to report low feelings of bonding compared to women who have given birth to their first child (Cuijlits et al., 2019). Future research should therefore distinguish between primiparous and multiparous women, to confirm possible differences in bonding between first-time mothers and those experiencing renewed motherhood. It is possible this is caused by the recruiting participants in social spaces such as parks, playgrounds and cafés, given that low mental health affects social capacity (Posmontier and Waite, 2011), possibly resulting in the overrepresentation of emotional-well women. Because we also used social media as a recruiting strategy, it is possible we did not reach all eligible women. Future studies should also include a more heterogeneous population with including women with a migration background, lower levels of education and income, and women with reduced emotional well-being.

Unlike the 25-item PBQ, the 21-item version of the PBQ has no validated cut-off values. In order to be able to use the scale as a successful screening tool for disturbed bonding in the future, further research should be carried out to define validated cut-off values for the 21-item version.

Limitations

The CFA showed that our model fits only moderately well with the current data. This may be due to our relatively small sample size and the use of a healthy population of mothers, that is, a sample of mothers with a low percentage of self-reported psychological problems, while the PBQ is originally developed and validated among women with psychiatric pathology (Brockington et al., 2006). Brockington (2011) claims that a sample of more than 1000 would be needed for validation, due to the infrequency of bonding disorders among mentally healthy women. Future quantitative research with a larger sample size would be of merit.

We have removed four items with a factor load of <0.40. This may explain the low cumulative explanatory power of our model, as especially items heavy with meaning were removed. We have thought about this very carefully but given our general population we have deliberately chosen to remove the four items. These items are more appropriate for a psychiatric population with possible impaired bonding (Brockington et al., 2006). We recommend using the 24-item version in a psychiatric population with suspected impaired bonding and to use the 21-item version in a general population of women up to one year postpartum. For example: Q18 "I have done harmful things to my baby", which had a very low factor load of 0.050, since 98.40% gave the same answer of "never". We do not know if or how these thought processes occurred among our participants. Future qualitative research would be of merit to better understand the interpretation of bonding throughout the process of transition to motherhood and represented by the PBQ in particular.

In addition, a possible response bias should be taken into account, with participants filling in socially desirable answers, as it is in general not socially accepted to not-to-bond with your child or have negative feelings towards your child (Reck et al., 2006). This could mean that our results are an underrepresentation of impaired bonding in the first-year postpartum. In an earlier study in a population of women who were 20-25 weeks postpartum, scores on the PBQ were correlated with scores on the Social Desirability Scale, showing a weak but significant correlation between these scores (van Bussel et al., 2010).

Conflict of Interest

The authors report no conflict of interest.

Ethical Approval

The study was approved by the Ethical Advisory Committee on Social and Human Sciences of the University of Antwerp (EA SHW_17_40_03).

Funding Sources

CRediT author statement

Bleijenbergh Roxanne: Conceptualization, Methodology, Formal analysis, Investigation, Writing – Original Draft, Visualization

Van den Branden Laura: Investigation, Writing – Review & Editing

van Gils Yannic: Resources, Writing – Review & Editing

Van de Craen Natacha: Investigation, Writing – Review & Editing

Prof. dr. Kuipers Yvonne J: Conceptualization, Methodology, Investigation, Writing – Original Draft, Writing – Review & Editing, Supervision

Acknowledgments

No acknowledgments are stated.

Declaration of interests

☒ The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Conclusion

After testing the Postpartum Bonding Questionnaire among a population of Flemish mothers up to one year postpartum, one dimension remained: "Impaired bonding", implying to play an important role during transition to motherhood out with the early postpartum period. The 21-item version of the PBQ is a valid and reliable tool to identify bonding in a general population of Flemish mothers up to one year postpartum opposed to the 24-item version. Further research is of merit.

Declaration of interest statement

The authors report no conflict of interest.

References

Aber, C., Weiss, M., Fawcett, J., 2013. Contemporary women's adaptation to motherhood: the first 3 to 6 weeks postpartum. Nursing science quarterly 26(4), 344-351. 10.1177/0894318413500345.

Ainsworth, M.D.S., Bell, S.M., 1972. Mother-infant interaction and the development of competence. Academic Press, New York.

Arrindell, W.A., J., v.d.E., 1985. An empirical test of the utility of the observations-to-variables ratio in factor and components analysis. Applied Psychological Measurement 9, 165-178.

Bell, D.C., 2001. Evolution of Parental Caregiving. Personality and Social Psychology Review 5(3), 216-229. 10.1207/s15327957pspr0503_3.

Bicking Kinsey, C., Hupcey, J.E., 2013. State of the science of maternal-infant bonding: a principle-based concept analysis. Midwifery 29(12), 1314-1320. 10.1016/j.midw.2012.12.019.

Brockington, I., 2011. Maternal rejection of the young child: present status of the clinical syndrome. Psychopathology 44(5), 329-336. 10.1159/000325058.

Brockington, I.F., Fraser, C., Wilson, D., 2006. The Postpartum Bonding Questionnaire: a validation. Archives of women's mental health 9(5), 233-242. 10.1007/s00737-006-0132-1.

Brockington, I.F., Oates, J., George, S., Turner, D., Vostanis, P., Sullivan, M., Loh, C., Murdoch, C., 2001. A Screening Questionnaire for mother-infant bonding disorders. Archives of women's mental health 3(4), 133-140. 10.1007/s007370170010.

Brockinton, I.F., Oates, J., George, S., Turner, D., Vostanis, P., Sullivan, M., Loh, C., Murdoch, C., 2001. A Screening Questionnaire for mother-infant bonding disorders. Archives of women's mental health 3, 133-140.

Byrne, B., 2010. tructural equation modeling with AMOS: basic concepts, applications, and programming. Routledge/Taylor & Francis Group, New York.

Costello, A.B., Osborne, J.W., 2005. Best practices in exploratory factor analysis: Four recommendations for getting the most from your analysis. Practical Assessment, Research & Evaluation 10(7).

Cuijlits, I., van de Wetering, A.P., Endendijk, J.J., van Baar, A.L., Potharst, E.S., Pop, V.J.M., 2019. Risk and protective factors for pre- and postnatal bonding. Infant mental health journal 40(6), 768-785. 10.1002/imhj.21811.

de Cock, E.S., Henrichs, J., Vreeswijk, C.M., Maas, A.J., Rijk, C.H., van Bakel, H.J., 2016. Continuous feelings of love? The parental bond from pregnancy to toddlerhood. Journal of family psychology : JFP : journal of the Division of Family Psychology of the American Psychological Association (Division 43) 30(1), 125-134. 10.1037/fam0000138.

Delmore-Ko, P., Pancer, S.M., Hunsberger, B., Pratt, M., 2000. Becoming a parent: the relation between prenatal expectations and postnatal experience. Journal of family psychology : JFP : journal of the Division of Family Psychology of the American Psychological Association (Division 43) 14(4), 625-640. 10.1037//0893-3200.14.4.625.

Emmanuel, E., Creedy, D., St John, W., Brown, C., 2011. Maternal role development: the impact of maternal distress and social support following childbirth. Midwifery 27(2), 265-272.

Field, A., 2013. Discovering statistics using SPSS SAGE Publications Ltd, Londen.

Fontein-Kuipers, Y., Jomeen, J., Dilles, T., Van Rompaey, B., 2019. The General Health Questionnaire as a measure of emotional wellbeing in pregnant women. Universiteit van Antwerpen, Antwerpen.

Fontenot, H.B., 2007. Transition and Adaptation to Adoptive Motherhood. the Association of Women's Health, Obstetric and Neonatal Nurses 36(2), 175-182.

Garcia-Esteve, L., Torres, A., Lasheras, G., Palacios-Hernández, B., Farré-Sender, B., Subirà, S., Valdés, M., Brockington, I.F., 2016. Assessment of psychometric properties of the Postpartum Bonding Questionnaire (PBQ) in Spanish mothers. Archives of women's mental health 19(2), 385-394. 10.1007/s00737-015-0589-x.

George, J., 2011. Nursing Theories. The base for professional nursing practice. Pearson, New Yersey.

Graham, J.E., Lobel, M., DeLuca, R.A., 2002. Anger after childbirth: An overlooked reaction to postpartum stressors. Psychology of Women Quarterly 26(3), 222-233.

Kaneko, H., Honjo, S., 2014. The Psychometric Properties and Factor Structure of the Postpartum Bonding Questionnaire in Japanese Mothers. Psychology 5, 1135-1142. http://dx.doi.org/10.4236/psych.2014.59126.

Kind & Gezin, 2018. World Maternal Mental Health Day op 2 mei. https://www.kindengezin.be/nieuws-en-actualiteit/2018/20180430-World-Maternal-Mental-Health-Day-op-2mei.jsp. https://www.kindengezin.be/nieuws-en-actualiteit/2018/20180430-World-Maternal-Mental-Health-Day-op-2mei.jsp.

Köberich, S., Farin, E., 2015. A systematic review of instruments measuring patients' perceptions of patient-centred nursing care. . Nursing Inquiry 22(2), 106-120.

Kunce, J.T., Cook, W.D., Miller, D.E., 1975. Random variables and correlational overkill. . Educational and Psychological Measurement 35, 529-534.

Marascuilo, A., Levin, J.R., 1983. Multivariate statistics in the social sciences. Brooks/Cole, Monterey, CA.

Meleis, A.I., 2010. Transitions Theory. Middle range and situation spefic theories in nursing research and practice. Springer Publishing Company, New York.

Mercer, R., 2004. Becoming a mother versus maternal role attainment. Journal of Nursing Scholarship 36(3), 226-232.

Milgrom, J., Schembri, C., Ericksen, J., Ross, J., Gemill, A.W., 2011. Towards parenthood: an antenatal intervention to reduce depression, anxiety and parenting difficulties. Journal of affective disorders 130, 85-94.

Miller, T., 2003. Shifting perceptions of expert knowledge: Transition to motherhood. Human Fertility 6(3), 142-146.

Nelson, A.M., 2003. Transition to motherhood. Journal of obstetric, gynecologic, and neonatal nursing : JOGNN 32(4), 465-477. 10.1177/0884217503255199.

Nunnally, J.C., 1978. Psychometric theory (2nd Ed.). McGraw-Hill, New York.

O'Higgins, M., Roberts, I.S., Glover, V., Taylor, A., 2013. Mother-child bonding at 1 year; associations with symptoms of postnatal depression and bonding in the first few weeks. Archives of women's mental health 16(5), 381-389. 10.1007/s00737-013-0354-y.

Ohashi, Y., Kitamura, T., Sakanashi, K., Tanaka, T., 2016. Postpartum Bonding Disorder: Factor Structure, Validity, Reliability and a Model Comparison of the Postnatal Bonding Questionnaire in Japanese Mothers of Infants. Healthcare 4(50). 10.3390/healthcare4030050.

Olsson, M.B., Larsman, P., Hwang, P.C., 2008. Relationship Among Risk, Sense of Coherence, and Well-being in Parents of Children with and Without Intellectual Disabilities. Journal of Policy and Practice in Intellectual Disabilities 5(4), 227-236.

Posmontier, B., Waite, R., 2011. Social energy exchange theory for postpartum depression. Journal of transcultural nursing : official journal of the Transcultural Nursing Society 22(1), 15-21. 10.1177/1043659610387156.

Reck, C., Klier, C.M., Pabst, K., Stehle, E., Steffenelli, U., Struben, K., Backenstrass, M., 2006. The German version of the Postpartum Bonding Instrument: psychometric properties and association with postpartum depression. Archives of women's mental health 9(5), 265-271. 10.1007/s00737-006-0144-x.

Rossen, L., Mattick, R.P., Wilson, J., Clare, P.J., Burns, L., Allsop, S., Elliott, E.J., Jacobs, S., Olsson, C.A., Hutchinson, D., 2019. Mother-Infant Bonding and Emotional Availability at 12-Months of Age: The Role of Early Postnatal Bonding, Maternal Substance Use and Mental Health. Maternal and child health journal 23(12), 1686-1698. 10.1007/s10995-019-02809-1.

Rousseau, S., van Leeuwen, K., Hoppenvrouwers, K., Desoete, A., Wiersema, J., Grietens, H., 2011. Hoe beleven ouders het ouderschap en welke zijn hun eerste vragen? . Steunpunt welzijn, volksgezondheid en gezin, Leuven.

Rubin, R., 1967. Attainment of the maternal role: part 1. Processes. Nurs Res 16(3), 237-245.

Schermelleh-Engell, K., Moosbrugger, H., Müller, H., 2003. Evaluating the fit of structural equation models: Tests of significance and descriptive goodness-of-fit measures. Method. Psychol. Res. Online 8, 23-74.

Schlossberg, N.K., Waters, E.B., Goodman, J., 1995. Counseling adults in transition: Linking practice with theory (2nd ed.). Spring, New York.

Schroeder, C.S., Gordon, B.N., 2002. Assessment and treatment of childhood problems: A clinician's guide. Guilford Press, New York.

Suetsugu, Y., Honjo, S., Ikeda, M., Kamibeppu, K., 2015. The Japanese version of the Postpartum Bonding Questionnaire: Examination of the reliability, validity, and scale structure. Journal of psychosomatic research 79(1), 55-61. 10.1016/j.jpsychores.2015.02.008.

Taylor, A., Atkins, R., Kumar, R., Adams, D., Glover, V., 2005. A new Mother-to-Infant Bonding Scale: links with early maternal mood. Archives of women's mental health 8(1), 45-51. 10.1007/s00737-005-0074-z.

Tichelman, E., Westerneng, M., Witteveen, A., van Baar, A., van der Horst, H., de Jonge, A., Berger, M., Schellevis, F., Burgh, H., Peters, L., 2019. Correlates of prenatal and postnatal mother-to-infant bonding quality: A systematic review. PLOS One 14(9).

Tsivos, Z., Wittkowski, A., Calam, R., Sanders, M.R., 2011. Postnatal depression – the impact for women and children and interventions to enhance the mother-infant relationship. Perspective 11, 16-20.

van Beeck, E., Fontein-Kuipers, Y., Baaima, I., Schuiteman-van der Hoek, S., 2019. Young Dutch Millenial women's perspective towards motherhood. Global Women's Health 2(1), 42-47.

van Bussel, J.C., Spitz, B., Demyttenaere, K., 2009. Anxiety in pregnant and postpartum women. An exploratory study of the role of maternal orientations. Journal of affective disorders 114(1-3), 232-242. 10.1016/j.jad.2008.07.018.

van Bussel, J.C., Spitz, B., Demyttenaere, K., 2010. Three self-report questionnaires of the early mother-to-infant bond: reliability and validity of the Dutch version of the MPAS, PBQ and MIBS. Archives of women's mental health 13(5), 373-384. 10.1007/s00737-009-0140-z.

Van den Branden, L., 2019. (B)roze wolk? Cross-sectioneel onderzoek naar het emotioneel welzijn van Vlaamse moeders. University of Antwerp, Antwerp.

van Geel, R., Verboon, P., 2015. Confirmatieve Factor analyse met SPSS en AMOS. Open Universiteit, Nederland.

Velicer, W.F., Fava, J.L., 1998. Effects of variable and subject sampling on factor pattern recovery. 3, 231-251.

Waters, E., Cummings, E.M., 2000. A secure base from which to explore close relationships. Child development 71(1), 164-172. 10.1111/1467-8624.00130.

Wiguna, T., Ismail, R.I., 2019. Validation study of Indonesian mother-infant bonding scale. Asian journal of psychiatry 43, 60-64. 10.1016/j.ajp.2019.05.003.

Wittkowski, A., Vatter, S., Muhinyi, A., Garrett, C., Henderson, M., 2020. Measuring bonding or attachment in the parent-infant-relationship: A systematic review of parent-report assessment measures, their psychometric properties and clinical utility. Clin Psychol Rev 82, 101906. 10.1016/j.cpr.2020.101906.

Wittkowski, A., Wieck, A., Mann, S., 2007a. An evaluation of two bonding questionnaires: a comparison of the Mother-to-Infant Bonding Scale with the Postpartum Bonding Questionnaire in a sample of primiparous mothers. Arch Womens Ment Health 10, 171-175. 10.1007/s00737-007-0191-y.

Wittkowski, A., Wieck, A., Mann, S., 2007b. An evaluation of two bonding questionnaires: a comparison of the Mother-to-Infant Bonding Scale with the Postpartum Bonding Questionnaire in a sample of primiparous mothers. Archives of women's mental health 10(4), 171-175. 10.1007/s00737-007-0191-y.

Wittkowski, A., Williams, J., Wieck, A., 2010. An Examination of the Psychometric Properties and Factor Structure of the Post-Partum Bonding Questionnaire in a Clinical Inpatient Sample. British Journal of Clinical Psychology 49, 163-172.

Zhao, N., 2009. The minimum sample size in factor analysis. https://www.encorewiki.org/display/~nzhao/The+Minimum+Sample+Size+in+Factor+Analysis. https://www.encorewiki.org/display/~nzhao/The+Minimum+Sample+Size+in+Factor+Analysis.