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## **Validating an Observational Measure of Prenatal Emotional Availability among Mothers with Depressive Symptoms**

**Salo, Saara J.; Flykt, Marjo; Isosävi, Sanna; Punamäki, Raija-Leena; Kalland, Mirjam ...**

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4 **Validating an Observational Measure of Prenatal**  
5 **Emotional Availability among Mothers with**  
6 **Depressive Symptoms**  
7

8 Saara J. Salo, Marjo Flykt, Sanna Isosävi, Raija-Leena Punamäki,  
9 Mirjam Kalland, Zeynep Biringen, and Marjukka Pajulo

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11  
12 Abstract: This study describes a new observational measure for assessing mother's  
13 prenatal emotional availability in relationship towards her unborn baby (Pre-EA).  
14 Concurrent associations between a mother's Pre-EA, her adult attachment style  
15 (AAD), and prenatal maternal reflective functioning (RF) (Pregnancy Interview)  
16 were assessed among 45 pregnant women (gw 22-31) screened positive for  
17 depressive symptoms in a community-based sample. Pre-EA was measured from  
18 videotaped, semi-structured maternal-fetal interaction assessment procedure  
19 (MIM). The two Pre-EA dimensions, sensitivity and non-hostility, were related to  
20 adult secure-autonomous attachment style and higher prenatal maternal RF. The  
21 results show that the observed emotional availability may be assessed already  
22 during pregnancy.

23  
24 Keywords: emotional availability, pregnancy, adult attachment, reflective  
25 functioning

26  
27 Prenatal attachment refers to emotions, perceptions, and behaviors that  
28 a mother develops towards her baby during the pregnancy. This emotional  
29 bond is critical for her postpartum relationship with the child as well as  
30 for the child's later social, emotional, and cognitive development (Alhusen,  
31 2008; Rossen et al., 2016). Maternal mental health problems during  
32 pregnancy may disrupt the development of the prenatal attachment  
33 (Alhusen, Gross, Hayat, Rose, & Sharps, 2012; Goecke et al., 2012).

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Saara J. Salo, Ph.D, Helsinki University, Finland ([saara.z.salo@helsinki.fi](mailto:saara.z.salo@helsinki.fi)), Marjo Flykt, Ph.D, Tampere University, Finland ([marjo.flykt@tuni.fi](mailto:marjo.flykt@tuni.fi)), Sanna Isosävi, Post-Graduate Student, Tampere University, Finland ([sanna.isosavi@tuni.fi](mailto:sanna.isosavi@tuni.fi)), Raija-Leena Punamäki, Professor, Tampere University, Finland ([raija-leena.punamaki-gitai@tuni.fi](mailto:raija-leena.punamaki-gitai@tuni.fi)), Mirjam Kalland, Professor, Helsinki University, Finland ([mirjam.kalland@helsinki.fi](mailto:mirjam.kalland@helsinki.fi)), Zeynep Biringen, Professor, Colorado State University, US ([Zeynep.Biringen@colostate.edu](mailto:Zeynep.Biringen@colostate.edu)), Marjukka Pajulo, Docent, Turku University, Finland ([marjukka.pajulo@utu.fi](mailto:marjukka.pajulo@utu.fi)). Correspondence concerning this article should be addressed: to Saara J. Salo, Helsinki University, Po. Box 9, Siltavuorenpenger 5 A, 00014 Helsinki University, Finland. E-mail: [saara.z.salo@helsinki.fi](mailto:saara.z.salo@helsinki.fi)

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34 Prenatal depressive symptoms have been shown to predict postpartum  
35 depression and to be associated with fetal growth difficulties, low birth  
36 weight, and socio-emotional, behavioral, and cognitive problems later in  
37 childhood and adolescence, often through disruptions in the early  
38 emotional parent-child relationship (Field, 2010; 2011). However, we still  
39 know relatively little about the direct prenatal emotional mechanisms  
40 underlying the formation of this postnatal relationship. Clinically, there  
41 is a need for preventive assessment and intervention tools to support the  
42 emotional side of parenting already during pregnancy. These tools are  
43 especially vital in helping expectant mothers who struggle with well-  
44 known parenting risks, such as prenatal depressive symptoms. This study  
45 aims at describing a new prenatal assessment and clinical tool, Prenatal  
46 Emotional Availability observational measure (Pre-EA), and validating it  
47 with two pre-existing gold-standard prenatal parenting measures  
48 relevant for postpartum parenting and child developmental outcomes:  
49 parental attachment and reflective functioning.

50 Emotional Availability perspective (EA) suggests that at the core of a  
51 healthy mother-child relationship is not only behavioral, but also  
52 *emotional* responsiveness to the child's interactive cues (Biringen,  
53 Derscheid, Vliegen, Closson, & Easterbrooks, 2014; Biringen &  
54 Easterbrooks, 2012). Whereas traditional attachment theory focuses  
55 mostly on the mother's ability to provide "safe haven" during infant  
56 distress, EA framework provides a broader emphasis on parental genuine,  
57 positive affect as well as capability of withholding and regulating negative  
58 emotions and interactive behaviors towards the child (Saunders, Kraus,  
59 Barone & Biringen, 2015). Maternal EA is a multidimensional construct,  
60 comprising dimensions of maternal *sensitivity*, i.e., appropriate affective  
61 and behavioral responsiveness towards the child; *structuring*, i.e. her  
62 ability to guide, teach, and set limits while remaining in contact; *non-*  
63 *hostility*, i.e., good regulation of negative affect and *non-intrusiveness*, i.e.,  
64 ability to follow child's lead and to refrain from interfering behavior  
65 towards him. From the child's side, too, dimensions of EA can be observed:  
66 *responsiveness*, i.e., appropriate affective responding towards the adult,  
67 and *involvement* i.e., actively seeking emotional contact with the adult.  
68 Maternal EA is positively linked with infant attachment security, and  
69 with various indicators of later socio-emotional well-being of the child  
70 (Biringen & Easterbrooks, 2012; Biringen et al., 2014). Furthermore,  
71 mothers with postpartum depression are known to show low EA in  
72 interactions with their children (Easterbrooks, Biesecker, & Lyons-Ruth,  
73 2000; van Doesum, Hossman, Riksen-Walraven, & Hoofsnaegels, 2007),  
74 highlighting the need to focus on the emotional qualities of parent-child  
75 relationship in interventions targeting depressed mothers. However, so  
76 far, such work has concentrated only on the postnatal period and little is  
77 known about the mother's emotional availability towards the baby during  
78 pregnancy.

79 Mother's postnatal EA towards the child can be measured with a  
80 video-based observational method, Emotional Availability Scales  
81 (Biringen, 2008), which is one of the most widely used observational  
82 assessments of parent-child relationship world-wide (Biringen et al.,  
83 2014). Thus, all aforementioned six EA dimensions are scored ranging  
84 from low to high measuring the EA dimensions on the basis of mother-  
85 child interaction observed either in free-play or in semi-structured  
86 situation usually lasting over 15 minutes (Biringen, 2008). Video-based  
87 observational assessments are generally considered gold-standard  
88 parenting measures, as self-reports may be more susceptible to bias such  
89 as social desirability or low reflective capacity (Lotzin et al., 2015).  
90 Nonetheless, assessment of *prenatal attachment* has mainly focused on  
91 maternal subjective self-reports, such as maternal fetal-attachment  
92 (MFA) (Brandon, Pitts, Denton, Stringer, & Evans, 2009).

93 MFA self-reports comprise thoughts, behaviors, and emotions towards  
94 the future baby (Alhusen, 2008; Condon & Corkindale, 1997; Cranley,  
95 1981; Muller, 1990). Findings on its associations with parenting have been  
96 somewhat inconsistent. On the one hand, high MFA has been linked with  
97 secure maternal adult attachment style (Alhusen, Hayat, & Gross, 2013),  
98 higher self-reported postnatal bonding (de Cock, 2017; Rossen et al.,  
99 2016), higher self-reported EA at 18 months (Punamäki, Isosavi, Quota,  
100 Kuittinen, & Diab, 2017), and more sensitive parent-infant interaction  
101 (Alhusen, 2008). On the other hand, high MFA did not predict either the  
102 mother's observed interactive behavior with her infant (Dau, Callinan, &  
103 Smith, 2019; Thun-Hohenstein, Wienerroither, Schreuer, Seim, &  
104 Wienerroither, 2008), nor maternal sensitivity to infant communication  
105 nor mind-mindedness capacity (Arnott & Meins, 2007; Walsh, 2010).  
106 Furthermore, there are some indications that highly positive MFA may  
107 imply more the felt importance of the fetal relationship rather than its  
108 security (i.e., actual emotionally signaled availability), at least among  
109 high-risk mothers (see also Walsh, 2010). For example, Lewis (2006) found  
110 that mothers whose previous children were taken into foster care, had  
111 stronger MFA in their next pregnancy as compared to mothers who had  
112 not previously lost custody of their children.

113 Taken together, developing direct observational measures for  
114 prenatal maternal-fetal relationship seems warranted, to allow  
115 delineating the actual, emotionally and behaviorally observable  
116 precursors of the affiliative relationship between the mother and child  
117 (Brandon et al., 2009). As a response, this study presents an alternative  
118 conceptualization and assessment of the prenatal relationship: The  
119 prenatal EA perspective, with focus on the observable maternal emotional  
120 and behavioral indicators of prenatal attachment with the baby. In order

121 to validate the novel approach, we examine the associations of prenatal  
 122 EA with maternal adult attachment and reflective functioning, as both  
 123 are core contributors of maternal-fetal and mother-infant relationship.

124 One of the most significant factors affecting the mother's relationship  
 125 with the baby during pregnancy are her own attachment representations.  
 126 These internal representations of the self and significant others in close  
 127 relationships are thought to guide maternal perceptions, interpretations,  
 128 emotions, and behavior in close relationships, including with the infant  
 129 (Main, Kaplan, & Cassidy, 1985; Stroufe & Fleeson, 1986). The Adult  
 130 Attachment Interview (AAI) (George, Kaplan, & Main, 1985) is considered  
 131 the "gold

132 Standard" of assessing attachment along the lines of coherence,  
 133 accessibility to emotions and memories, and balance vs. biases of state of  
 134 mind. Secure-autonomous adult attachment is reflected in the ability to  
 135 provide coherent (i.e., internally consistent and not emotionally restricted  
 136 or overwrought) narratives of one's own childhood experiences. Insecurely  
 137 attached adults instead show inconsistent and incoherent narratives in  
 138 AAI, including both idealization and difficulties in remembering, typical  
 139 for insecure-dismissing attachment, or actively angry or vague, difficult-  
 140 to-follow discourse, typical for insecure-preoccupied attachment. The  
 141 third insecure adult attachment pattern, insecure-unresolved  
 142 attachment, represents a local collapse in narrative coherence specifically  
 143 when describing traumatic life events such as death or abuse, and has  
 144 been linked with failed trauma processing (Bailey, Moran, & Pederson,  
 145 2007).

146 Parents with secure-autonomous attachment representations are  
 147 more likely to be sensitive and supportive during interactions with their  
 148 own children than individuals with insecure attachment (see for a meta-  
 149 analysis, van IJzendoorn, 1995), and they are less likely to show  
 150 depressive symptoms than insecurely attached individuals (Bakermans-  
 151 Kranenburg & van IJzendoorn, 2009; Lyons-Ruth, Lubchik, Wolfe, &  
 152 Bronfman, 2002; Smith-Nielsen et al., 2015). Mother's secure-autonomous  
 153 attachment may also buffer against parenting problems among those  
 154 mothers who show depressive symptoms (Flykt, Kanninen, Sinkkonen, &  
 155 Punamäki, 2010; McMahon, Barnett, Kowalenko, & Tennant, 2006).  
 156 Secure-autonomous maternal attachment is also associated with higher  
 157 maternal postpartum EA (Biringen et al., 2014) and with higher self-rated  
 158 MFA during pregnancy (Alhusen et al., 2013). In this study, we examine  
 159 whether maternal secure-autonomous attachment is similarly linked with  
 160 our new measure of mother's prenatal emotional availability.

## 162 **Mother's prenatal reflective functioning**

163  
 164 A body of evidence also highlights the relevance of explicit, narrative  
 165 psychological processing called parental mentalization (operationalized as

166 reflective functioning, RF) on adaptive preparation for motherhood (Slade,  
167 Cohen, Sadler, & Miller, 2009). Parental RF is defined as the verbally  
168 expressed imaginary capability of understanding the separation between  
169 the parent's and the child's minds, and how mental states, i.e., feelings,  
170 thoughts, intentions and desires, are linked to behavior (Slade, 2005).  
171 Prenatal RF is a distinct and unique aspect of parental RF, referring to  
172 the mother's prenatal ability to imagine the future, outside of her current  
173 understanding of herself, her spouse, and her situation and without  
174 linking the understanding to direct perceptions of the child (Slade et al.,  
175 2009). Prenatal RF is measured with a semi-structured interview probing  
176 about the mother's emotional experience of being pregnant, and her  
177 thoughts and fantasies about the baby (Slade, Patterson, & Miller, 2007).  
178 In addition, the interview aims to capture mother's representations about  
179 herself as a mother and the capability of anticipating the baby's needs in  
180 the future.

181 The role of prenatal RF for early parenting and child outcomes has  
182 been verified in studies showing that low prenatal RF is associated with  
183 various psychosocial risks, including psychiatric disorders, low SES, and  
184 substance misuse (Smaling et al., 2015; Suchman, DeCoste, Leigh, &  
185 Borelli, 2010), and with more aggressive infant behavior (Smaling et al.,  
186 2017). Mothers with higher prenatal RF have instead shown to exhibit  
187 more positive behavior during free-play, teaching tasks, and the Still Face  
188 Paradigm with their 6-month-old children (Smaling et al., 2016).  
189 Furthermore, in the postnatal period, parental RF capability has been  
190 linked with maternal sensitive interactions with the infant and the child's  
191 later attachment security (For a review, see Camoirano, 2017). In this  
192 study, we test whether mother's higher prenatal RF is also associated with  
193 her higher prenatal EA towards the baby.

194

195

### **The Present Study: Prenatal Emotional Availability**

196

197 Taken together, direct assessment of the developing emotional  
198 relationship between a mother and the baby already during pregnancy is  
199 clinically warranted for early identification of women in need of  
200 preventive parenting support (Barlow, 2018). Thus far, EA has been  
201 assessed from dyadic postpartum interactions involving a direct contact  
202 with the child, and is mostly based on nonverbal cues, via facial  
203 expressions, gestures, postures, and tone of voice, indicative of emotional  
204 connection (Biringen & Easterbrooks, 2012). Based on this, we aim to  
205 extend the EA perspective into pregnancy, and examine the emotional  
206 precursors of maternal attempts to emotionally connect with the fetus-  
207 baby. Optimally, we would expect to see maternal sensitivity, i.e., the

capability of expressing and attuning positive affect as well as verbal communication towards the fetus baby (when prompted) as well as non-hostility, i.e., the capability of regulating negative emotions and stress when addressing communication to the fetus-baby.

The present study aims to describe and study the validity of a new observational measure developed to assess the prenatal EA comprising prenatal sensitivity and non-hostility towards the unborn baby. To validate the scale, we compare the ratings of prenatal EA with ratings on previously validated prenatal measures highly relevant for postpartum parenting: Prenatal adult attachment and reflective functioning (RF). The hypotheses are that 1) low prenatal sensitivity and non-hostility are more common among insecurely than securely attached women, and 2) low sensitivity and non-hostility are related to lower levels of prenatal RF.

## Method

### Subjects

The sample consisted of 45 women from a community sample in four well-baby clinics in Lahti (a city in Southern Finland), who were screened positive for depressive symptoms using the Edinburgh Postnatal Depression Scale (EPDS) (Murray & Cox, 1990) between 22 - 31 gestational weeks. General sample characteristics are shown in Table 1. SES were assessed by the level of education from one (primary school) to four (doctoral degree). Over half had either high school or trade school or university degree of education. Most were married or co-habiting, and over half were first-time mothers. The average of depressive symptoms was 12.40, indicating that a high number of mothers had high levels of depressive symptoms.

Table 1  
*Maternal demographic information*

	Participants	
	%	n
Marital status		
<i>Married</i>	40	16
<i>Co-habiting</i>	50	20
<i>Single</i>	10	4
Number of children		
<i>First time mother</i>	66.7	30
<i>One previous child</i>	22.2	10
<i>Two or more children</i>	11.1	5
Education		
<i>Elementary school</i>	10	4

<i>High school/Trade</i>	47.5	19
<i>University degree</i>	32.5	13
<i>Doctoral degree</i>	10	4
	<i>M</i>	<i>Sd</i>
Maternal depressive symptoms (EPDS)	12.40	3.52

*Note.* Sample size varies between 40-45 due to missing information.

## Procedure

The mothers were invited by their well-baby clinic nurse in their regular prenatal check-up to participate in the study project called the “Baby Magic.” The study was run by a non-profit third sector organization (Diacony Foundation of Lahti), and funded by the Finnish Slottery Machine Foundation 2011-2015. Inclusion criteria included scoring nine or higher on depressive symptoms in EPDS. The purpose of the project was to develop intervention services for mothers with prenatal depressive symptoms (Salo et al., 2019). The current study represents the baseline measurement phase of the larger project where no intervention or randomization to interventions had yet been performed. If the mothers’ scores were beyond 13 (considered a clinical cut-off for severe depression in most postnatal samples [Mathey, Vedova, & Agostini, 2017]) they were additionally guided to appropriate communal adult psychiatric services unless they already had a contact. The mothers were invited to participate in the study between April, 2012 and May, 2013. About 92% of the invited mothers agreed to participate. The enrollment lasted for a previously designated time. If the mother was married or co-habiting, the fathers were present during the first meeting. The ethical committee of the City of Lahti approved the study plan. All parents gave their voluntary, informed consent for treatment and were informed of their rights to leave the study or treatment at any time.

## Measures

**Edinburgh Depression Scale (EPDS).** The EPDS (Murray & Cox, 1990) is a widely used and reliable 10-item self-report for the assessment of symptoms of depression, including feelings of happiness and sadness, fears, self-blame, sleeping problems, and thoughts about harming oneself during the previous week. It is commonly used both pre-and postpartum to screen for depression (Venkatesh et al., 2016). In the Finnish maternity and well-baby clinics the cut-off score 13 is used for probable major

depression, and cut-off score nine for probable depression (Hakulinen-Viitanen & Solantaus, 2016). Cronbach's alpha was .85.

**Emotional availability—Prenatal version (Pre-EA).** Observation of prenatal emotional availability was done in a setting designed by Ann Jernberg and her colleagues, the Prenatal Marschak Interaction Method (MIM) (Jernberg, Wickersham, & Thomas, 1985; Salo & Booth, 2019). Here the mother is asked to perform four activities with the fetus: (1) Draw a picture of yourself and the baby, (2) Play a music box to your baby, (3) Tell your baby something without using words and then do the same with words, and (4) Tell your baby about the people s/he will meet after birth (Salo & Booth, 2019). The goal is to pull out affective responses towards the fetus, see if mother is able to connect, e.g., make an effort of attuning, touching and guiding speech, gestures, and affects towards the fetus while performing the tasks. In other words, the goal is not to rate the actual performance or verbal content but rather the style and affective-behavioral way the mother is doing the tasks. In practice, mother is asked to read the Prenatal MIM tasks from cards the experimenter gives. Experimenter stays in the same room but stays neutral and refrains from commenting. The videotaped situation with the four MIM task lasts about 15 minutes.

The postpartum EA is based on a free play or semi-structured videotaped interactions that are scored on six scales (Biringen, 2008). They comprise parental sensitivity, structuring, non-intrusiveness and non-hostility, child responsiveness, and child involvement and are rated on a 7-point Likert-type scale. The prenatal EA version comprises two maternal scales, developed in collaboration with Prof. Biringen (Salo, Flykt, & Biringen, 2016): The maternal sensitivity and non-hostility.

In assessing the prenatal EA, most focus is on the affective and behavioral cues, not on the words or the content of the actual performance on the MIM tasks. For example, regardless of *what* the mother says in the task where she is asked to tell the baby about people he or she will meet after birth, the ratings of maternal prenatal sensitivity assessment focuses on the overall affective quality and attunement towards the fetus, evidenced for example by touching the tummy and commenting on the baby's movements, and responding to them with positive affect. Thus, being rated as highly sensitive (seven) would require expressions of positive affect in facial expressions (vs. a very still-face expression), as well as gentle touching of the tummy, using hands to hold the tummy, stroking the tummy, or turning head towards the tummy while talking to the fetus (vs. not touching one's tummy or not directing attention towards the baby while performing the MIM tasks). Overall positive, open, warm, lively, and responsive emotional communications are taken into account. Specific emotional expressions with a reciprocal intention, e.g., waiting for a response from the fetus as evidenced by movement, are considered

320 markers of good sensitivity. In the middle range of scores (five) maternal  
321 affect is bland. Mother is somewhat responsive in the sense of aiming to  
322 feel if the fetus responds by movement or just reflecting if the fetus is  
323 quiet. In lower scores, there is either a pseudo-quality in maternal affect,  
324 i.e., it is overly positive and bright and lacks authenticity (four), or  
325 depressed and withdrawn affect with little orientation (psychological or  
326 behavioral) towards the fetus (three). In the lowest end of scores (one and  
327 two) there are awkward expressions such as frowning or odd, childlike  
328 giggling, or complete shutting down.

329 Maternal non-hostility is characterized by the ability to regulate one's  
330 negative emotions. It is inferred by the absence of hostile responses, and  
331 overtly or covertly hostile behavior. The most hostile adult openly exhibits  
332 his or her hostility in facial expression and voice, such as frowning, using  
333 a raised, irritated tone when addressing the fetus, or making critical or  
334 sarcastic comments about the fetus (e.g., "you big bully, why do you kick  
335 mommy"). Signs of covert hostility include showing impatience or boredom  
336 such as repeated yawning, making negative comments about the testing  
337 situation, or other negative comments, not necessarily directed at the  
338 child. The high points refer to lack of any hostile qualities (seven). In the  
339 middle range of scores there are some subtle signs of (five) hostility. Lower  
340 than midpoint scores refer to clear examples of covert hostility (four)  
341 where the mother has occasional negative expressions in face, posture,  
342 and touch (tensed eyebrows, angry mouth, repeated yawning, sarcastic  
343 comments about the MIM tasks etc.) even if trying to mask them behind  
344 laughter. In lower scores, there are some to several expressions of clear  
345 anger or irritability, e.g., negativity in the face, posture, or touch (such as  
346 poking the fetus), critical remarks, minimizing the situation or the fetus,  
347 making sarcastic or negative comments, warranting scores three, two, or  
348 one, respectively.

349 Both prenatal EA scales were assessed with a seven-point Likert-type  
350 scale with high scores indicating more sensitivity or non-hostility.  
351 Additionally, a bottom-up scoring sheet with 29-metric was modified from the  
352 original EAS forth sensitivity and non-hostility scales and the top-down  
353 scores were checked using this metric. Two trained raters reliable in EAS  
354 forth edition and trained by Z. Biringen scored the tapes (first and second  
355 author), with five tapes checked with the method developer (Z.B). Interrater  
356 reliability was (Pearson's  $r$ ) .89 for sensitivity, and .84 for non-hostility.

357  
358 **Adult Attachment Interview.** The mothers' childhood attachment  
359 representations regarding their own parents were assessed with the Adult  
360 Attachment Interview (Main, Goldwyn & Hesse, 2003). The semi-  
361 structured interview explores how individuals describe their childhood

relationships to primary caregivers, and how these experiences are considered to influence one's developmental history and current personality. The interview includes questions of attachment-activating incidents such as being hurt, upset, or separated from the caregiver, as well as questions of loss and trauma. In addition, participants are asked about their fears, hopes, and worries related to the child-to-be. Probable experiences in relation to caregivers and states of mind regarding attachment and trauma/loss are each scored on a scale ranging from zero to nine (for a detailed account of the coding system, see Hesse, 2008). Audiotaped narratives were transcribed verbatim and then classified to four categories: secure/autonomous (F), insecure/dismissing (Ds), insecure/preoccupied (E) and unresolved/disorganized in relation to loss or trauma (U/d). The interviews classified as U/d received a secondary classification of one of the organized categories (F, Ds, or E). When a transcript did not fit any of the above categories, it was categorized as a CC (cannot classify). When a CC transcript was also assigned a U/d rating, the U/d was used as the primary classification.

The interviews were classified by the second author, a reliable coder trained by A. Broberg and T. Ivarsson (AAI institute in Gothenburg, 2011). For interrater reliability, the third author (trained by Broberg and Ivarsson in AAI institute in Oslo, 2012) analyzed 20% of the cases. The interrater reliability (Cohen's Kappa) was .69, which is considered as good level of agreement (Fleiss, 1981). With the two cases rated differently, the classification was negotiated and then checked with a third reliable coder. As instructed by the AAI reliability training, every transcript with a U/d or CC classification was double-checked by the second coder. Additionally, six other transcripts were re-read by the second author to ensure reliable classification. Finally, the AAI trainers (Broberg and Ivarsson) were consulted in the classification of a CC case without a primary U classification.

**The Pregnancy Interview (PI-RF).** The Pregnancy Interview (PI-RF) is a semi-structured clinical interview with 22 questions regarding a variety of mental states related to mothers' emotional experience with pregnancy and her expectations, hopes, and fears regarding her future relationship with the child, e.g., "Do you think you have a relationship with the baby?" The signs of explicit mentalizing classified from the interview include four categories: a) the parents' awareness of the nature of different mental states, b) clear and exact intention to understand mental states that underlie behavior, c) ability to recognize developmental aspect of mental states, d) considering mental states in relation to the interviewer. The scoring system is based on the same system used to score postpartum PDI-RF (Parent Development Interview) (Slade, Bernbach, Grienberger, Levy & Locker, 2005), with modifications to pregnancy

406 (Slade et al., 2007). The interview takes approximately 1-1.5 hours to  
407 administer.

408 In evaluating prenatal RF, audiotaped narratives were transcribed  
409 verbatim and scored for parental RF. Freshness and spontaneity of  
410 reflections about specific interaction episodes are taken into account and  
411 the importance of episodic memory is emphasized. Generalized  
412 expressions, opinions, or clichés are not considered signs of true RF. The  
413 number of indications of true reflectiveness found in the transcribed  
414 narrative is the basis for assigning the overall score. The greater the  
415 number of specific and varied indications of RF, the higher the score on  
416 an 11-point scale, with a score of -1 indicating a rejection of RF, and scores  
417 six-nine representing exceptionally high ability for RF. The interviews  
418 were scored by two reliable raters trained by Arietta Slade and her team  
419 (first and last author), and the interrater reliability assessed with 20% of  
420 the interviews was .95 (Pearson's  $r$ ).

421 All the observations and interviews were rated blindly to ensure the  
422 objectivity of the raters.

423

## 424 **Data Analysis**

425

426 Missing values for study variables were replaced with Expectation  
427 Maximization (EM). We first examined the associations between  
428 background characteristics (level of depressive symptoms, educational  
429 level, marital status, and parity) and study variables (prenatal RF,  
430 prenatal EA sensitivity and nonhostility, and adult attachment), using  
431 Pearson's correlations, Students'  $t$ -tests and Chi square tests depending  
432 on whether the variables were continuous or categorical. For the purposes  
433 of these analyses, categorical variables (attachment, educational level,  
434 parity, and marital status) were dichotomized to maintain adequate cell  
435 sizes (secure/insecure attachment, low/high educational level,  
436 primi/multiparous families, and partnership/single parent).

437 To answer the first research question, whether mother's adult  
438 attachment style was associated with prenatal EA sensitivity and EA non-  
439 hostility, we used a Multivariate ANOVA. The analyses were run both  
440 with four-way (Secure-autonomous, Insecure-dismissing, Insecure-  
441 preoccupied, and Unresolved/CC) and 3-way classifications (Secure-  
442 autonomous, Insecure-dismissing, and Insecure-preoccupied, where U  
443 categories with a secondary organized classification were forced into the  
444 main organized strategy. U-cases with a secondary CC classification were  
445 omitted from 3-way analyses). Second, we assessed whether prenatal RF  
446 was associated with prenatal EA sensitivity and non-hostility by using a  
447 Multivariate ANOVA (SPSS GLM function allowing the customization

models so that continuous variables can be used as predictors). This method was chosen to diminish the number of analyses due to small sample size.

## Results

**Descriptive Statistics.** The means, standard deviations and observed ranges of prenatal EA sensitivity and non-hostility, prenatal RF and the distribution of adult attachment classifications are presented in Table 2. About a third of mothers received a primary secure-autonomous (F) classification, and about a fourth were classified as insecure-dismissing (Ds), including, interestingly, three mothers with DS4 sub-category indicating fear of loss towards their (unborn) child. About 13% of the sample were classified as insecure-preoccupied (E). The prevalence of insecure-unresolved (U/d) pattern was 26.3% and one mother (2.6%) had a primary placement in cannot classify (CC) category without U. Three other U mothers had CC as their secondary classification but were placed in the U category due to the primary classification. Three of the U mothers had E as their secondary classification, two had F and one had Ds. The mean levels of prenatal EA sensitivity and non-hostility and prenatal RF and were very low compared to normative samples (five is indicated as typical for normative samples for RF scale and 5.5-6 for postnatal EA scales), but the estimates ranged from very low to normative range.

Table 2.

*Frequencies, Means, and Standard Deviations of Study Variables*

	n (%)	<i>M</i>	<i>SD</i>	Range
AAI: Secure-autonomous	13 (34.2 %)			
AAI: Dismissing	9 (23.7 %)			
AAI: Preoccupied	5 (13.2 %)			
AAI: Unresolved/Cannot Classify	11(28.9 %)			
PI		2.91	1.41	-1 - 5
MIM Sensitivity		3.41	1.21	1 – 5.5
MIM Non-hostility		3.79	1.08	2 - 6

Table 3 shows the associations between background factors (educational level, parity, marital status, and level of depressive symptoms) and study variables (prenatal RF, prenatal EA sensitivity and non-hostility, and adult attachment). Only the association between maternal two-way attachment classification and educational level was

480 significant, indicating that securely attached mothers more often had  
 481 higher educational level. Due to small sample size and lack of associations  
 482 between background factors and EA variables, covariates were not used  
 483 in the analyses.  
 484

Table 3.  
 Associations between background and study variables

	Educational level (high/low)		Parity (primi/multiparous)		Marital status (partnership/single)		Depressive symptoms	
	<i>t</i> (43)	<i>p</i>	<i>t</i> (43)	<i>p</i>	<i>t</i> (43)	<i>p</i>	<i>R</i>	<i>p</i>
RF	-1.16	.12	0.14	.89	-0.54	.59	-.07	.6
Sensitivity	-1.92	.06	-0.69	.50	-0.52	.60	-.11	.3
Non-hostility	-1.19	.24	-0.57	.57	0.66	.51	-.10	.4
								.8
								.5
								.2
Adult attachment (secure/insecure)	$\chi^2$	<i>p</i>	$\chi^2$	<i>p</i>	$\chi^2$	<i>p</i>	<i>t</i>	<i>p</i>
	5.96	.015	1.25	.26	0.50	.48	-0.94	.3
								.5

**Main Results**

Our first question was whether mother's prenatal adult attachment was associated with her prenatal emotional availability (sensitivity and non-hostility). The results presented in Table 4 showed significant associations between four-way adult attachment classifications and prenatal EA,  $F_{\text{Wilks' Lambda}}(6, 66) = 2.27, p = .047, \eta^2 = .17$ . Univariate tests showed that mother's adult attachment was associated both with her prenatal EA sensitivity and non-hostility. Related to prenatal EA sensitivity, according to our hypothesis, post-hoc tests (Tukey) suggested that mothers with secure-autonomous attachment differed significantly from mothers with dismissing ( $p = .013$ ), and unresolved ( $p = .044$ ) attachment. The difference to preoccupied attachment group was not significant but was to the expected direction ( $p = .099$ ). No significant differences emerged between the insecure attachment groups. Related to prenatal EA non-hostility, despite significant univariate tests, post-hoc tests indicated no significant group differences, although secure-autonomous attachment group showed a marginally higher level of non-hostility than the dismissing attachment group ( $p = .067$ ), and the differences to other attachment groups were to the expected direction. No significant differences emerged between the insecure attachment groups.

Concerning the three-way attachment classifications, there was again a significant effect of mother's attachment on prenatal EA,  $F_{\text{Wilks' Lambda}}(4, 60) = 3.60, p = .011, \eta^2 = .19$ . Univariate tests confirmed our hypothesis that mother's secure-autonomous attachment was associated with higher levels of both prenatal EA sensitivity and non-hostility than mother's insecure attachment. Related to prenatal EA sensitivity, post-hoc tests (Tukey) showed that mothers with secure-autonomous attachment differed significantly both from mothers with dismissing ( $p = .01$ ) as well as preoccupied attachment ( $p = .011$ ). Similarly, related to EA non-hostility, secure-autonomous mothers differed significantly from mothers with dismissing ( $p = .032$ ) and preoccupied ( $p = .015$ ) attachment.

Table 4.  
Associations between mother's adult attachment and her prenatal RF and prenatal EA sensitivity and non-hostility

	Secure-		Insecure-		Insecure-		Insecure-		F (3,34)	p	$\eta^2$
	M	Sd	M	Sd	M	Sd	M	Sd			
<i>4-way classification</i>											
Prenatal EA sensitivity	4.31 <sup>a</sup>	0.29	2.83 <sup>b</sup>	0.35	3.00 <sup>(b)</sup>	0.47	3.13 <sup>b</sup>	0.3	4.64	.008	.29
Prenatal EA non-hostility	4.46 <sup>a</sup>	0.28	3.33 <sup>(b)</sup>	0.34	3.20	0.45	3.60	0.3	5.96	.035	.22
<i>3-way classification</i>											
Prenatal EA sensitivity	4.13 <sup>a</sup>	0.26	2.85 <sup>b</sup>	0.32	2.83 <sup>b</sup>	0.33	-	-	7.05	.003	.31
Prenatal EA non-hostility	4.40 <sup>a</sup>	0.24	3.40 <sup>b</sup>	0.29	3.23 <sup>b</sup>	0.31	-	-	5.78	.007	.27

Note. F represents Univariate F-values. <sup>a</sup>b groups differ from each other in Tukey post-hoc tests <sup>(b)</sup>Group differs marginally (<.10) from group <sup>a</sup>

Our second question was whether mother's prenatal RF was associated with her prenatal EA sensitivity and non-hostility. The results show significant associations between prenatal RF and prenatal EA variables,  $F_{\text{Wilk's Lambda}}(2,42) = 13.41, p < .001, \eta^2 = .39$ . Consistent with our hypothesis, univariate tests confirmed that mothers with higher prenatal RF displayed higher prenatal EA sensitivity,  $F(1,43) = 20.49, p < .001, \eta^2 = .32$  and non-hostility,  $F(1,43) = 25.51, p < .001, \eta^2 = .37$ .

## Discussion

The present study aimed at validating a new observational assessment measure of maternal emotional availability towards her baby during pregnancy. The clinical and pragmatic goal was to develop a new method for both assessment and intervention for mothers suffering from prenatal depressive symptoms, a group known to be at high risk for later parenting problems (Field, 2011). The aim was to extend the previous work based mostly on self-report measures of prenatal maternal-fetal attachment (Alhusen, 2008) by developing an objective observational measure rated by a clinician.

The results supported the first hypothesis that mothers with secure-autonomous adult attachment representations showed higher observed prenatal EA, i.e., maternal sensitivity and non-hostility, than mothers with insecure attachment representations. Similarly, the results supported the second hypothesis that higher levels of maternal prenatal RF were related to higher observed prenatal EA. These results lend support for the validity of measuring direct emotionally expressed EA towards the fetus-baby, as a related, but yet distinct, construct from the mother's adult attachment representations and her verbal reflections on the future child and relationship with the child.

The main findings support the construct validity of Pre-EA, as mothers with secure-autonomous attachment representations and high reflective capacity also showed more positive and less negative emotions and willingness to communicate in the interaction with the fetus baby. As such, the present study extends previous work on the development of emotional bond between the mother and the child during pregnancy, which has mainly relied on subjective self-reports on attachment (Alhusen, 2008). It is important to note that direct, observable forms of emotional connection can be measured already during pregnancy, thus also opening new avenues of preventive relational interventions.

Altogether, there was a high number on insecurely attached mothers in this sample (65.8%). This is generally in line with other studies among mothers with depressive symptoms indicating the range of 40% (Smith-Nielsen, et al., 2015) to 60% (McMahon et al., 2006). In our sample, also the number of mothers with unresolved or cannot classify attachment classifications (28.9%) was much higher than previous studies have

565 generally found in non-clinical pregnant mothers (Slade, Grienberger,  
566 Bernbach, Levy & Locker, 2005). This may reflect the clinical nature of  
567 the present sample, as our results are more in line with studies using  
568 depressed populations (Bakermans-Kranenburg & van IJzendoorn, 2009),  
569 such as the McMahon et al. study (2006) who also found that over 20% of  
570 their clinically depressed mothers had unresolved attachment. As adult  
571 attachment theory predicts, vulnerabilities from one's own attachment  
572 history may have long-lasting influences on maternal sensitive  
573 interactions (van IJzendoorn, 1995), and this may be possible to see  
574 already during pregnancy.

575 In previous studies, a mother's secure-autonomous attachment has  
576 been shown to act as a buffering factor in terms of more sensitive  
577 interaction with the child among depressed mothers (Flykt et al., 2010;  
578 McMahon et al., 2006). The present study extends these findings into  
579 pregnancy in that here mothers with depressive symptoms, but with a  
580 secure-autonomous attachment, were also more able to express positive  
581 emotions and less hostility towards their unborn child. It is to be noted  
582 that the effect size of adult attachment on prenatal EA was relatively  
583 large, indicating that insecure attachment experiences may clearly  
584 endanger the early development of mother-infant relationship, which is  
585 vital to take into account in clinical work during pregnancy.

586 Our findings regarding the prenatal RF are also generally consistent  
587 with previous studies finding a link between postnatal RF and observed  
588 sensitive interaction with the child (Camaraino, 2017). As depressive  
589 symptoms may be especially harmful through biasing cognitions, it is of  
590 special relevance that in our study the mean level of prenatal RF was also  
591 very low (2.8). This is in line with previous studies showing average  
592 parental RF scores ranging from 2.4 to 3.3 with clinically referred samples  
593 (Pajulo et al., 2012; Schechter et al., 2008; Suchman et al., 2010), and 2.1  
594 in adult psychiatric depressed patients (Fischer-Kern et al., 2013). Our  
595 results, which also showed large effect size, suggest that the difficulties  
596 depressed mothers have in their reflective functioning may have negative  
597 associations with the emotional availability system with the child starting  
598 already during pregnancy. Targeting both these attachment-based  
599 mechanisms—reflective functioning as well as direct emotional  
600 availability—operating in related, yet distinguishable ways may enhance  
601 the potential efficacy of early prevention. As one is a verbal and the other  
602 a largely non-verbal mechanisms, it may be important to offer both verbal  
603 and body-oriented therapy elements during pregnancy.

604 Taken together, clinically, our results show that the affective system  
605 of emotional availability is operating already during pregnancy. Our  
606 results are line with experimental studies showing that attentional

607 processing of infant-related emotions may be disturbed with prenatally  
608 depressed mothers (Pearson, Lightman, & Evans, 2011). Making  
609 maternal emotions and related attuned behaviors towards the fetus baby's  
610 interactive signals (e.g., movements, rhythms) the target of early  
611 preventive work may give new possibilities of preventing relational  
612 disturbances common among mothers with depressive symptoms over the  
613 transition to parenthood. Most prenatal interventions to date focus only  
614 on depressive symptom reduction based on the assumption that reducing  
615 depression would decrease its harmful consequences on parenting (Field,  
616 2017; Lefkovich, Baji, & Rigo, 2014). Yet, reducing those symptoms alone  
617 does not appear to lead to improvements in parenting or in infant well-  
618 being and development (Forman et al., 2007). Subsequently, it has been  
619 suggested that early interventions should also focus directly on enhancing  
620 optimal mother-infant relationships already during pregnancy and  
621 beyond (Field, 2011; 2017; Lefkovich et al., 2014). According to our results,  
622 this may be especially relevant when the mother has, in addition to  
623 depressive symptoms, insecure adult attachment and low RF.

624 The main limitation of the study is its small sample size, and the  
625 results need to be verified using a larger sample. The use of multiple  
626 qualitative measurements including transcribed interviews and  
627 videotaped recordings may nevertheless pose practical challenges for  
628 larger studies. The results also need to be confirmed by using a non-  
629 clinical sample.

630 Despite these limitations, our study adds to the existing literature on  
631 emotional availability, adult attachment and RF by extending the focus  
632 into pregnancy. In clinical work, strengthening the actual, felt, and  
633 expressed emotional relationship to the fetus and treating the baby as a  
634 subject has long been considered a relevant part of both pre- and postnatal  
635 parent-infant psychotherapies (Baradon, Biseo, Broughton, James &  
636 Joyce, 2016). What our results may suggest, is that in terms of the  
637 developing emotional, attachment-based connection during pregnancy,  
638 considering the emotionally expressed side of the early bonding in  
639 addition to verbal subjectively experienced mother-fetal attachment may  
640 be clinically important (Pisoni et al., 2014). Moreover, the risk  
641 characteristics of the sample make the findings relevant for clinical  
642 application, including the development of parenting prevention and  
643 intervention programs. In future studies using a normative sample and  
644 including postnatal measures will be important to further study the  
645 validity and clinical relevance of the present findings.

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