

1 **Maternal and paternal depression and anxiety: their relationship with mother-** 2 **infant interactions at 3 months**

3
4

5 **Abstract**

6 While there have been studies on the effects of maternal depression and anxiety on mother-infant
7 styles of interaction in infancy, there have been no studies on the effects of paternal depression and
8 anxiety or on the joint effects of maternal and paternal depression and anxiety on mother-infant styles
9 of interaction. The aims of the study were: to examine the associations between maternal depression
10 and anxiety and paternal depression and anxiety; to examine the relationship between maternal and
11 paternal depression and anxiety and mother-infant styles of interaction at infant 3 months. 70 mother
12 and father couples were administered the EPDS for depression and the STAI-Y for anxiety and
13 mother-infant interactions were video-recorded and coded with the Care-Index. Analyses with Pearson
14 correlation indicated an association between maternal depression and paternal anxiety and between
15 maternal anxiety with paternal depression and anxiety. Moreover maternal and paternal depression and
16 anxiety were found to be associated with the quality of maternal style of interaction. Maternal sensitive
17 style was negatively associated with maternal depression and state anxiety. Maternal unresponsive
18 style was positively associated with both paternal depression and state and trait anxiety. Multiple
19 regression analysis has shown that maternal state anxiety was a greater predictor of a lower level of
20 maternal sensitivity than maternal depression.

21
22

23 **Keywords** maternal depression; maternal anxiety; paternal depression; paternal anxiety; mother-infant
24 styles of interaction

25

26 **Introduction**

27 Anxiety and depression are among the most significant disorders to affect parents in the perinatal
28 period, frequently in comorbidity in both mother and father (Cameron et al. 2016; Kessler et al.
29 2005). In this period, maternal depression is often associated with paternal depression and maternal
30 anxiety with paternal anxiety (Matthey et al. 2003). Depression and anxiety are among the principal
31 risk factors with respect to the quality of parenting of mothers and fathers starting from the first
32 year of the child's life, resulting in negative consequences for his/her development in the short and
33 long term relating, *inter alia*, to the occurrence of internalizing and externalizing disorders
34 (Matijasevich et al. 2015; van der Waerden et al. 2015).

35 It has also been shown that, during a child's first years, the father plays an important role in
36 supporting the mother (Kaitz and Katzir 2004), safeguarding her relationship with the child

37 (Melrose 2010). The quality of the conjugal relationship is also correlated with maternal
38 sensitivity to the child, influencing his/her psycho-emotional development (Gryc 2002).

39 Research has shown the effects of maternal depression on the mother-infant relationship,
40 including greater intrusiveness or withdrawal on the part of the mother (Tronick and Reck
41 2009), difficulty in regulating emotions in the mother-infant couple (Riva Crugnola et al.
42 2016) and, consequently, a child's insecure attachment (Murray et al. 2015). Various studies
43 have shown that paternal perinatal depression can also make his responsiveness and
44 involvement in play with the child less adequate, which impacts negatively on the child's
45 development (Paulson et al. 2006; Sethna et al. 2015).

46 While the literature on the effects of maternal depression is extensive, studies on the
47 effects of maternal anxiety in the perinatal period are less numerous and have mixed results.
48 According to some, mothers suffering from anxiety express little sensitivity and engagement
49 towards their infants (Warren et al. 2003), and their infants express little engagement
50 (Feldman et al. 2009); maternal anxiety is also correlated with both maternal negative states
51 and infant negative states (Riva Crugnola et al. 2016), with fewer positive emotions being
52 expressed by mothers (Nicol-Harper et al. 2007). According to others, there is no difference in
53 the sensitivity of anxious mothers and that of control mothers (Murray et al. 2007). Another
54 study (Field et al. 2005) has shown that depressed mothers with a high level of trait anxiety
55 compared with depressed mothers with a low level of trait anxiety expressed fewer positive
56 emotions and their children were less positive and more negative in dyadic interactions. One
57 study has shown, in this regard, that anxiety is a greater predictor than depression of less
58 adequate styles of mother-infant emotion regulation (Riva Crugnola et al. 2016).

59 A few studies have examined how maternal and paternal depression and anxiety
60 respectively influence mother-infant and father-infant interactions. Aktar et al. (2017) have

61 shown that depressed mothers and fathers were less positively involved in face-to-face
62 interactions with children at 3 and 5 months than mothers and fathers who were not
63 depressed and that their children expressed fewer positive emotions. However, the
64 expression of emotions by mothers and fathers during interactions with their child is not
65 affected by their levels of anxiety.

66
67 **Approach of our study**

68
69 In the light of the above, examining the effects of depression and anxiety in mothers and fathers is
70 important since such disorders impact negatively on the development of the child, increasing his/her
71 psychopathological risk (Murray et al. 2011). Depressed and anxious fathers, moreover, are unable
72 to provide sufficient emotional support and this may influence the mother-infant relationship. There
73 have also been numerous studies on the effects of parental depression on the quality of dyadic
74 interactions. Studies which have examined the influence of parental anxiety on interactions with the
75 child are less numerous and their results are contradictory. Furthermore, to our knowledge, no study
76 has examined the effect of paternal depression and anxiety on mother-infant styles of interaction in
77 the first months of a child's life.

78 The principal aims of this study, therefore, were to examine in a community sample the
79 relationship between maternal and paternal depression and anxiety at infant 3 months and the
80 correlation of these variables with the quality of mother-infant interactions in the same period.

81 Particularly the first objective was to analyze the associations between depression and anxiety in
82 mothers and fathers and the associations between maternal depression and anxiety and paternal
83 depression and anxiety. In this regard we hypothesized: high correlation between maternal anxiety
84 and depression and between paternal anxiety and depression; an association between maternal
85 depression and paternal depression; an association between maternal anxiety and paternal anxiety.

86 The second objective was to examine the associations between maternal and paternal depression
87 and anxiety and mother-infant interactions at 3 months. We hypothesized that maternal depression
88 and anxiety would be associated with a low level of maternal sensitivity and a low level of
89 cooperativeness in the infant. As there are no studies on the association between paternal anxiety
90 and depression and mother-infant styles of interaction the study was of an exploratory nature.

91 The third objective was to examine, at an exploratory level, the possible interaction effects
92 between maternal and paternal depression and anxiety on the quality of mother-infant interactions at
93 3 months.

94

95 **Method**

96 *Participants*

97 The participants were 70 couples of mothers and fathers, with their children (male infants = 32). All
98 mothers and fathers were European Caucasian. The average age of the mothers was 34.59 (SD =
99 5.21) with a range between 20 and 48. The average age of the fathers was 37.01 (SD = 7.25) with a
100 range between 26 and 48. The mothers had an average 15.22 years of education with a range
101 between 8 and 18 years (2.9% had left school at the age of 16, 25% had a high school diploma and
102 72.1% had a degree). All the mothers were married or lived with their partners. 28% were of a low
103 socio-economic level, 57% a medium socio-economic level and 15% a high socio-economic level.
104 75% of the mothers had jobs. 24% of the fathers were of a low socio-economic level, 61% a
105 medium socio-economic level and 15% a high socio-economic level. All the fathers had jobs. The
106 infants were all born full term, without organic pathologies. They were the first children for 83% of
107 the mothers.

108 The participants were recruited in the family centers and hospitals of the “*Azienda Sanitaria Locale*
109 *no. 2 Savonese*” located in Northern Italy and in “*Azienda Sanitaria Locale*” RM1 and RM4 in Central
110 Italy. The study protocol was approved by the institutional review boards of the University of Milano-

111 Bicocca and of “Sapienza” University of Rome. Informed consent was obtained from all individual
112 participants included in the study.

113 *Procedure*

114 At infant 3 months the mothers and fathers were given self-report questionnaires to evaluate
115 symptoms of depression and anxiety and a form to gather socio-demographic data. At 3 months
116 mother-infant couples were video-recorded for around 5 minutes in a laboratory consisting of a
117 suitably furnished play room. The video camera was positioned inside the room in front of the dyad
118 in order to frame mother and infant, who were sitting on a cushion, sideways. The behavior and the
119 expressions on the faces of both members of the dyad were thus visible and could be coded. The
120 mothers were instructed to interact with the infant as they would normally do at home.

121

122 **Measures**

123 *Post-partum depression*

124 The Edinburgh Postnatal Depression Scale (EPDS) (Benvenuti et al. 1999 for Italian version) is a 10-
125 item self-report questionnaire which evaluates post-partum depression. The cut off used to evaluate
126 probable depression in mothers was ≥ 13 (Benvenuti et al. 1999). The instrument has also been
127 validated for fathers (Matthey et al. 2001). In this study the cut off used to assess probable depression
128 in fathers was ≥ 12 (Loscalzo et al. 2015).

129

130 *Anxiety*

131 Maternal and paternal anxiety were assessed with the State Trait Anxiety Scale (STAI-Y; Spielberger
132 et al. 2012 for Italian version), a self-report questionnaire grouped into two scales relating to State
133 Anxiety, regarding the current state of anxiety, and Trait Anxiety, regarding the type of anxiety which
134 is characteristic of the personality of the subject. For evaluation of state anxiety (Y1) a cut off of 39

135 was used for mothers and of 36 for fathers. For trait anxiety (Y2) a cut off of 42 was used for mothers
136 and 37 for fathers.

137

138 *Mother-infant interactions*

139 Interactions were video-recorded and evaluated with the Child-Adult Relationship Experimental Index
140 (CARE-INDEX) (Crittenden 1994-2000), a method which codes interactions on the basis of 7
141 behavioural characteristics: facial expressions, vocal expressions, body position and contact, affection,
142 turn-taking, control and choice of activity. Parental styles of interaction are assessed on three scales:
143 Sensitive with responsiveness towards the emotions and actions of the child; Controlling with hostility
144 and intrusiveness towards the activities of the child; Unresponsive with physical and emotional
145 detachment. The styles of interaction of the child are assessed on four scales: Cooperative with
146 expression of positive emotions and acceptance of actions undertaken by the parent; Compliant-
147 Compulsive with cautious and inhibited behaviour and a compliant approach towards the parent;
148 Difficult with resistance to proposals of the parent; Passive with physical and emotional withdrawal.

149

150 *Data analysis*

151 The SPSS Statistic 24.0 package was used for all analyses. Preliminary analyses were undertaken to
152 identify missing data. Descriptive statistics were calculated with respect to demographic
153 characteristics: t-tests and bivariate correlations were applied. We first analyzed the distribution of
154 scores relating to depression and anxiety to identify the percentage of mothers and fathers
155 collocated in the clinical range. Secondly, using the Pearson correlation, we analyzed the
156 associations between maternal and paternal depression and anxiety. Thirdly, we used multiple linear
157 regressions to identify which states of maternal and paternal discomfort were more predictive of the
158 quality of mother-infant interactions.

159

160 **Results**

161 *Preliminary analysis*

162 Less than 5% of all questionnaire items were not filled in, so we managed the missing data with
163 listwise deletion. Preliminary analyses with correlations did not show significant relations between
164 maternal and paternal age, maternal education, socio-economic level and maternal and paternal
165 depression and anxiety or style of dyadic interactions. Moreover, no significant differences emerged
166 from t-test with respect to marital status, employment, gender and infant first born in relation to
167 paternal and maternal depression and anxiety or style of dyadic interactions. We therefore did not
168 consider these variables in the following analyses.

169

170 *Comparison between mothers and fathers*

171 We analyzed frequency, mean and standard deviation for anxiety and depression of mothers and
172 fathers and for the categories of the Care-Index. 14.3% of the mothers had scores which exceeded
173 the clinical cut-off (≥ 13) for depression, 32.9% of the mothers had high scores with respect to state
174 anxiety (cut-off ≥ 39) and 31.4% of the mothers had high scores with respect to trait anxiety (cut-off
175 ≥ 42). For what concerns fathers, 2.9% of the fathers had scores which exceeded the clinical cut-off
176 (≥ 12) for depression; 21.7% of the fathers had high scores with respect to state anxiety (cut-off \geq
177 39) and 11.6% of the fathers had high scores with respect to trait anxiety (cut-off ≥ 42). Moreover, a
178 paired sample t-test showed differences between EPDS and STAI-Y mean scores for the mothers
179 and fathers in each couple, with mothers showing higher scores than fathers (see Table 1).

180 Insert Table 1

181

182 *Correlations*

183 Maternal depression was positively correlated with maternal trait and state anxiety and positively
184 correlated with paternal state and trait anxiety. Maternal state anxiety was positively correlated with

185 paternal state and trait anxiety. Moreover, maternal trait anxiety was positively correlated with
186 paternal depression and state and trait anxiety. However, maternal depression was not correlated
187 with paternal depression (see Table 2).

188 Maternal sensitivity was negatively correlated with maternal depression and state anxiety and
189 paternal trait anxiety. Maternal controlling style was negatively correlated with paternal state
190 anxiety. Maternal unresponsive style was positively correlated with paternal depression, trait and
191 state anxiety. Infant passive style was positively correlated with paternal trait anxiety.

192 Insert table 2

193

194 *Multiple regressions*

195 Multiple regression analysis was conducted to analyze the effect of maternal and paternal
196 depression and anxiety on each mother and infant style of interaction; we tested theoretically
197 relevant interactions (see Table 3).

198 Insert table 3

199 For the maternal sensitivity style, the model explained 29% of the variance which was
200 statistically significant, $F(6, 53) = 2.04; p = .048$. A high level of maternal state anxiety ($t = -2.38;$
201 $p = .021$) was the only significant predictor of a lower score on the sensitivity scale. No interaction
202 effects were significant. For the maternal controlling category, the model explained 32% of the
203 variance which was statistically significant, $F(6, 53) = 2.99; p = .008$. The interaction effect
204 between maternal state and paternal state anxiety showed that a high level of maternal state anxiety
205 with a low level of paternal state anxiety ($t = -2.82; p = .007$) was a significant predictor of a higher
206 score on the controlling scale.

207 For the maternal unresponsive style, the model explained 31% of the variance which was
208 statistically significant, $F(6, 53) = 2.97; p = .008$. A high level of paternal state anxiety ($t = 2.10; p$
209 $= .040$) was a significant predictor of a higher score on the unresponsive scale. The interaction

210 effect between maternal depression and paternal depression showed that a high level of maternal
211 depression with a high level of paternal depression ($t = 2.04$; $p = .046$) was a significant predictor of
212 a higher score on the unresponsive scale. There were no significant predictive effects for the styles
213 of the child.

214

215 **Discussion**

216 The study provided significant results on the relationship between anxiety and depression in
217 mothers and fathers and on the effect of the discomfort of both in mother-infant interactions at 3
218 months.

219 Firstly, mothers had higher depression and anxiety scores than fathers, confirming the idea that
220 women are more vulnerable than men in the period of transition to parenthood (Figueiredo and
221 Conde 2011). High correlation between maternal depression and anxiety (Andersson et al. 2006)
222 and between paternal depression and anxiety (Cameron et al. 2016) also emerged. Maternal
223 depression was shown to be associated with paternal anxiety (Paulson et al. 2016) and maternal
224 anxiety with paternal anxiety and depression (Vismara et al. 2016). Contrary to the literature,
225 maternal depression was not associated with paternal depression.

226 Secondly, maternal anxiety and depression were associated with quality of mother-infant
227 interactions at 3 months. Maternal sensitive style was negatively correlated with maternal
228 depression and state anxiety. There were also significant associations between paternal depression
229 and anxiety and mother-infant styles of interaction. Maternal sensitive style was negatively
230 correlated with paternal trait anxiety; maternal unresponsive style was positively associated with
231 both paternal depression and state and trait anxiety. The results therefore show that paternal
232 depression and anxiety influence maternal styles of interaction, increasing withdrawal and
233 decreasing sensitivity.

234 Contrary to what we hypothesized, there were no significant correlations between maternal and
235 paternal depression and anxiety and the styles of interaction of the infant, apart from a correlation
236 between passive style and paternal trait anxiety. This is, to our knowledge, the first study to
237 examine at 3 months in natural conditions the effect of maternal and paternal anxiety and
238 depression on the styles of interaction of the infant as well as on those of the mother. Other studies
239 (Aktar et al. 2017) have examined the effect of parental depression and anxiety on the infant's
240 expression of emotions but not on his styles of interaction. One of these, (Aktar et al. 2017) has
241 shown that parental depression, but not parental anxiety, affects the infant's expression of positive
242 emotions at 3 months. Another study has examined the effects of maternal depression and anxiety
243 on the infant's styles of interaction, doing so however in stressful conditions constituted by the
244 FFSFP (Asselmann et al. 2018). The study showed, in particular, that maternal anxiety and
245 depression together (vs absence of maternal anxiety and depression) result in a greater increase of
246 distancing behavior in the infant at 4 months at that stage of the procedure in which the mother has
247 a still face expression. With regard to our results we may hypothesize that the effects of parental
248 depression and anxiety – observed in natural conditions - have an early impact on maternal styles of
249 interaction and a later impact on the styles that the infant develops progressively in interaction with
250 the mother. In order to verify this hypothesis it may be useful to conduct a longitudinal study,
251 examining the effects of parental depression and anxiety on the infant's interaction styles after 3
252 months during the first year. In this regard the study of Feldman (Feldman et al. 2009), conducted at
253 9 months, showed that maternal depression (vs absence of maternal depression) affects the infant,
254 causing lower social engagement, less mature regulation and more negative emotionality.

255 Furthermore, multiple regression analysis has shown that maternal state anxiety is a greater
256 predictor of lower maternal sensitivity than maternal depression and paternal depression and
257 anxiety. Moreover, maternal controlling style is predicted by high levels of maternal state anxiety
258 associated with low levels of paternal state anxiety. The analysis, therefore, shows that high

259 maternal anxiety plays a more important role than maternal depression in relation to maternal
260 sensitivity, a role which remains also with regard to maternal controlling style, when it is associated
261 with low paternal state anxiety. We may hypothesize that low paternal state anxiety implies that
262 there is little involvement on the part of the father in the context of mother-infant caregiving. This
263 low level of involvement could be correlated to a high level of maternal state anxiety, explaining
264 the effect of the interaction of low paternal anxiety and high maternal anxiety on maternal
265 controlling style. Lastly, maternal unresponsiveness, involving withdrawal and emotional
266 detachment, is predicted both by paternal state anxiety and by high levels of maternal depression
267 associated with high levels of paternal depression.

268 To sum up, our study is one of the few to have examined the relationship between maternal and
269 paternal depression and anxiety and quality of mother-infant interactions at 3 months. Compared to
270 previous research the results show the importance not only of maternal depression but also of
271 maternal anxiety in influencing maternal styles of interaction with the infant. In particular, maternal
272 state anxiety seems to be a greater predictor of maternal sensitivity. Moreover, to our knowledge
273 this is the first study to show that paternal anxiety and depression influence maternal styles of
274 interaction, with regard to levels of intrusiveness and withdrawal. It is also the first study to show
275 the joint effect of the association between maternal and paternal depression on maternal
276 unresponsive style.

277 The results, therefore, demonstrate how important it is to identify, with the use of screening
278 programs at an early stage, depression and anxiety, not only in mothers but also in fathers. Indeed,
279 parental anxiety and depression, involving the expression of negative emotions in interactions with
280 the infant, have been shown to be important factors in the parent-infant transmission of depression
281 and anxiety (El-Sayed 2012)

282 Since parental anxiety and depression seem to have an early influence on the quality of mother-
283 infant interaction, it is important to provide timely preventive and support interventions, such as

284 attachment-based intervention (Steele and Steele 2017), which is not only mother-focused but also
285 father-focused, in order to increase wellbeing and parenting skills and thus foster the mother-father-
286 infant relationship.

287 There are some limitations to and possible future directions for our study. The size of our sample
288 should be increased so that the results can be generalized to a greater extent. It must also be taken into
289 consideration that the study examined couples with primiparae women without at risk pregnancies.
290 Therefore, in order to generalize the results a further study could include pluriparae women and
291 women with at-risk pregnancies. A further analysis could examine the reciprocal impact of women and
292 partners' depression and anxiety and how this reciprocal impact affects the quality of mother-infant
293 interaction, using an analysis model such as the Actor Partner Interdependence Model (APIM; Kashy
294 and Kenny 1999). This model can determine how outcomes are influenced bi-directionally by both
295 members of the dyads (Cook and Kenney 2005). In this regard another limit of the study is that it
296 focuses on mother-infant interaction, not directly examining father-infant interaction, and the possible
297 interdependence of the father-infant interaction with the mother's level of depression and anxiety with
298 respect to the mother's interaction style.

299 Furthermore, anxiety and depression were assessed with questionnaires and not diagnostic
300 clinical interviews. Lastly, potentially important variables such as the quality of a couple's
301 relationship, the temperament of the infant and maternal attachment, which could serve as
302 moderators in the relationship between paternal and maternal depression and anxiety and styles of
303 interaction, were not considered.

304

305

306 **References**

307 Aktar E, Colonnese C, de Vente W, Majdandžić M, Bögels SM (2017) How do parents' depression
308 and anxiety, and infants' negative temperament relate to parent-infant face-to-face interactions? *Dev*
309 *Psychopathol* 29:697–710. <https://doi.org/10.1017/S0954579416000390>

- 310 Asselmann E, Venz J, Wittchenn H, Martini J (2018) Maternal anxiety and depressive disorders
311 prior to, during and after pregnancy and infant interaction behaviors during the Face-to-Face Still
312 Face Paradigm at 4 months postpartum: a prospective-longitudinal study. *Early Hum. Dev.* 122:
313 45–53. <https://doi.org/10.1016/j.earlhumdev.2018.05.007>
- 314 Andersson L, Sundstrom-Poromaa I, Wulff M, Astrom M, Bixo M (2006) Depression and anxiety
315 during pregnancy and six months postpartum: a follow-up study. *Acta Obstet. Scand* 85:937–944.
316 <https://doi.org/10.1080/00016340600697652>
- 317 Benvenuti P, Ferrara M, Niccolai C, Valoriani V, Cox JL (1999) The Edinburgh Postnatal
318 Depression Scale: validation for an Italian sample. *J Affect Disord* 53:137–141.
- 319 Cameron EE, Sedov ID, Tomfohr-Madsen LM (2016) Prevalence of paternal depression in
320 pregnancy and the postpartum: an updated meta-analysis. *J Affect Disord* 206:189–203.
321 <https://doi.org/10.1016/j.jad.2016.07.044>
- 322 Crittenden PM (1994-2000) CARE-Index: coding manual. Unpublished manuscript, Miami,
323 Florida.
- 324 Cook WL, Kenny DA (2005) The Actor-Partner Interdependence Model: a model of bidirectional
325 effects in developmental studies. *Int J Behav Dev* 29: 101–109.
326 <https://doi.org/10.1080/01650250444000405>
- 327 El-Sayed AM, Haloosim MR, Galea S, Koenen KC (2012) Epigenetic modifications associated
328 with suicide and common mood and anxiety disorders: a systematic review of the literature. *Biol*
329 *Mood Anxiety Disord* 14:10. <https://doi.org/10.1186/2045-5380-2-10>
- 330 Feldman R, Granat A, Pariente C, Kanety H, Kuint J, Gilboa-Schechtman E (2009) Maternal
331 depression and anxiety across the postpartum year and infant social engagement, fear regulation,
332 and stress reactivity. *J Am Acad Child Adolesc Psychiatry* 48: 919–927.
333 <https://doi.org/10.1097/CHI.0b013e3181b21651>
- 334 Field T, Hernandez-Reif M, Vera Y, Gil K, Diego M, Yando R (2005). Anxiety and anger effects
335 on depressed mother-infant spontaneous and imitative interactions. *Infant Behav Dev* 28:1–9.
336 <https://doi.org/10.1016/j.infbeh.2004.06.003>
- 337 Figueiredo B, Conde A (2011) Depression and anxiety in women and men from early pregnancy to
338 3-months postpartum. *Arch Womens Ment Health* 14:247-55. <https://doi.org/10.1007/s00737-011-0217-3>
- 340 Gryc JH (2002) Marital Relationships and Parenting. In: Bornstein MH (ed) *Handbook of*
341 *parenting*, 2nd edn. Lawrence Erlbaum Associates Publishers, London, pp. 203-226.
- 342 Kaitz M, Katzir D (2004) Temporal changes in the affective experience of new fathers and their
343 spouses. *Infant Ment Health J* 25:540–555. <https://doi.org/10.1002/imhj.20024>

- 344 Kashy DA, Kenny DA (1999) The analysis of data from dyads and groups. In: Reis HT and Judd
345 CM (eds) *Handbook of research methods in social psychology*. Cambridge University Press, New
346 York.
- 347 Kessler R C, Chiu WT, Demler O, Walters EE (2005) Prevalence, severity, and comorbidity of
348 twelve-month DSM-IV disorders in the national comorbidity survey replication (NCS-R). *Arch Gen*
349 *Psychiatry* 62: 617–627. <https://doi.org/10.1001/archpsyc.62.6.617>
- 350 Loscalzo Y, Giannini M, Contena B, Gori A, Benvenuti P (2015) The Edinburgh Postnatal
351 Depression Scale for fathers: a contribution to the validation for an Italian sample. *General Hospital*
352 *Psychiatry* 37:251–256. <https://doi.org/10.1016/j.genhosppsy.2015.02.002>
- 353 Matijasevich A, Murray J, Cooper PJ, Anselmi L, Barros AJD, Barros FC, Santos IS (2015)
354 Trajectories of maternal depression and offspring psychopathology at 6 years: 2004 Pelotas cohort
355 study. *J Affect Disord* 174:424–431. <https://doi.org/10.1016/j.jad.2014.12.012>
- 356 Matthey S, Barnett B, Howie P, Kavanagh DJ (2003) Diagnosing postpartum depression in mothers
357 and fathers: whatever happened to anxiety? *J Affect Disord* 74:139–147.
358 [https://doi.org/10.1016/S0165-0327\(02\)00012-5](https://doi.org/10.1016/S0165-0327(02)00012-5)
- 359 Matthey S, Barnett B, Kavanagh DJ, Howie P (2001) Validation of the Edinburgh Postnatal
360 Depression Scale for men, and comparison of item endorsement with their partners. *J Affect Disord*
361 64:175–184. [https://doi.org/10.1016/S0165-0327\(00\)00236-6](https://doi.org/10.1016/S0165-0327(00)00236-6)
- 362 Melrose S (2010) Paternal postpartum depression: how can nurses begin to help? *Contemp Nurse*
363 34:199–210. <https://doi.org/10.5172/conu.2010.34.2.199>
- 364 Murray L, Arteche A, Fearon P, Halligan S, Goodyer I, Cooper P (2011) Maternal postnatal
365 depression and the development of depression in offspring up to 16 years of age. *J Am Acad Child*
366 *Adolesc Psychiatry* 50:460–70. <https://doi.org/10.1016/j.jaac.2011.02.001>
- 367 Murray L, Cooper P, Creswell C, Schofield E, Sack C (2007) The effects of maternal social phobia
368 on mother on infant interactions and infant social responsiveness. *J Child Psychol Psychiatry* 48:
369 45–52. <https://doi.org/10.1111/j.1469-7610.2006.01657.x>
- 370 Murray L, Pasco F, Cooper P (2015) Postnatal depression, mother–infant interactions, and child
371 development. In: Milgrom J and Gemmill AW (eds) *Identifying perinatal depression and anxiety*.
372 Wiley, Chichester, pp. 139-164.
- 373 Nicol-Harper R, Harvey AG, Stein, A (2007) Interactions between mothers and infants: impact of
374 maternal anxiety. *Infant Behav Dev* 30:161–167. <https://doi.org/10.1016/j.infbeh.2006.08.005>
- 375 Riva Crugnola C, Ierardi E, Ferro V, Gallucci M, Parodi C, Astengo M (2016) Mother-infant
376 emotion regulation at three months: the role of maternal anxiety, depression and parenting stress.
377 *Psychopathology* 49:285–294. <https://doi.org/10.1159/000446811>

378 Paulson JF, Bazemore SD, Goodman JH, Leiferman JA (2016) The course and interrelationship of
 379 maternal and paternal perinatal depression. *Arch Womens Ment Health* 19: 655–663.
 380 <https://doi.org/10.1007/s00737-016-0598-4>

381 Paulson JF, Dauber S, Leiferman JA (2006) Individual and combined effects of postpartum
 382 depression in mothers and fathers on parenting behavior. *Pediatrics* 118:659–68.
 383 <https://doi.org/10.1542/peds.2005-2948>

384 Sethna S, Murray L, Netsi E, Psychogiou L, Ramchandani PG (2015) Paternal depression in the
 385 postnatal period and early father–infant interactions. *Parent Sci Pract* 15: 1–8.
 386 <https://doi.org/10.1080/15295192.2015.992732>

387 Steele H, Steele M (2017) *Handbook of attachment-based interventions*. Guilford Press, New York.

388 Spielberger CD, Pedrabissi L, Santinello M (2012) *STAI State-Trait Anxiety Inventory Forma Y*.
 389 Giunti, Florence.

390 Tronick E, Reck C. (2009) Infants of depressed mothers. *Harv Rev Psychiatry* 17:147–56.
 391 <https://doi.org/10.1080/10673220902899714>

392 van der Waerden J, Galéra C, Larroque B, Saurel-Cubizolles MJ, Sutter-Dallay AL, Melchior M
 393 (2015) Maternal depression trajectories and children’s behavior at age 5 years. *J Pediatr* 166:1440–
 394 8.e1. <https://doi.org/10.1016/j.jpeds.2015.03.002>

395 Vismara L, Rollè L, Agostini F, Sechi C, Fenaroli V, Molgora S, Neri E, Prino LE, Odorisio F,
 396 Trovato A, Polizzi C, Brustia P, Lucarelli L, Monti F, Saita E, Tambelli R (2016) Perinatal
 397 parenting stress, anxiety, and depression outcomes in first-time mothers and fathers: a 3- to 6-
 398 months postpartum follow-up study. *Front Psychol* 7:938. <https://doi.org/10.3389/fpsyg.2016.00938>

399 Warren SL, Gunnar MR, Kagan J, Anders TF, Simmens SJ, Roness M, Wease S, Aron E, Dahl RE,
 400 Sroufe LA (2003) Maternal panic disorder: infant temperament, neurophysiology, and parenting
 401 behaviors. *J Am Acad Child Adolesc Psychiatry* 42:814–825.
 402 <https://doi.org/10.1097/01.CHI.0000046872.56865.02>

403

404 **Table 1** Correlations between maternal risks and mean and standard deviations of EPDS, STAI-Y and Care-Index
 405 categories.

	Mother	Father	t	P
EPDS	7.46(4.68)	3.53(3.44)	5.70	.000***
STAI-Y state	35.91(8.85)	32.20(7.23)	3.34	.001**
STAI-Y trait	37.44(9.43)	31.72(8.01)	4.92	.000***

Sensitivity	7.46(3.07)
Controlling	4.20(3.06)
Unresponsive	2.34(3.45)
Cooperative	5.69(3.62)
Complusive	.15(.35)
Difficult	1.79(3.42)
Passive	6.41(3.53)

406 ** $p < .01$, *** $p < .000$

407

408 **Table 2** Correlations between maternal risks and mean and standard deviations of EPDS, STAI-Y and Care-Index
409 categories.

	(1)	(2)	(3)	(4)	(5)	(6)
Maternal depression (1)	-					
Maternal state anxiety (2)	.59***	-				
Maternal trait anxiety (3)	.66***	.71***	-			
Paternal depression (4)	.01	.16	.23*	-		
Paternal state anxiety (5)	.23*	.32**	.40**	.51***	-	
Paternal trait anxiety (6)	.24*	.35**	.38**	.57***	.84***	-
Sensitivity	-.26*	-.38**	-.23	-.10	-.17	-.30*
Controlling	.24	.22	.03	-.21	-.31*	-.21
Unresponsive	.02	.14	.18	.27*	.43***	.47***
Cooperative	-.24	-.28	-.16	-.18	-.11	-.23
Complusive	.24	.08	.14	.04	-.15	.07
Difficult	.01	.18	.47	.11	-.14	-.09
Passive	.20	.10	.10	.06	.23	.32*

410 * $p < .05$, ** $p < .01$, *** $p < .000$

411

412 **Table 3** Multiple regression models predicting Care-Index categories.

	B	SE	<i>p</i>
<i>Mother sensitivity</i>			
Maternal depression	.05	.12	.73
Maternal state anxiety	-.38	.05	.021*
Paternal depression	-.01	.13	.92
Paternal state anxiety	-.11	.06	.45
M depression X M state anxiety	-.07	.01	.60
M depression X F depression	.19	.03	.20
M depression X F state anxiety	-.06	.01	.71
M state anxiety X F state anxiety	.10	.00	.54
<i>Mother controlling</i>			
Maternal depression	.19	.11	.23
Maternal state anxiety	.14	.05	.32
Paternal depression	-.05	.11	.68
Paternal state anxiety	-.22	.06	.12
M depression X M state anxiety	.10	.01	.43
M depression X F depression	.12	.03	.38
M depression X F state anxiety	.07	.01	.62
M state anxiety X F state anxiety	-.43	.00	.007**
<i>Mother unresponsive</i>			
Maternal depression	-.23	.13	.16
Maternal state anxiety	.21	.06	.15
Paternal depression	.06	.13	.65
Paternal state anxiety	.30	.07	.040*
M depression X M state anxiety	-.02	.01	.84

M depression X F depression	.28	.03	.046*
M depression X F state anxiety	-.01	.01	.94
M state anxiety X F state anxiety	.29	.00	.06

413 * $p < .05$, ** $p < .01$.

414