

1 **Early detection of perinatal depression in couples: a single-center prospective study**

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23 **Keywords:** Depression; peripartum; prospective study; couple; screening; prevention; early
24 prenatal visit; early postnatal visit

25 **Abstract**

26 **Objective:** To prospectively assess the psychological status of couples during the perinatal
27 period, in order to identify parents at increased risk of postpartum depression.

28 **Methods:** This single-center prospective study was conducted from March to July 2022 at a
29 maternity ward of one of the Lyon university hospital, France. Pregnant women with no
30 progressive psychiatric pathology nor obstetric risk factors and their partners were asked to fill
31 the Edinburgh Postnatal Depression Scale (EPDS) at 3 different time-points: at the 9th month
32 of pregnancy consultation, during the maternity stay (immediate postpartum period), and 6 to
33 8 weeks after delivery (late postpartum period). The cut-off EPDS score for risk of depression
34 was 10 for both patients and their partners. Socio-demographic and obstetrical factors
35 potentially associated with a higher risk of perinatal depression were collected. The primary
36 endpoint was the EPDS score for both the patients and their partners throughout the perinatal
37 period.

38 **Results:** A total of 95 couples were included; 96% of the patients and 68% of the partners
39 answered to the questionnaire before birth, 81% and 71% during the maternity stay, 64% and
40 46% in the postpartum period. Overall, 14 (15%) patients and 1 (1%) partner had an EPDS
41 score above 10 in the postpartum period. A history of psychiatric/psychological follow-up and
42 the performance of an emergency cesarean section were associated with a significant increase

43 in the EPDS score in the immediate postpartum period in the patients [Beta 3.7 points, 95% CI
44 0.91;6.4 and Beta 5.2 points, 2.2;8.1, respectively]. The performance of an episiotomy during
45 delivery was significantly associated with a higher EPDS score for partners in the immediate
46 postpartum period, while the absence of perineal tear was not associated with a lower EPDS
47 score in patients. No significant association between the different factors studied and the EPDS
48 score was found at 6 to 8 weeks postpartum in patients nor their partners.

49 **Conclusions:** Although no risk factors for persistent perinatal depression in couples were
50 identified, a non-negligible prevalence of the patients had a high EPDS score. The screening of
51 all couples in both the pre- and postpartum periods should be performed, despite the absence of
52 risk factors.

53

54

55 **Introduction**

56 Perinatal depression affects 10 to 15% of women worldwide. [1] In addition to the adverse
57 health consequences for the mother, the most feared complication is death by suicide; in France
58 perinatal mental health disease and suicide are now the second cause of maternal death in the
59 year following childbirth. [2] Moreover, maternal depression affects the whole family and
60 impacts mother-infant bonding and the development of the child. [3] It is nowadays well
61 established that infancy is a highly sensitive period for mental, motor, and emotional
62 development. Such development is strongly dependent on environmental factors and
63 particularly on the quality of early parent-child interaction, [4] which can be impacted even in
64 the case of mild depressive symptoms. [5], [6]

65 Risk factors of perinatal depression have been studied and include personal or family
66 psychiatric history, multiple exposures to difficult life events, [7] lack of social support, history
67 of traumatic pregnancy experience, [8] extreme ages [9] and obstetrical factors.[10]

68 Recent studies highlight also the impact of father's postpartum depression, estimated between
69 8 to 10% in France, [11] on the mother's psychological status. [12] Such findings have led to a
70 paradigm shift: clinicians and researchers now prefer to focus on perinatal parental depression
71 rather than on maternal postpartum depression only [13]. But studies with both mother and
72 father data collected together are still scarce.

73 Most studies conclude that there is a need to detect perinatal depression as early and as widely
74 as possible in order to limit its consequences for the mother, the couple, the child's development,
75 and the mother-infant relationship.

76 Several scales have been developed for this purpose; the most commonly used is the Edinburgh
77 Postnatal Depression Scale (EPDS), [14] which has also been validated during pregnancy [15]
78 and in men. [11] In France, recent recommendations require professionals to systematically
79 propose early pre- [16] and post-natal interviews. [17] These interviews must be offered to both
80 members of the couple and aim to detect risk factors and first symptoms of depression, in order
81 to refer them for appropriate follow-up. However, there are few prospective studies testing the
82 feasibility of the couple depression screening in pre and post-partum and there is still no
83 consensus on the best tool nor on the time frame for perinatal depression screening. [18] Given
84 the lack of data regarding the psychological status of couples throughout the perinatal period,
85 there is a need for longitudinal prospective analyses assessing the mood disorders of both
86 parents during the perinatal period.

87 The present study aims to prospectively assess the depressive symptoms of couples through the
88 EPDS questionnaire during the prenatal, immediate and late postpartum periods in a low-risk
89 population in order to identify parents at increased risk for postpartum depression.

90 **Materials & Methods**

91 *Study design and participants*

92 We conducted a single-center observational prospective study based on the 2020 and 2022
93 recommendations of the French National Authority for Health (Haute Autorité de Santé). [16],
94 [17]) All couples followed up between March 7 and May 13, 2022 at the Croix Rousse maternity
95 of the Lyon university hospital, France, and who agreed to participate, were asked to fill the
96 EPDS at 3 different endpoints : the 9th month pregnancy consultation, during the stay in the
97 maternity ward after delivery (immediate postpartum period), and between 6 to 8 weeks after
98 delivery (late postpartum period).

99 The study was conducted in accordance with the Declaration of Helsinki and was approved by
100 the local ethics committee (number 22-51790). As observational study according to National
101 Health Care Recommendations the participants all participants received an information leaflet
102 detailing the protocol and the collected information but did not have to give written consent.

103 The inclusion criteria were: pregnant women over 18 years of age and their partners during the
104 9th month of pregnancy, with a pregnancy follow-up and delivery at the Croix Rousse maternity.
105 Patients and partners that did not speak French, or that were treated for an ongoing psychiatric
106 or psychological disorder, at the time of the inclusion, were excluded.

107 Eligible patients and their partners were recruited by the healthcare professionals providing the
108 9th month consultation (physician or midwife) between 37 and 39 weeks of gestation. The two
109 first EPDS were filled during the antenatal care consultation and during the maternity stay. The
110 third EPDS questionnaire was collected by email or phone for the late postpartum period.

111 The threshold of the EPDS test varies depending on the studies. For women, it ranges from 5/6
112 to 13, depending on the desired sensitivity and specificity. [19], [20], [21] For men, it is often
113 around 9.[22] We aimed to use the same threshold for both members of the couple. In a
114 screening approach and to achieve the best sensitivity, as in the following studies, we opted for
115 a threshold of 10 on the EPDS. This threshold is also found in the literature for men and has
116 been validated by the French National Authority for Health (HAS) for perinatal depression
117 screening in the French population. [23]

118 *Data collection*

119 Socio-demographic and medical data were collected at inclusion from the patients' medical
120 records. Data about delivery were collected after delivery, before the last EPDS score

121 collection. EPDS scores were collected at the 9th month of pregnancy, during the maternity stay,
122 and 6 to 8 weeks postpartum. The EPDS self-questionnaire was completed at the hospital for
123 the antenatal period and during the maternity stay. It was completed from home for the delayed
124 postpartum period, by e-mail or telephone. For patients who did not respond to the first email,
125 3 attempts by telephone and 2 additional attempts by email were made.

126 Data were collected from the medical record and analyzed by the medical team leading the
127 project (AP, SVS and BDLF).

128 The EPDS is a 10-item postnatal questionnaire that has been validated as a depression screening
129 tool throughout the perinatal period, translated and validated in French. [24] The EPDS score
130 ranges from 0 to 30. A cut-off value of 10 or higher was defined to qualify a risk of perinatal
131 depression. [20], [25], [26] A psychological or psychiatric medical support was offered to the
132 patients presenting during the study period at least one score higher or equal to 10. In these
133 cases, patients were offered psychological and psychiatric followed up either by the hospital
134 team or after referral to perinatal healthcare professionals close to their home.

135 *Statistical analysis*

136 The usual position and dispersion parameters were employed to describe the quantitative and
137 qualitative data.

138 A mixed model assessing the effect of primiparity on the evolution of the EPDS score over time
139 was performed. The model included as a random effect: an intercept and a slope; as a fixed
140 effect: age, time, primiparity, and a quadratic effect over time. The association between
141 different clinical factors and the EPDS score at different times was estimated by mean
142 differences with their confidence intervals.

143 The correlation between each pair of time combination of EPDS scores was estimated by a
144 Pearson correlation coefficient and its 95% confidence interval.

145 Analyses were performed using R[®] software version 4.1.2.

146 **Results**

147 *General characteristics of the study population*

148 Overall, 167 couples were eligible but 100 agreed to participate; 5 couples were excluded, 1
149 because the couple did not speak French and 4 because the patients had ongoing psychiatric
150 pathology or were under antidepressant treatment (Figure 1). At inclusion, the mean age was
151 32.7 years for the patients and 34.4 years for their partners. Most of the patients (n=41/95 ;
152 43%) and their partners (n=43/95 ; 45%) occupied higher intellectual professions, based on
153 employment status. A personal history of psychiatric disease was reported by 13/95 (14%)
154 patients and 2/95 (2%) partners. Among the studied population, 53% (n= 50/95) accepted and
155 underwent mandatory early perinatal counseling, held between 14 and 20 weeks of gestation.
156 (Table 1).

157 91/95 (96%) patients and 65/95 (68%) partners answered the EPDS questionnaire at the 9th
158 month of pregnancy, 77/95 (81%) and 67/95 (71%) during the maternity stay, 61/95 (64%) and
159 44/95 (46%) in the postpartum period. At the 9th month of pregnancy, the mean EPDS score
160 was 6/30 (SD 4.7) for the patients and 3.4/30 (SD 3.1) for their partners. It was 5.4/30 (SD 4.4)
161 and 3.1/30 (SD 3.1) during the maternity stay, then 5.8/30 (SD 6.1) and 2.1/30 (SD 2.8) in the
162 late postpartum period (Figure 2).

163 Overall, 14 patients and 1 partner had an EPDS score ≥ 10 in the late postpartum period; they
164 were all contacted and referred for consultation with the hospital psychiatric team or to an

165 outpatient psychological and psychiatric care near their home. One patient was followed by the
166 psychiatric team of the maternity hospital.

167

168 ***Obstetrical data and perinatal outcomes***

169 Half of the patients were primiparous (n= 48/95); 23% (n=22/95) had already had at least one
170 miscarriage, and 1% (1/95) had undergone a medical termination of pregnancy (Table 2). None
171 had experienced intrauterine fetal demise. Among the multiparous women, one (2%) had a
172 history of pre-eclampsia and one (2%) had been followed up for intrauterine growth restriction
173 during a previous pregnancy. The previous pregnancies had all led to full-term deliveries except
174 one (2%) that delivered at 36+1 weeks of gestation; 38% (18/47) had a history of medical
175 intervention during a previous delivery (i.e. personal history of induction of labor and/or
176 assisted vaginal delivery and/or cesarean section and/or hemorrhage). (Table 2)

177 76% (n=72/95) of patients had uneventful pregnancies, except for 14% (n=13/95) that presented
178 gestational diabetes and 13% (n=12/95) that were referred to the fetal anomaly clinic. Among
179 those patients, no significant fetal malformation had been described. Nine patients (9%)
180 accepted a psychological follow up during their pregnancies.

181 69/95 (73%) patients went into spontaneous labor and 66/95 (69%) had normal spontaneous
182 vaginal deliveries. During labor, 6/95 patients (6.5%) wished but did not receive an epidural
183 anesthesia, due to technical and organizational issues. Among the assisted deliveries and non-
184 elective cesarean sections, 54% (n=14/26) were non-urgent (code green, delivery recommended
185 within an hour), 19% (n=5/26) were relatively urgent (code orange, delivery recommended
186 within 30 minutes), and 27% (n=7/26) were very urgent (code red, delivery recommended

187 within 15 minutes). Eight patients (8%) were diagnosed with post-partum hemorrhage
188 (bleeding \geq 500 mL), requiring obstetrical intervention.

189 The neonates had a normal weight, except 2/95 (2%) of them who were below the 3rd percentile
190 according to the AUDIPOG curve. [27] Their umbilical cord pH was also within norms, only
191 one arterial pH was below 7.10 in the context of an emergency vacuum birth for fetal
192 bradycardia. Only one baby (n=1/95; 1%) required a transfer to the neonatology ward for
193 respiratory distress, with a length of stay of 7 days.

194 *Perinatal EPDS score according to patients and partners characteristics*

195 Among the patients, a personal history of psychiatric disease was associated with an increase
196 in the EPDS score (3.7 points [95% CI 0.91; 6.4]) during the maternity stay (Table 3).
197 According to the mixed model, at constant age, primiparity seemed to increase non-significantly
198 the EPDS score by 1.02 [95% CI -0.40; 2.44] (Figure 3).

199 Among the partners, no significant association was found between the EPDS score and the
200 studied factors (Table 4).

201 *Impact of delivery mode on immediate and late EPDS score*

202 Among the patients, the onset of an emergency cesarean section significantly increased the
203 EPDS score by 5.2 [95% CI 2.2; 8.1] points in the immediate postpartum period compared with
204 a spontaneous vaginal delivery (Table 5). An elective cesarean section was correlated with a
205 non-significant increase of the patients EPDS score (2.3 [95% CI -6.1 ; 11]) in the immediate
206 postpartum period and a non-significant decrease of the partner EPDS score in both the
207 immediate (-1.4 [95% CI -7.8 ; 5.0]) and delayed postpartum period (-2.0 [95% CI -6.1 ; 2.1]).

208 In patients, 2nd degree perineal tears were significantly associated with lower EPDS scores in
209 the immediate postpartum period (-2.8 [95% CI -5.5 ; -0.17]).

210 The performance of an episiotomy was the only factor to be significantly associated with the
211 EPDS score in the partners, the latter increasing the EPDS score in the immediate postpartum
212 period by 4.8 points [95% CI 1.6 ; 8].

213 The absence of epidural seemed to be associated with a lower patient EPDS score in the
214 immediate postpartum period for both patients who did not want it (-1.9 [95% CI -5.9 ; 2.1])
215 and those who had a precipitous labor (-2.5 [95% CI -6.5 ; 1.5]). For the former patients, the
216 score seemed to decrease further in the late postpartum period while it increased for the latter
217 (Table 5).

218 *Correlation between EPDS scores at the three study time points*

219 The correlation coefficients between the EPDS scores at the 3 time points were calculated in
220 order to assess the intensity of the interdependence between score values and were as follows:
221 $r_{EPDS\ t1-t2} = 0.4 [0.2-0.58]$, $r_{EPDS\ t2-t3} = 0.52 [0.3-0.69]$, $r_{EPDS\ t1-t3} = 0.4 [0.15 -0.59]$.

222 **Discussion**

223 *Main findings*

224 We prospectively studied the evolution of EPDS scores in both couple members, following the
225 latest National recommendations. This assessment of both parents was repeated at three key
226 time points during the perinatal period: at the 9th month of pregnancy, at birth, and after 2
227 months of the child's life. To our knowledge, there are no studies that have applied these new
228 recommendations and demonstrated the feasibility of this assessment in both parents, as we

229 have done. In the present population, 15% of patients and 1% of their partners had an EPDS
230 score suggestive of postpartum depression 2 months after birth. The result for the patients is in
231 accordance with the 2022 French national survey on maternal mortality, [2] while that of the
232 partners is lower than previously reported [11]. However, our study did not identify specific
233 predictive factors for persistent perinatal depression among couples 6 to 8 weeks after childbirth
234 in a low-risk population as illustrate in fig 2. It underscores the importance of screening all
235 couples during both the pre- and postpartum periods, regardless of the presence of known risk
236 factors. The suggestion to conduct repeated screenings for both couple members during three
237 critical periods—prepartum, immediate postnatal, and remote postnatal—is considered
238 innovative. This approach may enhance the likelihood of identifying individuals at high risk for
239 perinatal depression.

240 *Antenatal risk factors*

241 In this low-risk study population with no specific obstetrical nor social risk factor, no predictive
242 factor for depressive symptoms in the late postpartum period was identified, despite a relatively
243 large prevalence of patients with a EPDS score of 10 or higher. However, a personal history of
244 psychiatric or psychological follow up seems to be correlated with an increase in EPDS score
245 during the late post-partum period, suggesting that this factor should be considered during the
246 prenatal interview, in both members of the couple. Several authors have described personal or
247 family history of psychiatric disorders as major risk factors for developing perinatal depression.
248 [9], [11], [28], [29] However, this hypothesis is not unanimous, and may differ between men
249 and women as reported by a recent meta-analysis [30] and as suggested by the present results.
250 It is likely that the lack of association between a history of psychiatric or psychological follow-
251 up and the EPDS score in the partners herein was due to the small proportion of partners with
252 depressive symptoms and to the fact that the majority of partners did not spontaneously report

253 this type of history during the initial consultation. According to previous findings, paternal
254 perinatal depressive symptoms differ from those observed in women. Indeed, anger, irritability,
255 hyperactivity, and poor impulse control are more common among men facing post-partum
256 depressive symptoms. [11] Moreover, coping strategies are also divergent, with a greater
257 propensity for isolation and drug or alcohol consumption in men than in women. [31] Thus, we
258 suggest that post-partum depression might be under-diagnosed in partners and EPDS score
259 could not be the best tool to screen such a condition. Plus, since domestic violence is
260 increasingly highlighted during pregnancy follow-up consultations, [32] developing new
261 screening tools with evaluation of the patient vulnerability ought to be considered in future
262 research. [9]

263 Interestingly, although it was not statistically significant, our results show a progressive
264 decrease in EPDS score over time, in both members of the couple, when pregnancy was
265 obtained following assisted reproductive therapy. This is discordant with studies showing that
266 couples going through this long and stressful process are more likely to develop anxious
267 manifestations that disturb the establishment of a privileged link with their child. [33], [34],
268 [35] Some authors have hypothesized that the anxiety or depressive symptoms in these parents
269 may be due to a longer period of grief regarding the idealized child. [36] However, not all
270 studies report depressive symptoms in these couples, [37], [38], [39] and the present results
271 tend to suggest a potential protective effect of ART toward perinatal depression, possibly
272 explained by the achievement of a well-considered project, and the strong investment of both
273 members of the couple.

274 Conversely, pregnancy monitoring in the fetal anomaly clinic seemed to gradually increase the
275 EPDS score over time in both members of the couple. It is possible that couples apprehend
276 better the last month of the pregnancy compared to earlier months when a higher number of

277 stressful appointments and achievements can occur, leading to difficult decisions such as
278 undertaking amniocentesis or requesting a termination of pregnancy. It is worth mentioning that
279 the fetuses followed up in the fetal anomaly clinic herein did not carry serious anomalies that
280 could have led to a request for a medical termination of the pregnancy. However, the anxiety
281 generated by these additional appointments may generate ambivalent psychological state in
282 both parents at birth or during the weeks after. Although few studies have addressed this subject,
283 a recent one reported increased post-partum anxiety and depression in patients followed up for
284 fetal anomaly or abnormal ultrasound findings. [40]

285 When evaluating the effect of parity on the EPDS score independently of age, no significant
286 association between EPDS score over time and parity was observed. The EPDS score seemed
287 to be higher in multiparous women in the antenatal period, then the two curves crossed at
288 delivery, and the score of the multiparous women then tended to be lower in the immediate and
289 late post-partum periods (fig 3). This observation is consistent with the literature, [41], [42],
290 [43] and can be explained by the accumulated tiredness of multiparous women at the end of
291 pregnancy, and by the inexperience of primiparous women who are confronted for the first time
292 with labor and delivery, and then have to learn how to manage the needs of a newborn.

293 Of note, only half of the patients and very few partners herein had received early pregnancy
294 prenatal counseling, appointment recommended by National Health Care Recommendations
295 thus preventing a clear evaluation of the effect of this clinic on the risk of post-partum
296 depression. Since the aim of this counseling is to identify the needs in terms of support during
297 pregnancy, [44] efforts must continue to offer the pregnancy counseling to both members of the
298 couple.

299 ***Delivery-related risk factors***

300 Our study highlights a significant prevalence of high EPDS scores during their maternity stay
301 among patients with a personal history of psychological disorders and those who underwent
302 emergency cesarean sections, that could be linked to acute post traumatic symptoms. None
303 factor related to the delivery was significantly associated with a change in the EPDS score at 6
304 to 8 weeks postpartum. However, the experience of both parents seems to differ in case of a
305 cesarean section: the maternal EPDS score tended to increase in the immediate and late post-
306 partum period, even more so in case of an emergency cesarean section. In opposition to vaginal
307 delivery, during which endogenous oxytocin discharge is higher [45], [46] and skin-to-skin
308 contact is possible, it has been suggested that the surgical environment could trigger post-
309 partum depression. [47] Moreover, a Slovakian study published in 2021 showed that
310 dissatisfaction with the birth process is a source of post-partum depression, [48] and a Canadian
311 study has recently shown that emergency cesarean section was indirectly linked to post-partum
312 depression via a post-traumatic stress mechanism. [49] Conversely, scheduling an elective
313 cesarean section tended to be associated with a decrease in the partners' EPDS scores, according
314 to the present findings. To our knowledge, this has not yet been described in the literature and
315 should be further investigated. One possible explanation could be that the scheduling of the
316 birth date may allow them to anticipate the constraints related to their professional and/or family
317 life and to ensure their presence on this important day. Another hypothesis may be related to
318 the difficulty felt by some partners regarding their role during labor and delivery. Indeed, if
319 their presence is often considered as normal in some culture, it generates levels of vulnerability,
320 especially regarding their partner's pain, the shared deception of a long and unpredictable
321 cervical dilation, and the role of a powerless spectator of their partner and baby's fate. Finally,
322 in spite of all the factors mentioned above, it is commonly expected for them to be cheerful and
323 supportive. Thus, it seems essential to prepare partners for labor and delivery, and to support
324 them throughout their journey in the delivery ward.

325 In case of vaginal delivery, no association was found between assisted delivery and the
326 psychological status of women or partners in the immediate or late post-partum period. This is
327 consistent with a large cohort study in Great Britain. [50] However, the degree of perineal tear
328 was correlated with the EPDS score during maternity stay. Although the absence of perineal
329 tear was not a protective factor, 2nd degree tears was associated with a decrease in the maternal
330 EPDS score. This surprising result, which concerned a majority of primiparous women, could
331 be explained by the relief of not having endured an episiotomy. Since this change in the EPDS
332 score was not observed later in the postpartum period, the results are consistent with the study
333 of Kaya et al., that showed no difference in the maternal EPDS score at 1 and 3 months
334 postpartum, according to whether or not an episiotomy was performed. [51] Conversely, the
335 partners' EPDS score seemed to increase non-significantly with the degree of perineal tear, and
336 the performance of an episiotomy was associated with a significant increase in the EPDS score
337 during the maternity stay, which did not persist 6 to 8 weeks later. This result, although not
338 previously reported, is probably multifactorial. Episiotomies are often performed in emergency,
339 in the context of instrumental delivery or fetal heart rate abnormalities. [52], [53] Although the
340 patient's consent is always sought, the context is not conducive to obtaining informed consent.
341 At a time when mistrust of the medical profession is unprecedented, it is understandable that
342 some partners may perceive this act as a potential mutilation. Furthermore, numerous studies
343 have shown that episiotomy is correlated to persistent perineal pain in the post-partum period
344 [54] and a delayed sexual health recovery without adverse sexual functions. [55]

345 The results about analgesia during labor and delivery are consistent with numerous studies
346 published on the link between pain, post-traumatic stress, and depression. [56], [57] The present
347 results corroborate the well-established hypothesis that the perception of pain is multifactorial.
348 [58] Patients who were prepared to manage the pain during labor and delivery and who chose

349 not to have an epidural, had a decreased EPDS score during early and late post-partum period.
350 This suggests that pain, in this case, did not lead to post-traumatic stress or mood changes.
351 However, the mothers who did not receive an epidural anesthetic although they wished for it
352 seemed to have a low EPDS score in the immediate postpartum period, probably linked to a
353 rapid and eutocic delivery, but their score increased by 3 points 6 to 8 weeks later. This result
354 highlights the time frame of post-traumatic stress and the depression. [59], [60] In the future,
355 patients should be prepared for the possible lack of epidural anesthesia in the event of
356 precipitous labor. The management of pain with non-pharmacological approaches, intravenous
357 morphine or nitric oxide inhalation should be considered when the setting of an epidural is not
358 possible.

359 Finally, the occurrence of a hemorrhage did not significantly impact the maternal EPDS score
360 after delivery, which is consistent with a recent Swedish study. [61] The downward trend of the
361 partners' EPDS score in case of an abnormal bleeding could be explained by the same decrease
362 observed in the case of a cesarean section, which is more prone to bleeding.

363 *Correlation between EPDS scores at the three time points*

364 The EPDS scores at the three time points of the study were related to each other by a moderate
365 positive correlation. Indeed, the EPDS scores in the antenatal and early postnatal periods were
366 only slightly predictive of the EPDS score a few weeks after birth. Thus, the assessment of the
367 mental health status of the couples during pregnancy and immediately after birth is important,
368 as it allows early implementation of psychological or psychiatric care, but is not sufficient.
369 Therefore, prevention and screening of mood disorders must be pursued after delivery as
370 recommended by the French national health authority. [15]

371 *Strengths and limitations*

372 The major strength of this study is its prospective aspect. Moreover, the prevalence of patients
373 with a score suggestive of depression is consistent with the literature. [1], [62] Importantly,
374 psychological support was offered to patients when the score was 10 or greater and also when
375 the score was normal but the caregivers felt that it could be beneficial. Overall, the offer of
376 psychological or psychiatric counselling was well accepted and the patients took the initiative
377 to contact the medical teams when advised to do so.

378 An important limitation of this study is the lack of power due to a high prevalence of lost to
379 follow-up during the late postpartum period, despite numerous reminders. More than half of the
380 partners did not answer the EPDS questionnaire in the weeks following the delivery, which
381 prevented us to carry out all the statistical analyses initially planned. Moreover, the EPDS does
382 not allow to diagnose depression *per se*, and as such it is possible that some patients with a high
383 EPDS score were referred to a specialist consultation without any real indication for depression
384 while others were not although they might have needed it. Since we did not have access to the
385 contents of the psychological and psychiatric consultations, we do not have information on the
386 prevalence of patients who were finally diagnosed with perinatal depression. Finally, the
387 prevalence of an EPDS score over 10 in men was lower than expected, questioning the
388 acceptance, timing, performance, validation, and selected cut-off in this population.

389 **Conclusion**

390 This pioneering study aligned with the latest government recommendations, assessing their
391 feasibility and benefits. This study of emotional perinatal pathways of 100 couples highlighted
392 the importance and feasibility of screening all patients, with or without risk factors, at different
393 key time points demonstrating undeniable benefits in depression screening, uncovering cases

394 that would have otherwise gone unnoticed. Risk factors for each time point are sometimes
395 commune but also specific of each perinatal period.

396 In future research, it will be imperative to extend these screening procedures to verify their
397 effectiveness in a larger population. This will require increasing the size of the cohort and
398 replicating the screening process, as we have done, consistently at three key points: during the
399 9th month of pregnancy, at birth and during the postnatal period. Such an approach would
400 increase the likelihood of identifying all individuals at risk.

401 In addition, there is an urgent need to raise awareness of partners' depression among
402 professionals and adapt the screening tool for them. This will enable to better support the both
403 partners in this difficult phase and also highlight the often overlooked risks associated with
404 paternal perinatal depression.

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408 The authors declare that they have no conflict of interest.

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416 **Contributions of authorship**

417 AP, BDF, SVS and FJ contributed to the conception and the design of the study. AP collected
418 data. MN realized statistical analysis. AP, BD and SVS contributed to interpretation of results,
419 drafted the manuscript and revised it. All the authors have read and approved the final
420 manuscript.

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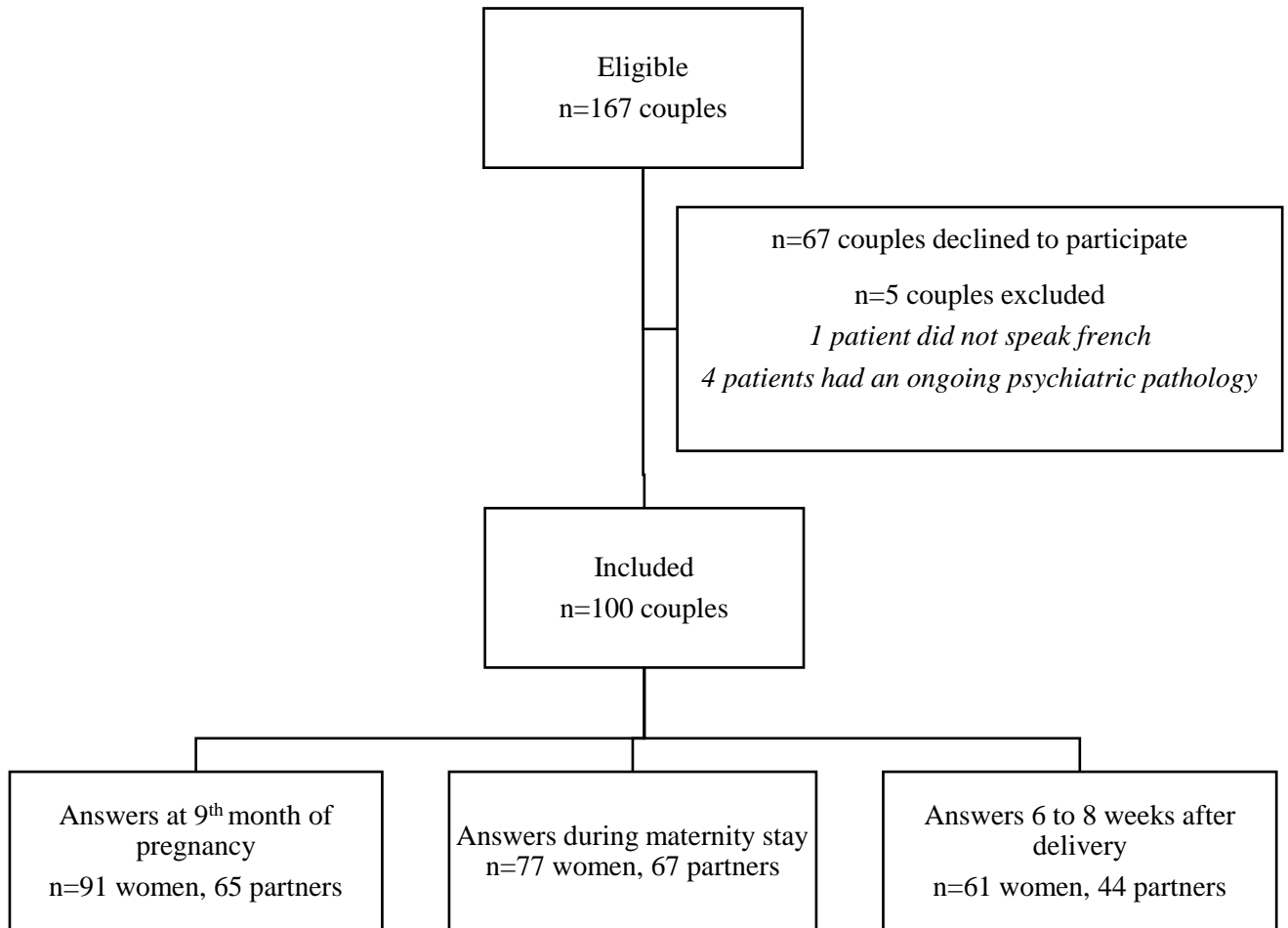
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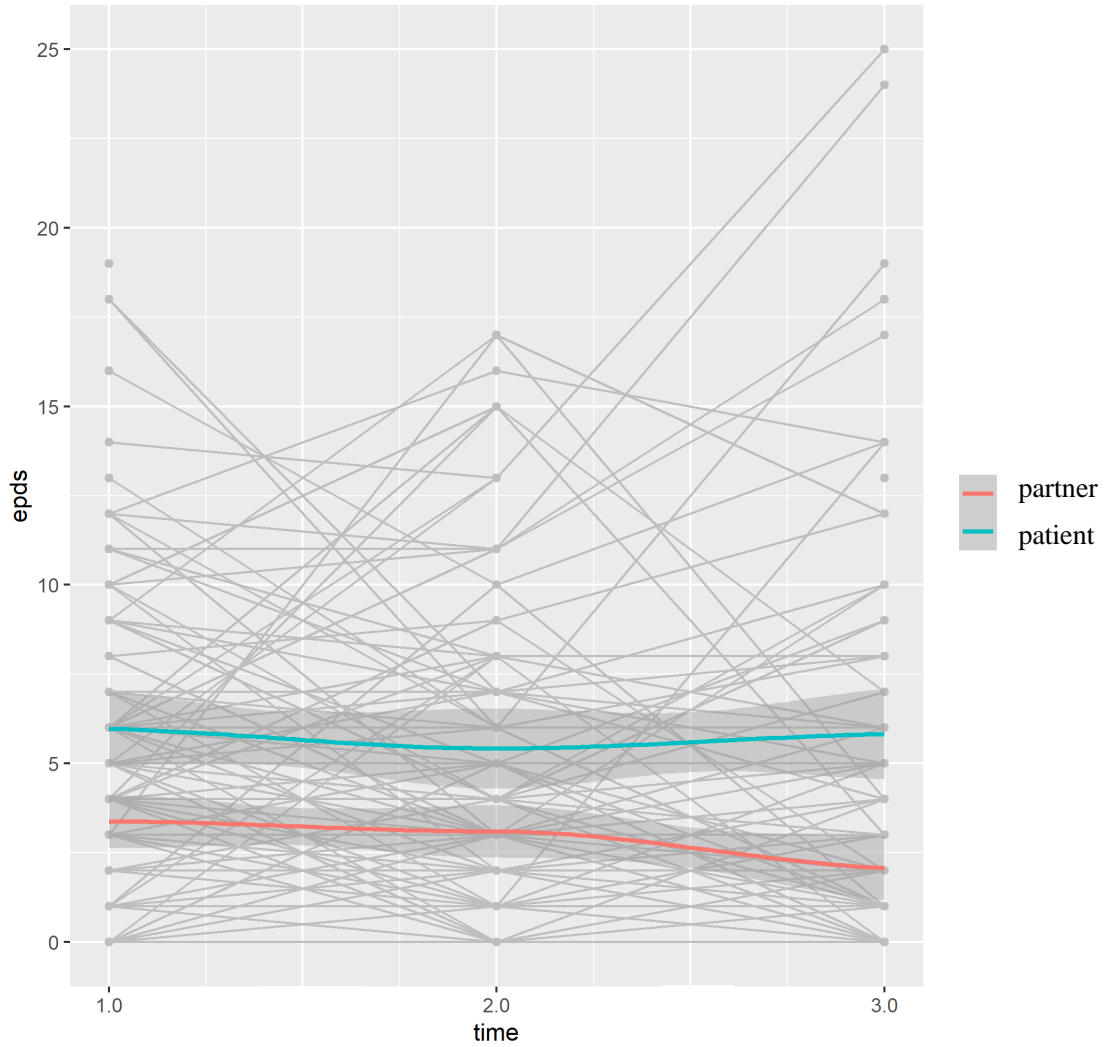
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Figure 1: Study flow chart

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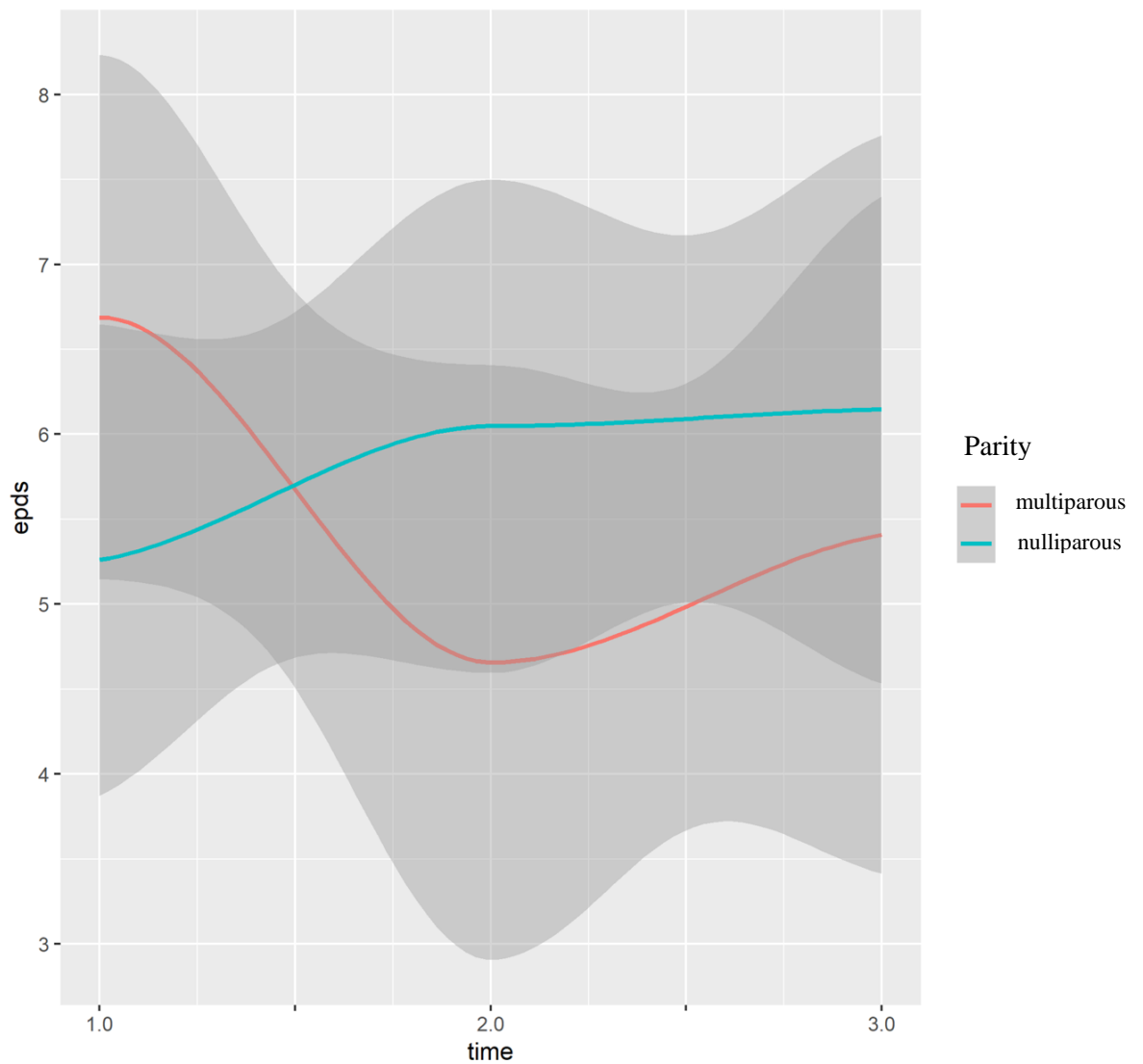
1: prenatal period
2: maternity stay
3: late post-partum period

Figure 2: Changes in the EPDS score over time

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635 1: prenatal period
636 2: maternity stay
637 3: late post-partum period
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639 **Figure 3: Effect of parity on the changes in EPDS score over time among patients (mixed**

640 **model)**

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Table 1: Characteristics of the population

Characteristics	patient, N = 95 ¹	partner, N = 95 ¹
Age	32.7 (4.7)	34.4 (5.3)
Profession		
high socioeconomic status	41 (43%)	43 (45%)
intermediate professions	33 (35%)	23 (24%)
employees	11 (12%)	13 (14%)
craftsmen, shopkeepers, company managers	3 (3.2%)	12 (13%)
workers	1 (1.1%)	3 (3%)
others and unemployed	6 (6.3%)	1 (1%)
History of psychological or psychiatric follow up	13 (14%)	2 (2%)
ART	10 (11%)	10 (11%)
Early prenatal interview		
Yes	50 (53%)	15 (16%)
No	26 (27%)	39 (41%)
Unknown	19 (20%)	41 (43%)
EPDS score		
At the 9 th month of pregnancy	6.0 (4.7)	3.4 (3.1)
During the maternity stay	5.4 (4.4)	3.1 (3.1)
6 to 8 weeks post-partum	5.8 (6.1)	2.1 (2.8)
Mean response delay in the post-partum period (days)	58 (22)	60 (23)

¹Mean (SD); n (%)

ART: assisted reproductive therapy

EPDS: Edinburgh Postnatal Depression Scale

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649 **Table 2: Obstetrical history, pregnancy course, delivery modalities**

Characteristics	N = 95 ¹
BMI (kg/m ²) (standard deviation)	22.0 (3.9)
Parity	
0	48 (50%)
1	37 (39%)
≥2	10 (11%)
History of pathological pregnancy	3 (3%)
History of miscarriage	
0	73 (77%)
1	17 (18%)
≥2	5 (5%)
History of ectopic pregnancy	2 (2%)
History of medical intervention during delivery	18 (38%)
Gestational diabetes	13 (14%)
Pregnancy follow-up at the fetal anomaly clinic	12 (13%)
Labor initiation	
spontaneous	69 (73%)
medical induction	23 (24%)
cesarian section before labor (standard deviation)	3 (3%)
Mean labor time on the partogram	5.0 (4.2)
Epidural anesthesia	
yes	83 (87%)
no, because unwanted	6 (6.5%)
no, because of precipitous labor	6 (6.5%)
Delivery modality	
spontaneous vaginal delivery	66 (69.5%)
assisted vaginal delivery	17 (18%)
cesarian section before labor	3 (3%)
emergency cesarian section	9 (9.5%)
Emergency code	
green	14 (54%)
orange	5 (19%)
red	7 (27%)
Perineal tear degree	
Intact	35 (37%)
1 st degree	32 (33.5%)
2 nd degree	20 (21%)
3 rd degree	2 (2%)
episiotomy	6 (6.5%)
Hemorrhage	8 (8%)
Birth weight (g)(standard deviation)	3400 (389)
Arterial pH	7.26 (0.08)
Apgar at 1min	
≤7	9 (9%)
8	10 (11%)
9	14 (15%)
10	62 (65%)
Apgar at 5min	
≤8	2 (2%)
9	10 (11%)
10	83 (87%)
Feeding type	
formula	15 (16%)
breastfeeding	78 (82%)
mixed	2 (2%)

¹Median (SD); n (%)

Table 3: EPDS score variations according to patients' characteristics

Characteristics	EPDS t1		EPDS t2		EPDS t3	
	Beta	95% CI ¹	Beta	95% CI ¹	Beta	95% CI ¹
Age	-0.01	-0.22, 0.20	-0.02	-0.26, 0.22	-0.24	-0.59, 0.11
Profession						
craftsmen, shopkeepers, company managers	—	—	—	—	—	—
executives and higher intellectual professions	-1.0	-6.5, 4.5	0.11	-5.3, 5.5	2.0	-5.5, 9.4
intermediate professions	-1.6	-7.2, 3.9	0.32	-5.2, 5.8	1.3	-6.5, 9.1
employees	2.1	-3.9, 8.0	-0.76	-7.0, 5.5	4.3	-4.0, 13
others and unemployed	0.83	-5.6, 7.3	-1.3	-12, 9.1	-0.67	-15, 14
BMI	0.00	-0.25, 0.24	0.17	-6.7, 7.1	6.8	-4.4, 18
Parity	0.60	-0.90, 2.1	-1.0	-2.4, 0.41	-0.60	-3.0, 1.8
History of miscarriage	0.45	-1.2, 2.1	-0.03	-1.9, 1.9	-3.0	-6.0, 0.00
History of medical intervention during delivery						
No	—	—	—	—	—	—
Yes	-0.48	-3.8, 2.8	-0.49	-3.1, 2.1	-3.6	-8.9, 1.7
History of psychological or psychiatric follow-up						
No	—	—	—	—	—	—
Yes	0.76	-2.0, 3.5	3.7	0.91, 6.4	2.3	-2.1, 6.7
ART						
No	—	—	—	—	—	—
Yes	-1.4	-4.5, 1.7	-1.7	-5.2, 1.7	-3.5	-8.7, 1.7
Early prenatal interview						
No	—	—	—	—	—	—
Yes	-0.71	-3.1, 1.7	0.43	-2.1, 3.0	-1.5	-5.1, 2.1
Gestational diabetes						
No	—	—	—	—	—	—
Yes	-0.44	-3.3, 2.4	-0.49	-3.3, 2.3	0.08	-4.3, 4.5
Follow-up at the antenatal diagnosis center						
No	—	—	—	—	—	—
Yes	0.66	-2.3, 3.6	1.7	-1.4, 4.8	2.4	-1.9, 6.8

¹CI = confidence intervalt1 = 9th month consultation; t2 = maternity stay; t3 = 6-8 weeks post-partum

BMI: body mass index ; ART: assisted reproductive therapy

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654 **Table 4: Partners EPDS score variations over time**

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Characteristics	EPDS t1		EPDS t2		EPDS t3	
	Beta	95% CI ¹	Beta	95% CI ¹	Beta	95% CI ¹
Age	-0.06	-0.20, 0.08	-0.13	-0.27, 0.02	-0.10	-0.27, 0.07
Profession						
craftsmen, shopkeepers, company managers	—	—	—	—	—	—
executives and higher intellectual professions	0.40	-2.6, 3.4	-1.2	-4.3, 1.8	-0.77	-5.0, 3.5
intermediate professions	1.5	-1.7, 4.7	0.51	-2.7, 3.7	0.19	-4.2, 4.6
employees	1.0	-3.0, 5.0	-0.23	-3.8, 3.4	0.00	-5.8, 5.8
workers	1.9	-3.3, 7.1	-0.60	-7.5, 6.3	-1.5	-8.6, 5.6
History of psychological or psychiatric follow-up						
No	—	—	—	—	—	—
Yes	-3.4	-9.6, 2.8	0.42	-4.1, 5.0	-2.1	-7.8, 3.6
ART						
No	—	—	—	—	—	—
Yes	1.6	-0.74, 3.9	-0.28	-3.0, 2.4	-0.85	-3.3, 1.6
Early prenatal interview						
No	—	—	—	—	—	—
Yes	0.57	-1.5, 2.6	-0.75	-3.2, 1.7	-1.1	-3.4, 1.1
Follow-up at the antenatal diagnosis center						
No	—	—	—	—	—	—
Yes	-0.28	-2.6, 2.1	0.86	-1.7, 3.4	1.1	-1.4, 3.5

¹CI = confidence intervalt1 = 9th month consultation ; t2 = maternity stay ; t3 = 6-8 weeks post-partum

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659 **Table 5: Influence of labor course and delivery on the EPDS scores of the patients and theirs**
 660 **partners.**
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Characteristics	Patient				Partner			
	EPDS t2		EPDS t3		EPDS t2		EPDS t3	
	Beta	95% CI ¹	Beta	95% CI ¹	Beta	95% CI ¹	Beta	95% CI ¹
Labor initiation								
Spontaneous	—	—	—	—	—	—	—	—
Medical induction	0.44	-1.8, 2.7	2.4	-1.1, 5.8	0.12	-1.7, 2.0	-0.44	-2.4, 1.5
Cesarian section before labor	1.7	-7.2, 11	1.4	-7.4, 10	-1.1	-7.5, 5.4	-1.8	-5.9, 2.4
Mean labor time	0.04	-0.21, 0.29	-0.31	-0.73, 0.11	0.01	-0.22, 0.24	-0.05	-0.36, 0.26
Epidural anesthesia								
Yes	—	—	—	—	—	—	—	—
no, because unwanted	-1.9	-5.9, 2.1	-3.3	-11, 4.0	0.83	-2.1, 3.7	-1.6	-4.9, 1.8
No, because of precipitous labor	-2.5	-6.5, 1.5	0.54	-8.3, 9.3	-2.4	-5.6, 0.80	-2.2	-7.9, 3.5
Delivery modality								
Spontaneous vaginal birth	—	—	—	—	—	—	—	—
Cesarian section before labor	2.3	-6.1, 11	0.87	-8.1, 9.8	-1.4	-7.8, 5.0	-2.0	-6.1, 2.1
Emergency cesarian section	5.2	2.2, 8.1	1.9	-3.1, 7.0	-0.38	-3.4, 2.6	0.02	-3.0, 3.0
Extraction	0.27	-2.1, 2.7	-0.27	-4.1, 3.6	-1.2	-3.1, 0.76	-1.3	-3.3, 0.71
Emergency degree								
Code Green	—	—	—	—	—	—	—	—
Corde Orange	3.2	-2.0, 8.4	4.7	-3.8, 13	0.53	-3.7, 4.7	-0.10	-4.0, 3.8
Corde Red	1.3	-3.5, 6.2	2.8	-3.4, 9.0	-0.17	-3.9, 3.5	-0.06	-3.7, 3.6
Perineal tear degree								
Intact	—	—	—	—	—	—	—	—
1 st degree	-0.85	-3.3, 1.6	0.86	-3.0, 4.7	1.2	-0.61, 2.9	0.44	-1.8, 2.6
2 nd degree	-2.8	-5.5, -0.17	-0.39	-4.7, 3.9	-0.29	-2.2, 1.6	-0.36	-2.7, 2.0
3 rd degree	0.07	-6.3, 6.4	-4.8	-14, 4.4	3.1	-1.3, 7.4	-1.1	-5.4, 3.3
Episiotomy	-1.6	-5.5, 2.3	0.23	-5.9, 6.4	4.8	1.6, 8.0	0.27	-3.4, 3.9
Hemorrhage								
No	—	—	—	—	—	—	—	—
Yes	0.45	-3.3, 4.2	0.41	-5.3, 6.1	-0.89	-4.1, 2.4	-2.0	-4.9, 0.89
Apgar 1min	0.04	-0.66, 0.75	0.74	-0.27, 1.8	-0.10	-0.63, 0.44	0.24	-0.29, 0.77
Apgar 5min	-0.51	-3.8, 2.8	-0.76	-5.0, 3.5	-0.08	-2.8, 2.6	1.2	-0.77, 3.2

¹CI = confidence interval

t2 = maternity stay; t3 = 6-8 weeks post-partum

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