



**HAL**  
open science

## Postpartum psychological distress associated with anal incontinence in the EDEN mother–child cohort

Xavier Fritel, Bertrand Gachon, Saurel-Cubizolles Mj

### ► To cite this version:

Xavier Fritel, Bertrand Gachon, Saurel-Cubizolles Mj. Postpartum psychological distress associated with anal incontinence in the EDEN mother–child cohort. *BJOG: An International Journal of Obstetrics and Gynaecology*, 2020, 127 (5), pp.619-627. 10.1111/1471-0528.16075 . inserm-02434984

**HAL Id: inserm-02434984**

**<https://inserm.hal.science/inserm-02434984v1>**

Submitted on 10 Jan 2020

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

1 ***Title***

2 Postpartum psychological distress associated with anal incontinence in the EDEN mother–  
3 child cohort.

4 ***Authors***

5 Fritel X, 1

6 Gachon B, 1

7 Saurel-Cubizolles MJ, 2

8 and the EDEN Mother-Child Cohort Study Group

9 EDEN Mother-Child Cohort Study Group: Annesi-Maesano I, Bernard JY, Botton J,  
10 Charles MA, Dargent-Molina P, de Lauzon-Guillain B, Ducimetière P, de Agostini M,  
11 Foliguet B, Forhan A, Fritel X, Germa A, Goua V, Hankard R, Heude B, Kaminski M,  
12 Larroque B†, Lelong N, Lepeule J, Magnin G†, Marchand L, Nabet C, Pierre F, Slama R,  
13 Saurel-Cubizolles MJ, Schweitzer M, Thiebaugeorges O. († deceased)

14 ***Institutions***

15 1. University Hospital of Poitiers, Gynaecology and Obstetrics Department, F-86000  
16 Poitiers, France.

17 2. Université de Paris, Epidemiology and Statistics Research Centre/CRESS-EPOPé,  
18 INSERM, INRA, F-75004 Paris, France

19 ***Correspondence***

20 Prof. Xavier FRITEL

21 Service de Gyn-Obs, CHU de Poitiers, rue de la Milétrie, F-86000 Poitiers, France

22 Phone +33 549 443 360. xavier.fritel@inserm.fr

23 ***Running title***

24 Postpartum psychological distress and anal incontinence

25 ***Abstract***

26 Objective: To estimate the prevalence of flatus-only and faecal incontinence, to describe  
27 their risk factors, and to analyse the association between anal incontinence and  
28 psychological distress over the first 1 year postpartum.

29 Design: Cohort study from pregnancy to 12 months postpartum

30 Setting: Two university hospital maternity wards in France

31 Population: 2002 pregnant women were recruited between 2003 and 2006. Data on anal  
32 incontinence was available for the 1632 women who comprise the sample for analysis.

33 Methods: Women were enrolled during pregnancy. A postal questionnaire was sent at 4  
34 and 12 months postpartum.

35 Main Outcome Measures: Anal (flatus-only and faecal) incontinence was assessed at 4  
36 months postpartum. Mental health was assessed at 4 and 12 months postpartum by the  
37 Edinburgh Postpartum Depression Scale (EPDS) and use of antidepressant drugs as well as  
38 by self-rated mental health.

39 Results: At 4 months postpartum, the prevalence for flatus-only incontinence was  
40 14.4% and for faecal incontinence 1.7%; multivariate analysis, restricted to women  
41 reporting no anal incontinence before the index pregnancy, showed that continuing  
42 breastfeeding at 4 months was related to a higher risk of de novo postpartum anal  
43 incontinence (OR=2.23). Women who reported anal incontinence at 4 months were more  
44 frequently depressed (EPDS  $\geq$  10 or antidepressant use) at 12 months postpartum: 36.0%  
45 of those with faecal incontinence were depressed, 23.3% of those with flatus-only  
46 incontinence, and only 14.8% of the continent women.

47 Conclusion: Postnatal faecal incontinence was rare but associated with poorer maternal  
48 mental health. Postnatal screening should be encouraged, and psychological support  
49 offered.

50 Funding: Fondation pour la Recherche Médicale, INSERM, Ministère de la Recherche,  
51 Université Paris Sud, Agence Nationale de la Recherche, Institut de Recherche en Santé  
52 Publique, Agence Française pour la Surveillance et la Sécurité de l'Environnement et du  
53 Travail, Santé Publique France, Direction Générale de la Santé, Association de Langue  
54 Française pour l'Etude du Diabète et du Métabolisme, Mutuelle générale de l'Education  
55 Nationale, Nestlé

56 Keywords: postpartum, anal incontinence, depression, cohort study

57 Tweetable abstract: Postnatal faecal incontinence was associated with depression; postnatal  
58 screening should be encouraged and psychological support offered.

59

60 ***Introduction***

61 In the year after childbirth, one in eight women develops a depressive illness; this  
62 distressing episode for new mothers can have dramatic consequences on the baby's health.<sup>1</sup>

63 The main risk factors for postpartum depression are history of depression, low partner  
64 support, anxiety, and stressful life events.<sup>1,2,3</sup>

65 Anal or faecal incontinence is a disability that has repercussions on health-related quality  
66 of life and mood.<sup>4</sup> Depression is two to five times more frequent in people with faecal  
67 incontinence.<sup>5-7</sup> The main risk factors for anal incontinence are ageing, diarrhoea, anorectal  
68 surgery, and childbirth. The risk of developing faecal incontinence after giving birth is  
69 between 1 and 10%, and 6 to 45% of women have symptoms of flatus incontinence.<sup>8-14</sup>

70 Major obstetrical risk factors are anal sphincter tears and instrumental delivery.<sup>8,9,15</sup>

71 The nature and direction of the association between faecal incontinence and depression  
72 remain controversial.<sup>16,17</sup> On the one hand, faecal incontinence may induce or worsen  
73 depression; on the other hand, depression may impair sphincter control or worsen  
74 perception of incontinence. A woman suffering from postnatal depression might be more  
75 likely to report symptoms about flatus incontinence than women without depression; and a  
76 woman suffering from anal incontinence may consider that her quality of life has  
77 deteriorated due to childbirth and thus develop postnatal depression, which can impair the  
78 mother-child relationship. We found few postpartum studies on the subject.<sup>18-21</sup> A Google  
79 search brought up many internet groups discussing this topic and suggests that woman  
80 giving birth are substantially concerned about it.

81 Our main aim was to analyse the association between anal incontinence and depressive  
82 symptoms during the first postpartum year, based on data from a two-centre cohort study.

83

84 **Methods**

85 Population

86 The EDEN mother–child cohort (Etude sur les Déterminants pré et postnatals précoces du  
87 développement psychomoteur et de la santé de l’ENfant) invited pregnant women  
88 attending a prenatal visit in the Obstetrics and Gynaecology departments of the Nancy and  
89 Poitiers University Hospitals (France) before 24 weeks of gestation to participate.  
90 Enrolment started in February 2003 in Poitiers and in September 2003 in Nancy and lasted  
91 27 months in each centre. Exclusion criteria were twin pregnancies, known diabetes before  
92 pregnancy, inability to speak and read French, and intention to move away from the region.  
93 Among women who met these inclusion criteria, 55% agreed to participate (969 in Poitiers  
94 and 1033 in Nancy). The study was approved by the Ethics Committee of the Kremlin-  
95 Bicêtre Hospital. Written consent was obtained from the mother at enrolment. More  
96 information about the EDEN cohort can be found on the web (<http://eden.vjf.inserm.fr/>)  
97 and in the article describing the cohort profile.<sup>22</sup>

98 Demographic and social details, including mother’s age, educational level, household  
99 income, smoking status, and weight, were obtained in a face-to-face interview at 24 to 28  
100 weeks of gestation, at the same time that midwife research assistants measured the  
101 mother’s height. Data on previous pregnancies, deliveries, birth weight of previous  
102 children, and weight gain in the index pregnancy were extracted from obstetric records.  
103 Marital status and relationship quality (measured from questions included in the postal  
104 questionnaire completed at 1 year) were summarised by an indicator in 3 classes: women  
105 living with the baby’s father with a good relationship, women living with the baby’s father  
106 with problems, and women not living with the baby’s father (see Table S1).

107 Anal incontinence assessment

108 At 4 months postpartum, the following questions were asked in a postal questionnaire:  
109 “During the last month, have you experienced involuntary leakage of gas or stools?  
110 yes/no”, “If yes, involuntary leakage of gas? Involuntary leakage of liquid stools?  
111 Involuntary leakage of solid stools?” These three questions were answered on a 4-point  
112 scale: never/less than once a week/at least once a week/every day.<sup>23</sup> From the answers to  
113 these questions, women were classified into three groups, those with no anal incontinence,  
114 with flatus-only incontinence, and with faecal (stool) incontinence. Data about anal  
115 continence before the index pregnancy were obtained at 4 months postpartum.

116 Mental health assessment

117 The women's mental health was measured with several indicators. First, we used the CESD  
118 questionnaire (completed at the end of the second-trimester) to evaluate the mood state of  
119 pregnant women and considered women with a CESD score below 16 as “not depressed”.<sup>24</sup>  
120 Second, the postnatal questionnaires, completed at 4 and 12 months after delivery,  
121 included questions about perceived physical health (“During the last month, how have you  
122 been feeling physically? very well/rather well/rather poorly/very poorly”) and perceived  
123 mental health (“During the last month, how have you been feeling from a mental point of  
124 view? very well/rather well/rather poorly/very poorly”). Third, the postnatal questionnaires  
125 also included the Edinburgh Postnatal Depression Scale (EPDS);<sup>25</sup> women with a score of  
126 10 or above were considered to have depressive symptoms and defined as depressed.  
127 Fourth, those questionnaires also asked about the postnatal use of antidepressant drugs  
128 during the preceding month (“yes/no”). Lastly, in the days after the birth, women  
129 responded to the question: “Have you ever been hospitalised in a psychiatry ward, before  
130 this pregnancy began? no/yes”.

131 Analysis

132 We estimated the prevalence of flatus-only incontinence and faecal incontinence at 4  
133 months postpartum. The prevalence was analysed according to social, demographic, and  
134 medical factors. Adjusted odds ratios of de novo flatus-only incontinence and faecal  
135 incontinence (among women reporting that they did not have anal incontinence before the  
136 pregnancy) were calculated by polychotomous logistic regression to take into account  
137 simultaneously each factor and incontinence severity (no incontinence, flatus only, faecal  
138 incontinence).

139 The relations between anal incontinence and mental health at 4 months and 12 months  
140 postpartum were studied by logistic regressions to adjust for the following factors:  
141 women's age, psychiatric hospitalisation before the index pregnancy, relationship, previous  
142 delivery of infant weighing 4000 g or more, perineal tear at index delivery, breastfeeding,  
143 hospitalisation of the baby in the first year, and medical centre. These factors were related  
144 to the exposure (anal incontinence) or to poor mental health, or to both. As complementary  
145 sensitivity analyses, these logistic regression models were run on a sample restricted to the  
146 women not classified as depressed during the second-trimester of pregnancy. Each logistic  
147 regression was adjusted for the medical centre. The statistical analysis was performed with  
148 SAS version 9.4 software.

149 Patients were not involved in the development of the EDEN cohort. No core outcome sets  
150 were used because no core outcome set for this topic has yet been developed.

151



152 **Results**

153 Questionnaires at 4 months postpartum were returned by 1668 of the 2002 women  
154 included at baseline, a response rate of 83.3%. Comparisons with the non-respondents  
155 showed that respondents were more likely to be 30 years or older (50.7 vs. 38.0%),  
156 married, smokers, and to have higher household incomes. They also had vaginal deliveries  
157 more often (87.8 vs. 64.7%). The response rate did not differ according to centre, parity, or  
158 BMI. Data on anal incontinence was available for 1632 women, who make up the main  
159 sample analysed.

160 Prevalence of anal incontinence at 4 months postpartum

161 The prevalence of anal incontinence was 16.1% ( $n = 263$ , 95% confidence interval: 14.3–  
162 17.9%) at 4 months postpartum. Prevalence of flatus-only incontinence was 14.4% (235,  
163 12.7–16.1%) and of faecal incontinence 1.7% (28, 1.1–2.3%). Among women who did not  
164 have anal incontinence before the index pregnancy ( $n = 1587$ ), 14.0% (223) reported *de*  
165 *novo* anal incontinence, 12.5% (199) *de novo* flatus-only incontinence, and 1.5% (24) *de*  
166 *novo* faecal incontinence.

167 The prevalence of postnatal anal incontinence was higher among women aged 30 years or  
168 older, who ever had an instrumental vaginal delivery, ever had a baby weighing 4000 g or  
169 more, or was still breastfeeding (Table 1). The prevalence of flatus-only incontinence or  
170 faecal incontinence did not differ significantly among women with caesarean compared  
171 with spontaneous vaginal deliveries.

172 Logistic regression – restricted to women reporting that they did not have anal  
173 incontinence before the index pregnancy – retained only one significant risk factor  
174 associated with *de novo* anal incontinence: continued breastfeeding (Table 2). The  
175 proportion of multiparous women ( $\geq 3$  deliveries) among the 45 women reporting anal

176 incontinence before their index pregnancy was significantly higher (31.1%) than among  
177 those continent before this pregnancy ( $n=1584$ , 17.9%), as was the proportion of women  
178 who had had a baby weighing 4000 g or more than (respectively 20.0% and 8.6%).

#### 179 Anal incontinence and mental health

180 At 4 months postpartum, women with anal incontinence reported that their physical and  
181 mental health was “rather poor” or “very poor” more frequently than the others (Table 3).  
182 The percentage of depressed women was especially high among women with faecal  
183 incontinence (50.0%) but also higher in women with flatus incontinence (26.6%) than in  
184 continent women (17.2%).

185 Women who had reported anal incontinence at 4 months reported poor mental health more  
186 often at 12 months; they were also more frequently depressed and used antidepressant  
187 drugs much more often at 12 months (Table 3). For instance, 6.4% of women with anal  
188 incontinence were using antidepressant drugs 1 year after the birth compared to 2.6% of  
189 women without anal incontinence. The percentage of depressed women (defined by the  
190 EPDS score) was 22.1% among women with anal incontinence compared to 13.5% among  
191 continent women (Table 3). The analysis excluding women depressed during their second-  
192 trimester of pregnancy found similar odds (Table S2).

193 In the overall population, the odds ratios of antidepressant drug use were significantly  
194 higher for women with flatus incontinence as well as for those with faecal incontinence.  
195 The odds ratio of depression was significantly higher among women with flatus-only or  
196 faecal incontinence (Table 4). This association between mental health 1 year after delivery  
197 and anal incontinence was similar in the sample restricted to women without anal  
198 incontinence before the index pregnancy and not depressed during the second-trimester of  
199 pregnancy (Table 4).

200

201 ***Discussion***

202 **Main findings**

203 In our population with a follow-up to 1 year postpartum, faecal incontinence at 4 months  
204 postpartum was rare but was followed by a significant risk of depressive symptoms and use  
205 of antidepressant drugs 8 months later.

206 **Strengths and limitations**

207 Our study has several weaknesses; variables such as prenatal anal incontinence, length of  
208 the active second phase of labour, and the existence of an episiotomy or perineal tear were  
209 only collected at the 4-month postpartum questionnaire; the infrequency of faecal  
210 incontinence (1.7% at 4 months postpartum in our sample) limits the power of the  
211 statistical analysis; we have no information on intestinal transit. The strengths of this study  
212 are its large sample; which came from a general population of recent mothers, in an  
213 organised regular cohort that continued past one year, the high response rates, and the  
214 quality of the data on mental health.

215 **Interpretation**

216 The prevalence of flatus-only incontinence or faecal incontinence in our population, 14.4  
217 and 1.7%, respectively, is consistent with that reported by other studies between 3 and 6  
218 months postpartum, with figures ranging from 6.3% to 45.3% for flatus incontinence and  
219 between 0.7 and 9.6% for faecal incontinence.<sup>9-14</sup>

220 In the general population older than 50 years, depression appears to be 2 to 5 times more  
221 frequent in people with faecal incontinence.<sup>5-7</sup> Data are sparse about the possible  
222 association between anal incontinence and depression in the postnatal period. In a cross-  
223 sectional study of 1331 women at 6 months postpartum, bowel problems were associated  
224 with postpartum depression (EPDS  $\geq 13$ ; OR 1.9, CI95% 1.3–2.9).<sup>18</sup> A retrospective study

225 of 294 women referred after delivery (mean 24 days) reported that anal incontinence was  
226 not associated with postpartum depression (EPDS  $\geq 10$ ).<sup>19</sup> In another small study of 284  
227 primiparous women interviewed 10 months after childbirth, severe dysphoria was  
228 associated with dyspareunia (2.5; 1.4–4.6) but not with anal incontinence (0.7; 0.4–1.2).<sup>20</sup>  
229 In the large enquiry by MacArthur of 4214 women, persistent faecal incontinence at 6  
230 years postpartum was associated with poor perceived health and a higher Hospital Anxiety  
231 and Depression score (mean score 7.6 versus 5.4).<sup>21</sup>

232 We used longitudinal data from the second-trimester of pregnancy and then at 4 and 12  
233 months postpartum to explore the association between anal incontinence and depressive  
234 symptoms. Our results suggest that anal incontinence is associated with poorer perceived  
235 physical and mental health at 4 months postpartum and that this association persists at 12  
236 months for mental but no longer for physical health. The observation of anal incontinence  
237 at 4 months postpartum could thus alert clinicians about the risk of depression persisting up  
238 to 12 months after delivery and enable early screening and management of this postnatal  
239 depression.

240 Our results can be interpreted in favour of a causal link between postnatal anal  
241 incontinence and depression:<sup>26</sup> i) Gradient: all measurements of mental health (EPDS  
242 questionnaire, perceived mental health, and antidepressant use) were consistent with a  
243 gradient linked to the intensity of exposure (stronger with faecal incontinence than with  
244 flatus); ii) Temporality: women with de novo faecal incontinence (related to childbirth) at  
245 4 months postpartum were at a higher risk of depression at one year; excluding women  
246 depressed during the second trimester of pregnancy or reporting anal incontinence before  
247 pregnancy produced similar odds; iii) Analogy: we also found an association between  
248 postnatal urinary incontinence and depression in the EDEN cohort.<sup>27</sup>

249 Faecal incontinence and depressive disorders are both somewhat taboo subjects that  
250 women do not often report spontaneously at postnatal consultations.<sup>28</sup> Fewer than 20% of  
251 women are questioned about anal continence during this visit.<sup>28</sup> Because of the serious  
252 harmful consequences of postpartum depression on the health of both women and their  
253 babies, it appears important to increase clinicians' awareness, especially in primary care, of  
254 the importance of screening for anal incontinence and depression at the postnatal  
255 consultation and to offer psychological support in women with incontinence or depressive  
256 symptoms.<sup>16,29</sup> The RCOG recommend that women who have undergone an obstetric anal  
257 sphincter injury or have anal incontinence should be referred to gynaecologists with a  
258 specific interest in pelvic floor trauma.<sup>30</sup>

## 259 Conclusions

260 In clinical practice, our results should encourage each physician to look for signs of  
261 postnatal depression related to anal incontinence. From the public health perspective, they  
262 show how these two sensitive issues of women's health during their child-bearing years can  
263 be intertwined, and they require further research for a better understanding of their  
264 associations as well as for the most effective and empathetic management possible.

265

266 ***Acknowledgements***

267 The authors thank the members of the EDEN mother–child cohort study group, Jo Ann  
268 Cahn for editing, and Laetitia Marchand-Martin for her useful advice in statistical analysis.

269 ***Disclosure of interest***

270 We have no direct or indirect commercial financial incentive associated with publishing  
271 the article.

272 ***Contribution to authorship***

273 XF and MJSC contributed to the conception, design, analysis, interpretation of data and  
274 article writing. BG contributed to analysis, interpretation of data and article writing. Each  
275 author had access to the data analysis, participated in revising the manuscript and approved  
276 the final submitted version.

277 ***Details of Ethics Approval***

278 The CCPPRB (Comité de Consultation pour la Protection des Personnes se Prêtant à la  
279 Recherche Biomédicale) of Kremlin-Bicêtre University Hospital approved EDEN cohort  
280 (December 12<sup>th</sup>, 2002, reference number 02-70). The data files were registered with the  
281 French Data Authority (CNIL, reference 902267).

282 ***Funding***

283 We acknowledge all funding sources for the EDEN study: FRM (Fondation pour la  
284 Recherche Médicale), INSERM, Ministère de la Recherche, Université Paris Sud (XI),  
285 ANR (Agence Nationale de la Recherche), IRESP (Institut de Recherche en Santé  
286 Publique), AFSSET (Agence Française pour la Surveillance et la Sécurité de  
287 l'Environnement et du Travail), Santé Publique France (Institut National Pour l'Education

288 et la Santé, Institut National de Veille Sanitaire), DGS (Direction Générale de la Santé),  
289 ALFEDIAM (Association de Langue Française pour l'Etude du Diabète et du  
290 Métabolisme), MGEN (Mutuelle générale de l'Education Nationale), Nestlé.  
291

- 1 Wisner KL, Parry BL, Piontek CM. Postpartum depression. *New Engl J Med* 2002;347:194–9.
- 2 Pearlstein T, Howard M, Salisbury A, Zlotnick C. Postpartum depression. *Am J Obstet Gynecol* 2009;200:357-64.
- 3 Gaillard A, Le Strat Y, Mandelbrot L, Keita H, Dubertret C. Predictors of postpartum depression: prospective study of 264 women followed during pregnancy and postpartum. *Psychiatry Res* 2014;215:341-6.
- 4 Philip B, Miner JR. Economic and personal impact of fecal and urinary incontinence. *Gastroenterology* 2004;126:S8–13.
- 5 Edwards NI, Jones D. The prevalence of fecal incontinence in older people living at home. *Age Ageing* 2001;30:503–7.
- 6 Andy UU, Vaughan CP, Burgio KL, Alli FM, Goode PS, Markland AD. Shared Risk Factors for Constipation, Fecal Incontinence, and Combined Symptoms in Older U.S. Adults. *J Am Geriatr Soc* 2016;64:e183-8.
- 7 Fritel X, Ringa V, Varnoux N, Zins M, Bréart G. Mode of Delivery and Fecal Incontinence at Midlife: A Study of 2,640 Women in the GAZEL Cohort. *Obstet Gynecol* 2007;110:31-8.
- 8 MacArthur C, Bick DE, Keighley MR. Fecal incontinence after childbirth. *BJOG* 1997;104:46–50.
- 9 Hatem M, Pasquier JC, Fraser W, Lepire E. Factors associated with postpartum urinary/anal incontinence in primiparous women in Quebec. *J Obstet Gynaecol Can* 2007;29:232–9.
- 10 MacArthur C, Glazener CMA, Wilson PD, Herbison GP, Gee H, Lang GD et al. Obstetric practice and faecal incontinence three months after delivery. *BJOG* 2001;108:678–83.
- 11 Groutz A, Fait G, Lessing JB, David MP, Wolman I, Jaffa A, et al. Incidence and obstetric risk factors of postpartum anal incontinence. *Scand J Gastroenterol* 1999;34:315–8.
- 12 van Brummen HJ, Bruinse HW, van de Pol G, Heintz AP, van der Vaart CH. Defecatory symptoms during and after the first pregnancy: prevalences and associated factors. *Int Urogynecol J Pelvic Floor Dysfunct* 2006;17:224–30.
- 13 Chaliha C, Sultan AH, Bland JM, Monga AK, Stanton SL. Anal function: effect of pregnancy and delivery. *Am J Obstet Gynecol* 2001;185:427–32.
- 14 Faltin DL, Sangali MR, Roche B, Floris L, Boulvain M, Weil A. Does a second delivery increase the risk of anal incontinence? *BJOG* 2001;108:684–8.
- 15 Fritel X, Gachon B, Desseauve D, Thubert T. Incontinence anale et lésions obstétricales du sphincter anal, épidémiologie et prévention [Anal incontinence and obstetrical anal sphincter injuries, epidemiology and prevention]. *Gynecol Obstet Fertil Senol* 2018;46:419-26.
- 16 Bailey N, Pares D. Faecal incontinence and depression: cause or effect? *Colorectal Dis* 2010;12: 397-8.



- 
- 17 Vasudev K, Gupta AK. Incontinence and mood disorder: is there an association? *BMJ Case Rep* 2010. doi: 10.1136/bcr.07.2009.2118
  - 18 Brown S, Lumley J. Physical health problems after childbirth and maternal depression at six to seven months postpartum. *BJOG* 2000;107:1194–1201.
  - 19 Swenson CW, DePorre JA, Haefner JK, Berger MB, Fenner DE. Postpartum depression screening and pelvic floor symptoms among women referred to a specialty postpartum perineal clinic. *Am J Obstet Gynecol* 2018;218:335.e1-6.
  - 20 Lal M, Pattison HM, Allan TF, Callender R. Postcesarean pelvic floor dysfunction contributes to undisclosed psychosocial morbidity. *J Reprod Med* 2009;54:53–60.
  - 21 MacArthur C, Glazener C, Lanashire R, Herbison P, Wilson D, Grant A. Faecal incontinence and mode of first and subsequent delivery: a six-year longitudinal study. *BJOG* 2005;112:1075–82.
  - 22 Heude B, Forhan A, Slama R, Douhaud L, Bedel S, Saurel-Cubizolles MJ, et al. Cohort Profile: The EDEN mother-child cohort on the prenatal and early postnatal determinants of child health and development. *Int J Epidemiol* 2016;45:353-63.
  - 23 Pescatori M, Anastasio G, Bottini C, Mentasti A. New grading and scoring for anal incontinence, evaluation of 335 patients. *Dis Colon Rectum* 1992;35:482–7.
  - 24 van der Waerden J, Bernard JY, De Agostini M, Saurel-Cubizolles MJ, Peyre H, Heude B et al. Persistent maternal depressive symptoms trajectories influence children's IQ: The EDEN mother-child cohort. *Depress Anxiety* 2017;34:105-17.
  - 25 Cox JL, Holden JM, Sagovsky R. Detection of postnatal depression: Development of the 10-item Edinburgh Postnatal Depression Scale. *Br J Psychiatry* 1987;150:782–6.
  - 26 Hill A. The environment and disease: association or causation? *Proc R Soc Med*. 1965;58:295-300.
  - 27 Fritel X, Tsegan YE, Pierre F, Saurel-Cubizolles MJ, EDEN Mother-Child Cohort Study Group. Association of postpartum depressive symptoms and urinary incontinence. A cohort study. *Eur J Obstet Gynecol Biol Reprod* 2016;198:62-7.
  - 28 Brown S, Gartland D, Perlen S, McDonald E, MacArthur C. Consultation about urinary and faecal incontinence in the year after childbirth: a cohort study. *BJOG* 2015;122:954–962.
  - 29 Fritel X. Should we systematically ask about postnatal incontinence? *BJOG* 2015;122:963.
  - 30 Royal college of Gynaecologists and Obstetricians. The management of third- and fourth- degrees perineal tears. Green-top guidelines N°29. June 2015. Available: <https://www.rcog.org.uk/globalassets/documents/guidelines/gtg-29.pdf>

Table 1. Women's characteristics and 4 months postpartum anal incontinence (no incontinence, flatus-only, or faecal incontinence) Fisher's exact test with Monte Carlo simulation.

Women's characteristics		N	Anal incontinence at 4 months postpartum			P
			Faecal % (n)	Flatus-only % (n)	No % (n)	
		1632	1.7 (28)	14.4 (235)	83.9 (1369)	
Age at birth	younger than 30	802	1.1 (9)	12.1 (97)	86.8 (696)	0.004
	30 or older	830	2.3 (19)	16.6 (138)	81.1 (673)	
Educational level	Below high school diploma	403	3.0 (12)	11.9 (48)	85.1 (343)	0.011
	High-school diploma (baccalauréat)	295	2.0 (6)	11.5 (34)	86.4 (255)	
	University, 1st degree	363	1.4 (5)	14.3 (52)	84.3 (306)	
	University, more than 1st degree	547	0.9 (5)	18.3 (100)	80.8 (442)	
Household monthly incomes	1500 € or less	220	3.6 (8)	10.9 (24)	85.4 (188)	0.066
	1501–2300 €	485	1.6 (8)	13.4 (65)	85.0 (412)	
	2301–3000 €	442	0.7 (3)	15.2 (67)	84.2 (372)	
	more than 3000 €	475	1.9 (9)	16.4 (78)	81.7 (388)	
Relationship	living with baby's father, good relationship	1097	1.4 (15)	12.9 (142)	85.7 (940)	0.005
	living with baby's father, problems	457	2.4 (11)	19.0 (87)	78.6 (359)	
	not living with baby's father	77	2.6 (2)	7.8 (6)	89.6 (69)	
Psychiatric hospitalisation before index pregnancy	no	1574	1.7 (27)	14.6 (229)	83.7 (1318)	0.785
	yes	50	2.0 (1)	10.0 (5)	88.0 (44)	
Smoking during index pregnancy	no	1381	1.4 (19)	15.0 (207)	85.8 (1155)	0.034
	yes (1 or more cig./day)	227	3.5 (8)	11.9 (27)	84.6 (227)	
Body mass index (kg/m <sup>2</sup> )	< 18.50	130	2.3 (3)	13.8 (18)	83.8 (109)	0.972
	18.50–24.99	1051	1.6 (17)	14.4 (151)	84.0 (883)	
	25–29.99	282	1.8 (5)	15.6 (44)	82.6 (233)	
	≥ 30	137	2.2 (3)	12.4 (17)	85.4 (117)	
Parity	Primipara: 1 <sup>st</sup> child	735	1.2 (9)	12.6 (93)	86.1 (633)	0.023
	Secondipara: 2 <sup>nd</sup> child	596	1.5 (9)	14.9 (89)	83.6 (498)	
	Multipara: 3 <sup>rd</sup> child or +	298	3.4 (10)	17.8 (53)	78.9 (235)	
Mode of delivery (all deliveries)	caesarean only	198	2.0 (4)	9.6 (19)	88.4 (175)	0.006
	vaginal spontaneous	1088	1.2 (13)	14.1 (153)	84.7 (922)	
	instrumental, at least one	346	3.2 (11)	18.2 (63)	78.6 (272)	
Any child with birth weight ≥ 4000 g	no	1480	1.7 (25)	13.5 (200)	84.8 (1255)	0.005
	yes	145	2.1 (3)	23.4 (34)	74.5 (108)	
Weight gain in index pregnancy	less than 20 kg	1441	1.9 (27)	14.3 (206)	83.8 (1208)	0.559
	20 kg or more	159	0.6 (1)	14.5 (23)	84.9 (135)	
Perineal tear at index delivery	episiotomy	470	1.1 (5)	18.1 (85)	80.8 (380)	0.074
	Third-degree perineal tear	90	2.2 (2)	13.3 (12)	84.4 (76)	
	vaginal with no tear or C-section	1069	2.0 (21)	12.9 (138)	85.1 (910)	
Hospitalisation of the child in the 1st year	no	1317	1.6 (21)	14.3 (188)	84.1 (1108)	0.692
	yes	315	2.2 (7)	14.9 (47)	82.9 (315)	
Breastfeeding	no	474	1.9 (9)	11.6 (55)	86.5 (410)	0.002
	breastfed < 4 months	637	1.3 (8)	12.6 (80)	86.2 (549)	
	still breastfeeding at 4 months	521	2.1 (11)	19.2 (100)	78.7 (410)	

Table 2. Risk factors for de novo anal incontinence at 4 months postpartum; multivariate polychotomous logistic regression with adjusted odds ratios (N = 1530), complete data missing for 57 women.

	N = 1530	Anal incontinence at 4 months postpartum				
		Faecal aOR	95% CI	Flatus-only aOR	95% CI	No p
<u>Age (years)</u>						
< 30		1		1		<i>p=0.119</i>
≥ 30		2.07	0.80-5.36	1.30	0.92-1.82	1
<u>Educational level</u>						
Below high school diploma		1		1		1
High-school diploma (baccalauréat)		0.54	0.16-1.80	0.95	0.57-1.58	1
University, 1st degree		0.53	0.17-1.67	0.90	0.55-1.48	1
University, >1st degree		0.20	0.05-0.78	1.22	0.78-1.91	<i>p=0.214</i>
<u>Relationship</u>						
living with baby's father, good relationship		1		1		<i>p=0.143</i>
living with baby's father, problems		1.53	0.62-3.80	1.48	1.06-2.05	1
not living with baby's father		1.64	0.34-7.94	0.82	0.34-1.99	1
<u>Smoking during pregnancy</u>						
no		1		1		<i>p=0.210</i>
yes		2.20	0.83-5.80	0.84	0.50-1.39	1
<u>Parity</u>						
Primipara: 1 <sup>st</sup> child		1		1		<i>p=0.904</i>
Secondipara: 2 <sup>nd</sup> child		0.98	0.34-2.85	1.18	0.81-1.72	1
Multipara: 3 <sup>rd</sup> child or +		1.32	0.38-4.51	1.15	0.70-1.88	1
<u>Mode of delivery (all deliveries)</u>						
caesarean only		1		1		<i>p=0.053</i>
vaginal spontaneous		0.68	0.17-2.74	1.50	0.82-2.77	1
instrumental, at least one		2.25	0.50-10.2	1.90	0.96-3.77	1
<u>Any child with birth weight ≥ 4000 g</u>						
no		1		1		<i>p=0.090</i>
yes		0.34	0.04-2.71	1.59	0.98-2.56	1
<u>Perineal tear at index delivery</u>						
episiotomy		0.74	0.23-2.32	1.52	1.05-2.19	1
third degree perineal tear		1.23	0.25-6.02	0.91	0.43-1.92	1
vaginal with no tear or C-section		1		1		<i>p=0.186</i>
<u>Breastfeeding</u>						
no		1		1		<i>p=0.016</i>
breastfed < 4 months		1.02	0.33-3.13	1.09	0.72-1.66	1
still breastfeeding at 4 months		2.23	0.75-6.60	1.77	1.16-2.69	1

+ Medical centre: no significant contribution of the variable to the model, *p=0.888*

Table 3. Anal incontinence at 4 months postpartum and mental health at 4 and 12 months. Comparison between women with faecal incontinence, flatus-only incontinence, and no incontinence (Fisher's exact test with Monte Carlo simulation).

Postpartum mental health	Anal incontinence at 4 months postpartum, % (n/N)			<i>p</i>
	Faecal (N=28)	Flatus-only (N=235)	No (N=1369)	
<u>4 months postpartum</u>				
Perceived physical health "rather poor" or "very poor"	10.7% (3/28)	15.5% (36/232)	7.8% (106/1364)	0.002
Perceived mental health "rather poor" or "very poor"	14.3% (4/28)	13.4% (31/231)	7.2% (98/1360)	0.039
Depression (EPDS≥ 10)	50.0% (14/28)	26.6% (62/233)	17.2% (233/1353)	<0.001
Antidepressant drug use during last month	3.6% (1/28)	2.6% (6/230)	1.9% (26/1340)	0.765
Depression (EPDS≥ 10) or antidepressant drug use	53.6% (15/28)	27.2% (64/235)	17.8% (244/1368)	<0.001
<u>12 months postpartum</u>				
Perceived physical health "rather poor" or "very poor"	0.0% (0/25)	12.9% (26/202)	10.1% (122/1211)	0.103
Perceived mental health "rather poor" or "very poor"	12.0% (3/25)	16.3% (33/202)	8.5% (103/1209)	0.004
Depression (EPDS≥10)	28.0% (7/25)	21.3% (42/197)	13.5% (163/1206)	0.004
Antidepressant drug use during last month	13.6% (3/22)	5.6% (11/198)	2.6% (31/1185)	0.007
Depression (EPDS≥ 10) or antidepressant drug use	36.0% (9/25)	23.3% (47/202)	14.8% (181/1221)	<0.001

Table 4. Anal incontinence at 4 months postpartum and mental health at 12 months postpartum. Logistic regression with odds ratios adjusted for women's age, psychiatric hospitalisation before index pregnancy, relationship, previous birth weight of 4000 g or more, perineal tear at index delivery, breastfeeding, hospitalisation of the baby in the 1<sup>st</sup> year, and medical centre.

Anal incontinence at 4 months postpartum	Mother's mental health 12 months after childbirth					
	Depression (EPDS $\geq$ 10)		Antidepressant use		Depression (EPDS $\geq$ 10) or antidepressant use	
	aOR	95% CI	aOR	95% CI	aOR	95% CI
<u>In the overall population</u>						
	n/N= 209/1415		n/N= 45/1392		n/N=234/1435	
No	1	<i>P=0.019</i>	1	<i>P=0.003</i>	1	<i>P=0.002</i>
Flatus-only	1.64	1.11-2.44	2.70	1.28-5.68	1.72	1.18-2.52
Faecal	2.11	0.84-5.31	5.98	1.50-23.80	2.87	1.21-6.81
<u>Among women reporting no anal incontinence before index pregnancy</u>						
	n/N= 201/1377		n/N=42/1353		n/N=224/1395	
No	1	<i>p=0.036</i>	1	<i>p=0.001</i>	1	<i>p=0.003</i>
Flatus-only	1.60	1.04-2.44	2.93	1.31-6.58	1.68	1.11-2.52
Faecal	2.25	0.83-6.08	8.34	1.98-35.05	3.24	1.28-8.20
<u>Among women who were not depressed during 2<sup>nd</sup> trimester of index pregnancy</u>						
	n/N= 103/986		n/N=21/974		n/N=117/998	
No	1	<i>p=0.045</i>	1	<i>p=0.080</i>	1	<i>p=0.008</i>
Flatus-only	1.66	0.96-2.88	3.18	1.05-9.62	1.78	1.06-3.01
Faecal	3.31	0.96-11.47	4.14	0.39-43.58	4.34	1.33-14.13
<u>Among women reporting no anal incontinence before and not depressed during 2<sup>nd</sup> trimester of index pregnancy</u>						
	n/N= 98/961		n/N=21/948		n/N=112/972	
No	1	<i>p=0.071</i>	1	<i>p=0.006</i>	1	<i>p=0.007</i>
Flatus-only	1.51	0.83-2.75	4.20	1.36-12.98	1.71	0.97-3.00
Faecal	4.16	1.00-17.27	17.42	1.49-203.19	6.23	1.65-23.59