

Association of postpartum depressive symptoms and urinary incontinence. A cohort study

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1 Title

2 Association of postpartum depressive symptoms and urinary incontinence. A cohort study.

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23

24 Condensation:

25 Clinician need to be aware that, although postpartum UI is often mild, it is followed by more new
26 cases of depression or antidepressant consumption.

27

28

29 Association of depression and urinary incontinence. A cohort study

30 Fritel X, Tsegan YE, Pierre F, Saurel-Cubizolles MJ.

31 Abstract

32 Objective: Our objective was to clarify whether de novo urinary incontinence (UI) in the
33 postpartum period is associated with depressive symptoms or antidepressant drug consumption.

34 Study Design: 2002 pregnant women were recruited between 2003 and 2006 for the EDEN
35 mother-child cohort. This analysis included 1413 women who reported no UI before pregnancy.
36 Severity of UI was assessed by the Sandvik index. At 4 and 12 months postpartum, depressive
37 symptoms were assessed by the Edinburgh Postpartum Depression Scale (EPDS \geq 10 defines
38 depressive symptoms) and consumption of antidepressant drugs was reported.

39 Results: At 4 months postpartum, 198 women (14%) reported de novo UI; 74% (n=146) reported
40 mild UI, 26% (n=52) moderate, and none severe; prevalence of depressive symptoms was higher in
41 women with than without UI (22.1% vs. 15.9%, $p=0.045$), and consumption of antidepressant
42 drugs was more frequent (4.7% vs. 1.4%, $p=0.005$). At 12 months postpartum, the mean (\pm SD)
43 EPDS score differed between women with than without UI (7.30 ± 3.46 vs. 6.57 ± 3.72 , $p=0.016$)
44 but was half that at 4 months postpartum. The incidence of new cases of depressive symptoms or
45 antidepressant consumption at 12 months was greater with than without UI (23.8% vs. 15.3%,
46 $p=0.012$).

47 Conclusions: Although UI is mild in most cases at 4 months postpartum, it is followed by more
48 new cases of depressive symptoms or antidepressant consumption at 12 months.

49 Key words: postnatal depression, antidepressant consumption, postpartum care, urinary
50 incontinence, cohort study

51

52 **Introduction**

53 Urinary incontinence (UI) is a common symptom after childbirth (1). Most often postnatal UI is
54 moderate and regresses after a few months (2). However, it can also persist and lead to deteriorated
55 quality of life and requests for care later in life (3,4). Fear of postnatal UI can motivate women or
56 obstetricians to request elective caesarean section even without a medical indication (5).

57 The postnatal period is also a period susceptible to depressive symptoms, sometimes severe, that
58 could impair the relationship between the mother and her baby or even lead to suicide (6). In the
59 general population, women with UI may be more depressed than others (7). Postnatal UI appearing
60 de novo in women who were continent before pregnancy may induce or increase a depressive
61 syndrome. The few studies of the postnatal period show that postnatal UI is associated with
62 depressive symptoms (8,9). However, these investigations did not determine a causal link between
63 the two situations.

64 A priori, risk factors of postnatal UI and those of postpartum depression differ. The main risk
65 factors for postnatal UI are obesity, maternal age, and vaginal childbirth. Muscle and neurological
66 vaginal birth trauma could explain the postnatal UI (10). The main risk factors for postnatal
67 depression are personal or family history of depression, stressful life events, low partner support, or
68 social isolation (11,12).

69 We aimed to test whether de novo postpartum UI is related to altered mood or taking psychotropic
70 drugs and whether this association is maintained or increases over time.

71

72 **Materials and methods**

73 The data were derived from the EDEN cohort (Etude sur les Déterminants pré et postnatals
74 précoces du développement psychomoteur et de la santé de l'ENfant,
75 <https://eden.vjf.inserm.fr/index.php?lang=en>), whose aim was to study the pre- and postnatal
76 determinants of child development and health. Study participation was proposed to all women
77 visiting the prenatal clinic before their 24th week of pregnancy in the university hospitals of Nancy
78 and Poitiers, our aim was to recruit women as early in pregnancy as possible.¹³ Exclusion criteria
79 were multiple pregnancies, known diabetes before pregnancy, French illiteracy or planning to move
80 out of the region within the next three years. Among the 3758 women invited to participate, 2002
81 (53%) accepted to be enrolled in the study. Recruitment started in February 2003 and lasted 27
82 months in each centre (1034 women from Nancy and 968 from Poitiers). On average, women were
83 included at 15 weeks of pregnancy (range: 8-26). Their mean age was 29 years (range: 18-44) and
84 30% of the women were pregnant for the first time. Compared to the 2003 Enquête Nationale
85 Périnatale (National Perinatal Survey: a sample of births recruited throughout the country),¹⁴
86 women included in EDEN and still followed-up at delivery, had a higher level of education.

87 To be included in this secondary analysis, the women had to complete a questionnaire about UI
88 mailed 4 months after childbirth and declare that they did not have UI before the pregnancy. UI 4
89 months after birth was defined by a positive response to the question "during the past month have
90 you had involuntary leaking of urine?" The severity of incontinence was assessed by the Sandvik
91 severity index (15). This index is the product of the frequency and volume of leaks, ranging from 0
92 to 8. Four classes are defined for UI severity: 0, no incontinence; 1–2, mild incontinence; 3–4,
93 moderate incontinence; 6–8, severe incontinence.

94 Depressive symptoms was assessed by questionnaires mailed 4 and 12 months postpartum by 2
95 indicators. The first, the Edinburgh Postpartum Depression Scale (EPDS), is a 10-item
96 questionnaire, responses to each item ranging from 0 to 3 (16). The overall score ranges from 0 to
97 30; a score of 10 or higher defining probable depression. The second relates to the consumption of
98 antidepressant drugs in the month preceding the mailed questionnaire.

99 Anthropometric and socio-demographic characteristics were maternal age at delivery grouped into
100 4 classes: < 25 years, 25–29, 30–34, \geq 35 years; educational level in 4 classes: below high school
101 diploma, high school diploma or equivalent, first university degree, above first university degree;
102 occupational group in 5 classes: 1) managers or professionals; 2) middle management; 3) office or
103 clerical workers and civil servants; 4) other employees in shops or services, farmers, and workers;
104 5) no paid occupation; marital status: married, part of an unmarried couple, or single; and body
105 mass index (BMI). Tobacco use in pregnancy and at 4 months postpartum was described in
106 dichotomic variables as smokers or non-smokers. For obstetric history, we retained the number of
107 deliveries and their mode (caesarean delivery only, at least one vaginal delivery); history of birth of
108 a baby weighing \geq 4 kg; and for the last delivery, mode of delivery (caesarean, vaginal
109 spontaneous, vaginal instrumental) and active second phase more than 30 min. Breastfeeding was
110 considered in 4 modalities: no breastfeeding, \leq 10 weeks, 11 to 17 weeks and still breastfeeding at
111 4 months at completion of the questionnaire.

112 UI was described by its incidence. Risk factors were studied by bivariate analysis of the relation of
113 obstetric and socio-demographic data and UI (no, mild, moderate) by chi-square test. The relation
114 between de novo UI and postpartum depressive symptoms was studied by comparing the
115 proportion of depressed women and women consuming antidepressant drugs at 4 and 12 months.
116 We also studied new cases of depressive symptoms at 12 months after excluding cases reporting
117 depressive symptoms at 4 months. The mean change in EPDS score between months 4 and 12
118 postpartum was compared for women with and without de novo UI at 4 months; we also analysed
119 new cases of consumption of antidepressant drugs. Then to evaluate the relation between UI and
120 several risk factors simultaneously, multivariate analysis was performed by polytomic logistic
121 regression; only variables with $p < 0.20$ on bivariate analysis were introduced in the multivariate
122 model, except for centre and mode of delivery which were forced in the multivariate model. A last
123 analysis restricted to women respondent to follow-up questionnaires (4 and 12 months) was
124 undergone to evaluate the relationship between UI and depressive symptoms or antidepressant
125 consumption, we used chi-square test for nominal variables and t test for continuous variables;

126 adjusted OR for age, occupational group, marital status, parity, and centre were estimated using a
127 logistic regression.

128 Data were analysed with SAS 9.3 (SAS Inst., Cary, NC). $P < 0.05$ was considered statistically
129 significant.

130 The EDEN study received approval from the ethics committee (CCPPRB, Comité Consultatif de
131 Protection des Personnes en matière de Recherche Biomédicale) of Kremlin-Bicêtre Hospital on
132 December 12th, 2002. Informed written consent was obtained from mothers for herself at
133 enrolment and for her newborn child after delivery. The data files were registered with the French
134 Data Authority (CNIL, Commission Nationale Informatique et Libertés).

135

136 **Results**

137 Among the 2002 women recruited during pregnancy, 1413 (71%; mean age 29.5 years \pm 4.7, range
138 17–44 years) were included in this analysis; 353 women who had not responded to questions about
139 UI and 236 who reported UI before pregnancy were excluded. Included women were older, with a
140 higher educational level, were more often in couple, and had a lower parity than excluded women
141 (Supplementary Table S1). In total, 14% (n=198) declared de novo UI at 4 months postpartum;
142 74% (n=146) were mild, 26% (n=52) moderate, and none severe UI. The incontinence was related
143 to stress only (leakage during physical effort, coughing, or sneezing) for 37% (n=74), urge only
144 (leakage related to an urgent need to urinate) for 9% (n=18), mixed (stress and urge) for 47%
145 (n=93) and other 7% (n=13). Table 1 shows the frequency of the postpartum urinary incontinence
146 and its severity by medical and socio-demographic characteristics. Moreover, the frequency of UI
147 and its severity were not at all related to smoking during pregnancy neither at 4 months postpartum.

148 In the multivariate model of UI (no, mild, moderate), factors contributing to UI were the
149 occupational group, with the lowest risk among the more qualified occupations and a higher risk of
150 moderate incontinence among women without a paid job, as well as duration of the second active
151 phase of the last delivery, with a higher risk among women with a second phase of labour \geq 30 min
152 (Table 2).

153 At 4 months postpartum, 17.8% (215/1210) of women reported depressive symptoms (EPDS \geq 10)
154 or used antidepressants. The prevalence of depressive symptoms or antidepressant consumption
155 was higher for women with than without de novo postpartum UI (Table 3). With a more severe
156 definition of depression, the difference was still significant: the proportion of women with EPDS \geq
157 13 or using antidepressants was higher among women with UI than among women without UI
158 (14.4% vs 8.7%, $p=0.02$).

159 Among the 1413 women included in the analysis, 177 did not respond at 12 months postpartum;
160 12-month respondents were older, with a higher educational level, and were more often in couple
161 (Supplementary Table S2). At 1 year postpartum, the mean EPDS score remained higher for
162 women with than without UI, but the difference was reduced by half between 4 and 12 months

163 postpartum (1.41 vs 0.73; Table 3). At 1 year postpartum, they were no more significant difference
164 for depression or antidepressant consumption between women with and without de novo
165 postpartum UI when the analysis was adjusted for age, occupational group, marital status, parity,
166 and centre (Table 3). New cases of depressive symptoms or antidepressant consumption at 12
167 months were more frequent in women with than without UI at 4 months postpartum (Table 3). At 4
168 months postpartum, depressive symptoms or antidepressant consumption was more often reported
169 in case of urge UI (50%, 7/14) than in case of mixed UI (32%, 26/81) or stress UI (15%, 10/67;
170 analysis restricted to women respondent to both questionnaires, chi-square test, $p=0.007$). At 12
171 months postpartum we didn't find any difference related to UI type: depressive symptoms or
172 antidepressant consumption was reported by 7% in case of urge UI (1/14), 36% in case of mixed
173 UI (29/81), 24% in case of stress UI (16/67); and 20% (2/10) in case of other UI ($p=0.095$).

174

175 **Comment**

176 In our sample, UI at 4 months postpartum was often mild and was associated with an increased
177 postpartum depression screening score and frequent consumption of antidepressant drugs. Follow-
178 up at 1 year postpartum demonstrated that postnatal UI was associated with an increased number of
179 new cases of depressive symptoms or increased consumption of antidepressants. At 1 year
180 postpartum, the mean screening depression score differed between women with than without
181 postnatal UI, but the difference was reduced by half as compared with 4 months postpartum.

182 The strengths of our study are its longitudinal follow-up and the large number of women included.
183 We use a standardised measure of UI that incorporates assessment of symptom severity, and a
184 measurement of depressive symptoms at 2 time points in the first 12 months postpartum using a
185 well-validated measure. With successive questionnaires, the EDEN cohort allows an exploration of
186 the temporal relationship between UI and postnatal depression. One limitation is that urinary
187 symptoms and incontinence history were reported at four months postpartum and not before. This
188 may explain why only 236 women reported incontinence prior to pregnancy. Another limitation is
189 the secondary and exploratory nature of this analysis, which did not allow for calculating a number
190 of subjects required. The questionnaire for UI was not repeated at 12 months; therefore, the effect
191 of postnatal depression on incident UI was not explored. Likewise, we could not specify whether
192 the decrease observed between 4 and 12 months postpartum for the relation between UI and the
193 depression score is associated with decreasing UI prevalence. Another limitation is that depressed
194 women may over report UI condition. To examine this potential bias we performed an analysis
195 limited to women without depressive symptoms at the time of UI assessment (4 months
196 postpartum), and we observed more new case of depressive symptoms or antidepressant
197 consumption at 12 months in case of UI at 4 months.

198 Studies using the EPDS found a score ≥ 13 in 7% to 17% of mothers between 6 weeks and 6
199 months after childbirth (8,9,17). These results are similar to our findings (8.2–10.5%). Results for
200 the mean EPDS score should be interpreted with caution because the mean score is not used in

201 clinical practice. The scale was developed to detect postnatal depression by using a cut-off between
202 9 and 13 depending on the sensitivity and specificity expected.

203 Postnatal UI prevalence is estimated between 6% and 21% and is often mild: in the cohort reported
204 by Altman et al., the prevalence of stress UI was 21% at 5 months postpartum and occurred less
205 than once a week for three quarters of women (18); for Viktrup *et al.*, the UI prevalence was 6% at
206 3 months postpartum and occurred daily for less than one quarter of women (1). In most cases,
207 women are not bothered by postnatal urinary symptoms (19).

208 In our longitudinal study, postnatal urinary incontinence reported at 4 months postpartum was
209 followed by an increase in new depression or intake of psychotropic drugs 8 months later. Brown
210 and Lumley interviewed 1336 women 6 to 7 months after giving birth: the risk of depression
211 (EPDS \geq 13) was multiplied by 2 with UI (8). Hullfish *et al.* interviewed 146 women 6 weeks after
212 childbirth: the depression score (EPDS) was associated with the urge incontinence quality of life
213 impact score (URGE-IIQ) but not urge incontinence symptoms (URGE-UDI) (9). In their
214 longitudinal study, van de Pol et al. found a relationship between overactive bladder syndrome and
215 depressive symptoms during pregnancy but not at 1 year postpartum (20). Mood disorders likely
216 increase the impact of incontinence on quality of life. Depression is known to decrease health-
217 related quality of life (21). Depression may be a factor favouring the reporting or complaining of
218 incontinence symptoms and happiness may favour ignoring or underreporting leakage. A cohort
219 study of older women (mean 60 years old) showed that depression was associated with incident UI,
220 but UI was not associated with incident depression (22).

221 Although postnatal UI in our sample was often mild, it was associated with increased incidence of
222 maternal depression or antidepressant use at 12 months postpartum. Thus, measuring the severity
223 of incontinence (leakage frequency and quantity) captures only a part of the problem experienced
224 by women. Clinicians need to be aware of the risk of depression associated with postnatal
225 incontinence.

226

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245

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Table 1. De novo urinary incontinence at 4 months postpartum and severity by women's characteristics. Chi² test.

Women's characteristics	De novo urinary incontinence at 4 months postpartum				p value
	N	No 1215 86.0%	Yes, mild 146 10.3%	Yes, moderate 52 3.7%	
Age, years					
	< 25	203	85.7	9.8	0.74
	25–29	530	87.9	8.9	
	30–34	471	84.7	11.7	
	≥ 35	209	84.2	11.5	
Educational level					
	< High school diploma	355	85.9	9.6	0.21
	High school diploma	257	82.9	12.1	
	University, first degree	319	84.0	11.9	
	> University, first degree	460	88.9	8.9	
Occupational group					
	Managers, professionals	159	88.0	10.1	0.04
	Intermediate occupations	551	86.8	10.2	
	Office or clerical workers, civil servants	324	82.7	13.3	
	Shop, service, manual workers	276	87.0	9.1	
	No paid occupation	82	85.4	4.9	9.8
Marital status					
	Married couple	768	86.6	9.9	0.81
	Unmarried couple	565	85.1	11.2	
	Single	72	86.1	8.3	
Body mass index, kg/m ²					
	≤ 18.5	121	91.7	6.6	0.14
	18.5–25	917	86.4	9.9	
	25–30	244	82.4	13.9	
	≥ 30	105	83.8	9.5	
Parity					
	1	686	87.0	9.6	0.88
	2	504	85.3	10.7	
	3 or more	221	84.6	11.3	
Highest birth weight, g					
	< 4000	1295	86.0	10.3	0.79
	≥ 4000	113	85.8	11.5	
Delivery by					
	Caesarean only	183	89.1	7.1	0.31
	Vaginal, at least one	1230	85.5	10.8	
Mode of last delivery					
	Caesarean	224	89.7	7.1	0.24
	Vaginal, spontaneous	1023	85.7	10.8	
	Vaginal, instrumental	162	82.1	12.4	
Last active second phase of labour					
	≤ 30 min	1175	87.0	9.5	0.02
	> 30 min	203	79.8	15.8	
Breastfeeding					
	no	367	85.8	11.4	0.77
	1–10 weeks	309	86.7	9.4	
	11–17 weeks	195	88.2	9.2	
	Still breastfeeding at 4 months	437	85.1	10.5	

Women's characteristics	De novo urinary incontinence at 4 months postpartum				p value
	<i>N</i>	No	Yes, mild	Yes, moderate	
	1413	1215 86.0%	146 10.3%	52 3.7%	
Smoking during pregnancy					
yes	320	87.5	9.7	2.8	0.55
no	1060	85.7	10.3	4.1	
Smoking at 4 months postpartum					
yes	313	87.2	9.6	3.2	0.75
no	1098	85.6	10.6	3.8	

Table 2. Risk factors of de novo urinary incontinence (UI) at 4 months postpartum.
Polytomic logistic regression adjusted for centre.

Women's characteristics	De novo urinary incontinence at 4 months postpartum			
	No UI	Yes, mild Adj OR (95% CI)	Yes, moderate Adj OR (95% CI)	p value
Occupational group				
Managers, professionals	1	1	1	0.09
Intermediate occupations	1	1.02 (0.6–1.8)	1.50 (0.4–5.2)	
Office or clerical workers, civil servants	1	1.29 (0.7–2.4)	2.08 (0.6–7.5)	
Shop, service, manual workers	1	0.86 (0.4–1.7)	1.84 (0.5–6.9)	
No paid job	1	0.47 (0.1–1.5)	4.92 (1.2–19.4)	
Body mass index, kg/m²				
≤ 18.5	1	0.62 (0.3–1.4)	0.38 (0.1–1.6)	0.19
18.5–25	1	1	1	
25–30	1	1.55 (1.0–2.4)	0.86 (0.4–1.9)	
≥ 30	1	1.08 (0.5–2.2)	1.44 (0.6–3.6)	
Last active second phase of labour				
≤ 30 min	1	1	1	0.06
> 30 min	1	1.77 (1.1–2.9)	1.03 (0.4–2.3)	
Mode of last delivery				
Caesarean	1	1	1	0.42
Vaginal, spontaneous	1	1.51 (0.8–2.7)	1.00 (0.4–2.3)	
Vaginal, instrumental	1	1.42 (0.7–3.1)	1.78 (0.6–5.4)	

Table 3. De novo urinary incontinence 4 months postpartum and depressive symptoms at 4 and 12 months postpartum. Non-adjusted p values, and adjusted odds ratios for age, occupational group, marital status, parity, and centre. Analysis restricted to women who responded both questionnaires (4 and 12 months postpartum; N = 1226)

Depression indicators	De novo urinary incontinence at 4 months postpartum		Non adjusted p value	Adjusted OR (95% CI)
	No % (n/N), or mean (\pm sd)	Yes % (n/N), or mean (\pm sd)		
4 months postpartum				
Depressive symptoms (EPDS \geq 10)	15.9 (168/1054)	22.1 (38/172)	0.045	1.47 (0.98-2.21)
Mean EPDS	4.84 (4.72)	6.25 (4.84)	0.001	
Antidepressant consumption	1.4 (15/1040)	4.7 (8/170)	0.005	3.13 (1.23-7.92)
Depressive symptoms (EPDS \geq 10) or antidepressant consumption	16.5 (172/1040)	25.3 (43/170)	0.006	1.67 (1.13-2.47)
12 months postpartum				
Depressive symptoms (EPDS \geq 10)	20.5 (216/1054)	24.4 (42/172)	0.242	1.18 (0.80-1.75)
Mean EPDS	6.57 (3.72)	7.30 (3.46)	0.016	
Mean EPDS change between 4 and 12 months postpartum	+1.72 (4.45)	+1.05 (4.45)	0.067	
Antidepressant consumption	2.8 (29/1048)	4.2 (7/166)	0.306	1.43 (0.61-3.37)
Depressive symptoms (EPDS \geq 10) or antidepressant consumption	22.0 (228/1036)	28.9 (48/166)	0.049	1.37 (0.94-1.99)
New cases of depressive symptoms or antidepressant consumption at 12 months postpartum ‡				
Depressive symptoms (EPDS \geq 10)	14.4 (128/886)	20.9 (28/134)	0.053	1.53 (0.96-2.43)
Antidepressant consumption	1.5 (13/865)	1.6 (2/126)	0.928	0.85 (0.24-2.92)
Depressive symptoms (EPDS \geq 10) or antidepressant consumption	15.3 (132/865)	23.8 (30/126)	0.012	1.70 (1.08-2.70)

‡ New cases of depressive symptoms or antidepressant consumption among women not reporting depressive symptoms or taking antidepressant at 4 months postpartum

Table S1. Characteristics of excluded women from the analysis (Chi² test).

	Included women N=1413 %	Excluded women N=589 %	p
Age, years			
less than 25	14.4	20.1	<0.001
25-29	37.5	28.5	
30-34	33.3	32.8	
35 or more	14.8	18.7	
Educational level			
< High school diploma	25.5	38.5	<0.001
High school diploma	18.5	16.6	
University, 1 st degree	22.9	18.2	
> University, 1 st degree	33.1	26.7	
Occupational group			
Managers, professionals	11.4	9.9	<0.001
Intermediate occupation	39.6	31.6	
Office or clerical workers, civil servants	23.3	18.6	
Shop, service, manual workers	19.8	32.7	
No paid occupation	5.9	7.1	
Marital status			
Married couple	54.7	46.1	<0.001
Unmarried couple	40.2	44.0	
Single	5.1	9.9	
Parity			
0	48.6	32.9	<0.001
1	35.7	39.4	
2	11.7	18.9	
3 or more	4.0	8.7	

Table S2. Characteristics of women who did not fill the 12 months questionnaire among those included in the analysis (Chi² test).

	Women without a follow-up at 12 months postpartum N=177 %	Women with a follow-up at 12 months postpartum N=1236 %	p
Age, years	N=177	N=1236	
less than 25	24.3	12.9	
25-29	39.0	37.3	0.0002
30-34	26.6	34.3	
35 or more	10.2	15.4	
Educational level	N=175	N=1216	
< High school diploma	41.1	23.3	
High school diploma	17.7	18.6	<0.0001
University, 1 st degree	20.6	23.3	
> University, 1 st degree	20.6	34.9	
Occupational group	N=176	N=1216	
Managers, professionals	6.2	12.2	
Intermediate occupations	31.2	40.8	0.0005
Office or clerical workers, civil servants	25.0	23.0	
Shop, service, manual workers	30.1	18.3	
Marital status	N=175	N=1230	
Married couple	47.4	55.7	
Unmarried couple	41.7	40.0	0.0006
Single	10.9	4.3	
Parity	N=177	N=1236	
0	46.9	48.9	
1	35.0	35.8	0.389
2	15.2	11.2	
3 or more	2.8	4.1	