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Xavier * Fritel, Virginie Ringa, Noëlle Varnoux, Marie Zins, Gérard Bréart

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HAL Authorization

1 Title

2 Mode of delivery and fecal incontinence at midlife. A study of 2640 women in the GAZEL cohort.

3 Authors

4 Xavier FRITEL, MD, 1

5 Virginie RINGA, MD, PhD, 1

6 Noëlle VARNOUX, 1

7 Marie ZINS, MD, 2

8 Gérard BREART, MD, PhD, 1

9 Institution

10 Inserm : Institut national de la santé et de la recherche médicale (French Institute for Health and Medical
11 Research).

12 1. Inserm, UMR S149, IFR69, Epidemiological Research on Perinatal Health and Women's Health, Villejuif,
13 F-94807 France ; Université Pierre-et-Marie-Curie Paris 6, Paris, F-75012 France.

14 2. Inserm, U687, Saint-Maurice, F-94410 France ; Equipe RPPC du Cetaf, Saint-Maurice, F-94410 France ;
15 IFR69, Villejuif, F-94807 France.

16 Correspondence

17 Dr Xavier FRITEL

18 Gynécologie & Obstétrique

19 CHD Félix Guyon

20 F-97405 Saint-Denis cedex, Réunion, France

21 tel: +33.262.905.541

22 fax: +33.262.907.748

23 e-mail: x-fritel@chd-fguyon.fr (best contact address)

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27 Short title

28 Mode of delivery and fecal incontinence

1 Précis

2 In our population of women in their 50s, fecal incontinence was not associated with either parity or mode of

3 delivery.

1 **Abstract**

2 Objective: To estimate obstetrical risk factors of fecal incontinence among middle-aged women.

3 Methods: We conducted a mail survey of the GAZEL cohort of volunteers for epidemiological research. A
4 questionnaire on anal incontinence was mailed to 3114 women aged 50-61 years; 2640 (85%) returned it. Fecal
5 incontinence was defined by involuntary loss of stool. Logistic regression was used to estimate the impact of
6 obstetrical and general risk factors.

7 Results: Prevalence of fecal incontinence in the past 12 months was 9.5% (250). Significant risk factors for fecal
8 incontinence were completion of high school (adjusted odd ratio [OR] 1.5; 95% confidence interval 1.1-2.0),
9 self-reported depression (OR 2.1; 1.6-2.7), overweight or obesity measured by body mass index (OR 1.5 for
10 BMI of 25-30; 1.1-2.0, OR 1.6 for BMI > 30; 1.1-2.5), surgery for urinary incontinence (OR 3.5; 2.0-6.1), and
11 anal surgery (OR 1.7; 1.1-2.9). No obstetrical variable (parity, mode of delivery, birth weight, episiotomy, or
12 third-degree perineal tear) was significant. Prevalence of fecal incontinence was similar for nulliparous,
13 primiparous, secundiparous, and multiparous women (11.3, 9.0, 9.0, and 10.4% respectively), and among parous
14 women, it was similar for women with spontaneous vaginal, instrumental (at least one), or only cesarean
15 deliveries (9.3, 10.0, and 6.6% respectively).

16 Conclusion: In our population of women in their 50s, fecal incontinence was not associated with either parity or
17 mode of delivery.

1 **Introduction**

2 Fecal incontinence is a serious handicap and its prevalence increases with age.¹⁻³ Because injury to the
3 anal sphincter may occur during vaginal delivery, childbirth is thought to be a predisposing event that may lead
4 to fecal incontinence.^{4, 5} Several months after delivery, fecal incontinence is more frequent in women with
5 instrumental deliveries and less frequent in those with cesarean deliveries than among women with vaginal
6 deliveries.⁶ It is unclear, however, if cesarean delivery still exerts a protective effect later in life.^{7, 8}

7 Our main purpose was to estimate the prevalence of fecal incontinence among middle-aged women
8 enrolled in a cohort study and to assess its obstetrical risk factors, while taking other characteristics into account.

9 Our secondary purpose was to analyze the association between fecal incontinence and other pelvic floor
10 disorders.

1 **Methods**

2 Our population belongs to the French GAZEL cohort (www.gazel.inserm.fr), which began in 1989 with
3 more than 20 000 men and women employed by the French national power company (EDF-GDF) who
4 volunteered to participate in an epidemiological research coordinated by INSERM (Institut National de la Santé
5 et de la Recherche Médicale, that is the French National Institute for Health and Medical Research).⁹ Women of
6 the GAZEL cohort aged 45-50 years between 1990 and 1996 (n = 3 114) were included in a separate prospective
7 survey, the “Women and their Health” project. Its principal objective is to study women's health as they reach
8 menopause and afterwards.¹⁰ They receive a general health questionnaire each year as part of the overall GAZEL
9 survey and a specific questionnaire about women’s health issues every three years. In 2000 an additional
10 questionnaire about incontinence and obstetrical history was mailed to all the women in this survey. All our data
11 come from the mail questionnaires, primarily the questionnaire focusing on incontinence and obstetrical history.
12 Two previous reports about urinary incontinence based on the same questionnaire and database have previously
13 been published.¹¹⁻¹²

14 The prevalence of anal incontinence over the previous year was estimated from responses to the question:
15 *In the past 12 months, have you experienced involuntary loss of gas or stool? Yes or No.* Fecal incontinence was
16 defined by involuntary loss of liquid or solid stool. Severity of anal incontinence was estimated according to
17 Pescatori’s scoring system,¹³ which takes into account degree (flatus, liquid stool, solid stool) and frequency
18 (less than once a week, at least once a week, every day) of anal incontinence. Pescatori scores range from 2 (loss
19 of flatus less than once a week) to 6 (loss of solid stool every day). Severe anal incontinence was defined by a
20 score of 4 or higher. Stress urinary incontinence was assessed by responses to the question: *Does urine leak*
21 *when you are physically active, cough or sneeze? Never, Rarely, Sometimes, Often, or All the time.*¹⁴ Women
22 who answered *Sometimes, Often* or *All the time* were considered to have stress urinary incontinence. Other pelvic
23 floor symptoms (urinary urge incontinence, voiding difficulties, constipation, defecation difficulties, lower
24 abdominal pain, pain at intercourse, vaginal bulge) were assessed by the same method.

25 We tested a wide assortment of potential risk factors for fecal incontinence: general characteristics (age at
26 questionnaire, educational level, body mass index (BMI), and menopausal status), medical history (diabetes
27 mellitus, hysterectomy, surgery for urinary incontinence or pelvic organ prolapse, anal surgery, and depression),
28 life-style (household income, marital status, smoking habits, and regular physical exercise), and obstetrical
29 history (parity, episiotomy, third-degree perineal tear, birth weight, and mode of delivery). Depression was

1 defined by self-reported depression, depressed mood, anxiety or stress during the previous 12 months.
2 Continuous variables were transformed into categories of three classes. Standard cutoff points were used when
3 they existed (BMI and birth weight); otherwise, classes were separated at the 25th and 75th percentiles (age and
4 income). We compared women with fecal incontinence to all others and conducted a multivariable analysis with
5 backward stepwise logistic regression (Table 4). Candidate variables for the multivariable model were those with
6 a p value less than 0.10 on univariable analysis. Variables remained in the final multivariable model only if the
7 OR was significant after backward elimination; otherwise they were excluded. Our population's size and
8 characteristics enabled us to show a significant 6% difference in the prevalence of fecal incontinence among the
9 parous women compared with the nulliparous (17 versus 11%) and a difference of 7% among those with
10 spontaneous vaginal delivery compared with cesarean delivery (13 versus 6%) with a power of 80% ($\alpha = 0.05$,
11 $\beta = 0.20$, bilateral test). We examined the association between anal incontinence according to the Pescatori score
12 and both parity and mode of delivery (Table 5).

13 To achieve our secondary objective, we studied the association between fecal incontinence and other
14 pelvic floor disorders, as defined above (Table 3). The univariable and multivariable analyses used logistic
15 regression, as described above.

16 The odds ratio and its 95% confidence interval is reported for all. All analyses were performed with
17 Statview SAS Institute Inc., Cary, NC, USA.

18 The GAZEL cohort scientific committee and the CNIL (Commission Nationale de l'Informatique et des
19 Libertés, that is the French Data Protection Authority) approved this study, which received no external funding.

1 **Results**

2 Questionnaires were sent to 3 114 women, and 2640 (85%) completed and returned them. Details of the
3 population's characteristics and obstetrical history have been already published.¹¹ Briefly, median age was 54
4 (range 50-61) and median parity 2 (0-6); 79% were postmenopausal (Table 1). Comparisons between
5 respondents and non-respondents showed no significant differences for age, BMI, parity, marital status or
6 smoking. Respondents had a higher educational level than non-respondents. Data about anal continence were
7 missing for 136 women and data concerning its severity for 11. Prevalence of anal incontinence in the past 12
8 months was 38.5% (1016), with 28.6% (755) experiencing flatus incontinence only and 9.5% (250) fecal
9 incontinence. The degree and frequency of anal incontinence symptoms are reported in Table 2, and the
10 association of fecal incontinence with other anorectal, pelvic or urinary symptoms in Table 3.

11 Characteristics associated with fecal incontinence were high BMI (overweight and obesity), anal surgery,
12 urinary incontinence surgery, completion of high school, and self-reported depression or stress (Table 4). No
13 obstetrical variable (parity, mode of delivery, birth weight, episiotomy, or third degree perineal tear) was
14 significant. Prevalence of fecal incontinence was similar for nulliparous, primiparous, secundiparous, and
15 multiparous women (11.3, 9.0, 9.0, and 10.4% respectively). Among parous women, the prevalence of fecal
16 incontinence was similar for women with spontaneous vaginal, instrumental (at least one) or only cesarean
17 deliveries (9.3, 10.0, and 6.6% respectively). We found no association between severity of anal incontinence and
18 parity or mode of delivery (Table 5).

1 **Discussion**

2 In our population of women in their 50s, the prevalence of fecal incontinence was 9.5%. Risk factors for
3 fecal incontinence were overweight and obesity, anal surgery, urinary incontinence surgery, completion of high
4 school, and lower household incomes. Its prevalence was similar among nulliparous and parous women and
5 among women with spontaneous, instrumental or cesarean deliveries.

6 Our population sample is not exactly representative of middle-aged French women, because women
7 enrolled in the GAZEL cohort were recruited from a work setting and volunteered to participate in medical
8 research. We know, for example, that the women who agreed to participate in GAZEL had a higher education
9 level and were in better health than nonparticipating employees.⁹⁻¹¹ The prevalence of fecal incontinence found
10 in our study is consistent with results from other studies of women in their 50s (Table 6).^{1-3,15}

11 The prevalence of fecal incontinence increases with age.¹⁻³ Even in asymptomatic women, manometry
12 shows that age alters the mechanisms of anal continence.¹⁶ We did not find any association with age, but the
13 narrow range of the age distribution in our study sample (50-61 years) may explain this result.

14 The effect of pregnancy itself on anal continence has not been clearly demonstrated. Several cross-
15 sectional studies report a higher prevalence of anal and fecal incontinence among women with children, but this
16 association disappears after adjustment for other risk factors.¹⁷⁻¹⁹ The large survey (10 116 men and women) by
17 Perry et al found no difference between men and women aged 40 years or more in the prevalence of fecal
18 incontinence (6.2 versus 5.7 respectively).² Van Brummen et al report a similar prevalence of flatus or fecal
19 incontinence at the beginning of a first pregnancy, at the end of the pregnancy and at 3 and 12 months
20 postpartum.²⁰ In their study, the only factors associated with flatus incontinence 12 months after first delivery
21 were BMI and presence of the symptom at 12 weeks of gestation. It is not surprising that the relation between
22 parity and fecal incontinence is so weak when we consider that the median age of onset of fecal incontinence is
23 55 years.¹

24 The effect of mode of delivery on anal continence is still debated. Vaginal delivery is known to expose
25 the anal sphincter to laceration, especially during first or instrumental deliveries or when birth weight is high.^{21,22}
26 Even without clinical tears, vaginal delivery may lead to occult injury of the anal sphincter, visible on
27 endosonography.⁵ The clinical significance of these occult defects is unclear. Chaliha et al reported similar
28 prevalence rates for fecal incontinence before and after first delivery and found no association between anal

1 symptoms and anal sphincter defects.²³ In cohort studies, the differences between women with vaginal and
2 cesarean deliveries appear to weaken with time since delivery (Table 7). MacArthur et al showed that three
3 months after a first delivery, fecal incontinence is more frequent after spontaneous or forceps delivery than after
4 cesareans (8.8, 13.9 and 5.0% respectively).⁶ In the same population six years later, however, no difference was
5 observed between women with spontaneous vaginal and cesarean deliveries.²⁵ The only randomized trial
6 evaluating vaginal delivery versus planned cesarean for breech presentation found no significant difference
7 concerning fecal incontinence.^{26, 27} Similarly, cross-sectional studies (of somewhat older women, on average)
8 found no differences for women with cesarean and vaginal deliveries, especially when other risk factors were
9 taken into account.^{1, 3, 18, 28, 29} In our study, fecal incontinence was slightly less frequent and anal incontinence
10 less serious after only cesarean deliveries and slightly more frequent and more serious after at least one forceps
11 delivery (Tables 4 & 5), but this difference is not significant. This may be due to a lack of power, but it also
12 means that the effects of mode of delivery, if they exist, are minor.

13 Third- and fourth-degree anal sphincter tears are associated with fecal incontinence one year after
14 childbirth,²⁰ but the association is not found 6 years after delivery.²⁵ In our work, fecal incontinence was slightly
15 more frequent among women reporting anal tears during delivery, but the difference is not significant.
16 We found an association between history of anal surgery and fecal incontinence. Our study did not collect details
17 of the surgery, but we can reasonably suppose that it most often involved minor procedures (for hemorrhoids,
18 fissures, or fistula), which involve a risk of fecal incontinence when the internal sphincter is cut or damaged.³⁰⁻³¹
19 Barucha et al thus found an increased risk of fecal incontinence among patients with a history of anorectal
20 surgery (univariable OR=2.3; 95%CI: 1.6-3.3), anal fissure (OR=1.6; 95%CI: 1.2-2.2) or anal fistula (OR=2.9;
21 95%CI: 1.7-5.0).¹ There is no known effect of urologic surgery that explains the association we found with fecal
22 incontinence. Nonetheless, we know that anal and fecal incontinence are often associated.^{3, 15, 18, 28} This
23 association may be explained by tissue characteristics that predispose women to pelvic floor disorders.

24 We observed that women with a higher educational level were more likely to report fecal incontinence.
25 Overall, respondents in the Gazel cohort have a higher educational level than nonrespondents.^{9, 11} We also note
26 that only 19% of our sample had completed high school (including passing the baccalaureate examination). It
27 may be that the better educated women find it easier to admit this type of symptom, which may be perceived as
28 stigmatizing, humiliating, or taboo. This association was not reported in two other studies that considered
29 educational level, but this result may be explained in part by the type of the population studied or by adjustments

1 for other characteristics, such as race or comorbidities.^{3,19} The association between obesity and anal incontinence
2 has previously been reported.^{17,18,32} The mechanism of this association remains unknown.

3 Melville et al also reported an association between depression — major depression in their study — and
4 fecal incontinence.³ We did not measure depression with a specific validated scale, but simply asked women to
5 report a history of depression, depressed mood or stress. The cross-sectional nature of our study sheds no light
6 on the question of whether incontinence causes depression in women, or whether depression itself causes
7 incontinence. It is possible that both depression and incontinence share a common pathway. On the other hand,
8 depressed subjects may be more sensitive to symptoms or more likely to report symptoms than nondepressed
9 subjects.

10 The principal limitation of this study was that fecal incontinence was not clinically confirmed. In
11 addition, we were unable to distinguish planned and cesarean section during labor. We note however that the
12 women questioned had given birth for the first time 30 years earlier on average (1970), at a time when elective
13 caesareans were still rare. Despite these limitations, our study is the largest epidemiological survey about anal
14 incontinence among middle-aged women that includes a detailed questionnaire about their delivery. In our
15 population of women in their 50s, fecal incontinence was not associated with either parity or mode of delivery.

1 References

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1. Bharucha AE, Zinsmeister AR, Locke GR, Seide BM, McKeon K, Schleck CD, et al. Risk factors for fecal incontinence: a population-based study in women. *Am J Gastroenterol*. 2006;101:1305–12.
 2. Perry S, Shaw C, McGrother C, Matthews RJ, Assassa RP, Dallosso H et al. Prevalence of faecal incontinence in adults aged 40 years or more living in the community. *Gut* 2002;50:480–4.
 3. Melville JL, Fan MY, Newton K, Fenner D. Fecal incontinence in US women: a population-based study. *Am J Obstet Gynecol* 2005;193:2071–6.
 4. Nelson RL. Epidemiology of fecal incontinence. *Gastroenterology* 2004;126: S3–7.
 5. Sultan AH, Kamm MA, Hudson CN, Thomas JM, Bartram CI. Anal-sphincter disruption during vaginal delivery. *N Engl J Med* 1993;329:1905–11.
 6. MacArthur C, Glazener CMA, Wilson PD, Herbison GP, Gee H, Lang GD, et al. Obstetric practice and faecal incontinence three month after delivery. *BJOG* 2001;108:678–83.
 7. Chaliha C, Digesu A, Hutchings A, Soligo M, Khullar V. Caesarean section is protective against stress urinary incontinence: an analysis of women with multiple deliveries. *BJOG* 2004;111:754–5.
 8. Lal M, Mann CH, Callender R, Radley S. Does cesarean delivery prevent anal incontinence? *Obstet Gynecol* 2003;101:305–12.
 9. Goldberg M, Chastang JF, Leclerc A, Zins M, Bonenfant S, Bugel I, et al. Socioeconomic, demographic, occupational and health factors associated with participation in a long-term epidemiologic survey: a prospective study of the French GAZEL cohort and its target population. *Am J Epidemiol* 2001;154:373–84.
 10. Ringa V, Ledésert B, Bréart G. Determinants of hormone replacement therapy among postmenopausal women enrolled in the French GAZEL cohort. *Osteoporosis Int* 1994;4:16–20.
 11. Fritel X, Ringa V, Varnoux N, Fauconnier A, Piau S, Bréart G. Mode of delivery and severe stress incontinence. A cross-sectional study among 2625 perimenopausal women. *BJOG* 2005;112:1646–51.

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12. Saadoun K, Ringa V, Fritel X, Varnoux N, Zins M, Bréart G. Negative impact of urinary incontinence on quality of life, a cross-sectional study among women aged 49-61 years enrolled in the GAZEL cohort. *Neurourol Urodyn* 2006;25:696-702.
 13. 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.
 14. Jackson S, Donovan J, Brookes S, Eckford S, Swithinbank L, Abrams P. The Bristol Female Lower Urinary Tract Symptoms questionnaire: development and psychometric testing. *Br J Urol* 1996;77:805-12.
 15. Roberts RO, Jacobsen SJ, Reilly WT, Pemberton JH, Lieber MM, Talley NJ. Prevalence of combined fecal and urinary incontinence: a community-based study. *J Am Geriatr Soc* 1999;47:837-41.
 16. Fox JC, Fletcher JG, Zinsmeister AR, Seide B, Riederer SJ, Bharucha AE. Effect of Aging on Anorectal and Pelvic Floor Functions in Females. *Dis Colon Rectum*. 2006;49:1726-35.
 17. Boreham MK, Richter HE, Kenton KS, Nager CW, Gregory WT, Aronson MP, et al. Anal incontinence in women presenting for gynecologic care: Prevalence, risk factors, and impact upon quality of life. *Am J Obstet Gynecol* 2005;192:1637-42.
 18. Varma MG, Brown JS, Creasman JM, Thom DH, Van Den Eeden SK, Beattie MS, et al. Fecal incontinence in females older than aged 40 years: who is at risk? *Dis Colon Rectum*. 2006;49:841-51.
 19. McKinnie V, Swift SE, Wang W, Woodman P, O'Boyle A, Kahn M, et al. The effect of pregnancy and mode of delivery on the prevalence of urinary and fecal incontinence. *Am J Obstet Gynecol* 2005;193:512-8.
 20. Van Brummen HJ, Bruinse HW, van de Pol G, Heintz APM, van der Vaart CH. Defecatory symptoms during and after the first pregnancy: prevalences and associated factors. *Int Urogynecol* 2006;17:224-30.
 21. Handa VL, Danielsen BH, Gilbert WM. Obstetric anal sphincter lacerations. *Obstet Gynecol* 2001;98:225-30.

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22. Richter HE, Brumfield CG, Cliver SP, Burgio KL, Neely CL, Varner RE. Risk factors associated with anal sphincter tear: A comparison of primiparous patients, vaginal births after cesarean deliveries, and patients with previous vaginal delivery. *Am J Obstet Gynecol* 2002;187:1194–8.
 23. 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.
 24. Eason E, Labrecque M, Marcoux S, Mondor M. Anal incontinence after childbirth. *CMAJ* 2002;166:326–30.
 25. MacArthur C, Glazener C, Lancashire R, Peter 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.
 26. Hannah ME, Hannah WJ, Hodnett ED, Chalmers B, Kung R, Willan A, et al. Outcomes at 3 months after planned cesarean vs planned vaginal delivery for breech presentation at term. *JAMA* 2002;287:1822–3.
 27. Hannah ME, Whyte H, Hannah WJ, Hewson S, Amankwah K, Cheng M, et al. Maternal outcomes at 2 years after planned cesarean section versus planned vaginal birth for breech presentation at term: The international randomized Term Breech Trial. *Am J Obstet Gynecol* 2004;191:917–27.
 28. Abramov Y, Sand PK, Botros SM, Gandhi S, Miller JJR, Nickolov A, et al. Risk Factors for Female Anal Incontinence: New Insight Through the Evanston-Northwestern Twin Sisters Study. *Obstet Gynecol* 2005;106:726–32.
 29. MacLennan AH, Taylor AW, Wilson DH, Wilson D. The prevalence of pelvic floor disorders and their relationship to gender, age, parity and mode of delivery. *BJOG* 2000;107:1460–70.
 30. American Gastroenterological Association Medical Position Statement: Diagnosis and Care of Patients With Anal Fissure. *Gastroenterol* 2003;124:233–234.
 31. Lindsey I, Jones OM, Smilgin-Humphreys MM, Cunningham C, Mortensen NJ. Patterns of fecal incontinence after anal surgery. *Dis Colon Rectum*. 2004;47:1643–9.
 32. Nelson R, Furner S, Jesudason V. Fecal Incontinence in Wisconsin Nursing Homes Prevalence and Associations. *Dis Colon Rectum* 1998;41:1226–1229.

Table 1

Characteristics of population (% for nominal variables and mean \pm standard deviation for continuous variables).

Characteristics	Fecal incontinence	
	No	Yes
N	2243	250
Age, years	54.9 \pm 3.4	54.9 \pm 3.4
High school diploma: Yes	19.0 %	24.4%
Occupation:		
Blue collar, clerical staff	25.5%	28.9%
Supervisors, sales representatives	65.9%	63.2%
Management or training	8.5%	7.9%
House monthly income:		
< 1600 €	20.4%	19.6%
1600-2592 €	43.4%	42.0%
> 2592	18.8%	18.4%
Marital status: Couple	67.1%	62.8%
Smoking: Yes	11.3%	14.8%
Regular physical exercise: Yes	52.6%	45.6%
Depression or stress: Yes	25.4%	41.6%
Body mass index, kg/m ²	24.3 \pm 4.0	25.2 \pm 4.3
Premenopausal	20.2%	17.6%
Diabetes: Yes	2.5%	4.4%
Hysterectomy: Yes	17.5%	19.2%
Urinary incontinence surgery: Yes	2.1%	7.6%
Pelvic organ prolapse surgery: Yes	2.5%	4.4%
Anal surgery: Yes	4.7%	8.4%
Parity	1.6 \pm 0.9	1.6 \pm 1.0
Heaviest birth weight:*		
< 3.0	16.2%	16.7%
3.0–3.9	72.0%	72.6%
\geq 4.0	10.4%	9.3%
Mode of deliveries:*		
Spontaneous	76.0%	76.3%
Forceps, at least 1	17.8%	19.5%
Cesarean only	6.1%	4.2%
Episiotomy: Yes*	56.7%	62.3%
3 rd degree perineal tear: Yes*	7.8%	9.8%

* For obstetrical variables percentages are among parous women only.

Table 2

Degree and frequency of anal incontinence symptoms in the past 12 months.

Anal Incontinence	< once a week % (n)	At least once a week % (n)	Every day % (n)	All % (n)
Flatus incontinence only	13.3 (352)	10.8 (286)	4.4 (117)	28.6 (755)
Liquid stool incontinence	7.2 (191)	0.4 (10)	0.1 (3)	7.7 (204)
Solid stool incontinence	1.5 (40)	0.2 (6)	0.0 (0)	1.7 (46)
Degree / frequency not stated	-	-	-	0.4 (11)
Missing data	-	-	-	5.2 (136)

Table 3

Association between pelvic floor disorders and fecal incontinence. Univariable and multivariable analysis using logistic regression.

Women's pelvic floor symptoms		n	Fecal incontinence %	Univariable analysis crude OR (95%CI)	Multivariable analysis adjusted OR (95%CI)
Difficult defecation	No	1735	8.8	1	<i>not significant</i>
	Yes	730	12.6	1.5 (1.1-2.0)	
Bowel movement < 3/week	No	1998	9.6	1	<i>not introduced</i>
	Yes	454	11.7	1.3 (0.9-1.7)	
Pain in lower abdomen	No	1960	8.5	1	<i>not significant</i>
	Yes	494	15.4	2.0 (1.5-2.6)	
Vaginal bulge	No	2351	9.4	1	<i>not significant</i>
	Yes	96	20.8	2.5 (1.5-4.3)	
Painful intercourse	No	1566	8.2	1	<i>not significant</i>
	Yes	350	14.9	2.0 (1.4-2.8)	
Stress urinary incontinence	No	1557	7.4	1	<i>not significant</i>
	Yes	1072	12.5	1.8 (1.3-2.3)	
Urge urinary incontinence	No	2186	7.5	1	1
	Yes	445	19.1	2.8 (2.1-3.8)	2.1 (1.6-2.9)
Urinary infection during the past 12 months	No	2265	9.3	1	<i>not introduced</i>
	Yes	329	11.9	1.3 (0.9-1.9)	
Difficult voiding	No	2106	7.4	1	1
	Yes	433	20.6	3.2 (2.4-4.3)	2.5 (1.9-3.4)

The candidate variables introduced in the multivariable model were those with a p value < 0.10 on univariable analysis. Variables remained in the final multivariable model only if the OR was significant (p value < 0.05) after backward elimination.

Table 4

Association between women's characteristics and fecal incontinence. Bivariable analysis and logistic regression.

Women's characteristics		n	Fecal incontinence %	Univariable analysis crude OR (95%CI)	Multivariable analysis adjusted OR (95%CI)
Age at questionnaire	< 52	643	9.8	1	<i>not introduced</i>
	52–57	1396	9.0	0.9 (0.7-1.3)	
	≥ 58	601	10.1	1.1 (0.7-1.5)	
High school diploma	No	2069	8.8	1	1
	Yes	509	12.0	1.4 (1.02-1.9)	1.5 (1.1-2.0)
Occupation	Blue-collar, clerical staff	667	10.5	1	<i>not introduced</i>
	Supervisors, sales representatives	1679	9.1	0.8 (0.6-1.1)	
	Management or training	213	8.9	0.8 (0.5-1.4)	
Household monthly income	< 1600 €	534	9.2	1	<i>not introduced</i>
	1600-2592 €	1133	9.3	1.0 (0.7-1.4)	
	> 2592 €	489	9.4	1.0 (0.7-1.6)	
Marital status	Couple	1759	8.9	1	<i>not introduced</i>
	Alone	600	10.7	1.2 (0.9-1.7)	
Smoking	No	2297	9.1	1	<i>not introduced</i>
	Yes	307	12.1	1.4 (0.9-2.0)	
Regular physical exercise	No	1214	11.0	1	<i>not significant</i>
	Yes	1368	8.3	0.7 (0.6-0.96)	
Depression or stress	No	1934	7.5	1	1
	Yes	706	14.7	2.1 (1.6-2.7)	2.1 (1.6-2.7)
Body mass index (kg/m ²)	< 25	1672	8.1	1	1
	25–30	660	11.2	1.4 (1.1-1.9)	1.5 (1.1-2.0)
	> 30	249	13.3	1.7 (1.1-2.6)	1.6 (1.1-2.5)
Menopausal status	Pre	529	8.3	1	<i>not introduced</i>
	Post with HRT	1306	9.6	1.2 (0.8-1.7)	
	Post without HRT	791	10.0	1.2 (0.8-1.8)	
Diabetes	No	2499	9.4	1	<i>not significant</i>
	Yes	71	15.5	1.7 (0.9-3.4)	
Hysterectomy	No	2120	9.4	1	<i>not introduced</i>
	Yes	463	10.4	1.1 (0.8-1.5)	
Urinary incontinence surgery	No	2563	9.0	1	1
	Yes	71	26.8	3.8 (2.2-6.5)	3.5 (2.0-6.1)
Pelvic organ prolapse surgery	No	2506	9.4	1	<i>not significant</i>
	Yes	70	15.7	1.8 (0.9-3.5)	
Anal surgery	No	2445	9.2	1	1
	Yes	134	15.7	1.8 (1.1-3.0)	1.7 (1.1-2.9)
Parity	0	310	11.3	1	<i>not introduced</i>
	1+	2330	9.2	0.8 (0.6-1.2)	
Heaviest birth weight (kg)	< 3.0	378	9.5	1	<i>not introduced</i>
	3.0–3.9	1675	9.3	1.0 (0.7-1.4)	
	≥ 4.0	244	8.2	0.9 (0.5-1.5)	
Mode of deliveries	Spontaneous	1772	9.3	1	<i>not introduced</i>
	Forceps, at least 1	421	10.0	1.1 (0.8-1.6)	
	Cesarean only	137	6.6	0.7 (0.3-1.4)	
Episiotomy	No	903	8.2	1	<i>not introduced</i>
	Yes, at least 1	1342	10.0	1.3 (0.9-1.7)	
3 rd degree perineal tear	No	2039	9.2	1	<i>not introduced</i>
	Yes, at least 1	184	11.4	1.3 (0.8-2.0)	

The candidate variables introduced in the multivariable model were those with a p value < 0.10 on univariable analysis. Variables remained in the final multivariable model only if the OR was significant (p value < 0.05) after backward elimination.

Table 5

Anal incontinence severity assessed with the Pescatori score (2-3: mild, 4-6: severe), parity and mode of delivery.

	Anal incontinence severity			
	Mild % (n)	OR (CI 95%)	Severe % (n)	OR (CI 95%)
Parity				
0	31.2 (93)	1	7.7 (23)	1
1	32.1 (233)	1.0 (0.8-1.4)	6.1 (44)	0.8 (0.5-1.3)
2	32.5 (373)	1.1 (0.8-1.5)	9.6 (110)	1.3 (0.8-2.1)
3 +	30.5 (99)	1.0 (0.7-1.4)	9.2 (30)	1.2 (0.7-2.2)
Mode of delivery				
Vaginal	31.1 (520)	1	8.3 (138)	1
Instrumental	34.1 (135)	1.2 (0.9-1.5)	10.1 (40)	1.3 (0.9-1.9)
Cesarean only	38.2 (50)	1.3 (0.9-1.9)	4.6 (6)	0.6 (0.3-1.4)

Table 6

Cross-sectional studies estimating the frequency of fecal incontinence among middle aged women.

Cross-sectional study	Population			Fecal Incontinence	
	n	type	age	definition	%
Roberts et al 1999 ¹⁵	228	random sample from a health register	50-59	leakage of stool in the previous year	13.1
Perry et al 2002 ²	ns	random sample from a health register	50-59	leakage from bowels at least several times a year	4.3
Melville et al 2005 ³	ns	random sample from a health register	50-59	loss of stool occurring at least monthly.	7.5
Bharucha et al 2006 ¹	493	random sample from a health register	50-59	leakage of stool in the previous year	21.7
Varma 2006 ¹⁸	796	random sample from a health register	50-59	leakage of stool in the previous year	24.2
Our work 2007	2640	volunteer workers	50-61	leakage of stool in the previous year	9.5

ns: not stated

Table 7

Cohort studies estimating the frequency of fecal incontinence (FI) after delivery.

Cohort study	Population	Time postpartum	Cesarean % FI	Vaginal	
				Forceps % FI	Spontaneous % FI
MacArthur 2001 ⁶	3261 primiparas	3 months	5.0*	13.9*	8.8
	3893 multiparas		9.7	12.2	10.0
Eason 2002 ²⁴	897	3 months	1,8	4.1	3.2
Hannah 2002 ^{26,26}	1596 †	3 months	0,8		1,5
Hannah 2004 ²⁷	917 †	2 years	2,4		2,2
MacArthur 2005 ²⁵	1793 primiparas	6 years	2.1	6.8*	2.8

* significant difference compared with spontaneous vaginal delivery.

† breech presentation, randomized trial, intention-to-treat analysis.