



Mode of delivery and fecal incontinence at midlife: a study of 2,640 women in the Gazel cohort.

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1 Title

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

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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.

Abstract

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

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

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

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

Introduction

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

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

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

Methods

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

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

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

defined by self-reported depression, depressed mood, anxiety or stress during the previous 12 months.

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

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

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

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

Results

Questionnaires were sent to 3114 women, and 2640 (85%) completed and returned them. Details of the population's characteristics and obstetrical history have been already published.¹¹ Briefly, median age was 54 (range 50-61) and median parity 2 (0-6); 79% were postmenopausal (Table 1). Comparisons between respondents and non-respondents showed no significant differences for age, BMI, parity, marital status or smoking. Respondents had a higher educational level than non-respondents. Data about anal continence were missing for 136 women and data concerning its severity for 11. Prevalence of anal incontinence in the past 12 months was 38.5% (1016), with 28.6% (755) experiencing flatus incontinence only and 9.5% (250) fecal incontinence. The degree and frequency of anal incontinence symptoms are reported in Table 2, and the association of fecal incontinence with other anorectal, pelvic or urinary symptoms in Table 3.

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

Discussion

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

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

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

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

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

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

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

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

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

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

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

1 References

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- <u>61</u> | 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 | Vaginal | |
|------------------------------|-----------------|-----------------|----------|-----------------|---------------------|
| | | | % FI | 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.