

Fecal Incontinence in US Adults: Epidemiology and Risk Factors

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Podcast interview: www.gastro.org/gastropodcast.

BACKGROUND & AIMS: The study aims were to estimate the prevalence of different types and frequencies of fecal incontinence (FI), describe demographic factors, and identify risk factors. **METHODS:** The National Health and Nutrition Examination Survey (NHANES) assesses health status in the civilian noninstitutionalized US population. The validated Fecal Incontinence Severity Index was added to NHANES in 2005–2006. Participants were 2229 women and 2079 men aged 20 years or older. FI was defined as accidental leakage of solid, liquid, or mucus at least once in the preceding month. Sampling weights were used to obtain prevalence estimates for the national population. Multivariate logistic regression identified independent risk factors. **RESULTS:** The estimated prevalence of FI in noninstitutionalized US adults is 8.3% (95% confidence interval, 7.1–9.5) and consists of liquid stool in 6.2%, solid stool in 1.6%, and mucus in 3.1%. It occurs at least weekly in 2.7%. Prevalence is similar in women (8.9%) and men (7.7%) and increases with age from 2.6% in 20 to 29 year olds up to 15.3% in participants aged 70 years and older. FI is not significantly associated with race/ethnicity, education, income, or marital status after adjusting for age. Independent risk factors in women are advancing age, loose or watery stools, more than 21 stools per week, multiple chronic illnesses, and urinary incontinence. Independent risk factors in men are age, loose or watery stools, poor self-rated health, and urinary incontinence. **CONCLUSIONS:** FI is a prevalent age-related disorder. Chronic diarrhea is a strong modifiable risk factor that may form the basis for prevention and treatment.

Fecal incontinence (FI) can have a devastating impact on quality of life^{1,2}; its effects may include embarrassment, social isolation, and even loss of employment.³

It is believed to be a frequent cause of referral to a nursing home.⁴ However, patients with FI often do not report this to their health care providers,⁵ and the prevalence of FI is poorly documented.

FI is commonly defined as the involuntary loss of solid or liquid feces or mucus,⁶ and definitions can include consistency of stool and frequency of occurrence. Data on national rates of FI and anal incontinence are currently limited by variability in definitions, lack of inclusion of a wide range of age groups, and underrepresentation of minorities.

To obtain national prevalence estimates for FI, the Pelvic Floor Disorders Network submitted a validated FI severity scale for inclusion in the National Health and Nutrition Examination Survey (NHANES) 2005–2006. In a prior publication⁷ we reported the overall prevalence of FI and its association with age, race, education, family income, and body mass index in adult women. However, the previous report was limited because it did not include data on men or compare the sexes; did not address important risk factors such as usual stool consistency, physical activity, and health status; and did not apply multivariate regression to distinguish “true” risk factors from associations that may be due to correlations among variables. The previous publication also did not report on the prevalence of different types (mucus, solid, liquid) or frequencies of FI, which may have different impacts on quality of life. The objectives of this study were to provide a comprehensive description of FI in adult men as well as women and to describe demographic and other risk factors associated with FI after multivariate adjustment.

Abbreviations used in this paper: BMI, body mass index; CI, confidence interval; FI, fecal incontinence; NHANES, National Health and Nutrition Examination Survey.

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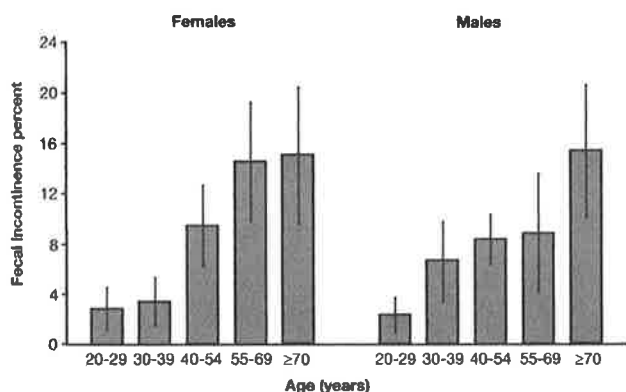


Figure 1. Prevalence of FI by age group in female and male subjects. Bars represent 95% CIs.

tus, education, or family income for women or men after adjusting for age (data not shown).

Table 3 lists candidate risk factors that were significantly associated with FI in either women or men when tested individually; associations are expressed as age-adjusted odds ratios and 95% CIs. This table also shows the final multivariate models for women and men. Supplementary Tables 1 and 2 provide estimates of the prevalence of FI by all risk factors considered in this study.

Participants who reported that their bowel movements were usually mushy or watery were substantially more likely to report FI compared with participants with normal stool consistency (Figure 2), even after multivariate adjustment for other risk factors. For women, the find-

ings for stool frequency paralleled those for stool consistency; having more than 21 bowel movements per week was significant in the final model. However, after multivariate adjustment, this relationship did not hold for men.

The inability to engage in physical activity was significantly associated with FI in women but not men (Table 3). In the bivariate analyses, engaging in vigorous physical activity appeared to be protective in women, but this association did not survive multivariate adjustment. Similarly, in bivariate analyses, obesity (BMI ≥ 30 kg/m²) was associated with a higher prevalence of FI compared with normal or low weight (BMI < 25 kg/m²) in women, but this association was no longer significant after multivariate adjustment.

Women with chronic illnesses were at increased risk for FI, but this association was not significant for men. However, in men (but not women), self-reported poor health was significantly associated with FI.

In women, the prevalence of FI increased with increasing numbers of vaginal deliveries, from 5.9% (95% CI, 3.2–8.6) in women with no vaginal deliveries to 15.1% (95% CI, 11.9–18.3) in women with 4 or more vaginal deliveries ($P < .0001$; Supplementary Table 2). However, the number of vaginal deliveries was no longer significantly associated with FI after adjustment for age ($P = .09$) and other risk factors ($P = .57$).

FI was significantly associated with urinary incontinence in men; for women, the bivariate association between urinary incontinence and FI was significant, but

Table 3. Odds Ratios for Variables Associated With FI

Risk factor	Women				Men			
	Bivariate analysis		Multivariate analysis		Bivariate analysis		Multivariate analysis	
	Odds ratio (95% CI)	P	Odds ratio (95% CI)	P	Odds ratio (95% CI)	P	Odds ratio (95% CI)	P
Age (10-year interval)	1.41 (1.31–1.51)	<.0001	1.20 (1.10–1.31)	<.0001	1.32 (1.22–1.44)	<.0001	1.24 (1.09–1.41)	.0009
Usual stool consistency (vs normal stools)								
Loose, watery stools	3.36 (2.21–5.10)	<.0001	2.82 (1.95–4.08)	<.0001	5.78 (2.76–12.08)	<.0001	4.76 (1.94–11.69)	.0007
Hard, lumpy stools	1.06 (0.60–1.90)	.84	1.00 (0.54–1.86)	1.00	2.60 (1.10–6.12)	.029	1.76 (0.64–4.82)	.27
Usual stool frequency (vs 3–21 bowel movements per week)								
>21 bowel movements per week	5.38 (2.55–11.30)	<.0001	2.36 (1.09–5.12)	.029	5.51 (2.68–11.3)	<.0001	2.26 (0.86–5.9)	.097
<3 bowel movements per week	1.96 (0.83–4.60)	.12	1.62 (0.65–4.03)	.30	1.71 (0.87–3.37)	.12	1.04 (0.43–2.54)	.93
BMI (vs normal/underweight; BMI <25 kg/m ²)								
Overweight (BMI 25–29.9 kg/m ²)	1.24 (0.82–1.86)	.31	1.09 (0.65–1.81)	.75	0.96 (0.59–1.56)	.87	0.90 (0.53–1.54)	.70
Obese (BMI ≥ 30 kg/m ²)	1.71 (1.15–2.54)	.0078	1.19 (0.76–1.87)	.44	1.35 (0.97–1.89)	.079	1.21 (0.86–1.70)	.28
Vigorous activity (vs no vigorous activity)								
Does vigorous activity	0.48 (0.24–0.97)	.041	0.59 (0.27–1.25)	.17	0.64 (0.40–1.04)	.071	0.78 (0.43–1.42)	.41
Unable to do any activity	2.61 (1.36–4.97)	.0037	2.23 (1.09–4.57)	.028	1.00 (0.44–2.26)	1.00	0.77 (0.31–1.92)	.57
Chronic ill (vs no chronic ill)								
1 chronic ill	2.37 (1.55–3.63)	<.0001	1.96 (1.34–2.87)	.0006	1.25 (0.73–2.14)	.41	1.07 (0.65–1.77)	.78
≥ 2 chronic ill	3.12 (1.73–5.63)	.0002	2.20 (1.19–4.05)	.012	1.38 (0.77–2.47)	.27	1.02 (0.55–1.90)	.95
Poor self-rated health	1.91 (1.14–3.21)	.015	1.20 (0.63–2.31)	.58	2.20 (1.62–2.98)	<.0001	1.78 (1.18–2.66)	.0056
Urinary incontinence	2.08 (1.41–3.07)	.0002	1.62 (0.99–2.66)	.054	3.39 (2.12–5.40)	<.0001	2.60 (1.44–4.67)	.0014

NOTE. Only variables found to be significant in bivariate analyses for women or men were included in the multivariate regressions and shown in this table. All bivariate analyses except age are age adjusted. Multivariate odds ratios are adjusted for all other risk factors in the table.

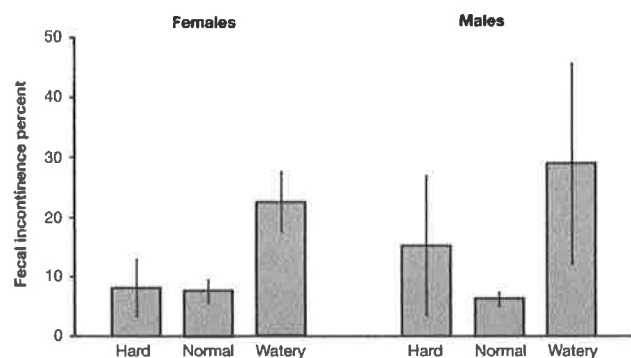


Figure 2. Prevalence of FI by usual stool consistency in female and male subjects. Bars represent 95% CIs. For both women and men, the odds of FI were significantly increased ($P < .001$) for subjects whose usual stool consistency was mushy or watery compared with subjects with normal stool consistency; see Table 3.

after multivariate adjustment, this association was no longer significant in women ($P = .054$; see Table 3). Both urinary incontinence and FI were reported by 2.7% (95% CI, 1.9–3.6) of women and 1.1% (95% CI, 0.7–1.5) of men in the noninstitutionalized population. The overall prevalence of urinary incontinence and FI occurring together (women and men combined) was 1.9% (95% CI, 1.5–2.4).

Discussion

Efforts to develop prevention and treatment strategies for FI have been hampered by lack of reliable information on its prevalence and characteristics.¹⁵ This study of a nationally representative sample of US adults shows that FI at least once in the past month is very common, affecting 8.3% of noninstitutionalized adults. FI occurs at least weekly in 2.7% (95% CI, 2.1–3.2) of the population and is a daily occurrence in 0.9%. The most common type of FI consists of the loss of liquid stools, followed by loss of mucus. Incontinence for solid stool at least once in the past month is reported by 1.6% of the population.

This study has limitations. First, prevalence estimates were limited to noninstitutionalized individuals, and because the prevalence of FI is higher in nursing homes than in the community, the overall prevalence of FI is likely underestimated, especially among older participants. Secondly, the volume of stool lost, in addition to the frequency and type of stool lost, may influence the impact of FI on quality of life,¹⁶ and volume of incontinence was not assessed. Finally, some possible risk factors of FI such as hemorrhoids and rectal prolapse were not assessed.

FI is frequently reported to be more common in the elderly,^{17,18} and this is often attributed to the confounding of age with poorer health status and with other risk factors such as mobility restriction. This survey confirms a strong association between FI and age, with the prevalence of FI increasing from 2.6% at ages 20–30 years up to 15.3% in people aged 70 years or older. However, this

effect of aging does not appear to be explained by poorer health in older participants; multivariate regression analysis showed age to be a strong predictor of FI after adjusting for the number of chronic illnesses, overall health status, and physical activity level. The mechanisms that could explain this effect of age on the prevalence of FI are unknown.

Women were found in some prior studies^{18,19} to have a higher prevalence of FI than men, and the speculation has been that sex differences occur because obstetric injuries are a major risk factor for FI. However, in this survey of the whole adult life span, there was no significant difference in the prevalence of FI between women and men. In univariate analysis, the number of vaginal deliveries was associated with increased prevalence of FI in women, but after adjustment for age and other risk factors, the number of vaginal deliveries was not found to be a significant independent predictor of FI. Other studies that included a broad range of ages^{20–22} have also failed to find a sex difference in FI prevalence or an effect of obstetric injury.²³ This suggests that obstetric injuries, while important because they are potentially preventable, are not the most common causes of FI in women. In addition, even though there have been some reports of differential rates of obstetric injuries by racial/ethnic group, no differences in rates of FI by race were noted here.

An aim of this study was to identify modifiable risk factors that can be incorporated into prevention or treatment strategies. Our data confirm previous reports of an association between FI and diarrhea^{22,24} and suggest that treating diarrhea may be an effective method for treating or preventing FI. There are studies showing that the treatment of diarrhea-associated FI with loperamide²⁵ or fiber supplements²⁶ is effective at least short-term, although more research to identify long-term effective treatments is needed.

Previous investigators have reported an association between poor overall health and FI.^{24,27} The number of chronic illnesses and self-described health status are correlated, and in multivariate regression analyses that adjust for this correlation, the number of chronic illnesses was found to be significantly associated with FI in women, while in men it was self-reported poor or fair health status that was a significant predictor of FI.

Urinary incontinence was significantly associated with FI, as others have shown.^{17,24} The association is believed to be related to the common innervation of both the external anal and external urethral sphincters by sacral nerves, the interactions between afferents from the rectum and bladder at the level of the spinal cord,²⁸ and the exposure of the rectum and bladder to the same traumas because both are located close together in the pelvis.

This study provides robust estimates of the prevalence of FI through the use of a nationally representative survey of the US population. We have shown that inconti-

nence for solid or liquid stool or mucus affects about 18 million noninstitutionalized adults in the United States throughout the adult life span. This study also confirms that the regular occurrence of mushy or watery stools is a strong risk factor for FI and suggests that the detection and treatment of diarrhea may be an effective method for reducing the prevalence and severity of FI.

Supplementary Data

Note: To access the supplementary material accompanying this article, visit the online version of *Gastroenterology* at www.gastrojournal.org, and at doi: 10.1053/j.gastro.2009.04.054.

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Reprint requests

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Conflicts of interest

The authors disclose no conflicts.

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Supplementary Table 1. Prevalence of FI by Usual Stool Consistency and Frequency

	Women	Men	Total
FI by stool consistency			
Liquid	22.7 (17.7–27.7)	28.9 (12.2–45.7)	25.3 (18.2–32.4)
Normal	7.8 (5.8–9.8)	6.4 (5.2–7.6)	7.1 (5.9–8.2)
Hard	8.2 (3.5–13.0)	15.1 (3.7–26.4)	9.9 (4.6–15.3)
FI by stool frequency (no. of bowel movements per week)			
>21	35.2 (16.4–54.0)	30.7 (11.4–49.9)	32.7 (18.6–46.8)
3–21	8.2 (6.4–10.0)	7.2 (5.7–8.7)	7.7 (6.5–8.9)
<3	11.3 (2.8–19.9)	12.9 (5.0–20.8)	11.5 (4.0–19.1)

NOTE. All values are expressed as percent (95% CI). Respondents with missing data and responses of “refused” or “don’t know” are excluded from the table. Usual stool consistency and frequency were defined using the Bristol Stool Scale.¹⁰

Supplementary Table 2. Prevalence of FI by Selected Health and Lifestyle Variables

	Women	Men	Total
BMI			
Normal/underweight (BMI <25 kg/m ²)	6.4 (4.7–8.2)	6.6 (4.6–8.5)	6.5 (5–7.9)
Overweight (BMI 25–29.9 kg/m ²)	8.9 (6.1–11.7)	7.0 (4.3–9.6)	7.8 (5.6–9.9)
Obese (BMI ≥ 30 kg/m ²)	11.0 (7.4–14.5)	9.3 (5.1–13.5)	10.2 (7.5–12.9)
Vigorous activity			
Yes	4.1 (1.2–7)	5.0 (2.9–7.2)	4.6 (2.6–6.6)
No	10.3 (8.2–12.5)	9.3 (7.2–11.5)	9.9 (8.2–11.5)
Unable to do any activity	29.8 (16.9–42.6)	13.3 (4.3–22.4)	22.7 (14.2–31.2)
Moderate activity			
Yes	7.6 (4.7–10.5)	6.6 (4.7–8.5)	7.1 (5.3–8.9)
No	9.8 (7–12.5)	9 (6.6–11.4)	9.4 (7.4–11.4)
Unable to do any activity	29.6 (13.8–45.5)	16.8 (4.7–28.9)	24.4 (13.5–35.3)
No. of chronic illnesses			
0	4.5 (2.6–6.4)	6.0 (4.7–7.3)	5.3 (4.2–6.4)
1	13.1 (10–16.1)	9.9 (6.1–13.8)	11.68 (9.5–13.8)
≥2	18.4 (12.9–23.9)	13.6 (7.4–19.7)	16.42 (12.9–19.9)
Self-reported health status			
Fair or poor	15.5 (11.6–19.3)	14.2 (10.4–18.0)	14.9 (12.4–17.4)
Excellent, very good, or good	7.6 (5.2–9.9)	6.5 (4.9–8.0)	7.0 (5.6–8.5)
Diabetes			
Yes	16.6 (11.1–22.1)	11.6 (5.2–17.9)	14.4 (11.5–17.2)
No	8.2 (6.4–9.9)	7.4 (6.0–8.8)	7.8 (6.6–9.0)
No. of vaginal deliveries			
0	5.9 (3.2–8.6)	n/a	n/a
1–3	9.1 (7.6–10.6)	n/a	n/a
≥4 (maximum, 15)	15.1 (11.9–18.3)	n/a	n/a
Urinary incontinence			
Yes	17.6 (13.5–21.6)	25.5 (16.4–34.6)	19.2 (15.8–22.6)
No	7.2 (5.3–9.1)	6.9 (5.3–8.5)	7.0 (5.8–8.3)

NOTE. All values are expressed as percent (95% CI).
n/a, not applicable.