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## Prevalence of Symptomatic Pelvic Floor Disorders in US Women

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**Additional Information:** The National Centers for Health Statistics acquired the data, as they actually interviewed the patients; therefore, 2005–2006 NHANES collected all data. However, Drs Nygaard, Meikle, and Whitehead and Ms Brody were responsible for spearheading the effort to add the Pelvic Floor Disorders questions to NHANES, assisting with pilot testing of questions, and assisting with training field workers on administering questions.

**Author Contributions:** Dr Spino had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

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**for the Pelvic Floor Disorders Network****Abstract**

**Context**—Pelvic floor disorders (urinary incontinence, fecal incontinence, and pelvic organ prolapse) affect many women. No national prevalence estimates derived from the same population-based sample exists for multiple pelvic floor disorders in women in the United States.

**Objective**—To provide national prevalence estimates of symptomatic pelvic floor disorders in US women.

**Design, Setting, and Participants**—A cross-sectional analysis of 1961 nonpregnant women ( $\geq 20$  years) who participated in the 2005–2006 National Health and Nutrition Examination Survey, a nationally representative survey of the US noninstitutionalized population. Women were interviewed in their homes and then underwent standardized physical examinations in a mobile examination center. Urinary incontinence (score of  $\geq 3$  on a validated incontinence severity index, constituting moderate to severe leakage), fecal incontinence (at least monthly leakage of solid, liquid, or mucous stool), and pelvic organ prolapse (seeing/feeling a bulge in or outside the vagina) symptoms were assessed.

**Main Outcome Measures**—Weighted prevalence estimates of urinary incontinence, fecal incontinence, and pelvic organ prolapse symptoms.

**Results**—The weighted prevalence of at least 1 pelvic floor disorder was 23.7% (95% confidence interval [CI], 21.2%–26.2%), with 15.7% of women (95% CI, 13.2%–18.2%) experiencing urinary incontinence, 9.0% of women (95% CI, 7.3%–10.7%) experiencing fecal incontinence, and 2.9% of women (95% CI, 2.1%–3.7%) experiencing pelvic organ prolapse. The proportion of women reporting at least 1 disorder increased incrementally with age, ranging from 9.7% (95% CI, 7.8%–11.7%) in women between ages 20 and 39 years to 49.7% (95% CI, 40.3%–

59.1%) in those aged 80 years or older ( $P<.001$ ), and parity (12.8% [95% CI, 9.0%–16.6%], 18.4% [95% CI, 12.9%–23.9%], 24.6% [95% CI, 19.5%–29.8%], and 32.4% [95% CI, 27.8%–37.1%] for 0, 1, 2, and 3 or more deliveries, respectively;  $P<.001$ ). Overweight and obese women were more likely to report at least 1 pelvic floor disorder than normal weight women (26.3% [95% CI, 21.7%–30.9%], 30.4% [95% CI, 25.8%–35.0%], and 15.1% [95% CI, 11.6%–18.7%], respectively;  $P<.001$ ). We detected no differences in prevalence by racial/ethnic group.

**Conclusion**—Pelvic floor disorders affect a substantial proportion of women and increase with age.

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Pelvic floor disorders include urinary incontinence, pelvic organ prolapse, fecal incontinence, and other sensory and emptying abnormalities of the lower urinary and gastrointestinal tracts. A regional study in the United States found that almost 10% of women have surgery for urinary incontinence, pelvic organ prolapse, or both during their lifetime, and 30% of those women have 2 or more surgical procedures.<sup>1</sup> However, because no single national population-based survey has assessed the prevalence of the 3 major pelvic floor disorders in US women, the national burden related to these diseases remains unknown.

Thus, in 2003, the Pelvic Floor Disorders Network (PFDN) submitted a proposal to add questions about pelvic floor disorders to the 2005–2006 National Health and Nutrition Examination Survey (NHANES). The PFDN, a clinical trials network of investigators from 7 clinical centers and a data coordinating center, is supported by the Eunice Kennedy Shriver National Institute of Child Health and Human Development and the National Institutes of Health Office of Research on Women's Health. The primary goal of the PFDN is to improve diagnosis, treatment, and prevention of pelvic floor disorders in women.

The goal of this research study is to provide prevalence estimates of symptomatic pelvic floor disorders by demographic characteristics in nonpregnant women aged 20 years or older between January 2005 and December 2006.

## METHODS

### The 2005–2006 NHANES Program

The NHANES program consists of cross-sectional, national health surveys conducted by the National Centers for Health Statistics Centers for Disease Control and Prevention. Each NHANES provides national estimates of health status of adults in the United States at the time of the survey by selecting a nationally representative sample of the civilian, noninstitutionalized US population, by using a complex, stratified, multistage, probability cluster design. The 2005–2006 NHANES oversampled persons aged 60 years or older, and black, Mexican American, and low-income white individuals to provide more reliable estimates for these groups. The National Centers for Health Statistics Ethics Review Board approved the protocol, and all participants provided written informed consent. This analysis of NHANES data met criteria for exemption of human subjects research review by the University of Utah Institutional Review Board.

### Study Population

Participants were interviewed in their homes and then underwent standardized physical examinations, including measured height and weight, in a mobile examination center. Trained interviewers asked about symptoms of pelvic floor disorders and reproductive history as part of a private interview in the mobile examination.

Of 3440 women aged 20 years or older originally selected through a probability sampling for the 2005–2006 NHANES survey, 2592 women (75.4%) agreed to participate and completed the household interview and 2489 women (72.4%) agreed to participate in the mobile examination center. Of these women, 236 (9.5%) were missing data on all 3 pelvic floor outcomes. After eliminating 292 women who were currently pregnant, our final analytic data set comprised 1961 women.

To define urinary incontinence, we used the validated 2-item incontinence severity index, which correlates well with incontinence volume based on pad weights and incontinence frequency obtained on bladder diaries.<sup>2,3</sup> The incontinence severity index is based on responses to frequency (<once per month, a few times a month, a few times a week, or every day and/or night) and amount of leakage (drops, splashes, or more). By multiplication, an index value of 1 to 12 is reached. Because many women report infrequent, nonbothersome urinary leakage, we limited our case definition to moderate to severe incontinence defined as a severity score of at least 3 on the incontinence severity index. This corresponds to at least weekly leakage or monthly leakage of volumes more than just drops. We considered women to be continent when the severity score was less than 3.

We defined fecal incontinence as at least monthly leakage of solid, liquid, or mucous stool, determined by responses on the validated fecal incontinence severity index, which applies a type × frequency matrix to obtain the patient's perception of symptom severity.<sup>4,5</sup> We did not include leakage of flatus in our definition of fecal incontinence as it is frequently reported but less bothersome.

We defined symptomatic pelvic organ prolapse as a positive response to the question, “Do you experience bulging or something falling out you can see or feel in the vaginal area?”, which was derived from the Pelvic Floor Distress Inventory.<sup>6</sup> A positive response correlates with the presence of a vaginal bulge on examination; however, the question has higher specificity than sensitivity for pelvic organ prolapse based on examination.<sup>7</sup> Prolapse estimates using this question underreport the true prevalence of prolapse on examination.

Participants self-reported their race/ethnicity based on lists that included an open response. In this analysis, a composite racial/ethnic variable was used to assess differences in pelvic floor disorders among 4 racial/ethnic groups: (1) non-Hispanic white; (2) non-Hispanic black; (3) Hispanic (composed mostly of Mexican Americans due to the oversampling); and (4) other (Indian [American], Alaska Native, Native Hawaiian, Guamanian, Samoan, other Pacific Islander, Asian Indian, Chinese, Filipino, Japanese, Korean, Vietnamese, and other Asian). Age was categorized in 20-year increments beginning with 20 years and ending with 80 years or more; education was categorized as less than high school, high school diploma including General Education Development, and more than high school; the poverty income ratio (an indicator of socioeconomic status that uses the ratio of income to the family's poverty threshold set by the US Census Bureau) was categorized as less than 1 (below the poverty threshold), 1 to 2 (1–2×above the poverty threshold), and more than 2 (>2×above the poverty threshold); body mass index (calculated as weight in kilograms divided by height in meters squared) was categorized as less than 25.0 (underweight/normal weight), 25.0 to 29.9 (overweight), and 30.0 or more (obese); and parity (total number of vaginal and cesarean deliveries) was categorized as 0, 1, 2, and 3 or more.

## Statistical Analysis

Weighted prevalence estimates and 95% confidence intervals (CIs) were calculated by using SAS version 9.1 (SAS Institute Inc, Cary, North Carolina), incorporating the design effect, appropriate sample weights, stratification, and clustering of the complex NHANES sample design. The sample weights adjust for unequal probabilities of selection and nonresponse.

Estimates with relative standard errors of more than 30% were considered statistically unreliable and are identified as such (Table). The Rao-Scott Modified  $\chi^2$  test was used to test the association between pelvic floor disorders outcome and demographic characteristics.  $P < .05$  was considered statistically significant.

## RESULTS

Overall, 23.7% (95% CI, 21.2%–26.2%) of women had symptoms of at least 1 pelvic floor disorder. Of these, 15.7% (95% CI, 13.2%–18.2%) experienced urinary incontinence, 9.0% (95% CI, 7.3%–10.7%) experienced fecal incontinence, and 2.9% (95% CI, 2.1%–3.7%) experienced symptomatic pelvic organ prolapse. The proportion of women that reported at least 1 pelvic floor disorder increased with age (9.7% [95% CI, 7.8%–11.7%] in women aged 20 to 39 years, 26.5% [95% CI, 23.0%–29.9%] in women aged 40 to 59 years, 36.8% [95% CI, 32.0%–41.6%] in women aged 60 to 79 years, and 49.7% [95% CI, 40.3%–59.1%] in women aged 80 years or older;  $P < .001$ ). The Table shows the percentage of respondents with each pelvic floor disorder by demographic characteristics. Other characteristics that were significantly associated with at least 1 pelvic floor disorder were (1) family poverty income ratio (20.8% [95% CI, 18.1%–23.5%] if  $>2$ -fold above the poverty threshold vs 28.8% [95% CI, 21.8%–35.7%] if below the poverty threshold and 29.7% [95% CI, 25.1%–34.3%] if  $1-2 \times$  above the poverty threshold;  $P = .002$ ); (2) body mass index (15.1% [95% CI, 11.6%–18.7%] for underweight/normal weight, 26.3% [95% CI, 21.7%–30.9%] for overweight, and 30.4% [95% CI, 25.8%–35.0%] for obese women;  $P < .001$ ); and (3) parity (12.8% [95% CI, 9.0%–16.6%] for nulliparous women vs 18.4% [95% CI, 12.9%–23.9%], 24.6% [95% CI, 19.5%–29.8%], and 32.4% [95% CI, 27.8%–37.1%] for those women with 1, 2, and  $\geq 3$  deliveries, respectively;  $P < .001$ ). Race/ethnicity and education were not significantly associated with having at least 1 pelvic floor disorder ( $P = .26$  and  $P = .06$ , respectively).

Similar patterns were observed in the analyses of each pelvic floor disorder separately, except that the prevalence of pelvic organ prolapse was only 2.9%, and thus estimates of its prevalence in subgroups were too small to be reliable.

## COMMENT

These data represent the first nationwide, population-based estimates of the 3 primary pelvic floor disorders in women in the United States derived from a single source. Nearly one-quarter of all women and more than one-third of older women reported symptoms of at least 1 pelvic floor disorder. By 2030, more than one-fifth of women will be 65 years or older.<sup>8</sup> As the population of older women increases, the national burden related to pelvic floor disorders in terms of health care costs, lost productivity, and decreased quality of life will be substantial. Furthermore, our prevalence estimates are likely underestimates for several reasons: (1) they do not reflect symptoms of women who have undergone successful treatment for pelvic floor disorders; (2) we used conservative definitions; and (3) symptom-based diagnosis underestimates the true prevalence of pelvic organ prolapse diagnosed by physical examination.

Other studies, including data from NHANES in earlier waves,<sup>9–13</sup> concluded that between 25% and 75% of women have urinary incontinence, depending on how the condition is defined. Higher rates represent a symptom of occasional leakage, while lower rates are more likely to represent a disease. We limited our definition to those women with moderate to severe leakage to better reflect the population of women more likely to seek treatment.

Similarly, published estimates of the prevalence of fecal incontinence in the community range widely, from 2.2%<sup>14</sup> up to 24%.<sup>15–18</sup> As with urinary incontinence, differences in prevalence estimates are explained in part by differences in case definition, with some studies including involuntary loss of flatus in the definition and other studies limiting the definition to loss of stool or mucus.

Population-based epidemiological studies of pelvic organ prolapse are rare, despite the fact that it is a common indication for gynecologic surgery in older women. A major impediment to population-based studies is the requirement of an examination to assess vaginal support. Several studies,<sup>19–21</sup> including our study, avoided this limitation by screening for prolapse based on the presence of prolapse-related symptoms rather than examination. The symptom most strongly correlated with the presence of advanced pelvic organ prolapse is “seeing” or “feeling” a vaginal bulge.<sup>22–25</sup> There is no clear consensus about what level of prolapse represents a variation of normal uterovaginal support and what represents disease, although there is growing consensus that prolapse beyond the hymen is more likely to be clinically significant.<sup>22,25</sup> Up to 75% of women presenting for routine gynecological care demonstrate some prolapse, and 3% to 6% have descent beyond the hymen.<sup>26,27</sup> The specificity of vaginal bulge symptoms for predicting prolapse beyond the hymen is high in low-prevalence populations (99%–100%); however, the sensitivity is low (16%–35%), because some women with even advanced prolapse deny symptoms.<sup>7,25</sup>

Thus, prolapse prevalence in studies using symptom-based screening such as this one underestimate the true prevalence of anatomic disease. However, because women typically do not seek care for prolapse until symptoms develop and physicians generally do not offer surgical treatment until symptoms become bothersome, symptom-based prevalence estimates likely represent the best estimate of disease burden on the population.

The finding that both urinary and fecal incontinence increase with age is consistent with the epidemiological literature.<sup>28–30</sup> The few studies available show that apical, anterior, and posterior vaginal wall prolapse also increases with advancing age.<sup>31–33</sup> The relationship between pelvic floor disorders and age is usually attributed to age-related connective tissue and neuromuscular changes and to comorbidities, such as obesity, pulmonary disease, and diabetes, that occur more commonly among older adults.

Consistent with prior studies, these data demonstrate a significant association between childbirth and pelvic floor disorders. In the Oxford Family Planning Study,<sup>33</sup> women with 2 deliveries were substantially more likely to have surgery for prolapse compared with women with no delivery. In a cross-sectional study of Norwegian women, compared with women with no deliveries,<sup>34</sup> the effect of 2 or more deliveries on urinary incontinence was greatest in younger women aged 20 to 34 years (relative risk [RR], 2.8; 95% CI, 2.3–3.3), decreased among women aged 35 to 64 years (RR, 2.0; 95% CI, 1.6–2.3), and then, consistent with other literature, was not associated with urinary incontinence in women older than 65 years. The association between fecal incontinence and parity is inconsistent.<sup>35,36</sup> However, the fact that more than 1 in 8 nulliparous women in the 2005–2006 NHANES reported at least 1 symptomatic pelvic floor disorder demonstrates the multifactorial nature of these conditions.

In contrast with several other large studies in which white women had a higher prevalence of urinary incontinence and pelvic organ prolapse than did black or Hispanic women,<sup>11,37–40</sup> we found no difference in prevalence in comparisons of black, non-Hispanic white, or Hispanic women. We did not categorize urinary incontinence by subtype (stress or urge) in this analysis, which may account for this difference. A recent analysis using earlier NHANES data (2001–2004) found a higher prevalence of stress urinary incontinence in white and Mexican American women than black women, but no differences in other

incontinence subtypes.<sup>41</sup> Although national hospital discharge statistics show that black women have lower rates of prolapse surgery than white women,<sup>41</sup> this difference cannot be attributed to just race. Many factors, including access to care, contribute to the decision to undergo surgery, and therefore to surgical prevalence rates. Because we have no information about treatment for pelvic floor disorders, we cannot comment on whether treatment varies by race/ethnicity in our sample. Although Hispanic women were less likely than white or black women to report fecal incontinence in our study, other studies found no such difference in community-dwelling adults.<sup>15,17</sup> Further research is needed to better characterize racial and ethnic variations in pelvic floor disorders and to understand why such differences exist. In addition, although the sample sizes were adequate to describe prevalence rates by demographic characteristics, they were too small to provide meaningful estimates of adjusted risk factors, including the effect of delivery type on pelvic floor disorders. Additional years of data will allow for these analyses.

In conclusion, pelvic floor disorders affect a substantial proportion of women and increase with age. Indeed, in a health maintenance organization, older women generated 10 times the number of consults per 1000 women-years for treatment of pelvic floor disorders than did younger women.<sup>42</sup> Given the burden pelvic floor disorders place on US women and the health care system, research is needed to further understand their pathophysiology, prevention, and treatment.

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**Table**

Weighted Prevalence Rates of Pelvic Floor Disorders by Demographic Categories in Nonpregnant US Women (N = 1961)<sup>a</sup>

Variable	No. of Women	Weighted Prevalence, % (95% Confidence Interval)			
		Urinary Incontinence (n = 331)	Fecal Incontinence (n = 176)	Pelvic Organ Prolapse (n = 58)	≥1 Pelvic Floor Disorder (n = 470)
Overall	1961	15.7 (13.2–18.2)	9.0 (7.3–10.7)	2.9 (2.1–3.7)	23.7 (21.2–26.2)
Age, y					
20–39	641	6.9 (4.9–9.0)	2.9 (1.9–3.9)	1.6 (0.6–2.6)	9.7 (7.8–11.7)
40–59	668	17.2 (13.9–20.5)	9.9 (7.4–12.5)	3.8 (2.0–5.7)	26.5 (23.0–29.9)
60–79	488	23.3 (17.0–29.7)	14.4 (10.4–18.3)	3.0 (0.9–5.1) <sup>b</sup>	36.8 (32.0–41.6)
≥80	150	31.7 (22.3–41.2)	21.6 (12.8–30.4)	4.1 (1.1–7.1) <sup>b</sup>	49.7 (40.3–59.1)
P value		<.001	<.001	.14	<.001
Race/ethnicity					
Hispanic	420	15.9 (11.1–20.7)	4.8 (1.9–7.6)	5.1 (1.6–8.6) <sup>b</sup>	20.6 (14.5–26.8)
Non-Hispanic white	993	16.0 (13.1–19.0)	9.8 (7.6–11.9)	2.8 (1.8–3.8)	24.8 (21.6–28.0)
Non-Hispanic black	461	13.8 (10.5–17.1)	7.9 (4.9–11.0)	1.9 (0.1–3.8) <sup>b</sup>	20.7 (16.4–24.9)
Other	87	15.0 (6.3–23.7)	8.2 (3.7–12.6)	1.5 (0.0–4.7) <sup>b</sup>	21.6 (14.3–29.0)
P value		.83	.04	.27	.26
Parity					
0	396	6.5 (4.2–8.9)	6.3 (2.9–9.6)	0.6 (0.0–1.5) <sup>b</sup>	12.8 (9.0–16.6)
1	293	9.7 (6.4–13.0)	8.8 (4.3–13.3)	2.5 (0.1–4.9) <sup>b</sup>	18.4 (12.9–23.9)
2	475	16.3 (12.3–20.3)	8.4 (5.8–11.0)	3.7 (1.7–5.6)	24.6 (19.5–29.8)
≥3	768	23.9 (20.1–27.7)	11.5 (8.7–14.3)	3.8 (2.1–5.4)	32.4 (27.8–37.1)
P value		<.001	.07	.04	<.001
Education					
<High school	484	19.5 (15.4–23.6)	10.6 (6.3–14.8)	4.1 (1.7–6.5)	27.5 (21.4–33.5)
High school diploma	470	16.3 (13.1–19.6)	9.8 (7.0–12.6)	2.2 (0.7–3.8) <sup>b</sup>	25.9 (23.7–28.2)
>High school	1006	14.5 (11.5–17.4)	8.2 (5.7–10.7)	2.8 (1.8–3.9)	21.8 (18.4–25.3)
P value		.06	.49	.38	.06
Family poverty income ratio					
<1	316	21.5 (15.3–27.7)	8.1 (4.2–12.1)	5.5 (2.4–8.5)	28.8 (21.8–35.7)
1–2	496	21.4 (17.3–25.4)	10.7 (8.1–13.4)	4.0 (1.8–6.2)	29.7 (25.1–34.3)

Variable	No. of Women	Weighted Prevalence, % (95% Confidence Interval)			
		Urinary Incontinence (n = 331)	Fecal Incontinence (n = 176)	Pelvic Organ Prolapse (n = 58)	≥1 Pelvic Floor Disorder (n = 470)
>2	1067	12.8 (10.8–14.9)	8.5 (6.3–10.8)	2.2 (1.3–3.2)	20.8 (18.1–23.5)
<i>P</i> value		<.001	.37	.08	.002
<b>BMI</b>					
<25.0	658	8.1 (5.4–10.7)	6.4 (4.6–8.3)	1.7 (0.6–2.9) <sup>b</sup>	15.1 (11.6–18.7)
25.0–29.9	533	19.0 (14.8–23.1)	9.3 (6.4–12.2)	3.4 (1.2–5.5)	26.3 (21.7–30.9)
≥30.0	746	21.1 (16.9–25.4)	11.0 (7.4–14.6)	3.6 (2.0–5.2)	30.4 (25.8–35.0)
<i>P</i> value		<.001	.05	.20	<.001

Abbreviation: BMI, body mass index, calculated as weight in kilograms divided by height in meters squared.

<sup>a</sup> A complete case analytic approach was used and of the 1961 women with pelvic floor disorders information, 14 women had missing age, 29 missing parity, 1 missing education, 82 missing poverty income ratio, and 24 missing BMI. See the “Methods” section for descriptions of race/ethnicity, parity, education, family poverty income ratio, and BMI.

<sup>b</sup> Relative standard errors of more than 30% (reflecting unreliable estimates).