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Establishing the Prevalence of Incontinence (EPI) Study: Racial Differences in Women's Patterns of Urinary Incontinence

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Abstract

Purpose—To examine racial differences in urinary incontinence (UI) prevalence, frequency, quantity, type, and risk factors in a population-based sample of community-dwelling black and white women.

Materials and Methods—Women ages 35–64 were sampled from telephone records from three southeast Michigan counties. Women self-identifying as black or white race completed a telephone interview that assessed demographics, health history, lifestyle factors, and UI experience. Statistical analysis included descriptive statistics, factor analysis, and multivariable logistic regression to determine adjusted odds of UI. Estimates were weighted to reflect probability and nonresponse characteristics of the sample and to increase generalizability of the findings.

Results—Interviews were completed by 1,922 black and 892 white women (response rate=69%). The overall prevalence of UI was 26.5%. By race, UI prevalence was 14.6% for black women and 33.1% for white women ($p<0.001$). Among incontinent women, there was no difference by race in the frequency of UI; however, black women reported more urine loss per episode ($p<0.05$). A larger proportion of white women with incontinence (39.2%) reported symptoms of pure stress incontinence compared to black women (25.0%), whereas a larger proportion of black women (23.8%) reported symptoms of pure urge incontinence compared to white women (11.0%). Risk factors for UI were generally similar for white and black women.

Conclusions—In this population-based study we observed racial differences in prevalence, quantity, and type of UI. Frequency of and risk factors for UI were generally similar for white and black women.

Introduction

Urinary incontinence (UI) affects up to half of women, with prevalence estimates varying widely depending on the definition used and population studied.^{1–6} Prevalence estimates of

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UI have been based predominantly on older, white populations with limited information on the prevalence among other age or racial/ethnic groups.

A number of studies based on surveys^{2, 7–13} and clinical evaluation^{14, 15} suggest differences between black and white women in the prevalence and type of UI.^{15, 16} These studies are limited for several reasons including inadequate representation of black women, secondary analysis not specifically designed to examine racial differences in UI, or inclusion of select populations such as health maintenance organization members.

We conducted a population-based cross-sectional study to examine racial differences in prevalence, frequency, quantity, and type of UI in black and white community-dwelling women ages 35–64 years. In addition, we explored demographic, health history, lifestyle, and obstetric/gynecologic factors associated with continence status. The aim was to determine if a population-based epidemiologic study would confirm racial differences in UI. If confirmed, physiological or biological explanations for these difference could be sought to advance our understanding of the pathophysiology, risk factors, and appropriate therapies for this condition.

Materials and Methods

Establishing the Prevalence of Incontinence (EPI) Study was conducted at the University of Michigan. The study population included community-dwelling black and white women ages 35–64 years from three southeast Michigan counties. Because it is hypothesized that black women have a lower prevalence of UI, our sample size was determined to ensure adequate representation of incontinent black and white women. Here we report the results of the survey component of the EPI Study.

Data collection commenced in the summer of 2002 and was completed in the fall of 2004. The sample was derived from 12,541 telephone numbers purchased from a commercial survey sampling firm. The name and address for the directory listing was appended to each record, which allowed us to control the likely racial distribution of the sample by referring to census information about the racial composition of geographic areas in southeastern Michigan. The sample was bought in several batches (while tracking rates for eligibility and consent) to meet the goal of interviewing approximately 1,500 black women and 1,000 white women. The power analysis was based on the number of continent and incontinent women of each racial group needed to analyze continence mechanism structure and function in the second (clinical) phase of the study. The research protocol was approved by the Institutional Review Board of the University of Michigan Medical School.

Prior to telephone contact, informational brochures and letters of introduction were mailed to the addresses associated with the purchased telephone numbers. Shortly thereafter, trained female professional telephone interviewers from the Survey Research Center (SRC) of the University of Michigan Institute for Social Research called the households to screen for eligible participants (Figure 1). Women who were between the ages of 35 and 64, who self-identified as black or white race, and who had not been pregnant in the past 12 months were eligible for study inclusion.

Eligible women were read a statement about the voluntary and confidential nature of their data, and were asked for verbal consent to continue with the interview. The interview assessed respondents' demographic characteristics, health history, lifestyle factors, obstetric and gynecologic history, and UI experience. Women who reported losing urine at least 12 times in the past 12 months were asked additional incontinence questions regarding their urine loss, including frequency, amount, and instigating situations and activities. These questions were based on widely used measures of incontinence.^{17, 18} Assessment of depressive symptoms was based on the Center for Epidemiologic Studies - Depression (CES-D) questionnaire.¹⁹

In quantifying frequency of urine loss, women were asked “Typically, how many times a month do you lose urine?” In assessing amount of urine loss, women were asked “Typically, when you lose urine do you: (1) leak a few drops; (2) wet underwear or pad; (3) soak your outer clothes; or (4) drip onto the floor?” Type of incontinence was determined by ten questions that assessed how often women lost urine during certain activities or situations. The four possible responses included: often, sometimes, rarely, or never. We performed a principal components analysis to empirically derive two components indicative of type of incontinence (Table 1). We classified women as having stress symptoms if they reported “often” losing urine to at least one question that factored with the “stress” component, or as having urge symptoms if they reported “often” losing urine for at least one question that factored with the “urge” component. Women who reported “often” to one or more questions from only one component were classified as having pure stress or urge symptoms, whereas women who reported “often” to questions from both components were classified as having mixed incontinence. Women who did not reach a threshold of “often” on any question were classified as having incontinence “below threshold.” With regards to depression, women who answered affirmatively to any of the questions of having felt “depressed,” “sad,” or “lonely” in the prior week were categorized as having depressive symptoms.

Demographic characteristics of the study sample, self-reported UI frequency, and quantity of urine loss in the last 12 months were described overall and within racial groups, and differences by race were assessed using chi-square tests for categorical variables and F tests for continuous variables. Variables (demographic characteristics, health history, lifestyle factors, and obstetric/gynecologic history) found to be statistically significant in bivariate analyses with continence status were included in a multivariable logistic regression model to explore their independent associations with continence status by estimating adjusted odds ratios (OR) and 95% confidence intervals (CI). Weights were constructed based on age, race, and geographic location to adjust for the oversampling and for survey nonresponse. P-values less than 0.05 were considered statistically significant. All analyses were performed with Stata release 9.2, which permits the incorporation of weights and makes appropriate adjustments to the standard errors for complex survey sample designs.

Results

Of the 3,692 households in which an eligible woman resided, interviews were completed by 1,922 black and 892 white women with a response rate of 69% (Figure 1). Characteristics of the study population, overall and by race, are shown in Table 2.

The overall prevalence of UI was 26.5% (95% CI: 24.3–28.7) based on self-reported number of episodes of urine loss in the past 12 months. The prevalence of UI was 14.6% (95% CI: 13.1–16.3) for black women and 33.1% (95% CI: 29.9–36.5) for white women ($p<0.001$). Overall, the mean age at onset of UI symptoms was 42.2 years (95% CI: 41.3–43.0); age at onset did not differ significantly by race. Among incontinent women, the mean number of urine leakage episodes per month was 14.9 (95% CI: 13.3–16.5). Mean episodes of urine leakage did not differ by race, with black women experiencing 14.8 episodes (95% CI: 12.9–16.7) and white women experiencing 14.9 episodes (95% CI: 13.0–16.9) per month. Among incontinent women, there was no significant difference by race in terms of the frequency of urinary incontinence (Table 3). However, a significant difference was observed in quantity of urine loss per episode ($p<0.05$). Half (50.1%) of white incontinent women reported losing a few drops of urine, compared to 37.0% of black women. Half of black incontinent women (50.6%) reported losing urine to the point of wetting their underwear or pad, compared to 37.7% of white incontinent women.

Types of UI are shown in Table 4. A significantly greater proportion of white women with UI (39.2%) reported symptoms of pure stress incontinence compared to black women (25.0%), whereas a greater proportion of black women (23.8%) reported symptoms of pure urge incontinence compared to white women (11.0%). There were no significant differences in self-reported mixed incontinence or “below threshold” incontinence symptoms by race

To identify factors for inclusion in multivariable logistic regression analyses, we conducted bivariate analyses of continence status with demographic characteristics, health history, lifestyle factors, and obstetric/gynecologic history (data available upon request). Demographic characteristics found to be significantly associated with continence status included age ($p<0.001$), race ($p<0.001$), and currently working for pay ($p<0.05$). Health history characteristics significantly associated with continence status included diabetes ($p<0.001$), mobility impairment ($p<0.001$), constipation ($p<0.001$), urinary tract infection ($p<0.05$), chronic lung disease ($p<0.01$), obesity ($p<0.001$), and depressive symptoms ($p<0.001$). The only lifestyle factor found to be associated with continence status was participating in exercise involving bouncing at least once per week ($p<0.01$). Obstetric/gynecologic characteristics associated with continence status included a history of at least one vaginal delivery ($p<0.05$), surgery for prolapse or UI ($p<0.001$), hysterectomy ($p<0.001$), current estrogen use ($p<0.05$), and menopause status ($p<0.001$). Characteristics that were not significantly associated with continence status ($p>0.05$) and, thus, were not included in multivariable analyses, included: years of education completed, household income, marital status, lifting at least 30 pounds more than once per week, current cigarette smoking, and drinking over eight glasses of fluid per day.

Shown in Table 5 are odds ratios for UI adjusted for variables found to be significant in bivariate analyses (demographic characteristics, health history, lifestyle factors, and obstetric/gynecologic history). Compared to women ages 35–44, the odds of UI were significantly higher among women ages 45–54 (OR=1.7; 95% CI: 1.2–2.4) and among women ages 55–64 (OR=1.8; 95% CI: 1.1–2.8). Black women had approximately one-third the odds of UI (OR=0.3, 95% CI: 0.2–0.3) as compared to white women. Several health history characteristics were significantly associated with approximately two-fold higher odds of UI, including mobility impairment (OR=1.9; 95% CI: 1.2–2.8), constipation (OR=2.1; 95% CI: 1.4–3.1), obesity (OR=2.3; 95% CI: 1.8–3.0), and depressive symptoms (OR=1.5, 95% CI: 1.1–1.9). With respect to obstetric/gynecologic history, women who had at least one vaginal delivery (OR=1.5; 95% CI: 1.1–2.0) and those who had undergone hysterectomy (OR=1.5; 95% CI: 1.1–2.2) had significantly higher odds of urinary incontinence.

When the adjusted odds ratios were examined within the racial groups, the risk factors were found to be generally similar for black and white women. This conclusion was supported by testing the significance of adding interaction terms for each predictor by race to the overall model. The F statistic for the main effects model was statistically significant ($p<0.001$), whereas the F statistic for the block of interaction terms was not significant ($p=0.25$).

Discussion

In this large, population-based cross-sectional study specifically designed to assess differences in UI among black and white women, we found that black women had approximately one-third the odds of UI as compared to white women after adjusting for multiple risk factors. Strengths of this study include in-depth assessment of self-reported UI experience and comprehensive examination of associations of continence status with health history, lifestyle factors, and obstetric/gynecologic history among black and white incontinent women.

Several health history factors were significantly associated with nearly 2-fold increased odds of UI in both black and white women, including mobility impairment, constipation, obesity,

and depressive symptoms. These risk factors are consistent with other population-based studies that evaluated racial differences.^{6, 20} Despite adequate representation of both racial groups, there was little evidence to support the idea that risk factors for UI differed between black and white women. This is in contrast to earlier work by Bump et al showing different risk factors for black versus white women; however, his study acknowledged that its small sample size limited its ability to make conclusions about racial differences.¹⁴ Within the age span we examined, older age appeared to have a greater impact on UI among white as compared to black women.

A factor analysis guided our assessment of incontinence symptom types. Similar to prior reports, we found different types of UI reported by each racial group.^{6, 14, 20, 21} White women reported stress incontinence symptoms more commonly than black women, whereas twice as many black women reported symptoms of urge incontinence as compared to white women. In a large cohort study from a health maintenance organization, Thom found similar results for stress urinary incontinence symptoms, but in their population, the difference in urge UI by race was relatively small and not statistically significant.²⁰ Almost half of incontinent women have either mixed or “below threshold” symptoms.

The overall prevalence of incontinence for the survey sample was 26.5% based on self-reported number of episodes of urine loss in the past 12 months. A significant difference in prevalence of incontinence was observed between racial groups, 14.6% of black women versus 33.1% of white women. Studies that defined UI as at least monthly urine loss have reported similar prevalence UI rates for white women (23–34.5%) versus black women (14–25.2%).^{2, 8–10} However, different prevalence rates have been reported in other population-based studies with differing definitions of UI and population studied.^{4, 12, 13}

Half of black incontinent women reported losing urine to the point of wetting their underwear or pad while only a third of white incontinent women complained of this quantity of urine loss. It is likely that a larger amount of urine loss is associated with the different types of urine loss reported by race, with urge incontinent episodes having greater volume versus stress incontinent leakage. Other reports have not noted this volume difference, possibly because the quantity or severity of incontinence is reported using a Sandvik scale that combines frequency and volume.²⁰ While a useful research and clinical tool, an increase in volume and a decrease in frequency alone may not be detected using this method. In contrast to the differences in quantity lost, there was no significant difference by race in terms of the frequency of UI. This finding is consistent with a study in 1999, where Fultz et al also reported that the frequency in urine loss was similar between black and white women.⁸

Several important factors must be considered when interpreting the findings from this study. Women were recruited from Southeastern Michigan, thus limiting the generalizability of our study to women of European or African descent in other parts of the United States. Moreover, we did not recruit Latinas or Asian American women, although these groups are a rapidly growing part of the U.S. population. Our results may only be generalizable to women between the ages of 35–64, and may not be applicable to younger or older populations. As a cross-sectional study, associations do not imply causality; longitudinal studies will be needed to further evaluate these predictive factors.

At a population level, epidemiologic studies can help us understand burden of disease and associated risk factors. The definitions of incontinence and frequency and quantity of urine loss may differ from patients seeking treatment. Since any individual woman – black or white – can suffer from UI, including stress, urge or mixed symptoms, race should not be used to direct differential evaluation and treatment for incontinent women.

Conclusions

In this population-based study we observed racial differences in incontinence prevalence, type and quantity of urine loss. With adequate representation of these racial groups, there is little evidence to support the idea that the profile of risk factors for UI differed between white and black women. Additional studies of EPI Study participants will focus on exploring these biological and non-biological differences, including urodynamic function and anatomical measures of physiological and biological variability.

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Key of Definitions for Abbreviations

UI Urinary Incontinence

References

1. Diokno AC, Brock BM, Brown MB, Herzog AR. Prevalence of urinary incontinence and other urological symptoms in the noninstitutionalized elderly. *J Urol* 1986;136:1022. [PubMed: 3490584]
2. Burgio KL, Matthews KA, Engel BT. Prevalence, incidence and correlates of urinary incontinence in healthy, middle-aged women. *J Urol* 1991;146:1255. [PubMed: 1942274]
3. Nygaard IE, Lemke JH. Urinary incontinence in rural older women: prevalence, incidence and remission. *J Am Geriatr Soc* 1996;44:1049. [PubMed: 8790229]
4. Brown JS, Grady D, Ouslander JG, Herzog AR, Varner RE, Posner SF. Prevalence of urinary incontinence and associated risk factors in postmenopausal women. Heart & Estrogen/Progestin Replacement Study (HERS) Research Group. *Obstet Gynecol* 1999;94:66. [PubMed: 10389720]
5. Melville JL, Katon W, Delaney K, Newton K. Urinary incontinence in US women: a population-based study. *Arch Intern Med* 2005;165:537. [PubMed: 15767530]
6. Waetjen LE, Liao S, Johnson WO, Sampsel CM, Sternfield B, Harlow SD, et al. Factors associated with prevalent and incident urinary incontinence in a cohort of midlife women: a longitudinal analysis of data: study of women's health across the nation. *Am J Epidemiol* 2007;165:309. [PubMed: 17132698]
7. Brown JS, Grady D, Ouslander JG, Herzog AR, Varner RE, Posner SF. Prevalence of urinary incontinence and associated risk factors in postmenopausal women. Heart & Estrogen/Progestin Replacement Study (HERS) Research Group. *Obstet Gynecol* 1999;94:66. [PubMed: 10389720]
8. Fultz NH, Herzog AR, Raghunathan TE, Wallace RB, Diokno AC. Prevalence and severity of urinary incontinence in older African American and Caucasian women. *J Gerontol A Biol Sci Med Sci* 1999;54:M299. [PubMed: 10411017]
9. Grodstein F, Fretts R, Lifford K, Resnick N, Curhan G. Association of age, race, and obstetric history with urinary symptoms among women in the Nurses' Health Study. *Am J Obstet Gynecol* 2003;189:428. [PubMed: 14520212]
10. Jackson RA, Vittinghoff E, Kanaya AM, Miles TP, Resnick HE, Kritchevsky SB, et al. Urinary incontinence in elderly women: findings from the Health, Aging, and Body Composition Study. *Obstet Gynecol* 2004;104:301. [PubMed: 15292003]
11. Melville JL, Katon W, Delaney K, Newton K. Urinary incontinence in US women: a population-based study. *Arch Intern Med* 2005;165:537. [PubMed: 15767530]
12. Sampsel CM, Harlow SD, Skurnick J, Brubaker L, Bondarenko I. Urinary incontinence predictors and life impact in ethnically diverse perimenopausal women. *Obstet Gynecol* 2002;100:1230. [PubMed: 12468167]

13. Thom DH, van den Eeden SK, Brown JS. Evaluation of parturition and other reproductive variables as risk factors for urinary incontinence in later life. *Obstet Gynecol* 1997;90:983. [PubMed: 9397116]
14. Bump RC. Racial comparisons and contrasts in urinary incontinence and pelvic organ prolapse. *Obstet Gynecol* 1993;81:421. [PubMed: 8437798]
15. Howard D, Delancey JO, Tunn R, Ashton-Miller JA. Racial differences in the structure and function of the stress urinary continence mechanism. *Obstet Gynecol* 2000;95:713. [PubMed: 10775735]
16. Knobel J. Stress incontinence in the Black female. *S Afr Med J* 1975;49:430. [PubMed: 1171526]
17. Sandvik H, Hunskaar S, Vanvik A, Bratt H, Seim A, Hermstad R. Diagnostic classification of female urinary incontinence: an epidemiological survey corrected for validity. *J Clin Epidemiol* 1995;48:339. [PubMed: 7897455]
18. Lemack GE, Zimmern PE. Predictability of urodynamic findings based on the Urogenital Distress Inventory-6 questionnaire. *Urology* 1999;54:461. [PubMed: 10475355]
19. Radloff LS. The CES-D Scale: a self-report depression scale for research in the general population. *Appl Psychol Meas* 1977;1:385–401.
20. Thom DH, van den Eeden SK, Ragins AI, Wassel-Fyr C, Vittinghof E, Subak LL, et al. Differences in prevalence of urinary incontinence by race/ethnicity. *J Urol* 2006;175:259. [PubMed: 16406923]
21. Klingele CJ, Carley ME, Hill RF. Patient characteristics that are associated with urodynamically diagnosed detrusor instability and genuine stress incontinence. *Am J Obstet Gynecol* 2002;186:866. [PubMed: 12015497]

Figure 1.

Flow diagram of recruitment of women for Establishing the Prevalence of Incontinence (EPI) Study (n=2,814).

Table 1Principal components of urinary incontinence symptom measures. EPI Study¹.

Survey Measures of Incontinence Type	Factor 1 ² (stress)	Factor 2 ³ (urge)
Coughing laughing, or sneezing	0.59	−0.24
Lifting heavy things	0.77	0.15
Straining to do something or pulling a heavy object	0.73	0.27
Sexual activity	0.55	0.00
Walking briskly, jogging, or exercising	0.65	0.10
Going outside into the cold or coming inside to A/C	0.33	0.51
Arriving at your door or putting your key in the lock	−0.04	0.79
Hearing or feeling running water	0.25	0.58
Receiving little warning and suddenly losing urine	0.12	0.68
Not finding the toilet, having the urge to urinate, and losing urine	0.17	0.69

¹This table is based on the 525 women who provided complete data for the 10 symptom type questions.

²The main loadings on Factor 1 are labeled as indicative of “pure stress” (coughing, lifting, straining, sexual activity, walking).

³The main loadings on Factor 2 are labeled as indicative of “pure urge” (cold, key in lock, running water, little warning, no available toilet).

Table 2

Demographic, health history, lifestyle, and obstetric/gynecologic characteristics of the study sample, overall and by race. EPI Study.

Characteristic	Overall (n=2,814) % (95% CI) ¹	Black (n=1,922) % (95% CI) ¹	White (n=892) % (95% CI) ¹	P-value ²
<i>Demographics</i>				
Age (years)				<0.001
35–44	40.6 (40.5–40.6)	41.7 (41.7–41.7)	39.9 (39.9–40.0)	
45–54	37.7 (37.7–37.8)	38.2 (38.2–38.2)	37.5 (37.4–37.5)	
55–64	21.7 (21.7–21.8)	20.2 (20.2–20.2)	22.6 (22.6–22.6)	
Education (years completed)				<0.0001
<12	6.6 (5.5–8.0)	6.1 (5.1–7.3)	6.9 (5.3–9.1)	
12	24.5 (22.5–26.7)	24.1 (22.2–26.1)	24.7 (21.8–27.9)	
13–15	32.4 (30.2–34.6)	42.2 (39.9–44.5)	26.9 (23.8–30.2)	
≥16	36.5 (34.4–38.6)	27.6 (25.7–29.6)	41.4 (38.4–44.6)	
Currently working for pay	69.4 (67.2–71.6)	69.5 (67.5–71.5)	69.4 (66.0–72.6)	0.93
Household Income (\$)				<0.05
<35,000	40.4 (38.0–42.9)	42.3 (40.0–44.6)	39.4 (35.8–43.1)	
35,000–69,999	31.8 (29.5–34.3)	33.7 (31.4–36.1)	30.8 (27.4–34.4)	
≥70,000	27.8 (25.6–30.0)	24.0 (22.1–26.0)	29.9 (26.7–33.2)	
Marital Status				<0.0001
Married/Living together	52.6 (50.2–54.9)	42.9 (40.6–45.2)	57.9 (54.5–61.4)	
Divorced/Separated	26.1 (24.1–28.2)	28.9 (26.9–31.1)	24.5 (21.6–27.7)	
Widowed	4.2 (3.4–5.1)	5.7 (4.9–6.8)	3.3 (2.2–4.8)	
Never married	17.2 (15.5–19.0)	22.4 (20.5–24.4)	14.3 (12.0–16.9)	
<i>Health history</i>				
Diabetes	11.7 (10.3–13.3)	13.4 (12.0–14.9)	10.8 (8.8–13.2)	0.07
Mobility impairment	11.0 (9.6–12.6)	10.8 (9.5–12.2)	11.2 (9.2–13.5)	0.78
Constipation	10.8 (9.4–12.4)	10.1 (8.8–11.6)	11.2 (9.1–13.6)	0.42
Urinary tract infection	13.3 (11.7–15.0)	13.1 (11.6–14.7)	13.4 (11.2–16.0)	0.81
Chronic lung disease	16.6 (14.8–18.5)	12.7 (11.3–14.3)	18.7 (16.1–21.7)	<0.001
Obesity (BMI ≥30 kg/m ²) ³	38.2 (35.9–40.6)	46.6 (44.3–48.9)	33.5 (30.2–37.0)	<0.0001
Depressive symptoms ⁴	42.1 (39.7–44.5)	39.8 (37.5–42.0)	43.4 (40.0–46.9)	0.08
<i>Lifestyle factors</i>				
Exercise involving bouncing at least once a week	29.9 (27.8–32.1)	34.1 (32.0–36.4)	27.6 (24.6–30.8)	<0.01
Lift or carry ≥30 pounds more than once a week	50.7 (48.4–53.0)	36.3 (34.0–38.5)	58.9 (55.4–62.2)	<0.0001
Current cigarette smoking	25.1 (23.1–27.3)	22.2 (20.4–24.2)	26.8 (23.8–30.0)	<0.05
Drink >8 glasses fluid per day	35.8 (33.5–38.2)	32.1 (29.9–34.3)	37.9 (34.5–41.5)	<0.01
<i>Obstetric/Gynecologic history</i>				
At least one vaginal delivery	69.3 (67.0–71.5)	74.7 (72.6–76.7)	66.2 (62.9–69.5)	<0.0001
Current estrogen use	10.2 (8.9–11.6)	9.4 (8.2–10.7)	10.6 (8.8–12.8)	0.27
Prior surgery for prolapse or UI	5.1 (4.1–6.2)	3.7 (3.0–4.6)	5.8 (4.4–7.6)	<0.01

	Overall (n=2,814)	Black (n=1,922)	White (n=892)	
Characteristic	% (95% CI) ¹	% (95% CI) ¹	% (95% CI) ¹	P-value ²
Menopause	43.7 (41.9–45.5)	42.9 (41.1–44.7)	44.1 (41.5–46.8)	0.45
Prior hysterectomy	17.8 (16.2–19.6)	22.0 (20.3–23.8)	15.5 (13.2–18.1)	<0.001

CI, confidence interval; BMI, body mass index; UI, urinary incontinence

¹ Percentages are weighted to reflect the complex sample design.

² Chi-square p-value for comparison between black and white women.

³ BMI based on self-reported height and weight

⁴ Self-reported feelings of sadness, depression, and/or loneliness in the prior week.

Table 3

Self-reported urinary incontinence frequency and amount of urine loss in the last 12 months, overall and by race. EPI Study¹.

	Overall	Black	White	
	% (95% CI) ²	% (95% CI) ²	% (95% CI) ²	P-value ³
Incontinence frequency (episodes per month)				0.44
<1	2.0 (1.1–3.5)	3.6 (1.8–6.9)	1.5 (0.6–3.7)	
1–4	34.5 (29.7–39.7)	35.0 (29.3–41.1)	34.4 (28.5–40.7)	
5–24	35.1 (30.2–40.3)	34.9 (29.2–41.1)	35.1 (29.3–41.5)	
25–90	28.5 (24.0–33.5)	26.6 (21.5–32.4)	29.0 (23.6–35.1)	
Quantity of urine loss (per episode)				<0.05
A few drops	47.5 (42.5–52.5)	37.0 (31.3–43.1)	50.1 (44.0–56.2)	
Wet underwear or pad	40.3 (35.4–45.4)	50.6 (44.5–56.7)	37.7 (31.8–44.0)	
Soak outer clothes	9.6 (6.8–13.3)	9.0 (6.1–13.0)	9.7 (6.5–14.4)	
Drip onto the floor	2.7 (1.6–4.4)	3.4 (1.8–6.5)	2.5 (1.3–4.7)	

CI, confidence interval

¹ Information on frequency was provided by 282 white women and 266 black women (548 total); information on quantity was provided by 295 white women and 280 black women (575 total).

² Percentages are weighted to reflect the complex sample design.

³ Chi-square p-value for comparison between black and white women.

Table 4

Types of urinary incontinence based on self-reported symptoms grouped according to principal components analysis, overall and by race. EPI Study.

Type	Overall (n=525)	Black (n=256)	White (n=269)	P-value ³
	% (95% CI) ¹	% (95% CI) ¹	% (95% CI) ¹	
Pure stress	36.3 (31.4–41.7)	25.0 (19.8–30.9)	39.2 (33.1–45.7)	<0.01
Pure urge	13.6 (10.7–17.1)	23.8 (18.8–29.7)	11.0 (7.8–15.4)	<0.001
Mixed	22.7 (18.4–27.7)	28.1 (22.6–34.2)	21.4 (16.3–27.5)	0.10
Below threshold ³	27.4 (23.0–32.2)	23.2 (18.2–28.9)	28.4 (23.1–34.4)	0.18

CI, confidence interval

¹ Percentages are weighted to reflect the complex sample design.

² P-value for comparison of incontinence type between black and white women: for the overall table, $p < 0.0001$.

³ Women who did not reach a threshold of “often” on any question about leakage with particular activities.

Table 5

Adjusted odds ratios for self-reported urinary incontinence, overall and by race. EPI Study.

Characteristic	Overall (n=2,663) ¹ OR ² (95% CI)	Black (n=1,819) OR ² (95% CI)	White (n=844) OR ² (95% CI)
Age (years)			
35–44	1.0 (referent)		
45–54	1.7 (1.2–2.4)	1.4 (1.0–2.1)	1.8 (1.2–2.7)
55–64	1.8 (1.1–2.8)	0.9 (0.5–1.4)	2.2 (1.3–3.9)
Race			
White	1.0 (referent)		
Black	0.3 (0.2–0.3)	___ ³	___ ³
Currently working for pay ⁴	1.1 (0.8–1.5)	1.1 (0.8–1.5)	1.1 (0.7–1.6)
Diabetes ⁴	1.3 (0.9–1.9)	1.4 (1.0–2.1)	1.2 (0.7–2.2)
Mobility impairment ⁴	1.9 (1.2–2.8)	2.2 (1.5–3.3)	1.7 (1.0–2.9)
Constipation ⁴	2.1 (1.4–3.1)	1.7 (1.1–2.6)	2.3 (1.3–3.8)
Urinary tract infection ⁴	1.2 (0.9–1.8)	1.5 (1.0–2.3)	1.1 (0.7–1.8)
Chronic lung disease ⁴	1.1 (0.8–1.6)	1.6 (1.1–2.4)	1.0 (0.7–1.7)
Obesity (BMI ≥30 kg/m ²) ^{4,5}	2.3 (1.8–3.0)	1.7 (1.2–2.2)	2.6 (1.8–3.8)
Depressive symptoms ^{4,6}	1.5 (1.1–1.9)	1.5 (1.1–2.1)	1.4 (1.0–2.0)
Exercises involving bouncing at least once a week ⁴	1.0 (0.8–1.4)	0.8 (0.6–1.2)	1.1 (0.7–1.6)
At least one vaginal delivery ⁴	1.5 (1.1–2.0)	1.2 (0.8–1.7)	1.6 (1.1–2.3)
Current estrogen use ⁴	1.1 (0.7–1.6)	1.3 (0.9–2.0)	1.0 (0.6–1.7)
Prior surgery for prolapse or UI ⁴	1.3 (0.8–2.3)	1.9 (1.0–3.7)	1.2 (0.6–2.3)
Menopause ⁴	0.8 (0.5–1.1)	0.9 (0.6–1.3)	0.7 (0.4–1.1)
Hysterectomy ⁴	1.5 (1.1–2.2)	1.5 (1.0–2.3)	1.6 (0.9–2.7)

OR, odds ratio; CI, confidence interval; BMI, body mass index; UI, urinary incontinence

¹ Analyses were limited to the 2,663 women for whom complete information was available for the dependent variable (continence status) and all independent variables in the model.² Model covariates include all variables found to be significantly associated with continence status in bivariate analyses.³ Models stratified by race did not include race as a covariate.⁴ The referent category is not having a history of the condition or not participating in the activity.⁵ BMI based on self-reported height and weight.⁶ Self-reported feelings of sadness, depression, and/or loneliness in the prior week.