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Hysterectomies and Urologic Symptoms: Results from the Boston Area Community Health (BACH) Survey

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Abstract

Objectives—To describe the characteristics of women who have had a hysterectomy and to assess the association of a past hysterectomy on current urologic symptoms.

Methods—The Boston Area Community Health (BACH) survey is a random sample of Boston, Massachusetts residents aged 30–79 years using a stratified two-stage cluster design (3202 women; 1067 Black, 1111 Hispanic, 1024 White). Urologic symptoms, hysterectomy, co-morbidities, lifestyle factors, and medical indications for a hysterectomy were by self-report. Socioeconomic status was measured as a combination of education and income.

Results—Hysterectomies were reported by 587 women and 1782 women reported one or more urologic symptoms. Minorities and those of lower socioeconomic status are more likely to have had a hysterectomy, even after adjusting for age and potential medical indications for a hysterectomy. Hispanic women were least likely to report fibroids, polycystic ovarian syndrome, or genitourinary cancers, but they were more likely to have had a hysterectomy if they reported these conditions than Black or White women. Women with a hysterectomy were more likely to report lower urinary tract symptoms, painful bladder syndrome, urinary frequency, urgency, and overactive bladder after adjusting for age, race/ethnicity, socioeconomic status, body mass index, depression, diabetes, heart disease, hypertension, smoking history, alcohol use, and physical activity.

Conclusions—Minorities and those of lower socioeconomic status are more likely to report having a hysterectomy and urologic symptoms (including painful bladder syndrome) may be an unintended consequence of a hysterectomy.

Keywords

Health disparities; hysterectomy; urologic symptoms

Introduction

Hysterectomy has long been a standard treatment for many benign indications, including menorrhagia, leiomyoma, uterine prolapse, and dysmenorrhea. Recent studies show a decrease in the total number of hysterectomies performed annually as reported using data from the Nationwide Inpatient Sample, in addition to changes in the indications for hysterectomy¹. Newer procedures such as prolapse repair using synthetic mesh, uterine

artery embolization for the treatment of leiomyoma, and endometrial ablation challenge the role of hysterectomy as the main surgical therapy for many diagnoses.

An increase in therapeutic alternatives to hysterectomy has led to a renewed interest in the effect of hysterectomy on postoperative quality of life. Several studies have indicated that hysterectomy for benign indications improves the quality of life in peri- and post-menopausal women^{2, 3}.

The negative impact of urologic symptoms on quality of life has been extensively studied^{4–6}. Despite this, any association between hysterectomy and urologic symptoms has not been thoroughly investigated. There is conflicting evidence among studies looking at the effect of hysterectomies on urologic symptoms^{7, 8}. Many of the longitudinal studies are convenience samples of patients with limited long-term follow up.

Using a diverse population-based random sample of Boston, Massachusetts residents aged 30–79 years, the objective of this cross-sectional study was: 1) to determine the characteristics of women who have had a hysterectomy and whether they vary by race/ethnicity; and 2) to determine the association of past hysterectomy on current urologic symptoms, overall and by race/ethnicity.

Materials and Methods

The Boston Area Community Health (BACH) survey is an epidemiologic survey of Boston residents aged 30–79. Detailed methods have been described elsewhere⁹. In brief, a stratified two-stage cluster sample was used to recruit residents of Boston with the goal of approximately equal number of participants by gender, race/ethnicity (Black, Hispanic, White), and age group (30–39, 40–49, 50–59, 60–79). In total, 5503 adults participated in BACH (1767 Black, 1877 Hispanic, 1859 White; 2301 men and 3202 women). The response rate was 63.3% of screened eligible participants, which is typical of an epidemiologic field survey requiring a lengthy in-home protocol and phlebotomy. Data were collected between 2002 and 2005. After obtaining written informed consent, data were collected during a two hour interview (in English or Spanish), usually in the respondent's home. All protocols and procedures were approved by the New England Research Institutes' Institutional Review Board.

Race/ethnicity was determined by self-report using the Office of Management and Budget classifications (Executive Office of the President of the United States, Federal Register Notice, 1997). **Socioeconomic status** (SES) was determined as a combination of education and income¹⁰, and categorized such that ¼ of the study population was lower, ½ middle, and ¼ upper. **Co-morbid conditions** such as diabetes (type 1 or 2), heart disease (angina, coronary artery bypass or stent, heart attack, congestive heart failure), high blood pressure (hypertension), fibroids, ovarian cysts, or cancer were self reports to the question: "Have you ever been told by a health care provider that you have or had _____". Note that self report of co-morbidities have been found to be well correlated with medical records¹¹. If the respondent reported cancer, the type(s) were determined. Genitourinary cancers included: vulva, cervical, uterine, ovarian, bladder, or kidney cancer. Women were asked if they had had "a hysterectomy, an operation to remove your uterus or womb", and if yes, they were asked if the surgery was done through the abdomen or the vagina. Women were also asked if they had had any ovaries removed and if so, if one or two ovaries were removed. A women who reported that both ovaries were removed was said to have no **endogenous female hormones**. **Exogenous female hormones** were ascertained using an inventory of all medications (prescription and over-the-counter) used in the last month as well as a prompt by indication (e.g. female hormones). We do not have information on the duration of use for

medications. **Depressive symptoms** were assessed using an abridged Center for Epidemiologic Studies depression scale where a respondent was considered to be depressed if they reported at least 5 of the 8 symptoms¹². **Smoking history** (cigarettes and cigars) was categorized as never, former or current smoker. **Physical activity** was assessed using the Physical Activity Scale for the Elderly and categorized into low, moderate, or high¹³. Interviewer measured height and weight was used to calculate body mass index (kg/m^2) which was categorized as normal (<25), overweight ($25\text{--}30$), or obese ($30+$). **Alcohol consumption** (during the last 30 days) included beer, wine, and hard liquor and was categorized as 0, <1 , or $1+$ drinks per day. **Health insurance status** was classified as having some private insurance, public only (Medicaid and/or Medicare), or none. The **number of visits** to a health care provider in the last year was categorized at 0–4, 5–9, and 10+.

Urologic symptoms were generally assessed over the last month prior to the survey administration. A women was said to have lower urinary tract symptoms (LUTS) if she scored 8 or higher on the American Urologic Association Symptom Index¹⁴ which includes seven questions on incomplete emptying, frequency, intermittency, urgency, weak stream, straining, and nocturia; weekly urine leakage if she reported involuntary loss of urine at least once per week; painful bladder syndrome (PBS) if she reported pain increasing as bladder fills (fairly often, usually, or almost always) and/or pain relieved by urination (fairly often, usually, or almost always) lasting for at least three months; frequency if she reported urinating more frequently than every two hours or had frequent urination during the day (fairly often, usually, or almost always), or reported urinating eight or more times per day; urgency if she reported having difficulty postponing urination or had a strong urge to urinate (fairly often, usually, or almost always) in the last month, or reported a strong urge to urinate in the last seven days (four or more times); nocturia if she got up to urinate more than once at night (fairly often, usually, or almost always) or reported two or more urinations at night after falling asleep; overactive bladder (OAB) if she reported frequency and urgency; OAB wet if she reported frequency and urgency and leaking urine in the last week when she had the strong feeling that she needed to empty your bladder but she couldn't get to the toilet fast enough; and OAB dry if she reported frequency and urgency and not leaking urine in the last week when she had the strong feeling that she needed to empty your bladder but she couldn't get to the toilet fast enough.

Chi-square tests were used to test the assumption of equal distributions by race/ethnicity. A multivariate logistic regression model (overall and by race/ethnicity) was used to determine the probability of a hysterectomy. Initially all explanatory variables (other than urologic symptoms) were entered into the model. A parsimonious model was obtaining using backwards elimination. Variables were kept in the model if they were statistically significant overall or in at least one racial/ethnic group. In contrast, when looking at the association of individual urologic symptoms and hysterectomy we controlled for race/ethnicity, age, socioeconomic status, body mass index, diabetes, heart disease, hypertension, depression, smoking history, alcohol consumption, and physical activity regardless of their level of significance. Multiple imputation was used to generate plausible values for missing observations using SAS 9.1.3 (SAS Institute, Cary, NC). Twenty-five multiply imputed data sets were created by gender and race/ethnicity. For most variables less than 1 percent of the data were missing. The only exceptions were income for which 4/11/3 percent was missing and abuse for which 10/15/7 percent was missing for Black/Hispanic/White participants respectively. To be representative of the city of Boston, observations were weighted inversely to their probability of selection and weights were post-stratified to the Boston census population in 2000. Analyses were conducted in SUDAAN 9.0.1 (Research Triangle Institute, Research Triangle Park, NC). Using an approximate effective sample size (due to sample weighting), at alpha equal to 0.05, and other variables explaining 10 percent of the variation, we have 80 percent power to detect an effect (odds ratio) due to hysterectomy of

1.7 to 2.9 overall and 2.5 to 5.4 in one race/ethnic group (as the prevalence of the urologic symptom varies from 40 to 3 percent).

Results

There are 3202 women in the BACH cohort with 1067 Black women, 1111 Hispanic women, and 1024 White women. About 1/3 are of normal weight, overweight, and obese, Table 1, with variation by race/ethnicity. Additional descriptive statistics for the BACH sample are shown in Table 1. Consistent with other studies, Black women report more fibroids, hypertension, and heart disease. Hispanic women report more depressive symptoms, but fewer prolapsed uteri or ovarian cysts, White women report more endometriosis, non-genitourinary cancer and were least likely to report diabetes. Black women were most likely to be obese. Hispanics were least likely to report any smoking, least likely to report high levels of physical activity and were most likely to have no health insurance. White women were most likely to have some type of private insurance, report consuming 1 or more drinks per day and were least likely to be obese. Minorities were more likely to report nocturia, while White women were more likely to report urinary frequency.

Overall, 587 (weighted 15.4%) women had a hysterectomy. The rates of hysterectomy, Table 2, vary by race/ethnicity and socioeconomic status with Black women and those of lower socioeconomic status more likely to report hysterectomies. The majority of hysterectomies were done through the abdomen and this did not vary significantly by race/ethnicity, Table 1. For women with a hysterectomy, White women were least likely to have endogenous female hormones (i.e. have at least one ovary) and exogenous hormones, Table 1. Although Hispanic women were least likely to report fibroids, polycystic ovarian syndrome (PCOS), or genitourinary cancers, they were the most likely to have had a hysterectomy if they reported these conditions, Table 2. In multivariate logistic regression models, Table 3, we found that even after adjusting for socioeconomic status and potential medical indicators for hysterectomy, minorities were still at increased risk of having had a hysterectomy. All potential medical indications for hysterectomy were significantly associated with the probability of having a hysterectomy either overall or in at least one racial/ethnic group. In addition we found that Hispanics who reported non-genitourinary cancers were less likely to have had a hysterectomy and if they reported 5 or more depressive symptoms or no current health insurance they were more likely to have had a hysterectomy. White women who were current smokers or who reported hypertension were more likely to have had a hysterectomy. Although women who reported 10 or more visits to a health care provider in the last year were more likely to have had a hysterectomy in bivariate analyses, Table 2, this variable was no longer significant ($p > 0.05$) in multivariate models.

In multivariate logistic regression models for the probability of urologic symptoms, after adjusting for (race/ethnicity in the overall model only), age, socioeconomic status, body mass index, diabetes, heart disease, hypertension, depression, smoking history, alcohol consumption, and physical activity, Table 4 and Figure 1, we found that having had a hysterectomy increases the likelihood of current urologic symptoms. In particular, overall, there was a significant association of having had a hysterectomy and current general lower urinary tract symptoms, painful bladder syndrome, frequency, urgency, overactive bladder, and overactive bladder-wet. While the same level of significance is not reached in each race/ethnic group (due to the smaller sample sizes), similar patterns held. We repeated these analyses to determine if the reported route of the hysterectomy (abdomen or vagina) affected the association of urologic symptoms and a hysterectomy. None of the odds ratios varied significantly by route, nor was one route more detrimental by symptom or by race/ethnicity (data not shown). We also examined the effect of endogenous and/or exogenous female

hormones on the association of hysterectomy and urologic symptoms and found no consistent patterns. There were also no consistent interactions of the other covariates and hysterectomy on the likelihood of urologic symptoms. Our statistical power for these stratified analyses (route of hysterectomy and endogenous / exogenous hormone use) is limited.

Discussion

From this study we have shown that minorities and those of lower socioeconomic status are more likely to have had a hysterectomy after adjusting for age and potential medical indications for hysterectomy. This is of particular interest as the rates of hysterectomy for all indications except dysmenorrhea and bleeding have decreased in recent years in the general population¹⁵. Our study found a similar rate of hysterectomy as a survey by the Center for Disease Control's (CDC) Behavioral Risk Factor Surveillance System (BRFSS), the National Uterine Fibroids foundation¹⁶ which identified Massachusetts as a state with one of the lowest hysterectomy rates in the country.

The literature contains many studies evaluating the effect of hysterectomy on urinary incontinence. Most population-based and cohort studies^{17, 18} identify an increased relative risk of urinary incontinence among women who have undergone hysterectomy. Our cross-sectional results are consistent with these findings. Danforth et al¹⁸ report a relative risk of 1.59 (OR 1.45, 1.73) for severe incontinence after hysterectomy among the 83,355 women ages 37–54 taking part in the Nurses Health Study II. However, this study did not analyze hysterectomized women by race/ethnicity, nor were questions regarding urinary incontinence evaluated using a validated survey. This is in contrast to several recent prospective studies. Gimbel et al² identified a decrease in urinary incontinence in patients undergoing total abdominal hysterectomy, but not subtotal hysterectomy. In a study using validated questionnaires, Kjerulff¹⁹ found that urinary incontinence is decreased in hysterectomized patients with severe preoperative urinary incontinence, but increased in patients with only minor preoperative incontinence. Many patients in that study underwent concomitant anti-incontinence procedures, making it difficult to identify the actual effect of hysterectomy on incontinence. In a novel study involving identical twins, Miller et al²⁰ found that hysterectomy was associated with reduced risk for stress urinary incontinence, but this finding was negated when controlling for concomitant pelvic floor defect surgeries.

Other urinary symptoms, such as frequency, urgency, nocturia and incomplete bladder emptying have also been evaluated. Radical hysterectomy has been associated with urinary frequency, urgency, and nocturia²¹. In contrast, simple hysterectomy, more commonly performed for benign procedures, has been associated with decreased frequency, urgency, and nocturia²². In population based studies, which do not generally identify the type of hysterectomy (radical vs. simple), no association was found between hysterectomy and nocturia or urgency²³ which is in contrast to our study which shows an association of hysterectomy with frequency, urgency, and nocturia.

The association of painful bladder syndrome and hysterectomy in our study is not entirely novel as women with interstitial cystitis are likely to have multiple pelvic surgeries²⁴ and women with interstitial cystitis may continue to have pelvic pain after a hysterectomy²⁵.

Some longitudinal clinical studies have not shown an association of hysterectomy and urologic symptoms. The difference between these studies and the BACH epidemiologic survey may be insufficient follow-up as urologic symptoms tend to come and go, as well as smaller sample sizes.

As with previous studies, the route of simple hysterectomy (vaginal vs. abdominal) did not alter the likelihood of urologic symptoms. Our study did not capture the type of hysterectomy (radical, simple, supracervical) as women may not know this information, though differences in urologic symptoms have been identified among these techniques. Patho-physiologic explanations for urologic symptoms after hysterectomy are probably multifactorial. Nerve damage resulting from bladder dissection is an obvious concern, and this concept is bolstered by more severe symptoms reported in patients undergoing radical hysterectomy and thus parametrial dissection, increasing the extent of bladder related nerve damage. In addition, urodynamic studies of patients who underwent simple hysterectomy have identified little or no changes before and after hysterectomy^{26, 27}, while studies of women who underwent radical hysterectomy identified changes in intraurethral pressure²⁸. One might expect subtotal hysterectomy to result in fewer urologic symptoms, due to a diminished bladder dissection. Curiously, this finding was not identified on in a randomized controlled trial comparing subtotal and abdominal (simple) hysterectomy².

A strength of the BACH study is its large community-based population, not a convenience sample of patients, with a wide variety of information on socio-demographics, urologic symptoms, and medical co-morbidities. It is also one of the few studies with adequate minority representation to report analyses by race/ethnicity. A potential limitation is that we do not know when the women had their hysterectomy or the specific reason for their hysterectomy. BACH has already transitioned to a longitudinal cohort study, and we are asking women for this information. We also do not know if a woman was experiencing urologic or pelvic pain symptoms prior to her hysterectomy. If menorrhagia or other pelvic symptoms are cured, lower urinary tract symptoms may become more noticeable even if they were present prior to surgery. In addition, if many hysterectomies were done for pelvic prolapse, there is already damage in the lower urinary tract. Women may have experienced additional pelvic surgeries which could lessen or worsen urologic symptoms. While we know if the surgery was done through the abdomen or vagina, we do not know if a radical, simple, or supra-cervical hysterectomy was performed. Although some studies indicated that a total hysterectomy was associated with lower rates of incontinence², most studies suggest no difference in symptoms^{29, 30}.

Conclusions

Our cross sectional study is consistent with many prior observational and longitudinal studies which indicate that a hysterectomy is a risk factor for lower urinary tract symptoms. Our data indicate that this is true not only for incontinence, but also for other symptoms such as frequency, urgency, nocturia, and overactive bladder. This is not surprising as urologic symptoms tend to cluster³¹. In addition, hysterectomy increases the odds of painful bladder syndrome by a factor of two to three. We also show that this pattern is consistent by race/ethnicity.

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Figure 1.

Odds Ratios (squares) and 95 percent confidence intervals for the odds of urologic symptoms (after adjusting for (race/ethnicity), age, socioeconomic status, body mass index, diabetes, heart disease, hypertension, depression, smoking history, alcohol consumption, and physical activity) overall (O) and for Black (B), Hispanic (H), and White (W) women. A line at 1 indicates no association. LUTS=lower urinary track symptoms, UI=weekly urine leakage, PBS=painful bladder syndrome, OAB=overactive bladder. Note the scales for the odds ratio and 95 percent confidence intervals for PBS and OAB wet are on a logarithmic scale).

Table 1Descriptive Statistics for the BACH sample of women^{1,2}.

	Overall	Black	Hispanic	White	p value
N (sample size)	3202	1067	1111	1024	
Demographics					
Age (years)					<.0001
30–39	33.5	32.7	43.4	31.6	
40–49	24.4	27.1	27.7	22.2	
50–59	18.4	20.0	15.9	18.2	
60–69	15.1	14.1	9.2	17.1	
70–79	8.6	6.2	3.9	11.0	
Socioeconomic status					<.0001
lower	30.8	44.1	63.3	16.2	
middle	45.2	46.8	30.9	47.8	
upper	23.9	9.1	5.8	36.0	
Health insurance / Health care utilization					
Health insurance status					<.0001
private	61.4	47.2	29.4	76.3	
public only	29.4	44.0	51.3	16.6	
none	9.2	8.8	19.3	7.1	
Visits to health care provider in last year					.0012
0–4	47.6	52.1	56.6	43.1	
5–9	23.6	20.0	21.4	26.1	
10+	28.8	27.9	22.0	30.8	
Lifestyle					
Smoking status					<.0001
never	49.8	52.3	65.4	44.9	
former	27.1	21.0	11.6	33.9	
current	23.1	26.7	23.0	21.2	
Physical activity					.0005
low	27.8	26.7	33.5	27.1	

	Overall	Black	Hispanic	White	p value
moderate	53.6	52.8	56.0	53.5	
high	18.5	20.5	10.4	19.4	
Alcohol consumption (drinks/day)					<.0001
0	41.7	52.2	56.7	32.6	
<1	43.2	39.7	34.8	47.1	
1+	15.1	8.0	8.5	20.3	
Body mass index (kg/m ²)					<.0001
<25	33.3	18.6	24.4	43.1	
25–30	28.6	27.9	32.5	28.0	
30+	38.1	53.4	43.1	28.9	
Medical indications for a hysterectomy					
Fibroids	18.9	29.0	7.6	16.2	<.0001
Polycystic Ovarian Syndrome	2.3	1.2	2.3	3.0	.0708
Ovarian cyst	14.5	13.7	10.4	15.9	.0289
Prolapsed uterus	3.2	2.9	1.1	3.9	.0092
Prolapsed bladder or rectum	2.4	1.2	3.1	2.8	.0412
Endometriosis	5.2	3.9	1.0	6.8	<.0001
Genitourinary cancer	2.7	2.3	1.4	3.2	.1612
Other co-morbidities					
Non-genitourinary cancer	6.4	4.0	2.4	8.7	<.0001
Hypertension	28.3	36.6	24.6	24.9	.0002
Diabetes	9.6	12.5	11.3	7.7	.0187
Heart disease	7.9	11.0	5.6	6.8	.0144
Depression	20.1	24.9	36.2	13.9	<.0001
Urologic Symptoms					
Lower urinary tract symptoms	18.6	21.2	17.7	17.5	.2402
Weekly urine leakage	10.4	9.4	7.3	11.6	.1411
Painful bladder syndrome	2.6	3.1	3.8	2.2	.2318
Frequency	36.9	31.4	30.3	41.4	.0007
Urgency	14.2	16.9	11.8	13.3	.1562
Nocturia	31.3	41.5	35.7	24.9	<.0001

	Overall	Black	Hispanic	White	p value
Overactive bladder	11.7	13.8	9.7	11.1	.3041
Overactive bladder – wet	6.9	8.8	5.4	6.2	.2724
Overactive bladder - dry	4.9	5.0	4.3	4.9	.8638
Hysterectomy Information					
Hysterectomy	15.4	19.3	15.1	13.4	.0264
N (sample size with a hysterectomy)	587	234	190	163	
Hysterectomy route					.1862
Abdomen	73.6	79.5	67.2	71.0	
Vagina	26.4	20.5	32.8	29.0	
Female hormone status (for those with a hysterectomy)					.0345
endogenous (yes) / exogenous (yes)	6.7	5.4	2.2	8.8	
endogenous (no) / exogenous (yes)	11.7	11.7	9.3	12.4	
endogenous (yes) / exogenous (no)	44.7	53.8	49.9	36.5	
endogenous (no) / exogenous (no)	36.9	29.1	38.6	42.4	

¹ Values are percents except for sample sizes.

² The p value is from a chi-square test that the distribution by race/ethnicity is the same.

Table 2Reported prevalence of hysterectomy by socio-demographics and medical indications^{1,2}.

	Overall	Black	Hispanic	White	p value
Hysterectomy	15.4	19.3	15.1	13.4	.0264
Number with hysterectomy	587	234	190	163	
Age	(<.0001)	(<.0001)	(<.0001)	(<.0001)	
30–39	1.2	2.0	2.0	0.6	.2898
40–49	11.6	13.5	15.8	9.0	.2669
50–59	21.7	28.7	29.8	16.0	.0055
60–69	33.7	44.8	39.7	28.2	.0341
70–79	35.9	47.8	38.4	32.3	.2101
Socioeconomic status	(<.0001)	(.3800)	(.0377)	(.0003)	
lower	22.6	22.0	18.6	27.1	.1448
middle	13.5	16.9	9.5	12.3	.1394
upper	9.9	19.0	7.2	8.8	.3526
Fibroids	(<.0001)	(<.0001)	(<.0001)	(<.0001)	
yes	38.8	39.1	57.6	36.3	.0300
no	10.0	11.2	11.6	9.0	.4066
Polycystic Ovarian Syndrome	(.0461)	(.6465)	(.0016)	(.2100)	
yes	30.3	14.2	75.8	25.4	.0083
no	15.1	19.4	13.7	13.1	.0106
Ovarian cyst	(.0062)	(.2916)	(.0009)	(.0599)	
yes	22.5	24.7	36.4	19.4	.0712
no	14.2	18.4	12.6	12.3	.0204
Prolapsed uterus	(.0012)	(.0182)	(.0950)	(.0461)	
yes	41.2	63.1	49.9	31.8	.1713
no	14.6	18.0	14.7	12.7	.0490
Prolapsed bladder or rectum	(.0004)	(.0976)	(.0516)	(.0054)	
yes	52.5	45.9	56.6	52.9	.8580
no	14.5	19.0	13.8	12.3	.0142
Endometriosis	(.0013)	(.2374)	(.3006)	(.0019)	

	Overall	Black	Hispanic	White	p value
yes	33.8	33.7	31.6	34.0	.9891
no	14.4	18.7	15.0	11.9	.0055
Genitourinary cancer	(.0032)	(.1336)	(.0034)	(.0184)	
yes	39.8	37.2	85.3	36.2	.0404
no	14.8	18.9	14.1	12.7	.0076
Non-genitourinary cancer	(.0012)	(.0442)	(.7628)	(.0045)	
yes	32.8	40.1	18.1	31.9	.2858
no	14.2	18.4	15.0	11.7	.0067
Hypertension	(<.0001)	(<.0001)	(.0001)	(<.0001)	
yes	29.3	31.8	29.1	27.4	.6152
no	10.0	12.1	10.6	8.8	.3569
Diabetes	(<.0001)	(.0004)	(.0423)	(.0149)	
yes	29.0	35.2	24.4	25.2	.2355
no	14.0	17.0	13.9	12.5	.1207
Heart disease	(<.0001)	(.0235)	(.0122)	(.0023)	
yes	34.1	34.7	36.0	33.2	.9656
no	13.8	17.4	13.9	12.0	.0438
Depression	(.7415)	(.0858)	(.0281)	(.8618)	
yes	16.0	14.9	22.5	13.0	.2020
no	15.3	20.8	12.0	13.5	.0012
Smoking status	(.1848)	(.0205)	(.3234)	(.2832)	
never	14.0	18.5	14.1	11.2	.0416
former	18.2	28.0	21.7	14.8	.0317
current	15.2	14.1	14.7	16.0	.8722
Physical activity	(.0001)	(.0658)	(.0306)	(.0028)	
low	22.5	25.7	23.5	20.5	.5284
moderate	13.6	18.3	11.3	11.7	.0305
high	10.1	13.6	9.0	8.3	.3934
Alcohol consumption (drinks/day)	(<.0001)	(.0126)	(.0001)	(.0446)	
0	21.0	23.8	21.8	18.5	.3519
<1	11.6	14.7	6.9	11.0	.0393

	Overall	Black	Hispanic	White	p value
1+	10.8 (.0001)	13.1 (.3767)	4.4 (.0439)	10.9 (.0034)	.2556
Body mass index (kg/m ²)					
<25	9.3	14.3	6.8	8.5	.2413
25–30	18.1	21.1	19.4	16.2	.4909
30+	18.8	20.1	16.6	18.2	.5942
Health insurance status	(.0457)	(.1550)	(.0016)	(.0165)	
private	13.8	22.4	6.5	11.6	.0001
public only	18.7	17.2	14.8	23.6	.1400
none	16.0	13.3	29.2	9.4	.0715
Visits to health care provider in last year	(.0051)	(.2383)	(.0531)	(.0606)	
0–4	12.3	16.8	10.4	10.0	.0226
5–9	16.6	18.5	13.8	16.4	.6125
10+	19.6	24.5	28.6	15.8	.0568

¹ Values are percents except for number with hysterectomy.

² The p values in the right hand column are from a chi-square test of whether the rates are the same by race/ethnicity. The p values in parentheses are from a chi-square test of whether the rates are the same across the covariate overall or within a race/ethnic group.

Table 3

Multivariate logistic models for the probability of a hysterectomy¹.

	OR	Overall 95% CI	p value	OR	Black 95% CI	p value	OR	Hispanic 95% CI	p value	OR	White 95% CI	p value
Race/Ethnicity			.0014									
Black	1.67	1.09, 2.55										
Hispanic	2.45	1.51, 3.96										
White	1.00	reference										
Age			<.0001			<.0001			<.0001			<.0001
30–39	1.00	reference		1.00	reference		1.00	reference		1.00	reference	
40–49	8.91	3.84, 20.67		4.45	1.50, 13.19		6.81	2.40, 19.32		33.29	2.54, 436.57	
50–59	18.63	8.36, 41.56		13.94	4.73, 41.07		23.18	8.26, 65.05		52.05	4.20, 644.43	
60–69	37.59	16.56, 85.37		31.66	10.74, 93.32		31.43	9.21, 107.23		96.00	8.15, 1130.06	
70–79	47.57	20.09, 112.61		38.60	12.29, 121.26		59.24	14.44, 243.11		137.14	11.28, 1667.53	
Socioeconomic status			.0246			.1952			.0371			.2764
lower	1.64	1.11, 2.43		1.69	0.92, 3.12		1.87	0.97, 3.62		1.67	0.88, 3.17	
middle	1.00	reference		1.00	reference		1.00	reference		1.00	reference	
upper	0.87	0.50, 1.49		0.85	0.28, 2.55		0.54	0.17, 1.74		0.97	0.51, 1.85	
Fibroids	4.74	3.23, 6.96		5.65	3.34, 9.58	<.0001	11.89	6.05, 23.36	<.0001	4.62	2.58, 8.27	<.0001
Polycystic ovarian Syndrome	4.69	0.83, 26.43	.0801	0.16	0.01, 2.04	.1560	21.44	6.20, 74.18	<.0001	8.12	0.66, 99.49	.1013
Ovarian cyst	1.28	0.83, 1.99	.2638	0.88	0.39, 1.97	.7602	3.11	1.44, 6.70	.0038	1.21	0.62, 2.34	.5728
Prolapsed uterus	2.09	0.87, 5.02	.0977	9.40	2.20, 40.21	.0026	1.15	0.34, 3.86	.8189	0.93	0.32, 2.71	.8914
Prolapsed bladder or rectum	3.15	1.21, 8.24	.0193	1.30	0.19, 8.85	.7894	7.04	2.03, 24.38	.0021	5.29	1.61, 17.40	.0061
Endometriosis	3.18	1.55, 6.50	.0016	2.45	0.77, 7.78	.1291	0.58	0.05, 6.94	.6703	4.26	1.79, 10.12	.0011
Genitourinary cancer	3.69	1.68, 8.13	.0012	1.94	0.61, 6.13	.2586	96.24	17.25, 536.94	<.0001	3.79	1.27, 11.29	.0168
Non-genitourinary cancer	1.58	0.91, 2.74	.1050	1.82	0.73, 4.54	.2018	0.22	0.08, 0.63	.0045	1.58	0.78, 3.17	.2021
Depression	0.88	0.61, 1.28	.5136	0.78	0.47, 1.29	.3281	2.77	1.55, 4.97	.0006	0.70	0.30, 1.59	.3887
Hypertension	1.51	1.06, 2.16	.0224	1.17	0.69, 2.00	.5556	1.22	0.70, 2.12	.4830	1.82	1.03, 3.21	.0381
Smoking status			.1463			.9757			.5377			.0219
never	1.00	reference		1.00	reference		1.00	reference		1.00	reference	
former	0.97	0.66, 1.41		1.04	0.57, 1.91		1.14	0.50, 2.62		1.05	0.61, 1.78	
current	1.48	0.93, 2.36		0.97	0.49, 1.91		1.51	0.73, 3.15		2.42	1.21, 4.85	
Health insurance status			.6852			.4454			<.0001			.6603

	OR	Overall 95% CI	p value	OR	Black 95% CI	p value	OR	Hispanic 95% CI	p value	OR	White 95% CI	p value
private	1.00	reference		1.00	reference		1.00	reference		1.00	reference	
public only	0.85	0.57, 1.28		0.77	0.44, 1.33		1.13	0.54, 2.39		1.16	0.56, 2.42	
none	1.06	0.55, 2.07		0.58	0.22, 1.55		6.06	2.60, 14.15		0.56	0.10, 2.97	

I Values in the tables are odds ratios (OR) for having a hysterectomy, 95% confidence intervals (95% CI), and p values of whether the odds ratio is significantly different from 1.

Table 4

Multivariate logistic regression models for the odds of a given urologic symptom^{1,2}.

Urologic Symptom	OR	Overall 95% CI	p value	OR	Black 95% CI	p value	OR	Hispanic 95% CI	p value	OR	White 95% CI	p value
Lower urinary tract symptoms	1.48	1.04, 2.10	.0301	1.66	0.94, 2.91	.0801	1.36	0.76, 2.46	.3022	1.52	0.88, 2.64	.1324
Weekly urine leakage	1.07	0.74, 1.56	.7234	0.84	0.39, 1.80	.6573	1.86	0.92, 3.75	.0840	1.23	0.71, 2.14	.4590
Painful bladder syndrome	2.69	1.13, 6.42	.0256	4.01	0.89, 18.16	.0716	3.05	1.27, 7.33	.0129	3.21	0.84, 12.27	.0888
Frequency	1.39	1.03, 1.88	.0337	1.38	0.88, 2.16	.1593	1.61	0.92, 2.80	.0936	1.40	0.88, 2.22	.1521
Urgency	1.54	1.07, 2.21	.0190	1.40	0.78, 2.54	.2608	1.21	0.82, 2.34	.5756	1.94	1.18, 3.22	.0097
Nocturia	1.27	0.91, 1.76	.1537	1.02	0.62, 1.68	.9267	1.81	0.95, 3.42	.0692	1.44	0.88, 2.36	.1432
Overactive bladder	1.50	1.02, 2.15	.0298	1.62	0.90, 2.93	.1073	1.85	0.98, 3.48	.0562	1.67	0.97, 2.88	.0668
Overactive bladder – wet	1.85	1.12, 3.06	.0156	1.28	0.61, 2.70	.5153	1.94	0.88, 4.27	.1005	2.95	1.32, 6.63	.0087
Overactive bladder – dry	1.07	0.64, 1.79	.7881	1.96	0.90, 4.26	.0883	1.59	0.68, 3.72	.2892	0.74	0.32, 1.70	.4801

¹ All models include (race/ethnicity), age, socioeconomic status, body mass index, diabetes, heart disease, hypertension, depression, smoking history, alcohol consumption, and physical activity.

² Values in the tables are odds ratios (OR), 95% confidence intervals (95% CI), and p values of whether the odds ratio is significantly different from 1.