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Race and Socioeconomic Status are Independently Associated with Benign Prostatic Hyperplasia (BPH)

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Abstract

Purpose—Prostate enlargement is common as men age, however differences in the diagnosis or treatment of clinical benign prostatic hyperplasia (BPH) between African-American (AA) and Caucasian (CA) men remain poorly understood. We investigated racial differences in BPH and surgical intervention for BPH in a large and predominantly low-income population.

Materials and Methods—Participants included 21,949 men (AA: 79.8%, CA (20.2%), recruited from 60 community health centers in the southeastern U.S. between 2002 and 2007. BPH and surgical intervention for BPH, and economic and demographic indices (e.g., education, household income, health insurance, marital status) were determined by in-person interview. Logistic regression was used to summarize the association between race and BPH while controlling for healthcare access and SES.

Results—African-American men were approximately one-half as likely to report a BPH diagnosis compared to CA men (4.1% vs. 9.9%, respectively, age adjusted OR=0.45, 95% CI (0.40, 0.51), a difference that persisted with only small abatement after controlling for age, income, insurance coverage, comorbidities, education, and other factors (OR_{adj}=0.49, (0.43, 0.56)). Among men with BPH, surgical intervention for BPH (n=133) was more prevalent among AA vs. CA BPH cases (12.9% vs. 9.1%, respectively, OR_{adj} =1.65 (1.10, 2.48)).

Conclusions—After controlling for economic factors associated with BPH, AA men were significantly less likely to report a prior BPH diagnosis. In contrast, surgical intervention typically reserved for severe BPH was more common among AA men. Our results suggest that race and SES are independently associated with BPH.

Keywords

race; socio-economic status; benign prostatic hyperplasia; prostate

INTRODUCTION

Benign prostatic hyperplasia (BPH) is one of the more common clinical diagnoses as men age, and BPH treatment is a leading source of healthcare expenditure [1,2]. Symptomatic BPH is diagnosed typically after age 50 years among men who report lower urinary tract symptoms

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Conflicts of Interest: None

(LUTS) such as nocturia, incomplete emptying, hesitancy, weak stream, greater frequency, or urgency.

Differences in BPH diagnosis and treatment between African-American (AA) and Caucasian (CA) men remain poorly understood. Prior investigation of racial differences in BPH have produced inconsistent results and may be limited by changing healthcare practices over time and the number of AA men available for analysis. For example, AA men (n=215) participating in the Prostate Cancer Prevention Trial reported greater severity from LUTS compared to CA men [3], and AA men participating in the Flint Men's Health Study (n=369) reported greater LUTS severity than CA men participating in the Olmsted County Study of Urinary Symptoms and Health Status [4]. Interestingly, while AA men may report an increased symptom severity compared to CA men, AA men also reported less bother from these symptoms [4]. In contrast to these prior reports, AA and CA men had a similar prevalence of symptomatic BPH or LUTS in the Health Professionals Follow-up Study (HPFS; AA: n=241) and in a probability sample of the U.S. population selected for NHANES III [5,6]. Finally, surgical intervention often necessary to treat severe BPH symptoms was less common among AA men in NHANES III and the HPFS [5,6], but more common among young AA men (n=118) enrolled in Kaiser Permanente Medical Care Program from 1971 to 1972 [7].

Thus, the goal of this study was to describe racial differences in BPH diagnosis and surgical intervention among a lower-income population. This analysis includes over 17,500 AA and 4,400 CA men over age 40 years and participating in the Southern Community Cohort Study. Given that physician contact is necessary to diagnose BPH, we hypothesized that factors related to healthcare access and SES would be associated with the likelihood of a BPH diagnosis. Furthermore, we hypothesized that any racial differences in BPH diagnosis may be attributable to differences in these indices of healthcare access.

METHODS AND MATERIALS

Study design

Detailed description of the Southern Community Cohort Study (SCCS) have been published previously [8]. Briefly, the SCCS is designed to be a large-scale prospective cohort study to help resolve questions regarding the etiology of lung, breast, colorectal, prostate, and other cancers, as well as to elucidate causes of the disparities in cancer incidence and mortality across racial and urban/rural groups. All SCCS protocols have been approved by IRBs at Vanderbilt University Medical Center and Meharry Medical College. This cross-sectional analysis of BPH prevalence utilized baseline data collected from participants at enrollment into the SCCS.

Recruitment and eligibility

SCCS recruitment strategies include in-person recruitment from 60 community health centers (CHCs) throughout the southeastern United States. The CHCs provide medical and preventive care mainly to medically-underserved and lower-income urban and rural areas. Trained interviewers approach potential study subjects at the CHC, inform them about the study and ask eligible persons to participate after completing a consent process and form approved by the Vanderbilt University and Meharry Medical College IRBs. To be eligible, participants must be between 40 and 79 years of age; English-speaking; and not under treatment for cancer within the past year (with the exception of non-melanoma skin cancer).

Data collection

Eligible participants were interviewed by a trained interviewer using a computer-assisted interview protocol. Baseline data collection included: demographics, income, occupation, use of alcohol and tobacco, diet, disease histories, medications, and a wide range of potential cancer

risk factors. The computer-assisted interview included built-in logic checks, skip patterns, and variable-specific range parameters to maximize data quality and completeness.

A clinical diagnosis of BPH was determined by the participant response to the question 'Has a doctor ever told you that you have an enlarged prostate, which is often called BPH or benign prostatic hyperplasia ?'. Participants responding positively to this question were further queried to determine if there was any surgical intervention in response to this diagnosis. Data regarding the frequency or severity of lower urinary tract symptoms, prescription drug use for BPH symptoms, or other non-surgical interventions were not ascertained during this interview.

Statistical analysis

After excluding 843 men with any prior cancer diagnosis or missing data on any prior diagnosis of prostate enlargement, the analytic study population included 21,949 AA and CA men enrolled in the SCCS between March 2002 and September 2007. Multivariable logistic regression was used to calculate odds ratios (OR) and 95 percent confidence intervals (95% CI) summarizing the association between BPH prevalence and race or factors associated with healthcare access and SES. Models included covariates to control for age, race, education, income, insurance source, prior diabetes or heart disease diagnoses (defined as a prior heart attack or coronary artery bypass surgery), marital status, and the time since the last doctor visit. We did not control for prostate cancer screening practices because a PSA test or DRE are routinely administered to men with suspected BPH and only 6.5 percent of all BPH cases reported never having received either one of these tests. Separate models investigated racial differences in BPH diagnosis within age strata or categories of healthcare access and SES. Interactions between race and factors related to SES or healthcare access were investigated using a cross-product term between race and the factor in a model that contained all main-effect terms. All analyses were conducted using Statistical Analysis System (SAS, version 9.3) software.

RESULTS

Study participants included 17,514 AA (80 percent) and 4,435 CA (20 percent) men (Table 1). Caucasian men on average were approximately 1.7 years older than AA men (CA: mean = 51.6 yrs, sd=8.9 yrs; AA: mean=49.9 yrs, sd=7.9 yrs). Approximately one-half of participants had no health insurance, and the median household income was less than $15,000 per year. Clinical diagnosis of prostate enlargement (BPH) was reported by 1160 subjects (5.3 percent), and surgical intervention was reported from 133 participants (11.5 percent) of men reporting a prior BPH diagnosis.

Diagnosis of BPH and Healthcare Access

In analyses adjusting for age and race, BPH was significantly associated with having military, private, or publicly funded health insurance, and a recent visit to the doctor (Table 2). Several demographic or economic factors indicative of a higher SES were also associated with BPH, including a greater education level, higher income, and being married. BPH was not significantly associated with a prior diagnosis of chronic disease such as diabetes or heart disease. We generated a logistic regression model that included age, race, and all factors described in Table 2. In this model, military health insurance, time since last doctor visit, education, and marital status remained significantly associated with BPH.

Diagnosis of BPH and Race

African-American men were approximately one-half as likely to be diagnosed with BPH compared to CA men (4.1 percent vs. 9.9 percent, age adjusted OR=0.45, 95% confidence interval: 0.40, 0.51). Further adjustment for SES, healthcare coverage, healthcare utilization,

and other factors listed in Table 2 somewhat reduced this difference, however African-American race remained significantly associated with a lower prevalence of BPH (full model: OR=0.49, 95% confidence interval: 0.43, 0.56).

Table 3 investigates whether racial disparities in BPH diagnoses are modified by indices of SES and healthcare access. As expected, the prevalence of a BPH diagnosis increased with age within CA or AA men. Across all age categories, CA men were more likely to be diagnosed with BPH than AA men. This same racial association also held across categories of prior diabetes or heart disease diagnosis, education levels, and time since last visiting a physician. Marriage had a significant positive association with BPH among AA men, but not CA men, and the interaction term representing differences in the marriage-BPH association between race groups was marginally significant (p-interaction=0.06). Also, AA men with an annual household income below $25,000 were significantly less likely to be diagnosed with BPH compared to AA men with a higher annual household income, while income was not associated with BPH among CA men. While the interaction of race and income was not found to be statistically significant (p=0.08), racial differences in BPH prevalence were reduced and no longer statistically significant in analyses restricted to the highest income categories.

Surgery for BPH and Race

African-American men diagnosed with BPH were significantly more likely to receive surgical intervention compared to CA men (AA (12.9 percent); CA (9.1 percent); $OR_{age\ adjusted}$ =1.67, 95% confidence interval: 1.12, 2.50). This racial difference persisted after adjustment for age, income, education, marital status, health insurance coverage, or time since the last doctor visit $OR_{full\ model}$ =1.65, 95% confidence interval: 1.10, 2.48).

Among both AA and CA men, the likelihood of surgical intervention rose with age, and was about twice as high for men having any vs. no health insurance ($OR_{adj.}$=2.11, 95% confidence interval: 1.23, 3.64) (Table 4). Sample size was insufficient to consider specific types of insurance or the effect of prior diagnosis of diabetes or other health-related conditions. We found a significant interaction between race and marital status (p-interaction = 0.04), perhaps suggesting that the effect of marriage on the decision to receive surgical intervention for BPH may differ between AA and CA men.

DISCUSSION

We found AA men were significantly less likely to report ever being diagnosed with an enlarged prostate. This racial difference persisted across age categories and after adjusting for income, insurance coverage, marital status, and other factors related to SES and healthcare utilization. At this time, we cannot exclude the possibility that AA men were simply less likely than CA men to report a prior clinical diagnosis of BPH. However, AA men in this study were significantly more likely to report a history of prostate cancer (0.91 percent vs. 0.76 percent, $OR_{age\ adj.}$ = 1.87, 95% confidence interval: 1.30, 2.70), consistent with prior evidence that AA men are at greater risk for prostate cancer [9]. AA men with BPH were more likely to report surgical intervention for the condition, further suggesting that AA participants were at least as willing as CA men to report prior diagnoses of urologic disease. Furthermore, we have previously reported that use of PSA or DRE testing was generally similar among AA and CA men in this cohort, although varying somewhat with age [10]. AA men were less likely to report a prior BPH diagnosis regardless of education level, and all questions were administered by a trained interviewer in a standardized fashion.

It is unlikely that the large differences in the prevalence of BPH reported in this study, approximately 50 percent lower among AA men, could be attributable to differences in the etiology of BPH between AA and CA men. Several prior studies report racial differences in

the prevalence of genetic polymorphisms or circulating hormone levels associated with prostate growth and prostate cancer [11–14], raising the possibility of more rapid prostate enlargement among AA men. In addition, several prior studies have reported either no racial difference, or a small increased risk of clinical BPH among AA men [3–7]. For example, Kristal and colleagues prospectively examined data collected from almost 9,500 men (AA: n=215) without a history of severe BPH [3]. After controlling for baseline symptom scores, the prevalence of total BPH or severe BPH were higher among AA men (BPH: HR=1.25, 95% confidence interval: 0.93, 1.68; Severe BPH: HR=1.57, 95% confidence interval: 1.12, 2.19; respectively). Additionally, differences in blood testosterone levels were not associated with BPH across CA, AA, or Nigerian men [15], and Aoki and colleagues found little difference in the cellular or prostate tissue composition between AA and CA men [16].

Several factors related to healthcare access may contribute to the likelihood of a BPH diagnosis, and we found significant associations with age, insurance coverage, income, marital status, and education. A suggested race difference with marital status is consistent with prior research describing the importance of AA women in healthcare of AA men [17]. Interestingly, racial disparities in BPH decreased as household income increased, although the smaller sample size in the higher income categories may have limited our ability to detect a significant association. We have previously reported that these factors are also associated with prostate cancer screening practices, including the PSA test and DRE used to evaluate the potential risk of prostate cancer [10]. We did not control for prostate cancer screening practices in our analyses as these screening tests are routinely administered to men with suspected BPH. Indeed, almost all men reporting BPH also reported having a prior PSA test (78 percent) or a DRE (86 percent), and BPH was strongly associated with ever having a PSA test and a DRE (PSA: OR=4.2, 95% confidence interval: 3.6, 5.0); DRE: OR=4.0, 95% confidence interval: 3.4, 4.8, adjusted for age and race). However, we have found little difference with race in lifetime prostate cancer screening practices [10], and differential screening practices with respect to race are unlikely to explain observed racial differences in BPH diagnosis.

Alternatively, our results may suggest that AA men are less likely to report urinary tract symptoms to their physician, or perhaps physicians are less likely to query AA men regarding such symptoms. NHANES III ascertained the prevalence of LUTS between 1988 and 1994 using a standardized data collection protocol and found the prevalence of LUTS did not significantly differ between AA and CA men [6]. Similarly, LUTS prevalence was similar between AA and CA healthcare professionals participating in the Health Professionals Follow-up Study [5]. Interestingly, although AA men reported greater LUTS severity compared to CA men in the Olmsted County and Flint studies, AA men also reported less bother from these symptoms [4]. Although we did not have information on symptom prevalence or severity, any less concern for LUTS among AA men could be consistent with our data if this led to a decrease in the reporting of LUTS to a physician or otherwise decreased the likelihood of a BPH diagnosis among AA men. Further understanding the causes of these racial differences in BPH and the generalizability of our results across other low-income populations will require continued investigation.

Surgery following a BPH diagnosis is usually reserved for patients with severe symptoms. We found AA men were significantly more likely to receive surgical intervention, consistent with the Olmsted/Flint analysis describing more severe urinary tract symptoms among AA men [4]. Perhaps as expected, insurance coverage was associated with surgical intervention for both AA and CA men. However, the effect of marital status was more complicated, as marriage was positively associated with surgical intervention among AA men but negatively associated among CA men (p-interaction = 0.04). These data suggest that AA men may delay reporting symptoms to the physician until such symptoms become severe, and that marital status has a race-specific role in the severity of BPH at diagnosis.

CONCLUSION

Low-income AA men were significantly less likely to report ever being diagnosed by a physician with prostate enlargement or BPH. In contrast, among those reporting BPH surgical intervention typically reserved for severe BPH was more common among AA men. Contrary to our original hypothesis, a substantial racial disparity in BPH remained after adjusting for indices of healthcare access suggesting race and SES are independently associated with BPH.

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Table 1

Study population characteristics

Factor	Level	AA		CA	
		n	%	n	%
Age (years)	40 – < 45	5,092	29.1	1,154	26.0
	45 – < 50	4,561	26.0	1,018	23.0
	50 – < 55	3,658	20.9	797	18.0
	55 – < 60	2,018	11.5	596	13.4
	60 – < 65	1,163	6.6	425	9.6
	65 – < 70	594	3.4	247	5.6
	70 – < 75	292	1.7	132	3.0
	75 – < 80	136	0.8	66	1.5
Health Insurance*	None	8,719	50.0	2,173	49.1
	Military	596	3.4	126	2.9
	Public	4,838	27.7	1,455	32.9
	Private	3,079	17.7	632	14.3
	Other	206	1.2	37	0.8
Time since last doctor visit	0–5 months	11,686	67.5	3,284	74.5
	6–11 months	1,205	7.0	322	7.3
	12 months or more	4,434	25.6	803	18.2
Prior Diabetes	Yes	3,026	17.3	858	19.4
	No	14,477	82.7	3,573	80.6
Prior Heart Disease	Yes	1,082	6.2	652	14.7
	No	16,418	93.8	3,778	85.3
Education	< High School	6,132	35.0	1,444	32.6
	High School or GED	7,370	42.1	1,736	39.2
	Any college	4,008	22.9	1,254	28.3
Household Annual Income ($)	< $15,000	10,968	63.2	2,627	59.6
	$15,000 – < $25,000	3,849	22.2	936	21.2
	$25,000 – < $50,000	1,939	11.2	579	13.1
	$50,000 – < $100,000	505	2.9	221	5.0
	$100,000 or more	92	0.5	46	1.0

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		AA		CA	
Factor	**Level**	**n**	**%**	**n**	**%**
Marital Status	Currently Married	5040	28.8	1,815	40.9
	Single/Divorced/widowed	12,471	71.2	2,619	59.1
BPH	Yes	720	4.1	440	9.9
	No	16,794	95.9	3,995	90.1
Surgery For BPH	Yes	93	12.9	40	9.1
	No	626	87.1	400	90.9

Military coverage includes participants reporting a military source (e.g., CHAMPUS) and without private or publically funded insurance. Public insurance includes participants who have any Medicare or Medicaid coverage, but who do not have any private insurance coverage. Private coverage includes participants reporting any private insurance coverage, either alone or in combination with public or other coverage. Missing data includes insurance (n=88), last doctor visit (n=215), diabetes (n=15), heart disease (n=19), education (n=5), income (n=187), marital status (n=4).

Table 2

Association between BPH and socio-economic status and access to healthcare

		BPH					
Factor	**Level**	**n**	**%**	**OR***	**95% CI**	**OR****	**95% CI**
Health Insurance	None	368	3.4	1.0	Ref	1.0	Ref
	Military/Champus	57	7.9	1.99	1.48, 2.68	1.52	1.12, 2.06
	Public	468	7.4	1.20	1.03, 1.40	1.10	0.94, 1.29
	Private	251	6.8	1.55	1.30, 1.84	1.12	0.92, 1.36
	Other	6	2.5	0.62	0.27, 1.43	0.54	0.23, 1.24
Time since last doctor visit	12 months or more	102	2.0	1.0	Ref	1.0	Ref
	6–11 months	62	4.1	1.82	1.31, 2.52	1.73	1.24, 2.40
	0–5 months	987	6.6	2.44	1.98, 3.01	2.37	1.91, 2.94
Prior diagnoses	Diabetes (Ever)	293	7.5	1.15	0.99, 1.33	1.05	0.91, 1.22
	Heart disease (Ever)	177	10.2	1.16	0.97, 1.39	1.08	0.90, 1.30
Education	< High School	362	4.8	0.74	0.63, 0.86	0.77	0.66, 0.91
	High School or GED	409	4.5	1.0	Ref	1.0	Ref
	Any college	389	7.4	1.51	1.30, 1.75	1.41	1.21, 1.65
Household Income ($)	< $15,000	637	4.7	0.62	0.52, 0.74	0.80	0.66, 0.99
	$15,000 – < $25,000	245	5.1	0.70	0.57, 0.86	0.82	0.66, 1.02
	$25,000 – < $50,000	180	7.2	1.0	Ref	1.0	Ref
	$50,000 or more	83	9.6	1.16	0.87, 1.54	1.02	0.76, 1.37
Marital Status	Single/Divorced/widowed	627	4.2	1.0	Ref	1.0	Ref
	Currently Married	533	7.8	1.33	1.17, 1.51	1.23	1.07, 1.41
Race	Caucasian	440	9.9	1.0	Ref	1.0	Ref
	African-American	720	4.1	0.45	0.40, 0.51	0.49	0.43, 0.56

*Odds Ratios and 95% confidence intervals describing the association between each factor and a prior BPH diagnosis adjusted for age and race.

**Odds ratios and 95% confidence intervals adjusted for age, race, and other factors listed on table. n=21,517

Table 3

Racial differences in BPH by and age, socio-economic status, and healthcare access

		AA				CA					Race and BPH	
Factor	**Level**	**n**	**%**	**OR***	**95% CI**	**n**	**%**	**OR***	**95% CI**	**p-interaction****	**OR*****	**95% CI**
Age (years)	40 – < 45	59	1.2	0.17	0.12, 0.23	41	3.6	0.36	0.24, 0.54	< 0.01	0.34	0.23, 0.52
	45 – < 50	101	2.2	0.31	0.24, 0.41	63	6.2	0.59	0.41, 0.85		0.39	0.28, 0.54
	50 – < 55	140	3.8	0.52	0.41, 0.67	79	9.9	0.96	0.68, 1.37		0.41	0.31, 0.55
	55 – < 60	145	7.2	1.0	Ref	64	10.7	1.0	Ref		0.69	0.50, 0.95
	60 – < 65	103	8.9	1.20	0.92, 1.57	78	18.4	1.83	1.27, 2.63		0.42	0.30, 0.59
	65 – < 70	91	15.3	2.17	1.61, 2.92	50	20.2	1.89	1.24, 2.87		0.79	0.52, 1.20
	70 – < 75	52	17.8	2.64	1.84, 3.80	39	29.6	3.14	1.95, 5.05		0.58	0.34, 0.99
	75 – < 80	29	21.3	3.46	2.16, 5.54	26	39.4	4.82	2.72, 8.55		0.42	0.20, 0.86
Insurance	Any	487	5.6	1.07	0.90, 1.28	298	13.2	1.25	0.98, 1.58	0.71	0.50	0.42, 0.59
	None	229	2.6	1.0	Ref	139	6.4	1.0	Ref		0.49	0.39, 0.61
Time since last doctor visit	0–5 months	609	5.2	2.16	1.67, 2.79	378	11.5	2.67	1.79, 3.97	0.40	0.50	0.43, 0.57
	6–11 months	32	2.7	1.41	0.92, 2.16	30	9.3	2.38	1.39, 4.10		0.36	0.20, 0.62
	12 months or more	73	1.7	1.0	Ref	29	3.6	1.0	Ref		0.63	0.40, 1.00
Prior diagnoses	Diabetes (Ever)	188	6.2	1.06	0.89, 1.28	105	12.2	0.96	0.75, 1.23	0.40	0.52	0.40, 0.68
	Never	531	3.7	1.0	Ref	335	9.4	1.0	Ref		0.49	0.42, 0.57
	Heart disease (Ever)	81	7.5	1.12	0.87, 1.45	96	14.7	1.06	0.82, 1.39	0.53	0.52	0.38, 0.73
	Never	638	3.9	1.0	Ref	344	9.1	1.0	Ref		0.49	0.42, 0.56
Education	Less than High School	231	3.8	0.70	0.58, 0.86	131	9.1	0.87	0.67, 1.13	0.44	0.44	0.34, 0.55
	High School or GED	261	3.5	1.0	Ref	148	8.5	1.0	Ref		0.52	0.42, 0.66
	Any college	228	5.7	1.40	1.15, 1.71	161	12.8	1.46	1.13, 1.88		0.53	0.42, 0.66
Household Income ($)	< $15,000	391	3.6	0.70	0.55, 0.88	246	9.4	0.99	0.72, 1.38	0.08	0.45	0.38, 0.53
	$15,000 – < $25,000	153	4.0	0.71	0.55, 0.92	92	9.8	1.03	0.72 1.47		0.48	0.36, 0.64
	$25,000 – < $50,000	117	6.0	1.0	Ref	63	10.9	1.0	Ref		0.70	0.49, 1.00
	$50,000 or more	46	7.7	1.03	0.71, 1.51	37	13.9	1.01	0.64, 1.62		0.69	0.41, 1.14
Marital Status	Currently Married	314	6.2	1.28	1.08, 1.52	219	12.1	1.13	0.90, 1.41	0.06	0.56	0.46, 0.68
	Single/Divorced/widowed	406	3.3	1.0	Ref	221	8.4	1.0	Ref		0.45	0.37, 0.53

* ORs and 95% confidence intervals describing association between each factor and a prior BPH diagnosis stratified by race and adjusted for age (continuous) and other factors in Table, CA: n=4373; AA: n=17,144.

** p-interaction: evaluation of potential race differences in association between each factor and BPH. p-value derived for race by factor cross-product term in a model containing race and other factors in Table.

*** OR and 95% confidence interval describing the association between race and BPH within each level of each factor in a model containing other factors in Table.

Table 4

Association between Surgical Intervention for BPH among men reporting BPH and Indices of SES and Healthcare Access by Race

		All			AA			CA			
Factor	**Level**	**n**	**OR***	**95% CI**	**n**	**OR***	**95 % CI**	**n**	**OR***	**95% CI**	**p-int****
Age (years)	40 – < 60	45	0.48	0.31, 0.77	32	0.45	0.26, 0.78	13	0.60	0.25, 1.47	0.47
	60 – < 70	49	1.0	Ref	37	1.0	Ref	12	1.0	Ref	
	70 – < 80	39	1.93	1.18, 3.16	24	1.56	0.83, 2.92	15	2.83	1.21, 6.61	
Household Income ($)	≤ $25,000	110	1.68	0.97, 2.91	76	1.40	0.72, 2.73	34	2.15	0.78, 5.96	0.53
	> $25,000	22	1.0	ref	16	1.0	Ref	6	1.0	ref	
Education	< high school	60	1.23	0.78, 1.92	49	1.60	0.93, 2.76	11	0.61	0.26, 1.44	0.07
	High school or GED	42	1.0	Ref	27	1.0	Ref	15	1.0	Ref	
	Any college	31	0.85	0.51, 1.43	17	0.70	0.36, 1.38	14	1.01	0.44, 2.33	
Marital Status	Currently Married	69	1.19	0.80, 1.77	51	1.50	0.93, 2.43	18	0.66	0.32, 1.39	0.04
	Single/Divorced/widowed	64	1.0	Ref	42	1.0	Ref	22	1.0	ref	
Health Insurance	Any	113	2.11	1.23, 3.64	78	2.01	1.07, 3.78	35	2.65	0.90, 7.83	0.98
	None	19	1.0	Ref	14	1.0	Ref	5	1.0	Ref	
Last doctor visit	0–5 months	115	0.87	0.49, 1.57	81	0.97	0.47, 2.04	34	0.71	0.27, 1.89	0.54
	> 6 months	17	1.0	ref	11	1.0	ref	6	1.0	ref	

*ORs and 95% confidence intervals adjusted for race and other factors listed on table.

**p-interaction: evaluation of potential race differences in association between each factor and surgical intervention for BPH. p-value from cross-product term between race and each factor in a model containing race and other factors in table.