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Hospital Racial Composition and the Treatment of Localized Prostate Cancer

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Abstract

BACKGROUND—Racial differences in the treatment of men with localized prostate cancer remain poorly understood. This study examines whether hospital racial composition is associated with the type of treatment black and white men receive.

METHODS—The authors performed a retrospective cohort study of men in Surveillance, Epidemiology, and End Results-Medicare diagnosed with localized prostate cancer from 1995 to 2005 linked to hospital and census data. A total of 134,291 men were assigned to the hospital where they received care. Generalized estimating equations were used to determine whether hospital racial composition was associated with the receipt of definitive therapy and type of treatment.

RESULTS—Black men were less likely to receive radiation and/or prostatectomy compared with white men (55.5% vs 63.7%, $P < .001$) and, among those who received definitive therapy, were less likely to undergo prostatectomy (27.5% vs 31.9%, $P < .001$). The percentage of black men who received their care at hospitals with a high proportion of black patients was 48.0%, compared with only 5.2% of white patients who received care in this subset of hospitals. Men were significantly less likely to receive definitive treatment (odds ratio, 0.81; 95% confidence interval, 0.74–0.90) in hospitals with a high proportion of black patients compared with men seen at hospitals with fewer black patients. The association between hospital racial composition and treatment did not significantly differ by patient race.

CONCLUSIONS—Hospital racial composition is consistently associated with the care that men receive for localized prostate cancer. Better understanding of the factors that determine where men receive care is an important component in reducing variation in treatment.

Keywords

prostate cancer; disparities; race and ethnicity; hospital

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Prostate cancer is common and differentially affects black men. The expected incidence of prostate cancer in 2010 is 232 per 100,000 in black men compared with 146 per 100,000 in white men.[1] Although black men have higher prostate cancer mortality than white men, they are less likely to undergo definitive treatment for localized prostate cancer and far less likely to undergo prostatectomy when they are treated.[2–6] Differences in treatment patterns persist after adjusting for individual factors such as stage, grade, and socioeconomic status.[3,7–9]

Reasons for these racial differences in treatment are poorly understood and are unlikely to solely reflect patient preferences.[10] In the setting of clinical uncertainty where debate exists as to which treatment, if any, is optimal,[11] variation in care has been postulated to relate to the characteristics of the particular provider that a patient sees. By using data from the CaPSURE registry, Cooperberg and colleagues found that practice sites accounted for a relatively large proportion in the observed variation in treatment patterns.[12] Research further suggests large, unwarranted variation in treatment patterns between geographical areas.[13–17]

It is largely unknown whether racial differences in the treatment of localized prostate cancer reflect the finding that black and white men tend to receive care from a small fraction of US providers and hospitals.[18,19] Prior research has indicated that significant differences may exist between hospitals that treat large numbers of black patients versus those with predominantly white patient populations. Quality of hospital care,[20] care for myocardial infarction[19,21] and pneumonia,[19] mortality after acute myocardial infarction[22] and gastrointestinal bleeding,[23] use of cardiac procedures,[24] diffusion of medical technologies,[25] and surgery for nonsmall cell lung cancer[26] have been found to vary according to hospital racial composition.

Although the majority of prostate cancer treatment care takes place in the outpatient setting, evidence suggests that patients' care and physicians' practices are clustered around a particular hospital environment.[27,28] In the current paper, we study hospitals as a way to examine the type of institutional environment in which patients receive their care. In particular, we ask whether hospital racial composition helps explain treatment differences for localized prostate cancer between black and white men.

MATERIALS AND METHODS

Data Sources

The study was a retrospective, observational cohort study using registry and administrative claims data from the Surveillance, Epidemiology, and End Results (SEER)-Medicare database. The SEER-Medicare database links patient demographic and tumor-specific data collected by SEER cancer registries to longitudinal health care claims for Medicare enrollees.[29] Hospital characteristics were determined using Medicare and American Hospital Association data. The study was approved by the institutional review boards of the University of Pennsylvania, Philadelphia, Pennsylvania and Johns Hopkins University, Baltimore, Maryland.

Study Population

We identified men aged 65 years or older who were diagnosed with prostate cancer from 1995 to 2005 in 1 of the SEER sites. Data on patients with inadequate Medicare records (ie, those enrolled in health maintenance organizations or not enrolled in a fee-for-service Medicare program) were excluded. The sample was limited to 140,899 men with localized disease defined as American Joint Committee on Cancer stage 1 or 2 and, because of our focus on racial differences in treatment, to white and black men.

Assignment of Patients to Hospitals

Two methods using both inpatient and outpatient claims were used to assign patients to hospitals. The *most frequent hospital* method assigned patients to the hospital from which they had the most distinct visits and reflects the place where they tended to receive their hospital care. The *first hospital* method assigned patients to the first hospital where a patient was seen either on their date of diagnosis or the first hospital in which the patient was seen after the date of diagnosis. This method may indicate their point of entry into the health care system. Patients were excluded if they did not have a hospital visit in the year after diagnosis (n = 1824), or could not be matched to any hospital (n = 2664 for most frequent hospital method, 9191 for first hospital method) or to hospital racial composition data (n = 2120 for most frequent hospital method, 5377 for first hospital method). Overall, 134,291 men were matched using the most frequent hospital method (95.3% of all eligible patients), and 124,507 were matched via the first hospital method (88.3%). White patients were significantly more likely to match (95.9 vs 90.4%, $P < .001$). In 60% of cases, the most frequent hospital was the same hospital as the first hospital assignment.

Variables

Treatment—Prostatectomy and radiation therapy (including external beam and brachytherapy) were identified from Medicare inpatient, outpatient, and physician/supplier component files as described previously.[30,31] Patients who had codes for both prostatectomy and radiation (n = 2077 among men matched to most frequent hospital) were categorized as having a prostatectomy, as radiation was thought to be adjuvant. Prostatectomy and radiation were considered to be definitive therapy as per clinical guidelines, compared with men who received expectant management (primary androgen deprivation therapy and/ or active surveillance).[11]

Additional patient and tumor characteristics—Tumor grade corresponds to Gleason status and is categorized as well differentiated (grade 1), moderately differentiated (grade 2), poorly differentiated or undifferentiated (grade 3), and unknown (grade 4). Race was classified from both SEER and Medicare sources. Individuals were considered black if they were classified as black in either data source without a codesignation of Hispanic or Asian. Individuals were considered white if they were classified as white in either data file without a classification of black, Hispanic, or Asian. Marital status was classified as married, single, or unknown. US Census information was used as a proxy for individual measures of socioeconomic status. Men were linked to their census tract or if that was not available Zip Code to determine median income.

Hospital Characteristics

Hospital racial composition—Hospital racial composition was estimated from the self-reported race of Medicare beneficiaries hospitalized at each US acute care facility from 2002 to 2005. In accordance with prior literature[23–26] and because the associations with hospital racial composition have been found to be nonlinear, hospital racial composition was categorized as <8% black, 8% to 30% black, and >30% black.

Additional hospital characteristics—Hospital characteristics were based on 1999 American Hospital Association data. Hospital size was dichotomized as fewer/greater than 250 beds. Hospital type was categorized as government, nonprofit, for-profit, or missing. Hospitals were defined as either general medical/surgical hospitals or specialty hospitals, and hospitals were classified as major academic centers if they were a member of the Council of Teaching Hospitals. Medicaid composition was determined by dividing the total Medicaid days by the total facility inpatient days and grouped into quartiles based on the

sample distribution. The hospital prostate cancer case volume was defined as the total number of patients in our sample assigned to each hospital and, similarly, divided into quartiles.

Statistical Analyses

Generalized estimating equations were used to fit logistic regression models to examine the association between hospital racial composition and treatment, with hospital included as the unit of clustering. Whether a person received definitive therapy was first modeled on individual characteristics (race, age, comorbidity, socioeconomic status). The next model added hospital racial composition. The third model added other hospital characteristics. The final model included an interaction term between race and hospital racial composition. Models were built separately for the most frequent hospital and first hospital assignment methods. A similar modeling approach was used among the treated patients with the outcome of whether they received prostatectomy or radiation. The most frequent hospital assignment method is presented in the Results section. Sensitivity analyses were run with men younger than 76 years, because active treatment is less frequently recommended for older men. Analyses were carried out using Stata 11.1 (StataCorp, College Station, Tex). Hypothesis tests were 2-sided and used a type I error rate of 0.05.

RESULTS

Of the 134,291 patients who were assigned to the most frequent hospital, 9.7% were black and 90.3% were white (Table 1). Black men were less likely to receive definitive therapy (55.5% vs 63.7%, $P < .001$) and, among those who received definitive therapy, were less likely to undergo prostatectomy (27.5 vs 31.9%, $P < .001$). Black men had slightly lower age of diagnosis, lower levels of socioeconomic status, and higher rates of most comorbidities. Blacks were more likely to be seen at teaching hospitals and hospitals with a high volume of Medicaid days. Hospitals with a high percentage of black patients were used by only 5.2% of white men versus 48.0% of black men. Table 2 shows the characteristics of the 2530 hospitals included in the sample.

In model 1 of the multivariate regression analyses (Table 3), black men were significantly less likely to receive definitive treatment (odds ratio [OR], 0.61; 95% confidence interval [CI], 0.59–0.65). Older men, higher numbers of comorbidities, and not being married were associated with lower likelihoods of treatment. Increasing tumor grade and stage and increasing median income were associated with higher rates of active treatment. In model 2, patients who were seen at hospitals with the highest proportion of black patients (≥30%) were significantly less likely to undergo surgery than patients seen in hospitals with the lowest proportion of black patients (<8%) (OR, 0.81; 95% CI, 0.74–0.90). Including hospital racial composition did not alter the relationship between race and treatment. Hospital racial composition remained significant in model 3, which controlled for additional hospital factors. Higher rates of Medicaid patients were associated with lower odds of treatment (OR, 0.91; 95% CI, 0.84–0.98 for the highest quartile of Medicaid patients compared with the lowest). Higher volumes of prostate cancer patients were associated with higher odds of active treatment (OR, 1.55; 95% CI, 1.41– 1.70 for the highest quartile vs the lowest). The association between hospital racial composition and treatment did not differ by race of the patient (interaction term not significant). Similarly, among the men who received active treatment, black and older men, men with a high number of comorbidities, and unmarried men were significantly less likely to undergo a prostatectomy. Hospital racial composition was not significantly associated with odds of prostatectomy among men who underwent definitive treatment, and there were no significant interactions between patient race and hospital racial composition.

Models that examined treatment classifying patients to the first hospital they were seen at after prostate cancer diagnosis were qualitatively the same for models 1 and 2 as the results for the most frequent hospital assignment method. However, the inclusion of hospital characteristics led to model nonconvergence (model 3). In the subset of men younger than 76 years, results were similar (according to the most frequent hospital and first hospital assignment methods) to the results presented.

DISCUSSION

This research extends prior work on hospitals that treat a large proportion of black patients to cancer care and on racial variation in the treatment of prostate cancer. Nearly half of black men with prostate cancer tend to receive care from hospitals with a high proportion of black patients. In contrast, a relatively small proportion of white patients receive care from these same hospitals. There exist significant differences in the rates of definitive therapy between hospitals; hospitals with high proportions of black patients had significantly lower rates of definitive treatment, and this association did not differ by patient race. Among patients who were treated, there did not appear to be differences between rates of prostatectomy versus radiation by hospital racial composition.

Why might hospital racial composition be associated with treatment decisions? The first hospital assignment may indicate the point of entry into care, and the most frequent hospital represents the hospital where men tend to receive care. In both cases, hospital assignments are meant to reflect the different institutional environments in which care is received. The hospital assignments may denote the ways in which the health care delivery system—including hospitals and outpatient care—is clustered within a particular area.[27] The clustering of care may lead to distinct physician practice styles,[13] for example through the diffusion of innovation.[25,32,33] Variation in practice styles may be especially prevalent in the setting of prostate cancer's clinical uncertainty.[11,34]

In addition to reflecting distinct practice styles, hospital racial composition may indicate different levels of access to care. Significant differences have been identified among primary care physicians who tend to serve white and black patients,[18] with physicians who treat black patients reporting greater difficulty accessing high-quality specialty care. In our sample, hospitals that served high proportions of black patients also had higher rates of Medicaid admissions. Rates of Medicaid admissions, which tend to have lower reimbursements, along with rates of unpaid or charity care may affect health system finances, potentially causing negative spillover effects for Medicare beneficiaries. We found some evidence of this spillover effect with higher percentages of Medicaid admissions associated with lower rates of definitive treatment for the Medicare beneficiaries in our sample. We were, however, unable to adjust for hospital rates of unpaid or charity care.

Although access to specialty care in certain hospital systems and geographic locations may be limited, different hospital assignments likely reflect differing choices about where to seek care. It is possible that patients' preferences regarding choice of hospital and specialist may covary with their choice of treatment; for example, distrust in the medical system may underlie both decisions.[35] However, evidence suggests that patients rely heavily on their primary care physicians when deciding where to receive surgical[36,37] and cancer care.[36,38] Physician decisions regarding referrals to specific cancer providers remain poorly understood,[39] and it is uncertain the extent to which providers currently take into account how referral patterns may alter the eventual care their patients receive.

More broadly, hospital racial composition may be a marker for patient-level and neighborhood-level socioeconomic status and for residential racial segregation.[40,41] In

accordance with the results of prior studies,[2,16] income (at the neighborhood level) was independently associated with higher rates of definitive treatment. Hospital racial composition has been linked to residential racial segregation,[40] and residential segregation has been linked with differences in rates of prostate cancer treatment and higher rates of mortality among black men with prostate cancer (K. Armstrong et al, unpublished data). It is plausible that hospital racial composition may, in part, mediate treatment differences because of residential racial segregation.

Considering that lower rates of treatment for black men persisted after accounting for hospital racial composition, additional explanations are required to understand these differences. It is possible that patient knowledge, preferences, and decision-making styles with regard to prostate cancer may vary between white and black patients.[42] Moreover, these beliefs may change over time, helping to account for changing patterns of treatment observed in our data. Decision aids may improve patient knowledge regarding prostate cancer treatment, although their impact on treatment choice and racial differences in treatment require additional investigation.[43] Another plausible explanation for the various rates of treatment for black patients may be that physicians working within the same hospitals may help patients reach different treatment decisions. Supporting this, Denberg and colleagues used clinical vignettes to demonstrate that urologists made different recommendations regarding prostate cancer treatment for patients of different races and social vulnerability.[44] Additional variation may stem from black men being less likely than white men to have a consultation with a radiation oncologist before treatment.[45] Specialists are more likely to recommend their own treatment modality,[46,47] and men who were not seen by a radiation oncologist are less likely to receive radiation therapy.[45]

The observed clustering of patients according to race has important implications in the setting of health care reform. Recent reforms have focused on the relationships between outpatient physicians and hospitals, for example attempting to create accountable care organizations. In these arrangements, it is hoped that hospital-led care delivery and payment may lead to improved coordination and cost reductions.[48,49] The creation of accountable care organizations may reify existing differences in where white and black patients tend to receive care and exacerbate observed racial differences in treatment patterns.[50]

There are multiple limitations to the study. First, lower rates of treatment in patients with low risk of disease would not necessarily represent lower quality of care.[11] Second, patients were assigned to hospitals where they were likely to be evaluated or received care for their cancer. Because it was not always possible to definitively assign patients, multiple different methods were used, showing consistent results. Hospital matching was higher for white versus black patients, which may also affect our results. Third, we were unable to determine whether physician-level characteristics may mediate the observed relationships. Fourth, hospital volume measures were defined using Medicare beneficiaries, which miss younger patients who are more likely to undergo active treatment for prostate cancer. Prior studies have shown that urologist volume as calculated from Medicare data is highly correlated with total patient volume.[51] Fifth, because of the availability of data, hospital racial composition is determined using data starting in 2002, although it is unlikely that hospital racial composition would have significantly changed over the study period. Sixth, our models of first hospital assignments did not converge when adjusting for additional hospital-level features. Results based on logistic regression models (not adjusting for hospital clustering) were similar to the most frequent hospital assignment findings. Lastly, an area-level measure of income was used as a proxy for individual socioeconomic status.

In the setting of clinical uncertainty, where treatment for localized prostate cancer remains controversial, differences in treatment based solely on patient race warrant careful

examination. Institutional factors as measured by hospital racial composition are associated with the care that both black and white patients receive, and interventions that focus solely on patient-level factors are unlikely to eliminate differences in care. Black men are much more likely to receive care at a certain subset of hospitals, and patients seen at these hospitals are less likely to undergo definitive treatment. Research and policy should focus on not only how patients come to receive care at specific hospitals but also why these environments are associated with various types of care. Understanding both steps is crucial when designing interventions to reduce differences in care.

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Table 1

Patient Sociodemographic and Hospital Characteristics, Based on Most Frequent Hospital Assignment

Characteristic	All Patients		*P*	Treated Patients		*P*
	White	Black		White	Black	
No. (%)	121,227 (100)	13,064 (100)		77,234 (100)	7252 (100)	
Mean age, y	74.3	73.3	<.001	72.4	71.5	<.001
Comorbidity, No. (%)						
0	37,884 (31.3)	3074 (23.5)		25,527 (33.1)	1525 (21.0)	
1	35,957 (29.7)	3415 (26.1)		24,687 (32.0)	2212 (30.5)	
2+	47,386 (39.1)	6575 (50.3)	<.001	27,020 (35.0)	3515 (48.5)	<.001
Grade, No. (%)						
1	6471 (5.3)	532 (4.1)		2499 (3.2)	204 (2.8)	
2	78,744 (65.0)	8117 (62.1)		52,206 (67.6)	4683 (64.6)	
3	32,815 (27.1)	3983 (30.5)		21,217 (27.5)	2204 (30.4)	
4	3197 (2.6)	432 (3.3)	<.001	1312 (1.7)	161 (2.2)	<.001
Stage, No. (%)						
1	50,240 (41.4)	5548 (42.5)		30,450 (39.4)	3065 (42.3)	
2	79,987 (58.6)	7516 (57.5)	.024	46,784 (60.6)	4187 (57.7)	<.001
SEER site, No. (%)						
San Francisco	4845 (4.0)	500 (3.8)		3044 (3.9)	258 (3.6)	
Connecticut	11,256 (9.3)	653 (5.0)		7039 (9.1)	381 (5.3)	
Detroit	13,238 (10.9)	4057 (31.1)		8537 (11.1)	2259 (31.2)	
Hawaii	681 (0.6)	19 (0.2)		401 (0.5)	_[a]	
Iowa	10,548 (8.7)	101 (0.8)		6337 (8.2)	55 (0.8)	
New Mexico	4497 (3.7)	51 (0.4)		2661 (3.5)	31 (0.4)	
Seattle	9939 (8.2)	249 (1.9)		6402 (8.3)	131 (1.8)	
Utah	6714 (5.5)	21 (0.2)		4023 (5.2)	_[a]	
Atlanta	3932 (3.2)	1356 (10.4)		2947 (3.8)	813 (11.2)	
San Jose	3385 (2.8)	82 (0.6)		1956 (2.5)	47 (0.7)	
Los Angeles	9630 (7.9)	1045 (8.0)		6140 (8.0)	516 (7.1)	
Rural Georgia	277 (0.2)	131 (1.0)		183 (0.2)	67 (0.9)	

Characteristic	All Patients		*P*	Treated Patients		*P*
	White	Black		White	Black	
Greater California	15,230 (12.6)	558 (4.3)		9828 (12.7)	336 (4.6)	
Kentucky	6481 (5.4)	434 (3.3)		4077 (5.3)	250 (3.45)	
Louisiana	6016 (5.0)	1893 (14.5)		3703 (4.8)	906 (12.5)	
New Jersey	14,558 (12.0)	1914 (14.65)	<.001	9956 (12.9)	1180 (16.3)	<.001
Diagnosis year, No. (%)						
1995	6968 (5.8)	661 (5.1)		4052 (5.3)	346 (4.8)	
1996	6680 (5.5)	697 (5.3)		3965 (5.1)	376 (5.2)	
1997	6900 (5.7)	764 (5.9)		4201 (5.4)	424 (5.9)	
1998	6587 (5.4)	707 (5.4)		4083 (5.3)	372 (5.1)	
1999	7148 (5.9)	711 (5.4)		4580 (5.9)	382 (5.3)	
2000	14,042 (11.6)	1453 (11.1)		9061 (11.7)	768 (10.6)	
2001	15,357 (12.7)	1622 (12.4)		9861 (12.8)	871 (12.0)	
2002	16,209 (13.4)	1771 (13.6))		10,500 (13.6)	983 (13.6)	
2003	14,709 (12.1)	1627 (12.5)		9503 (12.3)	943 (13.0)	
2004	13,889 (11.5)	1627 (12.5)		9153 (11.9)	915 (12.6)	
2005	12,738 (10.5)	1424 (10.9)	.001	8275 (10.7)	872 (12.0)	<.001
Marital status, No. (%)						
Married	86,886 (71.7)	7099 (54.3)		59,779 (77.4)	4411 (60.8)	
Unmarried	22,494 (18.6)	4771 (36.5)		12,547 (16.3)	2374 (32.7)	
Unknown	11,847 (9.8)	1194 (9.1)	<.001	4908 (6.4)	467 (6.4)	<.001
Income quartile, No. (%)						
1 (lowest)	25,857 (21.3)	7720 (59.1)		14,748 (19.1)	3982 (54.9)	
2	30,818 (25.4)	2752 (21.1)		19,279 (25.0)	1620 (22.3)	
3	31,936 (26.3)	1637 (12.5)		21,022 (27.2)	1052 (14.5)	
4 (highest)	32,616 (26.9)	955 (7.3)	<.001	22,185 (28.7)	598 (8.3)	<.001
Treatment, No. (%)						
None	43,993 (36.3)	5812 (44.5)		–	–	
Prostatectomy	24,620 (20.3)	1992 (15.3)		24,620 (31.9)	1992 (27.5)	
Radiation	52,614 (43.4)	5260 (40.3)	<.001	52,614 (68.1)	5260 (72.5)	<.001
Hospital racial composition, No. (%)						

Characteristic	All Patients		*P*	Treated Patients		*P*
	White	Black		White	Black	
<8% black	80,372 (66.3)	1832 (14.0)		50,430 (65.3)	1097 (15.1)	
8% to <30% black	34,564 (28.5)	4963 (38.0)		22,842 (29.6)	2840 (39.2)	
30%+ black	6291 (5.2)	6269 (48.0)	<.001	3962 (5.1)	3315 (45.7)	<.001
Hospital ownership, No. (%)						
Government	12,528 (10.3)	1360 (10.4)		7552 (9.8)	613 (8.5)	
Not for profit	89,535 (73.9)	8687 (66.5)		57,727 (74.7)	4974 (68.6)	
For profit	10,415 (8.6)	1066 (8.2)		6342 (8.2)	497 (6.9)	
Unknown	8749 (7.2)	1951 (14.9)	<.001	5613 (7.3)	1168 (16.1)	<.001
Hospital type, No. (%)						
General	73,392 (60.5)	5653 (43.3)		70,390 (91.1)	5981 (82.5)	
Specialty	23,515 (19.4)	3608 (27.6)		959 (1.2)	82 (1.1)	
Unknown	24,320 (20.1)	3803 (29.1)	<.001	5885 (7.6)	1189 (16.4)	<.001
Hospital bed size, No. (%)						
<250 beds	73,392 (60.5)	5653 (43.3)		45,667 (59.1)	3051 (42.1)	
250+	23,515 (19.4)	3608 (27.6)		16,204 (21.0)	2100 (29.0)	
Unknown	24,320 (20.1)	3803 (29.1)	<.001	15,363 (19.9)	2101 (29.0)	<.001
Teaching status, No. (%)						
Not teaching	90,059 (74.3)	6727 (51.5)		56,259 (72.8)	3609 (49.8)	
Teaching	22,404 (18.5)	4386 (33.6)		15,354 (19.9)	2475 (34.1)	
Unknown	8764 (7.2)	1951 (14.9)	<.001	5621 (7.3)	1168 (16.1)	<.001
Hospital % Medicaid, No. (%)						
1 (lowest)	28,448 (23.5)	2910 (22.3)		19,093 (24.7)	1748 (24.1)	
2	18,601 (23.6)	1924 (14.7)		17,889 (23.2)	1063 (14.7)	
3	27,859 (22.3)	2983 (22.8)		17,668 (22.9)	1563 (21.6)	
4 (highest)	27,570 (22.7)	3296 (25.2)		16,971 (22.0)	1710 (23.6)	
Unknown	8749 (7.2)	1951 (14.9)	<.001	5613 (7.3)	1168 (16.1)	<.001
Prostate cancer volume, No. (%)						
1 (lowest)	39,263 (25.0)	3374 (25.8)		17,577 (22.8)	1578 (21.8)	
2	30,560 (25.2)	3148 (24.1)		19,517 (25.3)	1754 (24.2)	
3	30,991 (25.6)	2425 (18.6)		20,277 (26.3)	1476 (20.4)	

Characteristic	All Patients		*P*	Treated Patients		*P*
	White	Black		White	Black	
4 (highest)	29,413 (24.3)	4117 (31.5)	<.001	19,863 (25.7)	2444 (33.7)	<.001

Abbreviation: SEER, Surveillance, Epidemiology, and End Results

[a]Cell values suppressed due to small sample size.

Table 2

Characteristics of Hospitals According to Hospital Racial Composition

Characteristic	Hospital Racial Composition (% Black), No. (%)			*P*
	<8%	8% to <30%	30%+	
Hospitals	1592	659	279	
Ownership				
Government	205 (12.9)	113 (17.2)	70 (25.1)	
Not for profit	956 (60.1)	370 (56.2)	130 (46.6)	
For profit	202 (12.7)	128 (19.4)	47 (16.9)	
Unknown	229 (14.4)	48 (7.3)	32 (11.5)	<.001
Hospital type				
General	1348 (84.7)	592 (89.8)	245 (87.8)	
Specialty	10 (0.6)	7 (1.1)	0 (0)	
Unknown	234 (14.7)	60 (9.1)	34 (12.2)	.003
Hospital bed size				
<250 beds	1089 (68.4)	427 (64.8)	165 (59.1)	
250+	75 (4.7)	97 (14.7)	33 (11.8)	
Unknown	428 (26.9)	135 (20.5)	81 (29.0)	<.001
Teaching status				
Not teaching	1294 (81.3)	510 (77.4)	186 (66.7)	
Teaching	67 (4.2)	100 (15.2)	61 (21.9)	
Unknown	231 (14.5)	49 (7.4)	32 (11.5)	<.001
Mean % Medicaid	15.5	15.7	21.6	<.001
Mean prostate cancer volume	51.6	60.7	45	.198

Table 3

Odds Ratio of Treatment, Based on Most Frequent Hospital Assignment

Characteristic	Odds Ratio of Active Treatment, Either Prostatectomy or Radiation N=134,291			Odds Ratio of Prostatectomy Among Men Actively Treated, N=84,486		
	Model 1	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
Age	0.85 (0.85-0.85)	0.85 (0.85-0.85)	0.85 (0.85-0.85)	0.83 (0.82–0.83)	0.83 (0.82–0.83)	0.83 (0.82–0.83)
Comorbidity						
0	1.00	1.00	1.00	1.00	1.00	1.00
1	1.30 (1.26–1.35)	1.30 (1.26–1.35)	1.31 (1.27–1.35)	0.99 (0.95–1.02)	0.99 (0.95–1.03)	0.99 (0.95–1.02)
2+	0.94 (0.91–0.97)	0.94 (0.91–0.97)	0.94 (0.91–0.97)	0.86 (0.82–0.89)	0.86 (0.82–0.89)	0.86 (0.83–0.90)
Grade						
1	1.00	1.00	1.00	1.00	1.00	1.00
2	2.76 (2.61–2.92)	2.76 (2.61–2.93)	2.77 (2.62–2.94)	1.39 (1.26–1.52)	1.39 (1.26–1.52)	1.38 (1.25–1.51)
3	3.32 (3.12–3.53)	3.32 (3.12–3.53)	3.35 (3.15–3.56)	1.71 (1.55–1.89)	1.71 (1.55–1.89)	1.71 (1.55–1.88)
4	1.08 (0.98–1.18)	1.08 (0.98–1.18)	1.08 (0.98–1.18)	0.65 (0.55–0.78)	0.65 (0.55–0.78)	0.66 (0.55–0.78)
Tumor stage						
1	1.00	1.00	1.00	1.00	1.00	1.00
2	1.32 (1.291.36)	1.32 (1.29–1.36)	1.33 (1.30–1.37)	1.51 (1.46–1.56)	1.51 (1.46–1.56)	1.50 (1.45–1.55)
Income quartile						
1 (lowest)	1.00	1.00	1.00	1.00	1.00	1.00
2	1.20 (1.16–1.25)	1.20 (1.15–1.24)	1.19 (1.15–1.24)	1.02 (0.97–1.08)	1.02 (0.97–1.08)	1.02 (0.97–1.07)
3	1.32 (1.27–1.37)	1.32 (1.26–1.37)	1.30 (1.25–1.36)	1.04 (0.99–1.10)	1.04 (0.99–1.10)	1.04 (0.98–1.09)
4 (highest)	1.40 (1.34–1.47)	1.40 (1.34–1.46)	1.38 (1.32–1.44)	1.03 (0.98–1.10)	1.03 (0.98–1.10)	1.02 (0.97–1.07)
Marital status						
Married	1.00	1.00	1.00	1.00	1.00	1.00
Not married	0.68 (0.66–0.70)	0.68 (0.66–0.70)	0.68 (0.65–0.70)	0.82 (0.78–0.86)	0.82 (0.78–0.86)	0.82 (0.79–0.86)
Unknown	0.34 (0.33–0.36)	0.34 (0.33–0.36)	0.34 (0.33–0.36)	0.56 (0.52–0.60)	0.56 (0.52–0.60)	0.57 (0.52–0.61)
Race						
White	1.00	1.00	1.00	1.00	1.00	1.00
Black	0.61 (0.59–0.65)	0.63 (0.60–0.66)	0.62 (0.59–0.65)	0.88 (0.82–0.94)	0.87 (0.82–0.94)	0.87 (0.82–0.93)
Hospital racial composition % black						

Characteristic	Odds Ratio of Active Treatment, Either Prostatectomy or Radiation N=134,291			Odds Ratio of Prostatectomy Among Men Actively Treated, N=84,486		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
<8		1.00	1.00		1.00	1.00
8 to <30		1.00 (0.94–1.07)	0.98 (0.92–1.04)		1.06 (0.96–1.17)	0.94 (0.85–1.04)
≥30		0.81 (0.74–0.90)	0.83 (0.75–0.92)		1.12 (0.96–1.30)	0.97 (0.82–1.13)
Hospital ownership						
Government			1.00			1.00
Not for profit			1.06 (0.99–1.14)			1.15 (1.02–1.29)
For profit			1.10 (1.00–1.21)			1.29 (1.11–1.51)
Unknown			1.17 (0.32–4.26)			0.58 (0.08–4.01)
Hospital type						
General			1.00			1.00
Specialty			1.06 (0.82–1.37)			1.83 (1.26–2.67)
Unknown			0.81 (0.56–1.16)			1.16 (0.62–2.16)
Bed size						
<250 beds			1.00			1.00
250+			1.05 (0.95–1.15)			1.30 (1.12–1.50)
Unknown			1.01 (0.94–1.08)			1.04 (0.93–1.16)
Teaching status						
Not teaching			1.00			1.00
Teaching			1.08 (0.99–1.18)			1.32 (1.15–1.52)
Unknown			1.04 (0.31–3.57)			1.50 (0.24–9.25)
Percent Medicaid[a]						
1 (lowest)			1.00			1.00
2			0.87 (0.81–0.94)			0.81 (0.71–0.91)
3			0.91 (0.84–0.98)			1.04 (0.92–1.18)
4 (highest)			0.91 (0.84–0.98)			0.97 (0.86–1.10)
Prostate cancer volume						
1 (lowest)			1.00			1.00
2			1.23 (1.16–1.30)			1.22 (1.10–1.34)
3			1.35 (1.25–1.45)			1.19 (1.06–1.34)

Characteristic	Odds Ratio of Active Treatment, Either Prostatectomy or Radiation N=134,291			Odds Ratio of Prostatectomy Among Men Actively Treated, N=84,486		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
4 (highest)			1.55 (1.41–1.70)			1.49 (1.28–1.73)

All models were additionally adjusted for Surveillance, Epidemiology, and End Results site and year of diagnosis

[a]Unknown category omitted due to collinearity.