Original Article

Prostate Cancer Treatment for Economically Disadvantaged Men

A Comparison of County Hospitals and Private Providers

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BACKGROUND. The authors compared the types of treatments prostate cancer patients received from county hospitals and private providers as part of a statewide public assistance program. **METHODS.** This was a cohort study of 559 men enrolled in a state-funded program for low-income patients known as Improving Access, Counseling, and Treatment for Californians With Prostate Cancer (IMPACT). Multinomial regression was used to compare types of treatments patients received from different providers. **RESULTS.** Between 2001 and 2006, 315 (56%) participants received treatment from county hospitals and 244 (44%) from private providers. There were no significant between-group differences with respect to age ($P = .22$), enrollment year ($P = .49$), Charlson comorbidity index ($P = .47$), Gleason sum ($P = .33$), clinical T stage ($P = .36$), prostate-specific antigen ($P = .39$), or D'Amico risk criteria ($P = .45$). Participants treated by private providers were more likely than those treated in county hospitals to be white (35% vs 10%, $P < .01$) and less likely to undergo surgery (29% vs 54%, $P < .01$). Multinomial regression analyses showed that participants treated by private providers were nearly 2½ times more likely than those treated by public providers to receive radiotherapy (odds ratio [OR], 2.36; 95% confidence interval [CI], 1.37-4.07) and >4½ times more likely to receive primary androgen deprivation (OR, 4.71; 95% CI, 2.15-10.36) than surgery. **CONCLUSIONS.** In this economically disadvantaged cohort, prostate cancer treatments differed significantly between county hospitals and private providers. These data reveal substantial variations in treatment patterns between different types of healthcare institutions that—given the implications for health policy and quality of care—merit further scrutiny. ***Cancer*** **2010;116:1378–84.** © *2010 American Cancer Society.*

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As the most commonly diagnosed noncutaneous cancer and the second leading cause of cancer death among US men, prostate cancer imposes a substantial burden on public health.[1,2] Although the overwhelming majority of patients now present with localized disease, there is no consensus as to the most effective form of treatment, and patients face a daunting array of choices in the absence of robust comparative data on efficacy.[3] Moreover, the most common treatmentsÅsurgery, radiation, and androgen deprivationÅare each associated with distinct morbidities that may significantly diminish quality of life and persist for years after treatment.[4,5]

If different treatments for localized prostate cancer are associated with disparate morbidities, and no single modality has as yet proved more optimal than the others, the question arises as to what factors drive treatment selection. Although life expectancy, coexisting morbidities, cancer severity, and patient preferences may account in part for treatment choice,[6] variables that determine treatment among patients of comparable health status, tumor grade, and tumor stage remain unclear.

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One potential variable is the type of healthcare facility at which a prostate cancer patient receives treatment. Different types of facilities might provide different environmental cues, which in turn might influence treatment choice. Although healthcare venues may be described by a host of features, a major distinguishing characteristic is public versus private; in contrast to private facilities, public ones such as county hospitals are typically funded by state or city governments to provide care for underserved populations. Moreover, because distribution of public funds is involved, differences in treatment between these types of institutions would have potential ramifications for health policy.

Little is known about potential differences in prostate cancer treatments provided in different healthcare venues. Comparisons of prostate cancer treatment in private versus public institutions constitute a clinically relevant and feasible approach to investigating this topic. Therefore, we compared the types of treatments prostate cancer patients received from county hospitals and private providers as part of a statewide public assistance program.

MATERIALS AND METHODS

Cohort Characteristics

Improving Access, Counseling, and Treatment for Californians With Prostate Cancer (IMPACT) is a state-funded program that provides prostate cancer treatment for lower income men. IMPACT program eligibility requirements include California residency, biopsy-proven prostate cancer, lack of health insurance, and a household income at or below 200% of the federal poverty level. Patients enrolled in IMPACT receive care through a network of publicly funded county hospitals and private providers. Treating physicians were remunerated by the state of California through the IMPACT program. Payments were the same regardless of whether men were treated at public or private institutions.

As part of an established research study, we collected extensive demographic, clinical, and provider information for all men enrolled in IMPACT from its inception in 2001 through June 2006. During this period, 772 men enrolled in IMPACT. We used all available clinical data—including clinician notes, laboratory studies, and radiological results—to classify each participant as having localized/locoregional or metastatic prostate cancer at the time of diagnosis.

Because patients with metastatic disease at initial presentation usually receive primary androgen deprivation as standard of care therapy, we excluded those with metastatic disease from analysis. We used the pretreatment prostate-specific antigen (PSA) level, clinical T stage, and Gleason sum to categorize each participant's cancer as low-, intermediate-, or high-risk based on the classification described by D'Amico et al, a pretreatment risk stratification instrument designed to predict the likelihood of recurrence after initial treatment.[7]

We categorized provider type as public county hospital versus private provider based on the initial facility at which participants received their treatment. County hospitals are full-service facilities whose infrastructure is funded by the state of California. Thirteen county facilities contracted with IMPACT. IMPACT contracts with multidisciplinary private practice physicians throughout California who provide prostate cancer treatment care to IMPACT enrollees within their own communities. The primary variable influencing provider type was geography; under IMPACT staff guidance, patients were directed to facilities located within their communities. Most county patients were referred to IMPACT by staff at the county facilities and remained within the county facility for continuity of care. Private patients were matched with providers in their communities with the appropriate lingual resources to communicate effectively with patients and family members. All patients received standardized education provided by IMPACT support staff regardless of facility type.

Statistics

We compared demographic and clinical characteristics between the county facility and private facility patients using chi-square and *t* test analyses. We also conducted multinomial regression with treatment type (expectant management, surgery, radiation, or androgen deprivation therapy) as the categorical outcome variable and type of facility as the dichotomous exposure variable. On the basis of the empirical data, we chose surgery as the referent treatment category and public as the referent facility category. From these regressions, we calculated odds ratios and 95% confidence intervals for each of the 3 treatment types at private versus public facilities.

We used 2 logistic regression models. In the first model (Model 1), we chose a priori to adjust for the following variables: year of program enrollment, age at enrollment ($\leq$50, 51-60, 61-70, and $>$70 years), race (white, Hispanic, black, and other), Charlson comorbidity index (0, 1, and $\geq$2), Gleason sum (2-4, 5, 6, 7, and 8-10), clinical T stage (T1, T2, T3, and T4), PSA ($<$4, 4-

10, and >10 ng/mL), and D'Amico risk category. In the second model (Model 2), we adjusted only for race, because it was the only variable in our preliminary analyses to differ significantly between the county and private groups (Table 1).

To account for potential residual confounding because of aggressiveness of disease, we conducted sensitivity analyses with 4 different subsets of the data: 1) excluding T3 and T4 patients; 2) excluding Gleason 8-10 patients; 3) excluding D'Amico high-risk patients; and 4) including only D'Amico low-risk patients. *P* values <.05 were considered statistically significant. All analyses were conducted with SAS 9.1 (SAS Institute, Cary, NC).

RESULTS

Patient Characteristics

The initial analytic cohort for this study numbered 559 men (72% of all IMPACT enrollees) who had localized or locally advanced prostate cancer at initial presentation. Mean ± standard deviation (SD) age at diagnosis was 61 ± 7 years, and the median age was 61 (range, 42-88) years. About half (49%) were Hispanic, and a plurality (43%) underwent surgery. Between 2001 and 2006, care was provided by county hospitals for 315 (56%) enrollees and by private providers for 244 (44%) enrollees.

There were no significant between-group differences with respect to mean ± SD age at diagnosis: 60.9 ± 7.4 years for county hospitals and 60.1 ± 7.0 for private providers ($P = .22$). There were also no significant differences for year of enrollment, age at enrollment, Charlson comorbidity index, Gleason grade, clinical T stage, PSA, or D'Amico risk criteria (Table 1). However, compared with county hospital patients, private patients were 3-fold more likely to be white ($P < .01$) and half as likely to undergo surgery ($P < .01$) (Table 1).

Treatment Patterns

In multinomial regression analysis adjusting for race, year of enrollment, age at enrollment, Charlson comorbidity index, Gleason grade of tumor, clinical T stage, pretreatment PSA, and D'Amico risk stratification, private patients were $2\frac{1}{2}\times$ and $4\frac{1}{2}\times$ more likely than county patients to receive radiotherapy or primary androgen deprivation, respectively, than surgery (Table 2, Model 1A).

Because of missing covariate data, only 375 of the 559 enrolled participants were included in the regression analysis. We compared the characteristics of the 375 who were included with the 184 who were not, and found that those who were included had enrolled during the earlier years of the program ($P < .001$), had lower D'Amico risk stratifications ($P = .002$), and were more likely to have undergone surgery and less likely to be undergoing expectant management ($P < .001$). There were no differences in facility type, age at enrollment, race, Charlson comorbidity index, Gleason sum, clinical T stage, or pretreatment PSA (data not shown).

Our results did not change after excluding men with higher T stage or higher Gleason sum (Table 2, Models 1B and C). Among men with low- or intermediate-risk disease, private patients were 2× and 15× more likely than county patients to receive radiotherapy or androgen deprivation, respectively, than surgery (Table 2, Model 1D). Among those with low-risk disease (none of whom had received primary androgen deprivation therapy in this cohort), there were no significant differences between private and county patients, although there was a trend toward increased likelihood of radiotherapy among private patients (Table 2, Model 1E).

Repetition of the analyses adjusting for race/ethnicity alone—the only variable to differ significantly between the county and private groups—produced similar results, but the effect estimates were more precise, owing to the increased analytic sample size (Table 2, Models 2A-D). However, patients with private providers were twice as likely as county patients to receive expectant management as surgery, except among those with low-risk disease (Table 2, Model 2E).

DISCUSSION

This is the first study to compare prostate cancer treatments between private and public institutions, and it reveals a novel variable influencing treatment choice: healthcare venue. In this cohort, men treated at county hospitals were significantly more likely to undergo surgery, whereas those treated by private providers were more likely to undergo radiotherapy or primary androgen deprivation, irrespective of age, race, comorbidity status, clinical tumor stage, Gleason sum, and D'Amico risk stratification. Men at private providers also had a nonsignificant trend toward a greater likelihood of expectant management.

Optimization of quality of life after diagnosis and treatment, a key principle of cancer survivorship, is emerging as an increasingly important aspect of improving the delivery of cancer care.[8] Treatment morbidity has become a focal point for survivorship study in localized prostate cancer, particularly because the

Table 1. Characteristics of Participants Stratified by Public (County Hospitals) and Private Facilities in the Improving Access, Counseling, and Treatment for Californians With Prostate Cancer (IMPACT) Program, 2001 to 2006

Characteristics	Total, No. (%)	Public, No. (%)	Private, No. (%)	*P*
Year of enrollment	559	315 (56)	244 (44)	
2001	30 (5)	16 (5)	14 (6)	.49
2002	142 (25)	82 (26)	60 (25)	
2003	164 (29)	95 (30)	69 (28)	
2004	63 (11)	28 (9)	35 (14)	
2005	72 (13)	42 (13)	30 (12)	
2006	88 (16)	52 (17)	36 (15)	
Age at enrollment, y	559	315 (56)	244 (44)	
≤50	31 (5)	18 (6)	13 (5)	.63
51-60	226 (40)	121 (38)	105 (43)	
61-70	246 (44)	141 (45)	105 (43)	
>70	56 (10)	35 (11)	21 (9)	
Race	559	315 (56)	244 (44)	
Hispanic	275 (49)	174 (55)	101 (41)	<.01
Non-Hispanic, white	114 (20)	30 (10)	84 (34)	
African American	101 (18)	63 (20)	38 (16)	
Other	69 (12)	48 (15)	21 (9)	
Charlson comorbidity count	461	259 (56)	207 (44)	
0	264 (58)	142 (55)	122 (60)	.47
1	86 (19)	52 (20)	34 (17)	
≥2	111 (24)	65 (25)	46 (23)	
Gleason sum	480	274 (57)	206 (43)	
2-4	21 (4)	14 (5)	7 (3)	.33
5	22 (5)	16 (6)	6 (3)	
6	201 (42)	111 (41)	90 (44)	
7	138 (29)	82 (30)	56 (27)	
8-10	98 (20)	51 (19)	47 (23)	
Clinical T stage	537	305 (57)	232 (43)	
T1	283 (53)	166 (54)	117 (50)	.36
T2	195 (36)	111 (36)	84 (36)	
T3	41 (8)	18 (6)	23 (10)	
T4	18 (3)	10 (3)	8 (3)	
Pretreatment PSA, ng/mL	490	278 (57)	212 (43)	
<4	30 (6)	18 (6)	12 (6)	.39
4-10	214 (44)	128 (46)	86 (40)	
>10	246 (50)	132 (47)	114 (54)	
D'Amico risk stratification	507	288 (57)	219 (43)	
Low	126 (25)	76 (26)	50 (22)	.45
Intermediate	167 (33)	97 (34)	70 (32)	
High	214 (42)	115 (40)	99 (45)	
Initial treatment	551	309 (56)	242 (44)	
Surgery	238 (43)	167 (54)	71 (29)	<.01
External beam radiotherapy	167 (30)	85 (28)	82 (34)	
Brachytherapy	13 (2)	4 (1)	9 (4)	
Expectant management	35 (6)	18 (6)	17 (7)	
Androgen deprivation therapy	98 (18)	35 (11)	63 (26)	

PSA indicates prostate-specific antigen.

Table 2. Likelihood of Receiving Expectant Management, Radiotherapy, or Androgen Deprivation Therapy Over Surgery Among Private Providers Compared With County Hospitals (Referent) in the Improving Access, Counseling, and Treatment for Californians With Prostate Cancer (IMPACT) Program, 2001 to 2006

Models	Surgery	Expectant Management	Radiotherapy	Androgen Deprivation
Model 1[a]				
1A. All stages and grades (n=375)				
OR (95% CI)	Ref	2.11 (0.55-8.12)	2.36 (1.37-4.07)	4.71 (2.15-10.36)
P		.28	<.01	<.01
1B. Excluding T3 & T4 (n=329)				
OR (95% CI)	Ref	2.12 (0.49-9.14)	2.14 (1.21-3.79)	6.61 (2.63-16.58)
P		.31	<.01	<.01
1C. Excluding Gleason 8-10 (n=295)				
OR (95% CI)	Ref	2.22 (0.57-8.62)	2.51 (1.38-4.59)	5.26 (1.91-14.51)
P		.25	<.01	.01
1D. Excluding high risk (n=227)				
OR (95% CI)	Ref	2.29 (0.52-10.05)	2.23 (1.16-4.31)	14.72 (1.55-140.2)
P		.27	.02	.02
1E. Excluding intermediate and high risk (n=95)				
OR (95% CI)	Ref	1.21 (0.21-6.88)	1.74 (0.65-4.65)	N/A
P		.83	.27	
Model 2[b]				
2A. All stages and grades (n=551)				
OR (95% CI)	Ref	2.08 (0.97-4.46)	2.38 (1.56-3.64)	4.52 (2.69-7.60)
P		.06	<.01	<.01
2B. Excluding T3 & T4 (n=471)				
OR (95% CI)	Ref	2.17 (0.88-5.31)	2.33 (1.49-3.66)	6.00 (3.24-11.09)
P		.09	<.01	<.01
2C. Excluding Gleason 8-10 (n=453)				
OR (95% CI)	Ref	2.37 (1.08-5.20)	2.37 (1.49-3.77)	4.92 (2.67-9.05)
P		.03	<.01	<.01
2D. Excluding high risk (n=339)				
OR (95% CI)	Ref	2.50 (1.08-5.83)	2.52 (1.51-4.22)	9.69 (3.02-31.11)
P		.03	<.01	<.01
2E. Excluding intermediate and high risk (n=108)				
OR (95% CI)	Ref	0.74 (0.19-2.90)	1.91 (0.78-4.67)	N/A
P		.67	.16	

OR indicates odds ratio; CI, confidence interval; Ref, referent; N/A, not applicable.
[a]Adjusted for race, year of enrollment, age at enrollment, Charlson comorbidity count, Gleason grade, clinical T stage, pretreatment prostate-specific antigen, and D'Amico risk stratification; not all participants were included due to missing values for these covariates.
[b]Adjusted for race only.

natural history of this disease can be quite prolonged, even in the absence of aggressive treatment.[9] Potential morbidities vary considerably by modality. Surgery is associated with urinary incontinence and erectile dysfunction; radiation with urinary and bowel irritation and erectile dysfunction; and androgen deprivation with hot flashes, depression, erectile dysfunction, decreased muscle mass, and increased risks of cardiovascular disease and metabolic syndrome.[4,5,10-12] In light of these different morbidity patterns, and the distinct impact each has on quality of life, prostate cancer survivorship studies should encompass a greater understanding of treatment planning, including identification of factors influencing treatment selection among patients with localized disease.

Although surgery was the most common type of treatment overall in our cohort, the disparity with which it was applied across the 2 types of care venues is striking: more than half of county hospital patients underwent surgery, compared with less than a third of private patients. A likely explanation for this imparity is that the initial provider in the county hospitals was always a urologist, whereas at the private venues the initial providers were a mix of urologists, radiation oncologists, and medical oncologists. Provider type is a strong predictor of treatment choice for localized prostate cancer. Patients who

identify a urologist as the last physician seen before selecting treatment are significantly more likely to choose surgery than those who saw a radiation oncologist.[13] Not surprisingly, provider advice for treatment of localized prostate cancer is shaped largely by specialty, with urologists more likely to recommend surgery and radiation oncologists radiation for patients with similar disease risk stratifications.[14] Because the type of information patients receive from their physicians influences treatment choice more than individual patient preferences,[6,13] it is not surprising that county hospital patients were more likely to undergo surgery, because initially they were under the care of providers more likely to recommend surgery. It is less clear why the adjusted likelihood of androgen deprivation was higher than radiation among private patients. Notably, although the magnitudes of these associations were highest for patients with intermediate-risk disease, none of the patients with low-risk disease received androgen deprivation.

This treatment pattern demonstrates how a systematic bias in provider access may potentially influence treatment choices in patients with localized prostate cancer. Promoting access to care—especially for the economically disadvantaged, minority populations represented in the IMPACT cohort—is a vital component for optimizing the quality of healthcare delivery. Although all of the IMPACT patients were offered second opinions after diagnosis, we were unable to assess how many—if any—obtained second opinions, and whether or not these opinions influenced treatment.

This observation reveals a novel challenge to improving the process, and thereby the quality, of localized prostate cancer care: assuring access to more than 1 specialist so as to minimize treatment counseling bias.[15] Prior studies have observed that patients choosing surgery over other modalities, or robotic-assisted over open surgery, may later express regret over their decisions.[16,17] For localized prostate cancer, for which there is no optimal treatment and morbidities differ, promoting access to multiple providers holds the potential for enhancing the informed decision-making process, framing appropriate expectations, reducing treatment regret, and thereby improving post-treatment quality of life.

Other explanations for our observations include unmeasured differences inherent between county and private institutions and economic incentives to provide 1 type of treatment over another. However, reimbursements were the same regardless of whether men were treated at public or private institutions. Moreover, provider and institutional participation in IMPACT was completely voluntary, thus reducing the probability that private providers susceptible to this type of bias were participating in this program.

There are potential limitations of our study that merit discussion. First, although the IMPACT cohort is racially diverse, it reflects an increased severity of disease not currently seen in the general US population.[18] The applicability of these results to patients with less aggressive disease and in other geographic regions has not yet been shown. Second, overlap between clinical variables and D'Amico risk stratification may have contributed to colinearity. However, Model 2, which adjusted only for race, produced the same effect estimates as Model 1, which adjusted for clinical characteristics and disease risk stratification. Therefore, the probability of bias based on colinearity is quite low. Third, because of missing data, not all IMPACT enrollees could be included in the study; compared with those who were not included, those who were included differed slightly with respect to year of enrollment, risk stratification, and treatment type. These differences may have potentially introduced biases. Finally, this study may have been subjected to the types of patient, provider, and reporting biases associated with other observational cohort studies. Still, there are no indications that any of these potential biases would have been differential with respect to the outcomes.

Conclusions

In this economically disadvantaged cohort, prostate cancer treatments varied significantly between county hospitals and private providers, irrespective of patient characteristics or disease severity. These data reveal substantial discrepancies in processes of care between different types of healthcare institutions. Given the potential implications for health policy and quality of prostate cancer care, these differences merit further scrutiny.

CONFLICT OF INTEREST DISCLOSURES

The authors made no disclosures.

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