Prostate Cancer Treatment Patterns in the State of Texas, 2004-2007

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ABSTRACT:

Background: Understanding current patterns of prostate cancer treatment in Texas is critically important in order to develop public health strategies to ensure appropriate treatment of unfavorable disease while discouraging inappropriate treatment of favorable disease. Yet to date, little is known regarding prostate cancer treatment patterns in Texas. Accordingly, we conducted the first population-based study of prostate cancer treatment patterns using the Texas Cancer Registry (TCR) data linked to patient Medicare claims.

Methods: We identified a total of 11,877 men residing in Texas, age 66 and older, who were diagnosed with incident prostate cancer from 2004 to 2007 and had fee-for-service Medicare coverage. TCR data classified patients as favorable risk (T1 or T2, low grade) versus unfavorable risk (T3 or T4 or high grade). Cancer treatment within one year of diagnosis was determined using TCR data and Medicare billing claims. Chi-square test evaluated for unadjusted associations between risk group and treatment, and multivariate logistic regression identified factors associated with observation in men with favorable disease and inappropriate omission of treatment in men with unfavorable disease.

Results: A total of 45% of men had favorable disease and 51% had unfavorable disease. Treatment was given to 86% of men with favorable disease and 94% of men with unfavorable disease ($p<0.001$). The most common treatment was external beam radiation (35% of cohort) followed by radical prostatectomy (27% of cohort). Among men with favorable disease, advanced age, comorbid illness, diagnosis in 2007, and consultation with an urologist only (compared to an urologist and radiation oncologist) were associated with increased odds of observation. Among men with unfavorable disease, advanced age, black race, and consultation with an urologist only (compared to an urologist and radiation oncologist) were associated with increased odds of inappropriate omission of cancer treatment.

Conclusion: The vast majority of older men diagnosed with prostate cancer in Texas receive cancer-directed treatment. Efforts are needed to decrease use of cancer-directed treatment in older men with favorable disease while preserving the high treatment rate in older men with unfavorable disease.

INTRODUCTION

Prostate cancer is the most common malignancy diagnosed in men in the United States and the second leading cause of cancer death.[1] The likelihood of diagnosis increases with age, with 60% of men diagnosed at age 65 or older. The majority of men diagnosed with prostate cancer have localized disease, meaning that the cancer does not appear to have spread outside the prostate or immediately adjacent tissues. Curative treatment options for localized prostate cancer include radical prostatectomy, external beam radiation, brachytherapy, cryotherapy, or a combination of one or more of these treatment options.[2] Hormone therapy intended to suppress testosterone production is also used to treat prostate cancer, but this treatment alone is unlikely to be curative.[3] Alternatives to active treatment include watchful waiting, in which the patient and his physician passively wait for symptomatic progression, and active surveillance, in which the patient and his physician routinely monitor the disease through serial physical exam, prostate specific antigen (PSA) testing, and biopsy.[2]

Ensuring appropriate treatment of localized prostate cancer is a major public health imperative. When indicated, treatment has the potential to cure prostate cancer before the disease disseminates, thereby improving patient quality of life and survival. Conversely, many patients likely do not require treatment because their disease is unlikely to disseminate during their lifetime. For such patients, treatment poses risk of morbidity that may negatively impact quality of life yet is unlikely to improve survival. To help determine when treatment is indicated, risk stratification tools have been developed that classify patients based on their PSA, clinical tumor (T) stage, and Gleason score.[4] For men classified as having "favorable" prostate cancer based on these parameters, there is no compelling data from published randomized trials that men age 65 and older with favorable prostate cancer derive a survival or quality of life benefit from cancer-directed treatment.[5,6] In contrast, it is widely accepted that most men with unfavorable prostate cancer do require treatment.[4]

Understanding current patterns of prostate cancer treatment is critically important in order to develop public health strategies to ensure appropriate treatment when indicated and to discourage treatment of patients unlikely to benefit. To date, however, little is known about prostate cancer treatment patterns in the state of Texas. Accordingly, in a population-based cohort of older men identified using Texas Cancer Registry data linked to patient Medicare billing claims (TCR-Medicare), we sought to describe treatment patterns and classify appropriateness of treatment according to patient's risk strata.

METHODS

Data from the TCR–Medicare linked database were used for the analysis. This database is a linkage of two large population-based sources of data, performed under the guidance of the National Cancer Institute (NCI), TCR, and Medicare claims data collected by the Centers for Medicare and Medicaid Services. This data set provides detailed information about elderly adults with cancer in Texas. Approximately 98% of all people aged 65 and older in TCR are matched with Medicare enrollment and claims files. TCR collects and provides information on participant demographics, cancer prevalence, cancer incidence, stage of disease, first course of therapy, and survival. The Medicare claims data include information on hospital stays, physician services, and hospital outpatient visits. Data use agreements have been signed with both data providers. The data used in this study include patients diagnosed with prostate cancer between 2004 and 2007 and their Medicare claims through 2009.

Table 1 specifies the inclusion criteria used for this study. Patient clinical-pathologic characteristics were determined using TCR and Medicare data. Patient-level variables evaluated included age at diagnosis, race/origin, year of diagnosis, Charlson comorbidity score using the Klabunde algorithm,[7,8] clinical T stage, tumor grade, distance from the centroid of the patient's zip code to the nearest radiation oncology facility,[9] and type of cancer specialist(s) seen within one year of diagnosis (determined from Medicare claims and the American Medical Association Physician Masterfile). We also evaluated certain census tract-level indicators of the patient's socioeconomic status. These variables included urban/rural metropolitan designation, percent of individuals who do not speak English, percent of individuals who have completed at least some college, and median income.

Table 1. Cohort creation

Inclusion Criteria	Met Criteria	Excluded
Initial Texas Cancer Registry sample of patients diagnosed with prostate cancer from 1995-2007	124,031	-
1. Residing in Texas at time of diagnosis	115,162	8,869
2. Age 66 years or older*	79,757	35,405
3. Diagnosed in 2004-2007	23,316	56,441
4. Non-metastatic	18,488	4,828
5. Prostate cancer was the first cancer diagnosis, and there were no additional cancers diagnosed with 12 months	17,812	676
6. Prostate cancer was histologically confirmed	17,698	114
7. Node-negative	15,310	2,388
8. Histology consistent with adenocarcinoma	15,070	240
9. Fee-for-service Medicare part A and B coverage from 12 months before through 12 months after diagnosis (or until death if died within 12 months of diagnosis)	11,877	3,193

*The cohort was limited to individuals age 66 and older to allow for one year of antecedent Medicare claims prior to diagnosis to permit calculation of comorbidity.

Patient risk strata were determined using tumor information reported by TCR. Patients were classified as favorable if they had a clinical stage T1 or T2 tumor and low histologic grade. Patients were classified as unfavorable if they had a T3 or T4 tumor or intermediate/high histologic grade (as used in this manuscript, the "unfavorable" includes both patients with intermediate- or high-risk disease according to current risk stratification systems[4]). PSA information is not currently captured by TCR and so could not be incorporated into patient risk stratification.

TCR data, supplemented by Medicare billing claims, were used to characterize treatment received within the first year following diagnosis as follows: observation (no claim for any cancer treatment; this category includes patients managed with watchful waiting and active surveillance), radical prostatectomy, external beam radiation, brachytherapy, external beam radiation plus brachytherapy, cryotherapy, and hormone therapy. Associations of treatment type with patient clinical-pathologic characteristics were assessed using the chi-square test. Multivariate logistic regression models were developed to identify clinical-pathologic variables associated with observation in patients with favorable prostate cancer and inappropriate omission of cancer-directed treatment in patients with unfavorable prostate cancer. Goodness of fit was tested using the method of Hosmer and Lemeshow.

The University of Texas MD Anderson Cancer Center Institutional Review Board reviewed this study and granted it exempt status. All analyses were conducted using SAS version 9.

RESULTS

Cohort characteristics

Of 11,877 older men identified with incident prostate cancer in the state of Texas from 2004 to 2007, 39% (n=4,638) were age 66 to 70 and only 10% (n=1,156) were over the age of 80. A total of 76% (n=9,066) were white, 13% (n=13%) were Hispanic, 8% (n=989) were black, and 3% (n=299) were of other/unknown race. Eighty-three percent (n=9873) resided in an urban area. Only 9.5% (n=1,131) had moderate to severe comorbid illness, indicated by a Charlson comorbidity score of 2 or more.

Regarding risk group, 45% (n=5,312) were in the favorable group, 51% (n=6,102) were in the unfavorable group, and 4% (n=463) could not be classified due to missing tumor stage or grade. Favorable risk patients were more likely to be younger ($p<0.001$) and to be diagnosed in an earlier year ($p<0.001$). Patient race was not associated with risk group ($p=0.59$).

Treatment patterns

A total of 90% (n=10,700) of patients in the cohort received cancer-directed treatment and 10% (n=1,177) received observation (Table 2). Unfavorable patients were more likely to receive cancer-directed treatment than favorable patients ($p<0.001$). Nevertheless, treatment was common in both risk groups. Specifically, 86% (n=4,566/5,312) of favorable patients received cancer-directed treatment and 94% (n=5,730/6,102) of unfavorable patients received cancer-directed treatment. Among favorable patients, the most common treatments were external beam radiation (32%, n=1,703/5,312), radical prostatectomy (22%, n=1,167/5,312), and brachytherapy (17%, n=923/5,312). Among unfavorable risk patients, the most common treatments were external beam radiation (39%, n=2,386/6,102) and radical prostatectomy (31%, n=1,873/6,102).

Multivariate analyses

Among patients with favorable prostate cancer, factors associated with the choice of observation over cancer-directed treatment included older age (compared to age 66 to 70 years), diagnosis in 2007 (compared to 2004), any comorbid illness (compared to Charlson score of 0), and consultation with a urologist only (compared to seeing a urologist and radiation oncologist) (Table 3). Neighborhood sociodemographic characteristics, such as English fluency, college education, and income, were not strongly correlated with the choice of observation versus cancer-directed treatment.

Among patients with unfavorable prostate cancer who would have been appropriate candidates for cancer-directed treatment (age ≤ 80 years and no comorbid illness, n=3,785), factors associated with inappropriate omission of treatment included older age (compared to age 66 to 70 years), black race (compared to white race), and consultation with a urologist only (compared to seeing a urologist and

Table 2. Descriptive characteristics of overall cohort and by risk strata (N = 11,877)

Variable	Total N (%)	Favorable N (%)	Unfavorable N (%)	Unknown N (%)	*p**
All subjects	11,877 (100)	5,312 (100)	6,102 (100)	463 (100)	
Age					**<0.001**
66-70	4,638 (39.1)	2,177 (41.0)	2,270 (37.2)	191 (41.3)	
71-75	3,853 (32.4)	1,778 (33.5)	1,929 (31.6)	146 (31.5)	
76-80	2,230 (18.8)	955 (18.0)	1,196 (19.6)	79 (17.1)	
>80	1,156 (9.7)	402 (7.6)	707 (11.6)	47 (10.2)	
Race					0.59
Non-Hispanic white	9,066 (76.3)	4,094 (77.1)	4,617 (75.7)	355 (76.7)	
Hispanic	1,523 (12.8)	650 (12.2)	818 (13.4)	55 (11.9)	
Non-Hispanic black	989 (8.3)	434 (8.2)	513 (8.4)	42 (9.1)	
Other/unknown	299 (2.5)	134 (2.5)	154 (2.5)	11 (2.4)	
Metropolitan designation					0.75
Urban	9,873 (83.1)	4,413 (83.1)	5,075 (83.2)	385 (83.2)	
Rural	2,002 (16.9)	8,99 (16.9)	1,025 (16.8)	78 (16.9)	
Year of Diagnosis					**<0.001**
2004	3,000 (25.3)	1,483 (27.9)	1,432 (23.5)	85 (18.4)	
2005	2,895 (24.4)	1,371 (25.8)	1,453 (23.8)	71 (15.3)	
2006	2,958 (24.9)	1,271 (23.9)	1,556 (25.5)	131 (28.3)	
2007	3,024 (25.5)	1,187 (22.4)	1,661 (27.2)	176 (38.0)	
Percent non-English speakers in patient's census tract					**<0.001**
0 to 10%	9,568 (80.6)	4,298 (80.9)	4,905 (80.4)	365 (78.8)	
> 10%	1,867 (15.7)	819 (15.4)	987 (16.2)	61 (13.2)	
Unknown	442 (3.7)	195 (3.7)	210 (3.4)	37 (8.0)	
Percent individuals with at least some college education in patient's census tract					**<0.001**
Quartile 1	2,895 (24.4)	1,251 (23.6)	1,527 (25.0)	117 (25.3)	
Quartile 2	2,873 (24.2)	1,273 (24.0)	1,490 (24.4)	110 (23.8)	
Quartile 3	2,847 (24.0)	1,297 (24.4)	1,451 (23.8)	99 (21.4)	
Quartile 4	2,820 (23.7)	1,296 (24.4)	1,424 (23.3)	100 (21.6)	
Unknown	442 (3.7)	195 (3.7)	210 (3.4)	37 (8.0)	
Median income in patient's census tract or zip code					**<0.001**
Quartile 1	2,929 (24.7)	1,289 (24.3)	1,536 (25.2)	104 (22.5)	
Quartile 2	2,803 (23.6)	1,299 (24.5)	1,400 (22.9)	104 (22.5)	
Quartile 3	2,820 (23.7)	1,231 (23.2)	1,504 (24.7)	85 (18.4)	
Quartile 4	2,883 (24.3)	1,298 (24.4)	1,452 (23.8)	133 (28.7)	
Unknown	442 (3.7)	195 (3.7)	210 (3.4)	37 (8.0)	

Charlson comorbidity score					0.21
0	8,335 (70.2)	3,779 (71.1)	4,226 (69.3)	330 (71.3)	
1	2,411 (20.3)	1,046 (19.7)	1,270 (20.8)	95 (20.5)	
2 or more	1,131 (9.5)	487 (9.2)	606 (9.9)	38 (8.2)	
Clinical T stage					**<0.001**
T1	6,838 (57.6)	3,388 (63.8)	3,334 (54.6)	116 (25.1)	
T2	4,530 (38.1)	1,924 (36.2)	2,318 (38.0)	288 (62.2)	
T3	362 (3.1)	0 (0)	362 (5.9)	0 (0)	
T4	48 (0.4)	0 (0)	48 (0.8)	0 (0)	
Unknown	99 (0.8)	0 (0)	40 (0.7)	59 (12.7)	
Tumor grade					**<0.001**
Low	5,450 (45.9)	5,312 (100)	>70 (>0.8)	58 (12.5)	
High	6,016 (50.7)	0 (0)	6,016 (98.6)	0 (0)	
Unknown	411 (3.5)	0 (0)	<11 (<1)	>390 (>85)	
Distance from centroid of patient's zip code to nearest radiation oncology facility					0.21
< 15 miles	8,726 (73.5)	3,928 (74)	4,462 (73.1)	336 (72.6)	
15 to 30 miles	1,528 (12.9)	647 (12.2)	827 (13.6)	54 (11.7)	
> 30 miles	1,439 (12.1)	656 (12.4)	721 (11.8)	62 (13.4)	
Unknown	184 (1.5)	81 (1.5)	92 (1.5)	11 (2.4)	
Treatment					**<0.001**
External beam radiation only	4,233 (35.6)	1,703 (32.1)	2,386 (39.1)	144 (31.1)	
Radical prostatectomy	3,171 (26.7)	1,167 (22)	1,873 (30.7)	131 (28.3)	
Brachytherapy only	1,361 (11.5)	923 (17.4)	407 (6.7)	31 (6.7)	
Androgen deprivation therapy only	673 (5.7)	238 (4.5)	407 (6.7)	28 (6.1)	
Cryotherapy	667 (5.6)	362 (6.8)	244 (4.0)	>50 (>11)	
External beam radiation plus brachytherapy	595 (5.0)	173 (3.3)	>400 (>6.5)	<11 (<2)	
Observation	1177 (9.9)	746 (14.0)	372 (6.1)	59 (12.7)	
Type of physician seen					**0.003**
Urologist and radiation oncologist	7,735 (65.1)	3,388 (63.8)	4,066 (66.6)	281 (60.7)	
Urologist alone	3,715 (31.3)	1,714 (32.3)	1,840 (30.2)	161 (34.8)	
Unknown	427 (3.6)	210 (4)	196 (3.2)	21 (4.5)	

* - *p* value from chi-square test comparing variable distribution across risk groups. Cutpoints for college education are 23.5%, 28.35%, and 33.24%. Cutpoints for median income are $31,000, $39,000, and $53,000. Cell sizes less than 11 are suppressed in accordance with patient confidentiality requirements.

Table 3. Factors associated with observation in patients with favorable prostate cancer (n=5,312)*

Variable	Odds Ratio	95% CI		*p*
Age (years)				
66-70	1.00			
71-75	1.78	1.43	2.22	**<0.001**
76-80	3.73	2.95	4.72	**<0.001**
< 80	7.96	6.05	10.48	**<0.001**
Race/origin				
Non-Hispanic white	1.00			
Hispanic	1.28	0.96	1.70	0.09
Non-Hispanic black	1.07	0.77	1.47	0.70
Other/unknown	2.30	1.43	3.71	**<0.001**
Charlson comorbidity score				
0	1.00			
1	1.62	1.31	1.99	**<0.001**
2 or more	2.54	1.97	3.27	**<0.001**
Metropolitan designation				
Urban	1.00			
Rural	1.09	0.78	1.51	0.62
Year of diagnosis				
2004	1.00			
2005	1.25	0.99	1.58	0.06
2006	1.14	0.90	1.45	0.29
2007	1.40	1.10	1.80	**0.007**
Percent non-English speakers in patient's census tract				
0 to 10%	1.00			
> 10%	0.87	0.66	1.14	0.31
Unknown	1.19	0.75	1.86	0.46
Percent individuals with at least some college education in patient's census tract				
Quartile 1	1.00			
Quartile 2	0.91	0.70	1.18	0.47
Quartile 3	0.90	0.68	1.20	0.48
Quartile 4	0.86	0.64	1.16	0.33
Median income in patient's census tract				
Quartile 1	1.00			
Quartile 2	0.79	0.61	1.03	0.08
Quartile 3	1.10	0.82	1.47	0.54
Quartile 4	0.84	0.62	1.14	0.26
Distance from centroid of patient's zip code to nearest radiation oncology facility				
< 15 miles	1.00			
15 to 30 miles	1.12	0.83	1.51	0.47
> 30 miles	1.04	0.72	1.50	0.83
Unknown distance	1.08	0.55	2.10	0.83
Type of physician seen				
Urologist and radiation oncologist	1.00			
Urologist alone	4.24	3.54	5.08	**<0.001**
Unknown	7.24	5.10	10.28	**<0.001**

*Analysis includes 5,312 men with favorable prostate cancer (T1/2 and low grade). Cutpoints for college education are 23.5%, 28.35%, and 33.24%. Cutpoints for median income are $31,000, $39,000, and $53,000.

Abbreviations: CI (confidence interval)

radiation oncologist) (Table 4). Neighborhood sociodemographic characteristics were not strongly associated with inappropriate omission of treatment in this group.

DISCUSSION

In this population-based cohort of older men diagnosed with prostate cancer in Texas from 2004-2007, cancer-directed treatment was commonly used for patients with both favorable and unfavorable cancer. Among those with favorable prostate cancer, use of observation increased in 2007, suggesting that greater awareness regarding observation may have started to impact care patterns by 2007.[10] More recent data will be needed to determine if this trend has continued. Given the very high rates of cancer-directed treatment in men in Texas with favorable prostate cancer, educational interventions for

Table 4. Factors associated with inappropriate omission of cancer-directed therapy in healthy older men with unfavorable prostate cancer (n=3,785)*

Variable	Odds Ratio	95% CI		P
Age (years)				
66-70	1.00			
71-75	0.98	0.64	1.50	0.93
76-80	2.21	1.42	3.43	**<0.001**
Race/origin				
Non-Hispanic white	1.00			
Hispanic	1.62	0.90	2.89	0.11
Non-Hispanic black	3.45	2.11	5.64	**<0.001**
Other/unknown	2.91	1.30	6.52	**0.009**
Metropolitan designation				
Urban	1.00			
Rural	1.39	0.63	3.05	0.41
Year of diagnosis				
2004	1.00			
2005	0.79	0.48	1.31	0.37
2006	1.06	0.65	1.71	0.83
2007	1.09	0.66	1.79	0.75
Percent non-English speakers in patient's census tract or zip code				
0 to 10%	1.00			
> 10%	0.73	0.41	1.30	0.29
Unknown	0.64	0.25	1.66	0.36
Percent individuals with at least some college education in patient's census tract				
Quartile 1	1.00			
Quartile 2	0.83	0.50	1.38	0.48
Quartile 3	0.56	0.32	1.00	0.05
Quartile 4	0.56	0.32	0.99	0.05
Median income in patient's census tract				
Quartile 1	1.00			
Quartile 2	1.10	0.64	1.90	0.73
Quartile 3	1.39	0.76	2.52	0.28
Quartile 4	1.00	0.55	1.84	0.99
Distance from centroid of patient's zip code to nearest radiation oncology facility				
< 15 miles	1.00			
15 to 30 miles	0.35	0.16	0.76	**0.008**
> 30 miles	0.64	0.27	1.51	0.30
Unknown distance	0.38	0.05	2.87	0.35
Type of physician seen				
Urologist and radiation oncologist	1.00			
Urologist alone	3.31	2.20	4.96	**<0.001**
Unknown	16.37	9.78	27.41	**<0.001**

*Analysis includes 3,785 men with unfavorable prostate cancer (T3/4 or high grade) who were age 66 to 80 and had a Charlson comorbidity score of 0. Cutpoints for college education are 23.5%, 28.35%, and 33.24%. Cutpoints for median income are $31,000, $39,000, and $53,000.

Abbreviations: CI (confidence interval)

both providers and patients should be considered to improve awareness of potential complications associated with prostate cancer treatment and lack of demonstrated survival benefit from treatment.[6] Treatment-related complications are known to impact patient quality of life and can include urinary incontinence, erectile dysfunction, rectal bleeding, and fecal urgency.[11] If patients with favorable prostate cancer can be appropriately selected for observation, then these treatment-related complications can be avoided, and quality of life can be preserved.

Among those with unfavorable cancer, the vast majority of men in this study did receive treatment as recommended by national guidelines.[4] However, among those with unfavorable prostate cancer, black men were found to be at risk for inappropriate omission of treatment, suggesting an ongoing racial disparity that may contribute to inferior outcomes in black patients.[1] Interventions targeted toward black patients should be considered to help decrease this racial disparity. Interestingly, failure to see a radiation oncologist also contributed to inappropriate omission of cancer treatment, suggesting that improving patient transfer between urologists and radiation oncologists through integrated health systems may be another mechanism to ensure appropriate treatment of men with unfavorable disease.[12]

This study is limited in that only older men in Texas were included. Results may not directly apply to younger men in Texas or men in other parts of the country. In addition, PSA data were was not available, thus limiting our ability to risk stratify patients. Finally, it remains difficult using claims to accurately predict an individual's life expectancy. Current National Comprehensive Cancer Network (NCCN) guidelines use expected patient survival to help determine when active surveillance may be acceptable.[4] For example, for a segment of men included in our unfavorable group (specifically those with Gleason Score 7 tumors or PSA between 10-20 ng/mL or clinical stage T2b/c), active surveillance is considered acceptable if expected life expectancy is less than 10 years. To account for this, we evaluated factors associated with inappropriate omission of treatment only in men under the age of 80 without comorbid illness, whose survival is expected to exceed 10 years according to the NCCN guidelines. Nevertheless, it remains likely that some segment of such patients included in our analyses had undiagnosed comorbidities and expected survival less than 10 years, thus resulting in potentially modest overestimation of the fraction of patients in whom treatment was inappropriately omitted.

In summary, the vast majority of older men diagnosed with localized prostate cancer in the state of Texas receive cancer-directed treatment for their disease. While this is likely to benefit men with unfavorable cancers, men with favorable cancers are subjected to significant risk of harm for unclear clinical benefit. Patient and provider educational initiatives should be considered to promote consideration of observation in men with favorable disease while maintaining ongoing high rates of treatment in men with unfavorable disease.

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