Advances in Radiation Oncology (2018) **3**, 181–189

advances
in radiation oncology

www.advancesradonc.org

Scientific Article

Risk factors involved in treatment delays and differences in treatment type for patients with prostate cancer by risk category in an academic safety net hospital

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Received 15 August 2017; received in revised form 25 November 2017; accepted 6 December 2017

Abstract

Objectives: Understanding the drivers of delays from diagnosis to treatment can elucidate how to reduce the time to treatment (TTT) in patients with prostate cancer. In addition, the available treatments depending on the stage of cancer can vary widely for many reasons. This study investigated the relationship of TTT and treatment choice with sociodemographic factors in patients with prostate cancer who underwent external beam radiation therapy (RT), radical prostatectomy (RP), androgen deprivation therapy (ADT), or active surveillance (AS) at a safety-net academic medical center.

Methods and materials: A retrospective review was performed on 1088 patients who were diagnosed with nonmetastatic prostate cancer between January 2005 and December 2013. Demographic data as well as data on TTT, initial treatment choice, American Joint Committee on Cancer stage, and National Comprehensive Cancer Network risk categories were collected. Analyses of variance and multivariable logistic regression models were performed to analyze the relationship of these factors with treatment choice and TTT.

Results: Age, race, and marital status were significantly related to treatment choice. Patients who were nonwhite and older than 60 years were less likely to undergo RP. Black patients were 3.8 times more likely to undergo RT compared with white patients. The median TTT was 75 days. Longer time delays were significant in patients of older age, nonwhite race/ethnicity, non-English speakers, those with noncommercial insurance, and those with non-married status. The average TTT of high-risk patients was 25 days longer than that of low-risk patients. Patients who underwent RT had an average TTT that was 34 days longer than that of RP patients.

Sources of support: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.
Conflicts of interest: The authors have no conflicts of interest.

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https://doi.org/10.1016/j.adro.2017.12.002

Conclusions: The treatment choice and TTT of patients with prostate cancer are affected by demographic factors such as age, race, marital status, and insurance, as well as clinical factors including stage and risk category of disease.

Introduction

Prostate cancer remains the most common cancer in men in the United States. In 2016, an estimated 180,890 new cases were diagnosed, with more than 26,000 deaths.[1] Disparities in cancer care are known to contribute to overall cancer mortality, and differences in socioeconomic status, race, insurance coverage, education level, marital status, and primary language spoken have all been found to cause differential prostate cancer outcomes. Interestingly, prostate cancer has one of the highest disparities for clinical outcomes with respect to race, and the mortality rates of black men are twice that of their white counterparts.[2]

Because prostate cancer treatment can be complex depending on the circumstances of the diagnosis and treatment options, understanding the various factors leading to patients' choice of treatment is important to better address the disparity in treatment outcomes. Generally, treatment decisions involve subjective tradeoffs between treatment efficacies and potential side effects. Patients with similar clinical presentations and ages may choose different treatments on the basis of their willingness and knowledge of each option. By understanding the factors involved in determining treatment choice, we can better address possible trends in certain subpopulations.

Second, the time between diagnosis and start of treatment, or time to treatment (TTT), may also be affected by a number of factors. Past studies have related significant differences in prostate cancer TTT on the basis of race groups and other demographic characteristics.[3-5] Breast cancer studies have also shown that TTT is linked to socioeconomic status and race.[6]

Furthermore, there have been few studies on the factors that are significant to prostate cancer treatment choice and TTT, especially stratified by risk categories. Risk categories, defined by the National Comprehensive Cancer Network guidelines,[7] provide a more holistic stratification of patients on the basis of their Gleason scores and prostate-specific antigen (PSA) values at diagnosis. Instead of looking at their clinical information separately, using risk categories as a predictor for treatment choice and TTT may allow for an easier translation to clinical practice.

Our institution's role as a safety-net academic hospital center affords us the advantage of examining these variables in a diverse patient population. Safety-net hospitals, usually as non-profit institutions, maintain an open-door policy to provide care to patients who may be low-income, uninsured, or otherwise unable to receive the health care they need because of financial circumstances.[8]

Our objectives were twofold. First, we aimed to assess sociodemographic and temporal predictors as well as risk categories on selection of one of four most common treatment choices (external beam radiation therapy [RT], radical prostatectomy [RP], androgen deprivation therapy [ADT], and active surveillance [AS]). Second, we examined the effect of the same set of predictors on TTT.

Methods and materials

Patient selection and demographic characteristics

A total of 1552 patients were diagnosed with prostate cancer at our institution between January 2005 and December 2013. Of these patients, 115 had advanced or metastatic disease, 75 were lost to follow-up, 57 received treatments elsewhere, 15 had multiple or recurrent carcinomas, 7 received diagnosis and treatments on the same day, and 19 had brachytherapy.

Patients with missing data were also excluded: 27 patients with missing treatment plans; 8 with missing diagnoses, treatment dates, or cancelled treatments; 32 with missing American Joint Committee on Cancer (AJCC) stages; 32 with AJCC stage 4 disease (metastatic); and 77 with missing insurance status. A breakdown of the excluded cases is listed in Supplemental Appendix A. After excluding these patients, a total of 1088 patients were included in the current retrospective analysis.

All prostate cancer diagnoses were confirmed by biopsy. Only the initial treatment was considered for analysis despite different subsequent treatments after the diagnosis. The institutional review board approved this study.

Demographic information was obtained from our institution's medical records using the Clinical Data Warehouse. We collected the following data: age, race/ethnicity (white, black, Hispanic, other), primary language spoken (English, Spanish, Haitian Creole, other), marital status (married, single, other), insurance coverage (commercial/private, Medicaid/charity, Medicare/military), and AJCC stage at diagnosis.

Clinical and treatment characteristics

Individual patient medical records were reviewed to collect dates of biopsy-confirmed diagnosis, Gleason scores, PSA values, and initial treatment plans. Risk categories (low, intermediate, high) were assigned in accordance with the NCCN guidelines.[7] RT start and end dates, RP surgery dates, and ADT start dates were collected. For RT, TTT was calculated from the date of biopsy to the date of first radiation treatment. For RP, TTT was calculated from the date of biopsy to the date of surgery. For ADT, TTT was calculated from the date of biopsy to the date of first ADT treatment. Although most patients who received ADT underwent RT subsequently, ADT was analyzed as a separate category due to differences in treatment start dates. Finally, patients who received AS were those who had AS explicitly recorded or who did not undergo any treatment for at least 1 year postdiagnosis.

Statistical analyses

All analyses were two-sided, and *P*-values <.05 were considered significant. Computations were performed using SAS Version 9.1 (SAS Institute, Cary, NC). Descriptive statistics were computed to describe the patient cohort. Multivariable quantile (median) regression models were employed, and covariate-adjusted parameter estimates and odds ratios (ORs) with 95% confidence intervals (CIs) were computed. For each time metric, the estimates generated from quantile regression were interpreted as difference in time interval (days) associated with 1 unit change in each covariate. Only those covariates with an overall *P*-value of <.1 in the crude model were selected and included for multivariate model analysis.

Results

Patient demographic characteristics

Of the 1088 patients in this study, the median age was 63 years (range, 39-94 years). For race/ethnicity, 453 (41.6%) were white, 420 (38.6%) were black, 130 (11.9%) were Hispanic, and 85 (7.8%) were of other race/ethnicity. For language, 847 patients (77.8%) spoke English as their primary language. For AJCC, 985 patients (90.5%) had stage II and 103 (9.5%) had stage III prostate cancer. For risk categories, 503 patients (46.2%) were low risk, 411 (37.8%) were intermediate risk, and 174 (16.0%) were high risk (Table 1). A breakdown of the PSA and Gleason scores by treatment choice can be found in Supplemental Appendix B.

Patient characteristics and treatment choice

Among the 1088 patients studied, 661 (60.8%) underwent RP, 181 (16.6%) received RT, 105 (9.7%) had ADT, and 141 (13.0%) chose AS. In the crude analysis of treatment choice by patient characteristics, all variables analyzed (age, race/ethnicity, language, insurance, marital status, AJCC, and risk category) were statistically significant (all $P < .001$; Table 1).

Multivariate analysis

In the multiple logistic regression analysis, patients aged >70 years were less likely to undergo RP (OR = 0.04; $P < .0001$) versus the increased odds of RT (OR = 5.6; $P < .0001$), ADT (OR = 3.8; $P = .001$), or AS (OR = 7.0; $P < .0001$; Tables 2 and 3).

Black patients were much less likely to undergo RP than white patients (OR = 0.2; $P < .0001$) but more likely to receive RT (OR = 3.8; $P < .0001$), ADT (OR = 3.3; $P = .002$), or AS (OR = 1.9; $P = .011$). Language spoken and insurance status, although both associated with treatment choice in crude analyses, were not associated with any particular treatment choice in adjusted analyses, with the exception of Haitian Creole speakers, who were more likely to choose AS than English speakers (OR = 2.4; $P = .017$) and showed a trend for decreased odds of receiving RP (OR = 0.48; $P = .038$).

Patients with Medicare/military insurance coverage were less likely to undergo RP (OR = 0.53; $P = .002$) and more likely to receive RT (OR = 1.8; $P = .019$) than patients with private/commercial insurance. Compared with married patients, single patients and those with other marital status were less likely to undergo RP (single: OR = 0.53, $P = .001$; other: OR = 0.39, $P < .0001$) and more likely to receive RT (single: OR = 1.7, $P = .013$; other: OR = 1.9, $P = .006$).

Patient characteristics and TTT

When focusing only on the 842 patients who received RP and RT, the median TTT was 75 days (interquartile range [IQR] = 60 days). Patients who received RP had a median TTT of 67 days (IQR = 47 days) and those who underwent RT 116 days (IQR = 93 days). In the crude analysis, all patient characteristics except AJCC stage ($P = .059$) were associated with TTT (Table 4). However, in the multivariate analysis, only age ($P = .030$), race/ethnicity ($P = .048$), insurance status ($P < .0001$), risk category ($P < .0001$), and treatment choice ($P < .0001$) remained as independent predictors of TTT. Interestingly, AJCC became significant for TTT in the multivariate analysis ($P = .032$).

When compared with patients aged ≤60 years, patients in the 60- to 70-year age group had a longer TTT by 7 days (95% CI, 0.14-12.2 days). Black and Hispanic/Latino patients had longer TTT than white patients by 7 and 10 days, respectively, but only the former was statistically significant in multivariate analyses (95% CI, 2.6-12.8 days; Table 4). Both Medicaid and Medicare patients took longer to initiate treatment compared with commercial/private

Table 1 Patient characteristics and treatment/management options of 1088 patients with prostate cancer who were diagnosed between January 2005 and December 2013

	All (N = 1088)	RP (n = 661)	RT (n = 181)	ADT (n = 105)	AS (n = 141)	*P*-value
	n (row %)					
Age (y)						<.0001
≤60	445	365 (82.0)	32 (7.2)	19 (4.3)	29 (6.5)	
>60 to ≤70	457	270 (59.1)	81 (17.7)	38 (8.3)	68 (14.9)	
> 70	186	26 (14.0)	68 (36.6)	48 (25.8)	44 (23.7)	
Race/ethnicity						<.0001
White	453	364 (80.4)	32 (7.1)	13 (2.9)	44 (9.7)	
Black	420	176 (41.9)	110 (26.2)	63 (15.0)	71 (16.9)	
Hispanic/Latino	130	78 (60.0)	23 (17.7)	19 (14.6)	10 (7.7)	
Other	85	43 (50.6)	16 (18.8)	10 (11.8)	16 (18.8)	
Primary language						<.0001
English	847	550 (64.9)	129 (15.2)	70 (8.3)	98 (11.6)	
Spanish	101	60 (59.4)	18 (17.8)	15 (14.9)	8 (7.9)	
Haitian Creole	71	21 (29.6)	18 (25.4)	12 (16.9)	20 (28.2)	
Other	69	30 (43.5)	16 (23.2)	8 (11.6)	15 (21.7)	
Insurance status						<.0001
Commercial/Private	403	317 (78.7)	33 (8.2)	16 (4.0)	37 (9.2)	
Medicaid/Free care	278	161 (57.9)	46 (16.6)	32 (11.5)	39 (14.0)	
Medicare/Military	407	183 (45.0)	102 (25.1)	57 (14.0)	65 (16.0)	
Marital status						<.0001
Married	643	434 (67.5)	80 (12.4)	49 (7.6)	80 (12.4)	
Single	284	152 (53.5)	59 (20.8)	34 (12.0)	39 (13.7)	
Other	161	75 (46.6)	42 (26.1)	22 (13.7)	22 (13.7)	
AJCC						<.0001
Stage II	985	586 (59.5)	170 (17.3)	88 (8.9)	141 (14.3)	
Stage III	103	75 (72.8)	11 (10.7)	17 (16.5)	0 (0.0)	
Risk category						<.0001
Low	503	344 (68.4)	52 (10.3)	1 (0.20)	106 (21.1)	
Intermediate	411	276 (67.2)	83 (20.2)	25 (6.1)	27 (6.6)	
High	174	41 (23.6)	46 (26.4)	79 (45.4)	8 (4.6)	

ADT, androgen deprivation therapy; AJCC, American Joint Committee on Cancer; AS, active surveillance; RP, radical prostatectomy; RT, radiation therapy.

insurance patients, with TTT of 11 days (95% CI, 4.5-15.7 days) and 9 days (95% CI, 0.16-13.9 days), respectively. Although marital status was not a significant predictor of TTT, patients with other marital status took longer to start treatment than married patients (7 days; 95% CI, 1.3-17.8 days).

Compared with low-risk patients, high-risk patients had longer TTT (25 days; 95% CI, 8.8-40.5 days). Intermediate-risk patients had comparable TTT and were not significantly different from low-risk patients. In terms of treatment care, patients who received RT had longer TTT (34 days; 95% CI, 25.0-50.0 days) than patients who underwent RP.

Discussion

To our knowledge, there are few published studies assessing whether socioeconomic and demographic characteristics are related to prostate cancer treatment choice or time to first treatment. This novel analysis shows that treatment choice is significantly affected by older age, nonmarried status, and nonwhite race/ethnicities ($P < .05$). Additionally, time delays to treatment are found in similar subpopulations in addition to non-commercial insurance.

Treatment choice and TTT can be affected by social, economic, cultural, and clinical factors, which together may prevent patients with prostate cancer from receiving the treatments that are ideally suited to their health needs. For example, a previous study showed an increasing reluctance with age to discuss surgical treatment for prostate cancer, especially among black patients,[9] which may explain the decreased rates of RP among older men in our study. Although increasing age is correlated with more medical comorbidities and thus decreasing surgical suitability, our finding that patients aged >60 years old had longer TTT suggests that they also took longer to decide on their treatment.

Table 2 Odds of RP and RT for prostate cancer by patient characteristics

	N	RP			RT		
		n (row %)	OR* (95% CI)	*P*-value	n (row %)	OR* (95% CI)	*P*-value
Age (y)							
≤60	445	365 (82.0)	1.0	Ref	32 (7.2)	1.0	Ref
>60 to ≤70	457	270 (59.1)	0.28 (0.19-0.41)	<.0001	81 (17.7)	2.5 (1.6-4.1)	.0001
>70	186	26 (14.0)	0.04 (0.02-0.07)	<0.0001	68 (36.6)	5.6 (3.3-9.7)	<.0001
Race/ethnicity							
White	453	364 (80.4)	1.0	Ref	32 (7.1)	1.0	Ref
Black	420	176 (41.9)	0.20 (0.13-0.30)	<.0001	110 (26.2)	3.8 (2.4-6.0)	<.0001
Hispanic/Latino	130	78 (60.0)	0.54 (0.20-1.4)	.220	23 (17.7)	1.7 (0.58-5.1)	.325
Other	85	43 (50.6)	0.45 (0.22-0.91)	.027	16 (18.8)	2.1 (0.93-4.9)	.076
Primary language spoken							
English	847	550 (64.9)	1.0	Ref	129 (15.2)	1.0	Ref
Spanish	101	60 (59.4)	0.83 (0.29-2.4)	.735	18 (17.8)	1.3 (0.42-4.2)	.633
Haitian Creole	71	21 (29.6)	0.48 (0.24-0.96)	.038	18 (25.4)	0.88 (0.46-1.7)	.714
Other	69	30 (43.5)	0.51 (0.24-1.1)	.079	16 (23.2)	1.3 (0.60-3.0)	.466
Insurance status							
Commercial/Private	403	317 (78.7)	1.0	Ref	33 (8.2)	1.0	Ref
Medicaid/Free Care	278	161 (57.9)	0.71 (0.45-1.2)	.138	46 (16.6)	1.3 (0.77-2.2)	.324
Medicare/Military	407	183 (45.0)	0.53 (0.35-0.79)	.002	102 (25.1)	1.8 (1.1-2.8)	.019
Marital status							
Married	643	434 (67.5)	1.0	Ref	80 (12.4)	1.0	Ref
Single	284	152 (53.5)	0.53 (0.36-0.78)	.001	59 (20.8)	1.7 (1.2-2.6)	.013
Other	161	75 (46.6)	0.39 (0.25-0.62)	<.0001	42 (26.1)	1.9 (1.2-3.1)	.006
AJCC							
Stage II	985	586 (59.5)	1.0	Ref	170 (17.3)	1.0	Ref
Stage III	103	75 (72.8)	4.5 (2.4-8.6)	<.0001	11 (10.7)	0.42 (0.21-0.83)	.014
Risk category							
Low	503	344 (68.4)	1.0	Ref	52 (10.3)	1.0	Ref
Intermediate	411	276 (67.2)	1.5 (1.1-2.2)	.024	83 (20.2)	1.8 (1.2-2.7)	.005
High	174	41 (23.6)	0.22 (0.13-0.37)	<.0001	46 (26.4)	1.6 (0.98-2.6)	.063

AJCC, American Joint Committee on Cancer; CI, confidence interval; OR, odds ratio; Ref, reference; RP, radical prostatectomy; RT, radiation therapy.
* Odds Ratios were calculated using multiple logistic regression adjusting for all patient characteristics.

A study conducted by Xu et al showed differences in the choice of treatment when risk groups were compared by race. White high-risk patients had lower rates of AS than intermediate- and low-risk white patients, as opposed to black high-risk patients whose rate of AS was unchanged among risk groups.[10] Furthermore, black patients have been shown to have higher mortality rates due to reduced access to care.[11-13] They are diagnosed at a more advanced stage,[14] with decreased rates of RP and higher rates of ADT and RT as compared with white patients.[15,16]

Our study, which shows rates of RT, ADT, and AS for black patients that are several times higher than those of white patients, corroborates the finding that the rate of surgery is significantly lower in nonwhite ethnicities. A meta-analysis performed by Barocas et al demonstrated that black patients with prostate cancer had historically been treated with a less aggressive approach,[17] and among black men who received surgery, poorer surgical outcomes, higher rates of mortality, and longer hospital stays were observed.[18] Additionally, high-risk patients were less likely to be treated in accordance with guideline-appropriate management.[19] The finding of longer TTT among our black patients is concordant with a previous study that showed an increased delay in treating high-risk black patients.[3]

Haitian-speaking patients have shown higher rates of distrust in Western medicine and increased reluctance to seek help.[20] These, together with inherent difficulties with a language barrier, may hinder the treatment pursued by Haitian-speaking patients[20] and partially explain the increased incidence of AS and the decreased incidence of surgery in the Haitian-speaking patients in our study. Interestingly, Haitian-speaking patients in several large patient population studies have shown increased survival rates compared with other language groups despite less aggressive treatments.[21-23] Further research is needed to explain this phenomenon.

Patient populations with lower rates of private insurance have been previously shown to have higher rates of mortality[24] and fewer surgeries.[25] Our patient cohort was also less likely to undergo surgery and more likely to receive RT if they had Medicare or military insurance, providing further evidence for decreased surgical treatments among

Table 3 Odds of ADT and AS for prostate cancer by patient characteristics

	N	ADT			AS		
		n (row %)	OR* (95% CI)	*P*-value	n (row %)	OR* (95% CI)	*P*-value
Age (ye)							
≤60	445	19 (4.3)	1.0	Ref	29 (6.5)	1.0	Ref
>60 to ≤70	457	38 (8.3)	1.4 (0.69-2.7)	.376	68 (14.9)	3.3 (2.0-5.5)	<.0001
>70	186	48 (25.8)	3.8 (1.8-7.9)	.001	44 (23.7)	7.0 (3.7-13.1)	<.0001
Race/ethnicity							
White	453	13 (2.9)	1.0	Ref	44 (9.7)	1.0	Ref
Black	420	63 (15.0)	3.3 (1.5-6.9)	.002	71 (16.9)	1.9 (1.2-3.1)	.011
Hispanic/Latino	130	19 (14.6)	3.7 (0.79-17.6)	.098	10 (7.7)	0.72 (0.15-3.4)	.673
Other	85	10 (11.8)	3.3 (0.92-11.5)	.066	16 (18.8)	1.3 (0.59-3.1)	.487
Primary language							
English	847	70 (8.3)	1.0	Ref	98 (11.6)	1.0	Ref
Spanish	101	15 (14.9)	1.4 (0.29-6.9)	.672	8 (7.9)	0.97 (0.18-5.3)	.968
Haitian Creole	71	12 (16.9)	0.84 (0.33-2.1)	.707	20 (28.2)	2.4 (1.2-4.8)	.017
Other	69	8 (11.6)	0.75 (0.21-2.7)	.656	15 (21.7)	1.8 (0.78-4.3)	.169
Insurance status							
Commercial/Private	403	16 (4.0)	1.0	Ref	37 (9.2)	1.0	Ref
Medicaid/Free Care	278	32 (11.5)	1.5 (0.68-3.3)	.315	39 (14.0)	1.5 (0.82-2.6)	.198
Medicare/Military	407	57 (14.0)	1.5 (0.71-3.0)	.309	65 (16.0)	1.5 (0.89-2.4)	.136
Marital status							
Married	643	49 (7.6)	1.0	Ref	80 (12.4)	1.0	Ref
Single	284	34 (12.0)	1.1 (0.62-2.0)	.717	39 (13.7)	1.4 (0.89-2.3)	.136
Other	161	22 (13.7)	1.9 (0.92-3.7)	.084	22 (13.7)	1.1 (0.64-2.0)	.671
AJCC							
Stage II	985	88 (8.9)	1.0	Ref	141 (14.3)	1.0	Ref
Stage III	103	17 (16.5)	0.86 (0.43-1.7)	.665	0 (0.0)	—	—
Risk category							
Low	503	1 (0.20)	1.0	Ref	106 (21.1)	1.0	Ref
Intermediate	411	25 (6.1)	25.8 (3.5-192.6)	.002	27 (6.6)	0.19 (0.11-0.31)	<.0001
High	174	79 (45.4)	289.4 (39.2 to>999.0)	<.0001	8 (4.6)	0.08 (0.04-0.18)	<.0001

ADT, androgen deprivation therapy; AJCC, American Joint Committee on Cancer; AS, active surveillance; CI, confidence interval; OR, odds ratio; Ref, reference.

* OR calculated using multiple logistic regression adjusting for all patient characteristics.

patients with nonprivate insurance. Having any insurance type other than private/commercial also increases the risk of poor short-term outcomes after surgery, including increased mortality, complications, and longer hospital stays.[26] Furthermore, TTT is significantly longer in Medicaid/charity care patients, an interesting finding that is in line with a previous study that showed a significantly increased TTT for low-income patients.[27]

Marital status is shown to be a significant predictor of prostate cancer–related mortality, with poorer prognoses among unmarried men even when adjusted for age, race, and stage at diagnosis.[28,29] Our study showed higher rates of RT than RP and longer TTT among unmarried men, which may indicate that treatment choices and delays play a role in mortality outcomes.

As expected, patients with high-risk disease are less likely to pursue RP or AS. Although an increasing number of patients with high-risk disease are being treated with RP, the mainstay of treatment for these patients remains RT with neoadjuvant, concurrent, and adjuvant ADT. However, we also note that high-risk patients had longer TTT by a median of 25 days than low-risk patients, a finding that is fairly concerning. At a practical level, it remains plausible that these patients are likely considering their options more deliberately, but high-risk disease associates with a more aggressive histology, and treatment delays in this regard are potentially more detrimental to clinical outcomes than treatment delays in lower-risk disease.

Finally, the difference in TTT between patients who underwent RP and RT is considerable: 67 days for RP versus 116 days for RT. In multivariate analyses, patients who underwent RT initiated treatment a median of 34 days later than patients who received RP. The explanation may be a combination of factors, including urology referral and consultation times, consideration of multiple RT modalities (e.g., external beam and brachytherapy), consideration of ADT and medical oncology referrals, and treatment planning time. A potential bias toward longer TTT in patients who underwent RT due to radiation oncology referral delays is possible; however, in our study, most patients were

Table 4 Patient characteristics and time from diagnosis to start of treatment (days) in patients receiving radical prostatectomy or radiation therapy

	n	Crude model		Multivariate model*	
		Median (IQR)	*P*-value	Adjusted parameter estimate (95% CI), *P*-value	
Intercept		N/A		49 (41.2-58.9)	
Age (y)			< .0001		.030
≤60	397	69 (53)		Ref	
>60 to ≤70	351	76 (59)		7 (0.14-12.2)	
>70	94	105 (67)		6 (−10.7-20.8)	
Race/Ethnicity			<.0001		.048
White	396	63.5 (48)		Ref	
Black	286	85 (70)		7 (2.6-12.8)	
Hispanic/Latino	101	82 (47)		10 (−0.58 to 28.4)	
Other	59	89 (81)		4 (−10.6 to 24.5)	
Primary language spoken			.0001		.393
English	679	72 (58)		Ref	
Spanish	78	78.5 (57)		−1 (−24.4 to 11.2)	
Haitian Creole	39	108 (105)		20 (−10.0 to 54.6)	
Other	46	90 (107)		14 (−6.7 to 25.7)	
Insurance status			<.0001		<.0001
Commercial/Private	350	64 (47)		Ref	
Medicaid/Free care	207	82 (65)		11 (4.5-15.7)	
Medicare/Military	285	84 (72)		9 (0.16-13.9)	
Marital status			<.0001		.066
Married	522	69 (58)		Ref	
Single	211	80 (65)		5 (0.40-11.6)	
Other	117	84 (63)		7 (1.3-17.8)	
AJCC			.059		.032
Stage II	756	74 (60)		Ref	
Stage III	86	82 (59)		9 (1.0-16.4)	
Risk category			<.0001		<.0001
Low	396	67 (49)		Ref	
Intermediate	359	78 (55)		2 (−3.6 to 5.9)	
High	87	120 (86)		25 (8.8-40.5)	
Treatment type			<.0001		<.0001
Radical prostatectomy	661	67 (47)		Ref	
Radiation therapy	181	116 (93)		34 (25.0-50.0)	

AJCC, American Joint Committee on Cancer; CI, confidence interval; IQR, interquartile range; N/A, not available; Ref, reference.
Note: Overall median time to treatment is 75 days (IQR = 60 days).
* Multivariate model included all characteristics with $P < .1$ in the crude model.

referred to radiation oncology as a second opinion regardless of whether they received RP or RT, which effectively removed such a bias. Furthermore, our radiation oncology department has a standard 7-day turnaround policy from referral request to consultation appointment. Therefore, the longer RT TTT is influenced less by RT department consultation availability and more by individual patient factors.

Being in an academic hospital allows patients the opportunity to partake in multidisciplinary care as well. Briefly, patients have access to a team of urologists, radiation oncologists, medical oncologists, and other important medical personnel, although not everyone is needed, depending on the patients' circumstances. Patient cases that need comprehensive care also are fully reviewed on an ongoing basis by the multidisciplinary tumor board to ensure that the best possible care is delivered.

Our study investigated a large and diverse patient population, and the variety of ethnic and socioeconomic backgrounds available to us allowed us to explore barriers to cancer treatment in ways that a more homogenous patient population could not. The findings from this study are consistent with those from other academic hospitals. For example, Sommers et al found that younger age significantly correlated with receiving RP, whereas men with high- or medium-risk tumors were more likely to have RT or ADT within Boston-area teaching hospitals' populations.[30] Xiao et al analyzed hospital data from Florida to determine multilevel factors that affect overall mortality.[31] In the study by Kinlock et al, black men were more likely to experience longer waits from diagnosis to treatment after adjusting for demographic and clinical variables within the North Carolina hospital system.[32] Therefore, the applicability of our study reaches beyond our own hospital network and can be generalized to a wider population.

The observed patterns of care can also be aligned to national trends. For instance, there has been a steep increase in AS over the past couple decades,[33,34] which can be seen by the fact that more people are choosing AS in our hospitals as well.

Some limitations of our study include possible selection bias derived from the retrospective study design. Patients who were lost to follow-up, were referred to another facility, had metastatic disease, or had multiple carcinomas were excluded from the study. Patients with missing data on diagnosis date, treatment choice, treatment start date, AJCC stage, or clinical pathology also were excluded from the analysis. However, this would lead to a nondifferential bias to the results, thereby underestimating the true value of the association between risk factors and treatment choice or TTT.

We also have only explored a few broad modalities of treatment and did not examine other details such as perioperative and postoperative outcomes for RP, lengths of hospital stay, or follow-up treatments after initial interventions. We also did not examine the degree of patient education available to these patients and to what extent they understood the implications and risks associated with the treatments. The distance traveled for treatment was also not taken into account in this study, although it has been previously shown to affect RT choice in patients with prostate cancer.[35] Moreover, the results for Haitian-speaking patients may have more relevance in local disparities than at a national level, thereby limiting their generalizability.

This study demonstrates significantly reduced rates of surgical treatments and increased TTT across ethnicity, insurance type, marital status, and age. By having a deeper understanding of the trends per treatment choice, physicians can further guide patients to appropriate treatments on the basis of their demographic characteristics, including but not limited to age and risk category. For instance, high-risk patients take almost 1 month longer to start treatment than low-risk patients and should be followed more closely for subsequent clinical visits.

Health care access issues in underserved populations should be further studied and monitored on a clinical basis. Such information would provide a better understanding of the various barriers that potentially affect effective cancer care and timely treatment.

Conclusions

Treatment choice and TTT are subject to a number of sociodemographic, economic, cultural, and clinical factors. Our study serves to contribute to the understanding of treatment choice and treatment delays by evaluating them in relationship to potentially important factors. According to the Institute of Medicine, 1 of 6 goals in delivering quality health care is timely treatment.[36] Health disparities across age, insurance type, marital status, and ethnicity can unfortunately manifest as reduced access to care that prevents patients with prostate cancer from receiving the treatment best suited to their needs.

In our study, age, race, and marital status were significantly related to differences in treatment choice among patients who received RT, RP, ADT, and AS. These same factors in addition to insurance status were also significantly related to differences in TTT. Finally, patients with high-risk disease and those pursuing RT over RP were found to have significant treatment delays and should be studied further to reduce disparities in prostate cancer care.

Acknowledgments

The authors are grateful for the contributions by the Clinical Data Warehouse to facilitate the compilation and collection of data.

Supplementary data

Supplementary material for this article (https://doi.org/10.1016/j.adro.2017.12.002) can be found at www.advancesradonc.org.

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