



# Racial variation in receipt of quality radiation therapy for prostate cancer

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## Abstract

**Purpose** Racial disparities are apparent in the management and outcomes for prostate cancer; however, disparities in compliance to quality measures for radiation therapy for prostate cancer have not been previously studied. Therefore, the goal of the study was to characterize disparities in the compliance rates with quality measures.

**Methods** The comparative effectiveness analysis of radiation therapy and surgery study is a population-based, prospective cohort study that enrolled 3708 men with clinically localized prostate cancer from 2011 to 2012. Compliance with 5 radiation-specific quality measures endorsed by national consortia as of 2011 was assessed, and compliance was compared by race using logistic regression.

**Results** Overall, 604 men received definitive external beam radiation therapy (EBRT) of which 20% were self-reported black, 74% non-Hispanic white, and 6% Hispanic. Less than two-thirds of black and Hispanic men received EBRT that was compliant with all available quality measures ( $p=0.012$ ). Compared to white men, black men were less likely to receive dose-escalated EBRT (95% vs. 87%,  $p=0.011$ ) and less likely to avoid unnecessary pelvic radiation for low-risk disease (99% vs. 20%,  $p<0.001$ ). Compared to white men, Hispanic men were less likely to undergo image guidance (87% vs. 71%,  $p=0.04$ ). Black and Hispanic men were more likely to receive EBRT from low-quality providers than white men.

**Conclusions** Addressing disparities in access to providers that meet quality guidelines, and improving adherence to evidence-based processes of care may decrease racial/ethnic disparities in prostate cancer outcomes.

**Keywords** Prostate cancer · Racial disparities · Radiation therapy · Quality measures

## Introduction

Despite innovation and dedicated investigation, racial inequalities persist in prostate cancer (PCa); black men have twice the mortality risk from PCa [1]. Inequalities in the provision of evidence-based care may account for some of the observed differences in cancer outcomes. However, the association between race/ethnicity and compliance with

evidence-based quality measures has not been well characterized in the treatment of localized PCa with contemporary radiation therapy.

## Methods

We evaluated the effect of patient race/ethnicity on compliance with five evidenced-based external beam radiation therapy (EBRT) quality measures (QM) among 604 men with localized PCa enrolled in the prospective, population-based Comparative Effectiveness Analysis of Surgery and Radiation (CEASAR) study (see Table 1). Details of the study design and objectives have been described elsewhere [2]. Race was self-reported as Non-Hispanic white, Non-Hispanic black, and Hispanic, and each category was mutually exclusive. Prostate cancer disease risk was stratified according to the D'Amico criteria [3]. Two of the QM reflect care

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**Table 1** Compliance rates with quality metrics

Quality measure	Rationale for quality measure	Compliance with quality measure				<i>p</i> value
		White ( <i>N</i> =447)	Black ( <i>N</i> =119)	Hispanic ( <i>N</i> =38)	Combined ( <i>N</i> =604)	
Receipt of $\geq 75$ Gy radiation for men treated with conventional fractionation (1.8 or 2.0 Gy per day)	Dose-escalated radiation improves prostate cancer control	95% (363/381)	87% (87/100)	92% (34/37)	93% (484/518)	0.011
Utilization of image-guided radiation therapy	Image guidance improves the accuracy of radiation, ensuring appropriate targeting of the prostate while limiting dose to the adjacent bowel and bladder	87% (342/395)	88% (86/98)	71% (25/35)	86% (453/528)	0.04
Administration of androgen deprivation therapy with EBRT for high-risk disease	ADT improves prostate cancer survival for high-risk patients receiving EBRT	78% (79/101)	77% (27/35)	100% (9/9)	79% (115/145)	0.283
No androgen deprivation therapy with EBRT for low-risk disease	ADT has side effects and does not improve outcomes for low-risk patients receiving EBRT	94% (121/129)	88% (28/32)	78% (7/9)	92% (156/170)	0.149
Treatment of the prostate only, without lymph node radiation for low-risk disease	Radiation to the pelvic lymph nodes increases acute and late toxicity and does not improve outcomes for low-risk patients receiving EBRT	99% (120/121)	80% (24/30)	100% (9/9)	96% (153/160)	<0.001
Compliance with all EBRT measures for disease risk group		77% (307/399)	64% (68/106)	64% (23/36)	74% (398/541)	0.012

ADT Androgen deprivation therapy, EBRT External beam deprivation therapy, Gy Gray

that improves PCa control (administration of dose-escalated EBRT) [4], and one improves PCa survival (administration of androgen deprivation therapy (ADT) with EBRT for high-risk disease) [4]. Two of the QM prevent unnecessary treatment toxicity (no ADT or pelvic node radiation for men with low-risk disease) [4]. The fifth QM, use of image-guided radiation therapy (IGRT) [4], improves the accuracy of radiation treatment which can both improve cancer control and decrease treatment toxicity.

Treatment adherence to disease-specific QMs was evaluated for individual patients. Treatment of low-risk disease was evaluated for compliance with dose-escalation, IGRT, no ADT, and no pelvic node radiation. Treatment of intermediate-risk disease was evaluated for compliance with dose-escalation and IGRT. Treatment of high-risk disease was evaluated for compliance with dose-escalation, IGRT, and administration of concurrent ADT. To explore the impact of the treating physician on racial variation in quality EBRT, a provider-level score was calculated for each physician by averaging patient-level disease-specific treatment adherence rates (number of compliant items divided by number of QMs evaluated for the patient's risk group) for all of the

physicians' individual patients. Compliance with each QM was given equal weight. Low-scoring providers were identified as those whose provider-level score was less than 50%. A provider-level score less than 50% indicates that on average the provider's individual patients received treatment that adhered to less than 50% of disease-specific QMs relevant to their prostate cancer risk category. Differences between the race categories were assessed with the  $\chi^2$  test. To assess the association between race and QM compliance, a multivariable logistic regression was performed, in which education, insurance status, and disease risk status were adjusted.

## Results

Twenty-nine percent of the men had low-risk, 47% intermediate-risk, and 24% high-risk disease according to D'Amico risk criteria. Twenty percent self-identified as black and 6% as Hispanic. Less than two-thirds of black (64%) and Hispanic (64%) men received EBRT that adhered to all the recommended QM for their disease risk group, compared to 77% of white men ( $p=0.01$ , see Table 1). There

was racial variation in treatment with dose-escalated EBRT ( $p=0.01$ ) and treatment with IGRT ( $p=0.04$ ). Black men were less likely to receive a dose-escalated EBRT (87% vs. 92% Hispanic vs. 95% white,  $p=0.011$ ) and less likely to avoid unnecessary pelvic radiation for low-risk PCa (80% vs. 100% Hispanic vs. 99% white,  $p<0.001$ ), while Hispanic men were less likely to receive IGRT (71% vs. 88% black vs. 87% white,  $p=0.04$ ). The racial disparity in compliance with QM was especially apparent in men with low-risk and intermediate-risk prostate cancer (see Appendix). Forty-five percent and 56% of black and Hispanic men with low-risk PCa received EBRT that was compliant with all low-risk QM compared to 75% of white men ( $p=0.007$ ). Logistic regression analysis of compliance with all QM for disease risk group demonstrated that black men had 46% lower odds than white men to receive EBRT that met all QM after adjusting for education, insurance status, and disease risk (OR 0.54,  $p=0.03$ , 95% CI 0.32–0.89).

There were 354 unique providers administering EBRT for the 604 patients. The physicians treating black and Hispanic men had lower average QM compliance scores than those treating white men ( $p=0.025$ ). Hispanic men were almost five times as likely to undergo care by a low-scoring provider (19%) compared to white men (4%,  $p=0.016$ ). Black men were more commonly treated by low-quality providers (7%) than white men (4%); however, the difference was not statistically significant ( $p=0.36$ ). A sub-analysis, limited to the 296 providers who treated at least 2 or more patients enrolled in the CEASAR study, confirmed that Hispanic men were more likely to receive EBRT from low-scoring providers (17% vs. 2%,  $p=0.009$ ); the numeric difference between black men and white men persisted but was not significant (5% vs. 2%,  $p=0.17$ ). Forty-four percent of the providers for white patients had 100% compliance to all the quality measures for all their patients, compared to 28% for the providers for black patients and 58% for Hispanic patients ( $p=0.039$ ).

## Discussion

This study, to the best of our knowledge, is the first to highlight the racial disparity in the quality of care for contemporary EBRT in PCa. Compliance with evidence-based QM for EBRT was significantly lower among minority men compared to white men, even after accounting for socioeconomic and disease differences.

Non-compliance with some QM is associated with inferior prostate cancer control outcomes, and, thus, could play a role in the disparity in PCa oncologic outcomes seen in black men [1]. In this study, black men received an adequate radiation dose less frequently than white men. Ameliorating unnecessary variation in adherence to such evidence-based processes could reduce the observed disparities in PCa

oncologic outcomes. Disparities in PCa control outcomes among black and Hispanic men have not been well studied especially among those treated with EBRT, and should be included in future studies to help identify and eliminate racial disparities in outcomes.

Similarly, non-compliance with QM can increase the side effects of EBRT and negatively impact quality of life by delivering radiation to unnecessary areas and without the accuracy of image guidance. In this study, Hispanic men were less likely to receive image-guided EBRT, and were more likely to receive unnecessary ADT in the setting of low-risk cancer, while black men were more likely to undergo unindicated pelvic lymph node radiation for low-risk cancer. Improving adherence to these evidence-based QM has the potential to decrease treatment side effects for minority men receiving EBRT.

Lower-quality radiation for minority men appears to be driven in part by access to physicians and facilities that comply with quality measures. The care of minority patients is often concentrated among relatively few hospitals and physicians that tend to have fewer financial resources and provide inferior quality care than providers for white patients [5]. Applying Donabedian's triad of health care quality to this clinical scenario, structure, i.e., access to physicians that provide high-quality radiation therapy, can affect both processes of care (adherence to guideline recommendations) and quality of cancer-related outcomes. In our cohort, we found that Hispanic men were most vulnerable to structural barriers with respect to limited access to facilities that provide IGRT and have quality providers. For black men, there was less of a deficit in terms of access to high-quality providers, yet the disparity in certain processes of care remained significant. The identification of these disparities may represent opportunities for improvement. Potential levers for improving adherence to process measures, and reducing unnecessary variation, include harnessing the power of electronic medical records to support clinical decisions. Access and structural issues may best be addressed at the policy level.

This study demonstrates that black and Hispanic men are more likely to receive lower-quality EBRT and be treated by physicians who administer lower-quality EBRT. Addressing disparities in access to facilities and providers that meet quality guidelines, and improving adherence to evidence-based processes of care may decrease racial/ethnic disparities in prostate cancer outcomes.

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## Compliance with ethical standards

## Appendix

**Conflicts of interest** No author has any relevant conflicts of interest.

See Tables 2, 3, and 4.

**Table 2** Compliance rates with quality metrics for patients with D'Amico low-risk prostate cancer

Quality measure	Rationale for quality measure	Compliance with quality measure				<i>p</i> value
		White ( <i>N</i> =132)	Black ( <i>N</i> =32)	Hispanic ( <i>N</i> =9)	Combined ( <i>N</i> =173)	
Receipt of $\geq 75$ Gy radiation for men treated with conventional fractionation (1.8 or 2.0 Gy per day)	Dose-escalated radiation improves prostate cancer control	94% (102/108)	76% (22/29)	89% (8/9)	90% (132/146)	0.01
Utilization of image-guided radiation therapy	Image guidance improves the accuracy of radiation, ensuring appropriate targeting of the prostate while limiting dose to the adjacent bowel and bladder	85% (97/114)	89% (24/27)	75% (6/8)	85% (127/149)	0.62
No androgen deprivation therapy with EBRT for low-risk disease	ADT has side effects and does not improve outcomes for low-risk patients receiving EBRT	94% (121/129)	88% (28/32)	78% (7/9)	92% (156/170)	0.149
Treatment of the prostate only, without lymph node radiation for low-risk disease	Radiation to the pelvic lymph nodes increases acute and late toxicity and does not improve outcomes for low-risk patients receiving EBRT	99% (120/121)	80% (24/30)	100% (9/9)	96% (153/160)	<0.001
Compliance with all EBRT measures for disease risk group		75% (85/114)	45% (13/29)	56% (5/9)	68% (103/152)	0.007

ADT Androgen deprivation therapy, EBRT External beam deprivation therapy, Gy Gray

**Table 3** Compliance rates with quality metrics for patients with D'Amico intermediate-risk prostate cancer

Quality measure	Rationale for quality measure	Compliance with quality measure				<i>p</i> value
		White ( <i>N</i> =211)	Black ( <i>N</i> =52)	Hispanic ( <i>N</i> =20)	Combined ( <i>N</i> =283)	
Receipt of $\geq 75$ Gy radiation for men treated with conventional fractionation (1.8 or 2.0 Gy per day)	Dose-escalated radiation improves prostate cancer control	96% (172/180)	88% (36/41)	95% (19/20)	94% (227/241)	0.16
Utilization of image-guided radiation therapy	Image guidance improves the accuracy of radiation, ensuring appropriate targeting of the prostate while limiting dose to the adjacent bowel and bladder	87% (162/186)	83% (34/41)	68% (13/19)	85% (209/246)	0.088
Compliance with all EBRT measures for disease risk group		84% (155/184)	72% (31/43)	63% (12/19)	80% (198/246)	0.027

ADT Androgen deprivation therapy, EBRT External beam deprivation therapy Gy Gray

**Table 4** Compliance rates with quality metrics for patients with D’Amico high-risk prostate cancer

Quality measure	Rationale for quality measure	Compliance with quality measure				<i>p</i> value
		White ( <i>N</i> =101)	Black ( <i>N</i> =35)	Hispanic ( <i>N</i> =9)	Combined ( <i>N</i> =145)	
Receipt of $\geq 75$ Gy radiation for men treated with conventional fractionation (1.8 or 2.0 Gy per day)	Dose-escalated radiation improves prostate cancer control	96% (87/91)	97% (29/30)	88% (7/8)	95% (123/129)	0.54
Utilization of image-guided radiation therapy	Image guidance improves the accuracy of radiation, ensuring appropriate targeting of the prostate while limiting dose to the adjacent bowel and bladder	87% (81/93)	93% (28/30)	75% (6/8)	88% (115/131)	0.35
Administration of androgen deprivation therapy with EBRT for high-risk disease	ADT improves prostate cancer survival for high-risk patients receiving EBRT	78% (79/101)	77% (27/35)	100% (9/9)	79% (115/145)	0.283
Compliance with all EBRT measures for disease risk group		66% (67/101)	71% (24/34)	75% (6/8)	68% (97/143)	0.82

*ADT* Androgen deprivation therapy, *EBRT* External beam deprivation therapy, *Gy* Gray

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