

## Critical Review

# Disparities in the Utilization of Radiation Therapy for Prostate Cancer in the United States: A Comprehensive Review



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## Abstract

**Purpose:** Major advances in radiation therapy (RT) for prostate cancer increase the importance of equity in the use of RT. We sought to assess the evolution of RT utilization disparities in prostate cancer to inform clinicians and health care organizations of persistent areas of need that can be addressed in their practices and policies.

**Methods and Materials:** A comprehensive PubMed literature search was undertaken in June 2020 and subsequently in March 2021. Studies were excluded that were not based in the United States, did not examine health disparities or inequities, did not examine RT or related resource utilization, or did not examine prostate cancer.

**Discussion:** Of 257 studies found, 32 met inclusion criteria. Health disparities were most prominently reported by race, socioeconomic status, geographic location, insurance status, practice characteristics, and age. Older men were less likely to receive definitive RT or prostatectomy. Black men were less likely to receive curative therapy or dose-escalated RT. Black, Hispanic, and Asian men were less likely to receive proton therapy. Lower income was associated with decreased prostate-specific antigen testing and treatment with proton therapy or stereotactic body RT. Medicaid patients were less likely to receive definitive treatments. Rural residents were less likely to receive RT. Minority-serving hospitals were less likely to offer definitive treatments for prostate cancer.

**Conclusions:** Sociodemographic disparities and inequities in RT for prostate cancer persist. Robust efforts are imperative to eliminate disparities to improve outcomes for all patients with prostate cancer.

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## Introduction

Prostate cancer is the most prevalent cancer in men and is the second-most common cause of cancer-related mortality in men worldwide, and the numbers are expected to continue to rise.<sup>1,2</sup> There are variations in incidence and mortality based on geographic location when stratified by ethnicity or race, geographic location, and socioeconomic status (SES).<sup>3</sup> The latter highlights the

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importance of recognizing and addressing social determinants of health that lead to disparities or significant differences in comparable populations in prostate-specific outcomes, especially when compounded by health illiteracy, lack of education, decreased access to quality care, and biases from patients and providers.

Radiation therapy (RT) has made great advances in technology over the past several decades, specifically with the use of intensity modulated RT, stereotactic body RT, and proton beam therapy, which allow for a more conformal and escalated dose of ionizing radiation with a reduction in morbidity and mortality relative to historical conventional techniques. In regard to disparities in the use of RT for prostate cancer, several studies continue to document that the use of these modalities for prostate cancer differ by race, SES, geographic location, insurance status, and age of patients.<sup>4-9</sup> Inequities, the unequal distribution of resources or care between populations or groups, leading to the avoidance or delay in the use of these technologically advanced RT techniques in vulnerable populations is a specific area of research that needs to be continually explored in radiation oncology to decrease the gap in differential outcomes.<sup>10</sup>

In 2016, a comprehensive review of reported health disparities and inequities in health care resource utilization for all cancers found that prostate cancer was the most reported disease site. In that paper, the authors concluded that disparities in the field of radiation oncology, particularly with access to RT, are pervasive throughout radiation oncology and are most related to race and insurance status.<sup>11</sup> In this paper, we present a review of prostate cancer disparity literature since 2017 to inform clinicians and health care organizations of persistent areas of need that can be addressed in their practices and policies.

## Methods and Materials

A comprehensive literature review was conducted after a June 25, 2020, PubMed database search for articles spanning 2017 to 2020 using the search terms “prostate AND (radiation OR proton) AND (disparities OR “socioeconomic status” OR “health services research” OR inequity OR race [Title]).” One hundred eighty-four studies resulted from this inquiry. A subsequent PubMed database search was done on March 18, 2021, for additional articles spanning 2017 to 2020 using the terms “Prostatic Neoplasms”[Mesh] AND (“Radiation Oncology”[Mesh] OR “Radiation Oncologists”[Mesh] OR “Radiation therapy”[Mesh] OR “Radiosurgery”[Mesh] OR “Proton Therapy”[Mesh] OR “Brachytherapy”[Mesh]) AND (“Healthcare Disparities”[Mesh] OR “Health Status Disparities”[Mesh] OR “Social Class”[Mesh] OR “health services research”[MeSH Terms]).

Seventy-three studies resulted from this inquiry with 6 studies duplicated. As delineated in [Figure 1](#), studies were excluded that were not based in the United States, did not examine health disparities or inequities, did not examine RT or related resource utilization, or did not examine prostate cancer.

## Discussion

As noted in [Table 1](#), 32 articles met inclusion criteria with disparities most reported by race. Descriptions of these studies are grouped by demographic category and are summarized in [Table 2](#). A full list and summary of the resultant studies is available in [Table 3](#).

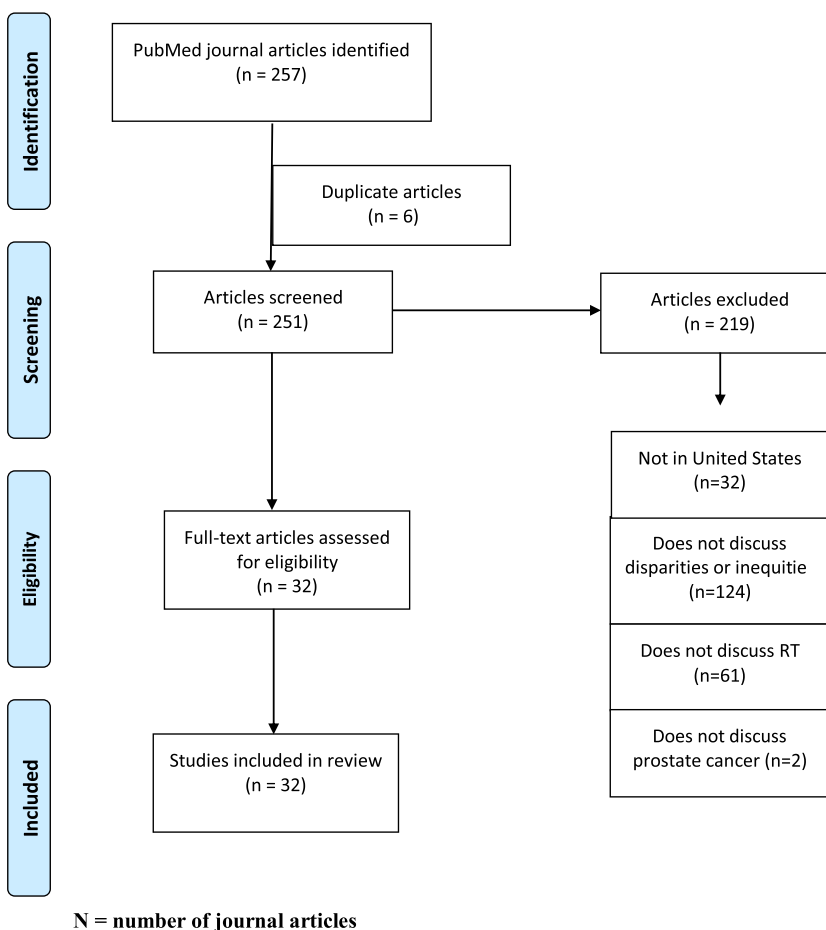
### Race

Twenty-five of 32 articles addressed racial disparities in prostate cancer and focused on race. These studies concluded that black men have a higher incidence of prostate cancer and prostate cancer–specific mortality (PCSM) and are diagnosed at an earlier age compared with non-black men.<sup>12-14</sup> Interestingly, in studies that model equal-access health systems, such as the Veteran Affairs health care system, black men do not experience delays in diagnosis and care and have equal or improved PCSM.<sup>15,16</sup> When treated with risk-appropriate RT for prostate cancer, there is similar survival between black and white men; however, when comparing age and race, younger black men have poorer survival within the same cohort.<sup>17</sup>

Several studies support that black and Hispanic men receive definitive, guideline-concordant radiation treatments for prostate cancer less than white men.<sup>6,7,18,19</sup> Additionally, black men are less likely to receive dose-escalated external beam RT or proton therapy and avoid pelvic radiation for low-risk disease.<sup>20-22</sup> One study did conclude that race should be considered as a major effect on PCSM, as even with dose-escalated external beam RT, PCSM did not significantly decline in black and Asian men as in white males.<sup>23</sup>

### SES

Reports analyzing SES, an individual’s relative societal position based on factors such as occupation, education, income, and disparities, generally concluded that lower SES is associated with a decreased likelihood of receiving RT for prostate cancer.<sup>5,6,19,21,22,24-26</sup> More specifically, lower income is paralleled to greater odds of not receiving dose-escalated or proton therapy.<sup>24</sup> However, patients with Medicare and Medicaid are more likely to receive proton therapy than those without or with private insurance.<sup>21</sup>



**Figure 1** Flowchart of systematic review of publications identified after PubMed query with results showing 32 studies meeting inclusion criteria.

**Geographic location**

Studies reporting geographic location as a disparity mostly noted that travel time and proximity to a radiation facility may introduce disparities in the utilization of RT for prostate cancer,<sup>21,27</sup> although distance is not a significant factor in all studied cohorts.<sup>28</sup> Rural residents are less likely to undergo treatment for prostate cancer in comparison to urban residents.<sup>8</sup> Additionally, rural residency and treatments facilitated at academic/high-volume centers are linked to long-

distance travel.<sup>29</sup> Lastly, geographic location in close proximity to hospitals that treat racial minority groups is associated with less likelihood of receipt of definitive treatment and increased incidence of treatment delays in patients with prostate cancer.<sup>30</sup>

**Insurance**

Articles reporting insurance status as a disparity in the receipt of RT for prostate cancer generally

**Table 1** Radiation oncology health disparities studies meeting inclusion criteria grouped by specific disparity studied

Reported disparity	Number of studies	Reference number
Race	25	[4,6-7,10,12-23,25-27,29,32-35]
Socioeconomic status	8	[5-6,19,21,22,24-26]
Geographic location	7	[8-9,21,27-30]
Insurance status	5	[6,19,25,31-32]
Practice characteristics	5	[19,32-35]
Age	2	[4,25]

**Table 2** Summary of reported radiation therapy (RT) disparities in prostate cancer from 2017 to 2020

<i>Race</i>	<ul style="list-style-type: none"> <li>• Black men have the highest incidence and prevalence of prostate cancer<sup>12</sup> and prostate-cancer specific mortality (PCSM) across all Gleason scores<sup>13</sup></li> <li>• Black men are diagnosed earlier and are more likely to have comorbidities<sup>14,26</sup></li> <li>• Black men do not present with more advanced disease or have a significant difference in survival in comparison to White men with equal-access to health care<sup>15-17,38</sup></li> <li>• Black men are less likely to receive definitive therapy, dose-escalated RT, or treatments that meets quality measures for prostate cancer<sup>10,18,20</sup></li> <li>• Black and Hispanic men are more likely to receive systemic or no treatment<sup>19</sup></li> <li>• Black, Hispanic, and Asian men are less likely to receive proton therapy<sup>21-22</sup></li> </ul>
<i>Socioeconomic status</i>	<ul style="list-style-type: none"> <li>• Low SES is associated with a decreased likelihood of receiving radiation therapy or radical prostatectomy<sup>5-6,19,25</sup></li> <li>• Lower-income men are less likely to receive proton therapy or SBRT for prostate cancer<sup>21-22,24</sup></li> </ul>
<i>Geographic location</i>	<ul style="list-style-type: none"> <li>• Rural residents are less likely to undergo treatment with radiation therapy for prostate cancer<sup>8,30</sup></li> <li>• Geographical location and long-distance travel are factors to consider as determinants to receiving RT<sup>21</sup></li> <li>• Long distance travel for RT is less likely in Black men and Medicaid-insured men<sup>30</sup></li> </ul>
<i>Insurance status</i>	<ul style="list-style-type: none"> <li>• Medicaid, Medicare, and uninsured patients are less likely to receive definitive treatments<sup>6,19,25,32</sup></li> <li>• Medicaid-insured patients are more likely to present with metastatic disease, are less likely to receive definitive treatment, and have a higher PCSM<sup>31</sup></li> </ul>
<i>Practice characteristics</i>	<ul style="list-style-type: none"> <li>• Black patients with high-risk prostate cancer are more likely to receive definitive treatment in a multi-disciplinary clinic versus a community cancer program<sup>19,35</sup></li> <li>• Minority serving hospitals are less likely to offer definitive treatment options<sup>32-33</sup></li> <li>• Active surveillance is more likely to be used at an academic center for intermediate-risk prostate cancer<sup>34</sup></li> </ul>
<i>Age</i>	<ul style="list-style-type: none"> <li>• Older age is associated with a decreased likelihood of receiving RT after prostatectomy in cN<sup>+</sup> and pN<sup>+</sup> patients<sup>4</sup></li> <li>• Older men with node-positive prostate cancer are less likely to receive definitive treatment with RT or radical prostatectomy<sup>25</sup></li> </ul>

referenced patients with Medicaid, Medicare, or without insurance being less likely to receive RT.<sup>6,19,25,31,32</sup>

Likely, men with only Medicaid are more likely to present with metastatic disease, are less likely to receive definitive treatment, and have increased PCSM compared with private insurance.<sup>31</sup>

### Practice characteristics

Four studies reported on institutional characteristics as barriers to patients receiving RT for prostate cancer, with most prominent differences being between academic versus community practices. Notably, receiving care at racially minority serving hospitals or community-based treatment facilities is associated with a decreased likelihood of receiving definitive treatment.<sup>19,33,34</sup> For patients with high-risk prostate cancer, definitive treatment is more likely offered if managed at an academic/multidisciplinary clinic, which leads to increased overall survival<sup>35</sup> versus facilities using lower quartile technology.<sup>32</sup>

### Age

Age is a reported disparity to receiving RT for node-positive prostate cancer, with studies showing older men are less likely to receive local treatment, including pelvic RT or radical prostatectomy.<sup>25</sup> One study added many patients  $\geq 65$  years significantly do not receive RT after prostatectomy despite the possibility of long-term control and cure,<sup>4</sup> although this could likely be linked to provider preference.

### Conclusions

Prostate cancer is a common, yet complex disease process with risks and outcomes influenced greatly by factors such as socioeconomic, access, quality of care, and genetics and biology. As highlighted in Tables 2 and 3, reported health disparities remain numerous in RT for prostate cancer despite significant advancements in oncologic care.

**Table 3 List of the studies meeting inclusion criteria regarding health disparities in the utilization of radiation therapy for prostate cancer in the United States**

Reference no.	Author (year)	Study title	Study type	Sample size	Population	Key finding(s)
4	Moon et al (2017)	Patterns of Care of Node-Positive Prostate Cancer Patients Across the United States: A National Cancer Data Base Analysis	Population-based (NCDB)	13,354	Men diagnosed with prostate adenocarcinoma (PCa) from 2006 to 2011	Older and non-Hispanic Black patients are less likely to receive definitive treatment.
5	des Bordes et al (2018)	Sociodemographic Disparities in Cure-Intended Treatment in Localized Prostate Cancer	Population-based (Texas Cancer Registry)	46,971	Men diagnosed with stage T1 or T2 PCa between 2004 and 2009	Low socioeconomic status associated with less likelihood of receiving RT.
6	Friedlander et al (2018)	Racial Disparity in Delivering Definitive Therapy for Intermediate/High-risk Localized Prostate Cancer: The Impact of Facility Features and Socioeconomic Characteristics	Population-based (NCDB)	283,135	Men with biopsy confirmed intermediate/high-risk PCa from 2004 to 2013	Significant facility-level variation in the utilization of definitive therapy for PCa among Blacks vs Whites exists. Lower income and insurance types associated with less likely to undergo definitive therapy.
7	Fang et al (2018)	Racial disparities in guideline-concordant cancer care and mortality in the United States	Population-based (SEER Medicare data)	37,369	Patients age >65 years of Black or non-Hispanic White race with breast, lung, and prostate cancer	The adoption of evidence-based cancer treatments in Black patient cohorts lag behind that of White patients. There is an underuse of curative treatment and guideline-concordant care in Black versus White patients.
8	Maganty et al (2020)	Under Treatment of Prostate Cancer in Rural Locations	Population-based (Pennsylvania Cancer Registry)	51,024	Men diagnosed with localized or metastatic PCa between 2009 and 2015	Compared to urban residents, rural residents are less likely to undergo treatment.
9	McClelland et al (2020)	The pervasive crisis of diminishing radiation therapy access for vulnerable	Retrospective review/Meta-analysis	N/A	Literature review for studies investigating RT access	Data is sparse, but it is likely the use of RT for cancer is less likely in this region.

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**Table 3 (Continued)**

Reference no.	Author (year)	Study title	Study type	Sample size	Population	Key finding(s)
		populations in the United States-Part 4: Appalachian patients			disparities in Appalachian patients	
10	McClelland et al (2020)	The pervasive crisis of diminishing radiation therapy access for vulnerable populations in the United States, part 1: African-American patients	Retrospective review/Meta-analysis	N/A	Literature review to examine studies investigating disparities in RT access for African Americans (AAs)	AAs less likely to receive care proven superior to conservative management. AAs have the highest death rate and shortest survival for most cancers. Access to RT may contribute to disparities for AAs.
12	Verges et al (2017)	The Relationship of Baseline Prostate Specific Antigen and Risk of Future Prostate Cancer and Its Variance by Race	Retrospective/single-institution	994	Men referred to the urology clinic for elevated PSA from 2007 to 2014	Black men are more likely to be diagnosed with PCa than White men with comparable baseline PSAs.
13	Mahal et al (2018)	Prostate Cancer-Specific Mortality Across Gleason Scores in Black vs Nonblack Men	Population-based (SEER Prostate AS/WW database)	192,224	Men diagnosed with localized PCa from 2010 to 2015	Black men were younger at diagnoses. PCSM is higher in Black patients across all Gleason scores 6-10 in comparison to non-Black men.
14	Williams et al (2018)	African-American men and prostate cancer-specific mortality: a competing risk analysis of a large institutional cohort, 1989-2015	Single-institution	7,307	Men newly diagnosed with PCa from 1989 to 2015	Black men are more likely to be diagnosed at an early age and have higher comorbidities. Black men have a higher risk of PCSM, especially >60 years of age.
15	Riviere et al (2020)	Survival of African American and non-Hispanic white men with prostate cancer in an equal-access health care system	Population-based (longitudinal, centralized database)	101,869	Veterans diagnosed with PCa between 2000 and 2015	In an equal-access health care system, AA men do not present with more advanced disease, demonstrate delays in diagnosis or care, or have higher mortality compared to the general population.

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**Table 3** (Continued)

Reference no.	Author (year)	Study title	Study type	Sample size	Population	Key finding(s)
16	Krimphove et al (2019)	Evaluation of the contribution of demographics, access to health care, treatment, and tumor characteristics to racial differences in survival of advanced prostate cancer	Population-based (NCDB)	35,611	Black and White men with metastatic or locally advanced PCa between 2004 and 2010	OS significantly worse for Black men; however, after simulating equal-access to care, there is no significant difference in survival between races.
17	Kodiyan et al (2020)	Race Does Not Affect Survival in Patients With Prostate Cancer Treated With Radiation Therapy	Population-based (NCDB)	27,150	African American and Caucasian men with N0M0 PCa diagnosed between 2004 – 2013	No significant difference in survival between treatment and race with risk-appropriate definitive RT. However, younger Black men with unfavorable risk have poorer survival.
17	Kodiyan et al (2020)	Race Does Not Affect Survival in Patients With Prostate Cancer Treated With Radiation Therapy	Population-based (NCDB)	27,150	Black or White men with PCa diagnosed between 2004 and 2013	There is no significant interaction between treatment and race for Black versus White men treated with risk-appropriate definitive RT. However, a significant interaction between race and age with less OS in younger ( $\leq 60$ years) Black men with unfavorable risk versus their White counterparts.
18	Lee et al (2018)	Contemporary prostate cancer radiation therapy in the United States: Patterns of care and compliance with quality measures	Population-based (SEER & Cancer of the Prostate Strategic Urologic Research Endeavor database)	926	Men <80 years with clinically localized PCa and a PSA <50ng/mL	Black and minority men were less likely to receive EBRT that was compliant with quality measures (dose-escalation, image-guidance, ADT appropriate use, and targets)
19	Bagley et al (2020)	Association of Sociodemographic and Health-Related Factors With Receipt of Nondefinitive Therapy	Population-based (NCDB)	70,036	Men aged $\leq 70$ years with high-risk PCa and Charlson Comorbidity Index scores	Men with no insurance, Medicaid or Medicare, and Black and Hispanic are most likely to receive systemic or no

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**Table 3** (Continued)

Reference no.	Author (year)	Study title	Study type	Sample size	Population	Key finding(s)
		Among Younger Men With High-Risk Prostate Cancer			of $\leq 2$ between 2018 and 2019	therapy in comparison to Caucasian patients or those with private insurance or managed care.
20	Lee et al (2018)	Racial variation in receipt of quality radiation therapy for prostate cancer	Population-based, prospective cohort	3,708	Men with clinically localized PCa from 2011 to 2012	Black men are less likely to receive EBRT compliant with all quality measures, dose-escalated EBRT, and pelvic RT for low-risk disease; more likely to receive EBRT from lower-quality providers.
21	Woodhouse et al (2017)	Sociodemographic disparities in the utilization of proton therapy for prostate cancer at an urban academic center	Single-institution	633	Men with low- and intermediate-risk PCa treated with definitive RT between 2010 and 2015	Older, Black men with close access to facilities, living in poverty with higher PSA and larger prostate volumes are more likely to receive IMRT vs proton therapy in comparison to White men. After adjustment for demographic and clinical factors, race and distance remain significant determinants of receiving proton therapy. Authors suggest explanation is provider implicit bias.
22	Parikh-Patel et al (2020)	A population-based assessment of proton beam therapy utilization in California	Population-based (California Cancer Registry)	2,499,510	Persons with diagnoses of all types of cancer types from 2003 to 2016 treated with any type of RT	The racial distribution of proton beam therapy was disproportionately White compared to any other forms of RT. Blacks, Hispanics, and Asian patients have significantly lower odds of receiving proton therapy. The odds of receiving proton therapy were higher in patients in the medium and high SES.

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**Table 3** (Continued)

Reference no.	Author (year)	Study title	Study type	Sample size	Population	Key finding(s)
23	Wang et al (2017)	Racial Disparity in Prostate Cancer-Specific Mortality for High-Risk Prostate Cancer: A Population-Based Study	Population-based (SEER)	28,956	Men diagnosed with clinically localized PCa and Gleason score 8-10 from 2004 to 2013 treated with EBRT, EBRT with a brachytherapy boost, or RP	Black and Asian Americans do not demonstrate a significant decrease in PCSM with dose escalation compared to non-Hispanic White men.
24	Mahase et al (2020)	Trends in the Use of Stereotactic Body Radiotherapy for Treatment of Prostate Cancer in the United States	Population-based (NCDB)	106,926	Men diagnosed with PCa from 2010 to 2015 who underwent definitive RT	Black men and those with lower incomes are less likely to receive SBRT.
25	Muralidhar et al (2017)	Disparities in the Receipt of Local Treatment of Node-positive Prostate Cancer	Population-based (NCDB)	9,771	Men with clinical N1M0 PCa diagnosed from 1998 to 2012	Black, lower income, older, and Medicaid beneficiary or no insurance patients are less likely to receive local treatment for node-positive PCa and are associated with reduced OS.
26	Pollack et al (2017)	A multidimensional view of racial differences in access to prostate cancer care	Survey-based	2,374	Men diagnosed with localized PCa between 2012 and 2014	Black men with PCa are younger and more likely to have Medicaid insurance, lower income, and a high school education or less. Black men report less availability to care and a lower level of perceived quality of care and doctor-patient communication.
27	Wong et al (2017)	Racial Differences in Geographic Access to Medical Care as Measured by Patient Report and Geographic Information Systems	Population-based (Pennsylvania Cancer Registry)	2,136	Men diagnosed with localized PCa between 2012 and 2014	Patient-reported travel times are generally longer than GIS-calculated times. Patient reported travel times were 2.11 minutes longer for Blacks than Whites for urologic and radiation oncology care

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**Table 3** (Continued)

Reference no.	Author (year)	Study title	Study type	Sample size	Population	Key finding(s)
28	Ghali et al (2018)	Does Travel Time to a Radiation Facility Impact Patient Decision-Making Regarding Treatment for Prostate Cancer? A Study of the New Hampshire State Cancer Registry	Population based (New Hampshire State Cancer Registry)	4,731	Men with newly diagnosed localized prostate cancer from 2004 to 2011	Travel time is not associated with receipt of radiation therapy in this cohort.
29	Vetterlein et al (2017)	Impact of travel distance to the treatment facility on overall mortality in US patients with prostate cancer	Population-based (NCDB)	775,999	Men with prostate cancer in all stages who received RP, RT, observation, ADT, multimodal treatment, and/or chemotherapy between 2004 and 2012	Blacks and Medicaid beneficiaries are less likely to travel long distances for treatment. Patients are less likely to travel far for RT vs RP. Patients who traveled long distances are associated with less OM as travel to academic/research or high-volume centers is likely.
30	Fletcher et al (2020)	Geographic Distribution of Racial Differences in Prostate Cancer Mortality	Population-based (SEER)	229,771	Men with biopsy-confirmed PCa between 2007 and 2014 from 17 geographic locations with SEER	The greatest survival difference between Black and White men with PCa is in low-risk PCa. Men who present to hospitals that primarily treat minority groups are less likely to receive definitive treatment and are more likely to experience delays in treatment.
31	Mahal et al (2018)	Prostate cancer outcomes for men aged younger than 65 years with Medicaid versus private insurance	Population-based (SEER)	155,524	Men, aged <65 years, who were diagnosed with PCa from 2007 to 2014	Men with Medicaid present with metastatic disease at a higher rate, are less likely to receive definitive treatment, and have a higher risk of PCSM.
32	Gerhard et al (2017)	Treatment of men with high-risk prostate cancer based on race, insurance coverage,	Population-based (NCDB)	60,300	Men diagnosed with high-risk PCa from 2010 to 2012	Non-white men with Medicaid or no insurance and those treated at low-quartile technological facilities with high-

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**Table 3** (Continued)

Reference no.	Author (year)	Study title	Study type	Sample size	Population	Key finding(s)
		and access to advanced technology				risk PCa are most likely to receive non-definitive management. At high-technological hospitals, these disparities are diminished.
33	Krimphove et al (2019)	Quality of Care in the Treatment of Localized Intermediate and High Risk Prostate Cancer at Minority Serving Hospitals	Population-based (NCDB)	536,539	Men aged ≥40 years old with intermediate- and high-risk PCa in the US between 2004 and 2015	Patients have lower odds of receiving definitive therapy and a longer time to treatment for localized intermediate- and high-risk PCa at minority serving hospitals.
34	Agrawal et al (2021)	Active Surveillance for Men with Intermediate Risk Prostate Cancer	Population-based (NCDB)	176,122	Men with intermediate risk prostate cancer from 2010 to 2016	Active surveillance use has increased significantly in recent years in patients with intermediate-risk prostate cancer. Use is associated with factors such as older age, lower Gleason score and tumor state, and treatment at an academic center.
35	Tang et al (2020)	Reply to Multidisciplinary clinics: A possible means to help to eliminate racial disparities in prostate cancer	Single-institution	N/A	Men with intermediate- and high-risk PCa	Black patients with high-risk PCa are more likely to receive definitive treatment if seen in a MultiD clinic
36	Dess et al (2019)	Association of Black Race With Prostate Cancer-Specific and Other-Cause Mortality	Multi-cohort (SEER, VA health system, NCI RTOG)	306,099	Men with clinical T1-4N0-1M0 PCa diagnosed from 1992 to 2013	After adjusting for nonbiological differences, notably access to care and standardized treatment, Black race does not associate with inferior PCSM.

*Abbreviations:* NCDB = national cancer database; PCSM = prostate cancer–specific mortality; RT = radiation therapy; RTOG = radiation therapy oncology group; SEER = surveillance, epidemiology, and end results program; VA = veteran affairs.

The most prevalent disparity reported in prostate cancer, by far, is race. Black men are 80% more likely to be diagnosed with prostate cancer than white men and 220% more likely to die of PCSM.<sup>36</sup> This may be related to the observation that there is a paucity of data in prostate cancer disparity research and the adoption of evidence-based cancer treatment in black patients tends to lag behind that of white patient counterparts, leading to racial gaps in the use of standard treatments.<sup>7</sup> Socioeconomics and insurance status are also highly reported factors that introduce a divide into who receives RT for prostate cancer. Men without insurance or with lower income are less likely to have appropriate screenings, receive definitive treatment, or be offered advanced therapy such as escalated-dose RT,<sup>22,24</sup> which has the proven benefit of a lower risk of biochemical failure in patients with localized disease.<sup>37</sup> Synergistically, many of the variables that increase disparities in prostate cancer (low SES, no insurance or not enough insurance, geographic location, etc.) may interact and markedly compound as barriers that impede equity.

Mitigating actions include diversifying the physician workforce to increase the available pool of physicians that are likely to care for underserved and minority populations and undertake disparities research. Increasing enrollment of black men and other underserved populations in prostate cancer clinical trials and studies is similarly important. Expanding high-quality care into rural and underserved areas that are traditionally highly populated by black and other minority men is vital, as geographic location and local practice characteristics are increasingly reported factors affecting prostate cancer disparities. Additionally, increasing community engagement and patient education is invaluable in decreasing barriers to care, as minority patients with prostate cancer tend to be younger, identify with a lower socioeconomic class, and are more likely to be unaware of resources available for disease prevention and management.<sup>26</sup> Academic faculty should be encouraged to conduct disparities research while partnering with appropriate colleagues and experts to avoid the expectation that minority faculty researchers alone will advance diversity, equity, and inclusion initiatives. In clinical practice, it is imperative that clinicians are consciously aware of their implicit and explicit biases, as practice characteristics and provider preferences directly affect outcomes and contribute to disparities. It is important to continue to explore and eliminate disparities, as it has been shown that when access to health care is equalized these differential outcomes are greatly reduced.<sup>15,16,27,38</sup>

Disparities and inequities in RT for prostate cancer are most likely multifactorial and a limitation of this paper is the lack of precise explanations as to why these disparities exist. Factors such as cancer biology; structural, systemic, and interpersonal biases (eg, racism); availability of advanced technology; practice characteristics; and social determinants (eg, education, income, influence, insurance status, and

geographic location) must be included when assessing systems to decrease the inequalities that exist in the use of RT to treat prostate and any other cancer. The use of RT is best considered in a multidisciplinary setting, as it has been shown to help remove some disparities as well as the uncertainties of treatment planning and recommendations.<sup>35</sup>

Limitations to this study also include the use of the PubMed database for publications and the specificity of the search terms “inequity” and “disparities.” Some authors may not use these terms in their work to investigate factors that limit radiation use for prostate cancer, such as the factors included in this work as well as ethnicity, health literacy, and comorbidities. Another limitation is the use of large databases, such as the National Cancer Database and the Surveillance, Epidemiology, and End Results Program, in most of the studies identified, as these databases may be incomplete on certain cancer-specific data such as risks and treatment.

In conclusion, the study of disparities in radiation oncology continues to appropriately increase and is necessary, as major advancements have been made in the use of RT for prostate cancer therapeutics, which greatly affect outcomes. In comparison with the first comprehensive investigation of health disparities in RT access in 2016, most of the disparities studies continue to derive from large, population-based databases. There has been very limited prospective research or robust evidence focusing on identifying and reducing disparities to ensure quality and guideline-driven care for all patients with prostate cancer. This specific research with inclusivity and representation of all populations is needed and highly anticipated to shape the future of RT use to eliminate health disparities and inequities and improve health outcomes for all men with prostate cancer.

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