HHS Public Access

Author manuscript

J Cancer Surviv. Author manuscript; available in PMC 2025 June 16.

Health-related quality of life among prostate cancer survivors with metastatic disease and non-metastatic disease and men without a cancer history in the USA

Zhiyuan Zheng[1], **Kewei Sylvia Shi**[1], **Arif Kamal**[1], **David H. Howard**[2], **Michal Horný**[2,3], **Thomas B Richards**[4], **Donatus U. Ekwueme**[4], **K. Robin Yabroff**[1]

[1]American Cancer Society, Atlanta, GA, USA

[2]Emory University Rollins School of Public Health, Atlanta, GA, USA

[3]Emory University School of Medicine, Atlanta, GA, USA

[4]Centers for Disease Control and Prevention, Atlanta, GA, USA

Abstract

Background—Few studies have comprehensively compared health-related quality of life (HRQoL) between metastatic prostate cancer survivors, survivors with non-metastatic disease, and men without a cancer history.

Methods—We used the Surveillance, Epidemiology, and End Results-Medicare Health Outcomes Survey (SEER-MHOS) data linkage to identify men aged ≥ 65 years enrolled in Medicare Advantage (MA) plans. Prostate cancer survivors were diagnosed between 1988 and 2017 and completed MHOS surveys between 1998 and 2019. We analyzed data from 752 metastatic prostate cancer survivors (1040 survey records), 19,583 localized or regional prostate cancer survivors (non-metastatic; 30,121 survey records), and 784,305 men aged ≥ 65 years without a cancer history in the same SEER regions (1.15 million survey records). We used clustered linear regressions to compare HRQoL measures at the person-level using the Veterans RAND 12 Item Health Survey (VR-12) T-scores for general health and physical and mental component summaries.

Results—Compared to men without a cancer history, prostate cancer survivors were older, more likely to be married, and had higher socioeconomic status. Compared to men without a cancer history, metastatic prostate cancer survivors reported lower general health (*T*-score differences

✉Zhiyuan Zheng jason.zheng@cancer.org.

Author contributions All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by Zhiyuan Zheng. The first draft of the manuscript was written by Zhiyuan Zheng and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s11764-023-01509-8.

Conflict of interest Dr. Yabroff serves on the Flatiron Health Equity Advisory Board and has received honoraria from the National Comprehensive Cancer Network. Dr. Arif H. Kamal reports personal fees from Homebase Medical outside the submitted work and is chief executive officer of Prepped Health. All other authors have no conflict of interest to report.

Disclaimer The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention, Emory University, or the American Cancer Society.

[95% confidence interval]: − 6.26, [− 7.14, − 5.38], $p < .001$), physical health (− 4.33, [− 5.18, − 3.48], $p < .001$), and mental health (− 2.64, [− 3.40, − 1.88], $p < .001$) component summaries. Results were similar for other VR-12 T-scores. In contrast, non-metastatic prostate cancer survivors reported similar VR-12 *T*-scores as men without a cancer history. Further analyses comparing metastatic and non-metastatic prostate cancer survivors support these findings.

Conclusion—Interventions to improve health-related quality of life for men diagnosed with metastatic prostate cancer merit additional investigation.

Implications for cancer survivors—Interventions to improve health-related quality of life for metastatic prostate cancer survivors merit additional investigation.

Keywords

HRQoL; Prostate cancer; Metastatic disease; SEER-MHOS

Introduction

A total of 201,082 men were diagnosed with prostate cancer in the USA in 2021, and 32,707 men died of prostate cancer [1]. Although overall incidence rates of prostate cancer remained stable over the past decade, the proportion of patients diagnosed with advanced disease continued to increase from 2015 to 2019 [2–4]. Men diagnosed with localized or regional stage have a 5-year survival rate greater than 99%, but the 5-year survival rate for metastatic prostate cancer is only 31% [5]. Treatment for metastatic prostate cancer may include standard hormonal therapy [6–8] and other systemic therapies such as chemotherapy, in addition to local therapies targeted towards the primary tumor or metastatic lesions. Although systemic combination therapies are associated with improved overall survival [9], they often carry severe side effects, such as fatigue, neuropathy, hypertension, edema, cardiac events, and seizures [6]. These severe side effects can adversely affect patients' health-related quality of life (HRQoL) many years after initial diagnosis [10].

HRQoL includes multiple dimensions, including physical and mental health [11], and can influence patients' satisfaction with care, treatment adherence, and health outcomes [12–14]. For metastatic prostate cancer survivors, many of whom have a prognosis measured in years, minimizing disease symptoms, mitigating treatment side effects, and maximizing HRQoL are important therapeutic goals [6]. HRQoL measures can also be important tools to help guide clinician recommendations as part of shared treatment decision-making [15]. However, most existing evidence about HRQoL among patients with prostate cancer has been from randomized clinical trials, which may not be generalizable to long-term metastatic prostate cancer survivors due to patient selection, the limited timeframe over which outcomes are measured, and differences in therapeutic approaches. Moreover, little is known about the effect of metastatic prostate cancer on HRQoL over and above the impact of aging and the onset of chronic conditions. The purpose of this study was to comprehensively compare HRQoL measures between metastatic prostate cancer survivors, non-metastatic prostate cancer survivors, and men without a cancer history in the USA.

Methods

Study data

The Surveillance, Epidemiology, and End Results-Medicare Health Outcomes Survey (SEER-MHOS) linked data were used to identify prostate cancer survivors and men without a cancer history. SEER is a population-based cancer registry supporte by the National Cancer Institute (NCI), with detailed information on cancer diagnoses, including stage at diagnosis. The MHOS survey is a longitudinal survey administered annually by the Centers for Medicare and Medicaid Services to a random sample of Medicare beneficiaries who enrolled in Medicare Advantage (MA) plans; the survey collects multiple HRQoL measures [16]. The NCI links SEER tumor registry data with MHOS data to promote research on cancer patients' outcomes. The most recent data linkage included surveys fielded from 1998 to 2019. The SEER-MHOS linkage consists of survey respondents from 18 SEER registries who enrolled in more than 400 MA plans [17]. MA plans are offered by private companies, which are approved and paid by Medicare to provide health care to enrollees [18]. Compared with Original Medicare, MA plans often provide additional benefits, including vision, hearing, and dental services. Moreover, most MA plans include prescription medication and may require patients to use services only from in-network providers. MA enrollees may also need a referral to see a specialist, whereas Original Medicare enrollees do not need referrals [18].

The SEER-MHOS linkage includes information about individuals enrolled in MA plans with cancer diagnoses as well as individuals living in the same SEER areas enrolled in MA plans without reported cancer diagnoses. A baseline MHOS survey is administered to each cohort of Medicare beneficiaries, and a follow-up MHOS survey is conducted after 2 years. The conduct of this study was approved by the Emory University Institutional Review Board (IRB number: STUDY00001791).

Inclusion and exclusion criteria

Prostate cancer survivors were identified as those who had prostate cancer as their primary cancer diagnosis [19] and completed the MHOS survey(s) between the time of their cancer diagnoses and 10 years post-diagnosis. Prostate cancer survivors who completed the MHOS survey prior to their cancer diagnoses or after 10 years post-diagnoses were excluded. For respondents who received a prostate cancer diagnosis between the initial baseline survey and the follow-up survey, only the survey records after their cancer diagnosis were included in the analyses. SEER historic stage was used to define men with metastatic (distant stage) and non-metastatic (localized or regional stage) prostate cancer at the time of initial diagnosis because this measure was available across all years of the study period. Prostate cancer survivors with unknown stage were included in our study as a separate group in addition to survivors diagnosed with localized and regional disease. Survey respondents aged younger than 65 years at the time of the survey were excluded. Multiple years of surveys were pooled together to increase the analytical sample size and statistical power to detect differences in HRQoL between prostate cancer survivors and men without a cancer history. The final analytical sample consisted of prostate cancer survivors diagnosed between 1988 and 2017

and men without a cancer history. All respondents were ages 65 years and above at the time of the survey.

Survey record-level characteristics

For each survey record, information identified through SEER-MHOS included age at cancer diagnosis, initial stage at diagnosis, receipt of active treatment for prostate cancer, survey year, time between year of diagnosis and survey year, and SEER region. The MHOS included self-reported demographic and socioeconomic characteristics such as race/ethnicity, marital status, educational attainment, household income, and home ownership [17]. Survey participants' health characteristics included body mass index (BMI) categories and number of comorbidities. Self-reported comorbidities included the following conditions: osteoporosis, hypertension, any heart condition (coronary artery disease, congestive heart failure, myocardial infarction, other heart conditions), stroke, emphysema/asthma/chronic obstructive pulmonary disease, Crohn's disease/ulcerative colitis/inflammatory bowel disease, arthritis (hip/knee or hand/wrist), sciatica, and diabetes/high blood sugar/sugar in urine. The MHOS also collected information about the receipt of any prostate cancer treatment at the time of the survey by asking the following question: "Are you currently under treatment for prostate cancer?"

HRQoL measures

The Veterans RAND 12-item Health Survey (VR-12 scores) is a well-validated and commonly used HRQoL instrument in the USA [20]. It is a patient-reported instrument which includes 8 health domains: general health, physical functioning, role limitations due to physical problems, role limitations due to emotional problems, bodily pain, energy/fatigue, social functioning, and mental health [21].

Although the HRQoL measure administered by the MHOS changed during the study period, validated algorithms were developed for pooling these data across study years. In 2006, the VR-12 instrument replaced the Veterans RAND 36 Item Health Survey (VR-36) for the MHOS, which had been used 1998–2005 [22]. To make the VR-12 and VR-36 scores comparable across multiple years, the MHOS utilized algorithms developed and validated by Boston University (March, 2016) to re-score the VR-36 instrument. As a result, the MHOS can be pooled before and after 2006 to increase the sample size [22]. VR-12 scores were transformed into *T*-scores to facilitate interpretation. *T*-scores are a linear 0–100 version of the original scale that yields a population mean of 50 and a standard deviation of 10, based on the 1990 population distributions. The final HRQoL measures included 10 separate VR-12 *T*-scores: physical component summary, mental component summary, physical functioning, physical role limitation, emotional role limitation, pain, general health, emotional well-being, social functioning, and energy/fatigue.

Statistical methods

Survey respondents may complete both baseline and follow-up MHOS surveys, and some respondents may participate in multiple surveys. We treated each survey record as a separate data point and calculated the time between year of diagnosis and year for each survey record accordingly. Therefore, the same survey respondent could have different values for

years between diagnosis and survey for each survey record. We used Chi-squared tests to examine record-level patient characteristics between prostate cancer survivors and men without a cancer history. We then generated unadjusted distributions of selected VR-12 *T*-scores (general health, physical component summary, and mental component summary) and compared those scores for metastatic prostate cancer survivors, non-metastatic prostate cancer survivors, and men without a cancer history (5% non-cancer sample from SEER in the same MA plans). In adjusted clustered linear regressions, survey records were grouped at the person level for respondents who completed both baseline and follow-up surveys or multiple years of surveys. A unique de-identified person ID was used to group survey records at the person level, which enabled clustering in the analyses. The clustered analyses assumed that survey responses from the same person were correlated, whereas responses from different persons were uncorrelated. Clustered linear regressions were used to compare metastatic prostate cancer survivors, non-metastatic prostate cancer survivors, and men without a cancer history across all 10 HRQoL measures (i.e., VR-12 *T*-scores). All adjusted analyses controlled for age at time of the survey, stage (without a cancer history, localized/regional, missing, and metastatic), number of comorbid conditions, BMI category, race/ethnicity, marital status, educational attainment, home ownership, SEER region, and survey years (1998–2003, 2004–2008, 2009–2013, and 2014–2019).

Further analyses focused on prostate cancer survivors only and compared distributions of survey record-level characteristics between metastatic and localized/regional prostate cancer survivors. Additional adjusted clustered analyses among cancer survivors only included cancer-specific characteristics, including stage at diagnosis, time between year of diagnosis and survey year, prostate cancer treatment status at the time of the survey, and year of diagnosis. Although the Food and Drug Administration approved the use of prostate-specific antigen (PSA) testing for prostate cancer screening in 1994, many professional organizations began to recommend patients discuss the benefits and harms of PSA testing with their providers in 2008 [23]. Therefore, the years of diagnosis were grouped into 1988–2001, 2002–2007, 2008–2013, and 2014–2017 years to reflect the empirical distribution of our sample and the historical changes in recommendation of PSA testing to screen for prostate cancer. All statistical analyses were conducted using SAS, version 9.4. All statistical comparisons were 2-sided, and statistical significance was defined as $p < .05$.

Results

We identified a total of 27,828 prostate cancer survivors ($n = 42,277$ survey records), of whom 752 were diagnosed with metastatic disease ($n = 1040$ survey records; 2.46% of total survivors' survey records); 17,211 were diagnosed with localized disease ($n = 26,611$ survey records; 61.85%); 2,372 were diagnosed with regional disease ($n = 3510$ survey records; 8.53%). There were 7493 survivors for whom stage was missing ($n = 11,116$ survey records; 26.29%). An additional 784,305 men ($n = 1.15$ million survey records, Table 1) had no cancer history. About 86% of prostate cancer survivors had only one primary cancer diagnosis in their lifetime, 84.5% were diagnosed more than 2 years prior to the time of their MHOS survey, 80% were aged 70 and above, and 57% were receiving prostate cancer-related treatments at the time of MHOS survey. Compared to men without a cancer history, prostate cancer survivors were older, more likely to be married, had higher

educational attainment and household income and were more likely to own their houses rather than renting.

Figure 1 shows the distributions of the of general health *T*-score, physical component summary *T*-score, and mental component summary *T*-score. The area under the curve equals to 100% for all outcomes. Metastatic prostate cancer survivors were more likely to report lower HRQoL compared to men without a cancer history and survivors diagnosed with localized/regional diseases (Fig. 1).

In adjusted analyses, compared to men without a cancer history, metastatic prostate cancer survivors reported consistently lower *T*-scores at the time of the MHOS survey in all 10 HRQoL measures (Fig. 2a): general health (difference = − 6.26, 95% confidence interval [95% CI]: − 7.14 to − 5.38; $p < .001$, Table 2), physical component summary (difference = − 4.33, 95% CI: − 5.18 to − 3.48; $p < .001$, Table 3), mental component summary (difference = − 2.64, 95% CI: − 3.40 to − 1.88; $p < .001$, Table 4), physical functioning (difference = − 2.88, 95% CI: − 3.80 to − 1.95; $p < .001$, eTable 1), emotional well-being (difference = − 2.12, 95% CI: − 2.87 to − 1.36; $p < .001$, eTable 2), pain (difference = − 3.07, 95% CI: − 3.87 to − 2.87; $p < .001$, eTable 3), social functioning (difference = − 4.07, 95% CI: − 4.96 to − 3.17; $p < .001$, eTable 4), energy/fatigue (difference = − 3.83, 95% CI: − 4.63 to -−.02; $p < .001$, eTable 5), role limitations due to physical problems (difference = − 4.32, 95% CI: − 5.16 to − 3.48; $p < .001$, eTable 6), and role limitations due to emotional problems (difference = − 6.46, 95%CI: − 6.57 to − 6.34; $p < .001$, eTable 7). In contrast, HRQoL measures were similar between men with localized/regional diseases and men without a cancer history (Fig. 2b).

In adjusted analyses and across all 10 VR-12 *T*-scores, men with a higher number of comorbidities, lower educational attainment, and who rented, rather than owned, their home had lower HRQoL (Tables 2, 3 and 4, and eTables 1–7). We did not find consistent changes of VR-12 *T*-scores over survey years (Tables 2, 3 and 4, and eTables 1–7).

Among prostate cancer survivors only, metastatic disease was associated with older age at time of diagnosis and survey completion, being more recently diagnosed, higher likelihood of undergoing prostate cancer related treatments at survey, and lower socioeconomic status (Table 5). Adjusted clustered multivariable analyses comparing metastatic to localized/regional prostate cancer survivors showed that men with metastatic disease experienced poorer HRQoL (eTables 8–17). Receiving prostate cancer treatments at the time of the survey was associated with lower HRQoL (eTables 8–17). Similar to the main results, we did not find consistent changes of VR-12 *T*-scores over diagnosis years among cancer survivors (eTables 8–17).

Discussion

In this sample of Medicare beneficiaries enrolled in MA plans, we comprehensively examined HRQoL among prostate cancer survivors by stage, controlling for demographics, socioeconomic status, and comorbid conditions. We found that men initially diagnosed with metastatic prostate cancer were significantly more likely to experience lower HRQoL

scores across all domains than men without a cancer history. In contrast, men initially diagnosed with localized or regional prostate cancer had similar HRQoL as men without a cancer history. Our results can help inform clinician treatment recommendations and decision-making and symptom management in downstream care when HRQoL is also included as part of the treatment outcomes [24, 25].

Analyzing differences in HRQoL among men with prostate cancer by stage is a major contribution of this study. In the USA and for every 100,000 men, on average, 112 new prostate cancer cases were reported, and 18 patients died of this cancer in 2019 [4]. Most survivors are diagnosed with localized or regional diseases, and some may never develop symptoms during their lifetime. Those who chose to undergo treatment may be exposed to the risk of long-term erectile, urinary, and bowel dysfunction problems [26]. The long-term survival rate among men diagnosed with localized disease is almost the same as for the general population without a cancer history [3], leading some patients and clinicians to choose active surveillance rather than immediate treatment following diagnosis [27]. Previous research also shows that patients with localized disease who opt for active surveillance report higher HRQoL compared to those who received more intensive treatments with well-documented side effects [28]. Moreover, patients with low risk prostate cancer on active surveillance have similar HRQoL to men without prostate cancer [29]. Our study also finds that men enrolled in MA plans and diagnosed with localized disease reported comparable HRQoL to men enrolled in MA plans without a cancer history. Randomized trials of localized disease showed that different therapeutical approaches (i.e., radical prostatectomy, external beam radiation therapy, interstitial implantation of isotopes) have distinct patterns of side effects, resulting in differences in HRQoL [30]. HRQoL among men diagnosed with localized disease and treated with surgery or radiation declines during and shortly after treatment but gradually recovers over time [25, 31].

Compared to men diagnosed with localized disease, men with advanced prostate cancer face a very different set of choices. Standard hormonal therapy for metastatic prostate cancer focuses on lowering the level of testosterone through medical or surgical castration, which is commonly referred as androgen deprivation therapy (ADT) [32, 33]. Randomized trials show improved overall survival when ADT is combined with chemotherapy or newly developed drugs such as abiraterone acetate, apalutamide, and enzalutamide [33]. One study found that the addition of chemotherapy did not affect long-term quality of life among metastatic hormone-sensitive prostate cancer patients [34]. Other studies have linked intensive treatments with a decrease in physical measures of quality of life [35, 36], whereas several contemporary stage III trials from Europe suggest that developments in systemic treatments can improve HRQoL and survival at the same time [37]. However, there is little evidence comparing HRQoL across treatments for advanced prostate cancer.

Preserving HRQoL in men with metastatic prostate cancer requires anticipating and addressing health problems beyond the management of the primary cancer. For example, consistent with other evidence [38, 39], we found that comorbidity burden significantly affects HRQoL. The early and regular involvement of palliative care physicians in the care of patients with advanced cancer has been shown to improve quality of life, even in cases when patients continue life-prolonging therapy [40–42]. Patients may experience various

treatment side effects, and specialty palliative care clinicians should consider anticipating threats to HRQoL and implementing detailed plans to address them [43]. Currently, palliative care physicians treat fewer than 10% of metastatic prostate cancer patients [44], highlighting the unmet potential to support patients in their last years of life [44, 45].

This study has several limitations. First, the study sample is limited to Medicare beneficiaries enrolled in MA plans, and thus our results may not be generalizable to all Medicare beneficiaries. On the other hand, the focus on Medicare beneficiaries in MA plans is a potential strength of this study, because an increasing proportion of Medicare beneficiaries are enrolled in MA plans, rising from less than 20% in 2007 to 48% in 2022 [46]. Moreover, recent surveys suggest that MA enrollees are similar to traditional fee-for-service Medicare beneficiaries in terms of demographics, socioeconomic status, and prevalence of chronic conditions [47]. This trend is likely to continue; the Congressional Budget Office predicted that more than 60% of Medicare beneficiaries will enroll in MA plans by 2032 [46]. However, previous studies suggested that compared with Original Medicare enrollees, MA enrollees reported similar care satisfaction and coordination, but higher rates of having a usual source of care, receiving preventive care services, and getting needed prescription medications [48]. Future research should evaluate whether improved access to care and prescription medication are associated with better HRQoL between Original Medicare enrollees and MA enrollees. A second limitation is that the majority of prostate cancer survivors in this study were originally diagnosed with non-metastatic (local or regional stage), who were long-term prostate cancer survivors. Moreover, more than 70% of metastatic and 80% of localized/regional prostate cancer survivors were diagnosed between 2 and 10 years at the time of the survey. Newly diagnosed prostate cancer survivors undergoing intensive treatments were likely under-represented in our study, and our results may underestimate the differences in HRQoL between metastatic prostate cancer survivors and those without a cancer history. Future studies that examine the changes in HRQoL before and after a prostate cancer diagnosis by stage could further broaden the existing evidence. However, our findings are consistent across all domains of HRQoL measures. Moreover, detailed comprehensive cancer treatment information at diagnosis from SEER was missing or incomplete for many patients in our sample [49]. In analyses focusing on prostate cancer survivors only, we added cancer-specific characteristics comparing metastatic with localized/regional disease. We found that receiving prostate cancer treatment at the time of the survey was associated with lower HRQoL. These findings suggest that for localized and regional stage, patients with high-risk prostate cancer, who often receive a longer period of ADT compared with patients with low-risk prostate cancer, may experience worse HRQoL. However, our study could not evaluate the differences in HRQoL between high and low risk of localized prostate cancer survivors due to lack of detailed prognostic and treatment information.

In conclusion, metastatic prostate cancer survivors report lower HRQoL than prostate cancer survivors with non-metastatic disease and men without a cancer history. Additional investigation on how to improve health-related quality of life for men diagnosed with metastatic prostate cancer could lead broader adoption of effective strategies.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Funding

This project was supported by the Centers for Disease Control and Prevention, Prevention Research Center, Special Interest Project 19-009 with Emory University.

References

1. U.S. Cancer Statistics Working Group. U.S. Cancer statistics data visualizations tool, based on 2022 submission data (1999–2020): U.S. Department of Health and Human Services, Centers for Disease Control and Prevention and National Cancer Institute; https://www.cdc.gov/cancer/dataviz, released in November 2023. Accessed.
2. Centers for Disease Control and Prevention. Prostate cancer incidence by age and stage at diagnosis, United States—2001—2019. USCS data brief, no 34. Atlanta, GA: Centers for Disease Control and Prevention, US Department of Health and Human Services; 2023.
3. Siegel RL, Miller KD, Fuchs HE, Jemal A. Cancer statistics, 2022. CA Cancer J Clin. 2022;72(1):7–33. [PubMed: 35020204]
4. Cancer Statistics At a Glance. Cancer statistics home. Centers for Disease Control and Prevention. https://www.cdc.gov/cancer/uscs/. Accessed March 10, 2023.
5. The American Cancer Society medical and editorial content team. Survival rates for prostate cancer. https://www.cancer.org/cancer/prostate-cancer/detection-diagnosis-staging/survival-rates.html#references. Accessed Oct 10, 2022.
6. Kretschmer A, van den Bergh RCN, Martini A, et al. Assessment of health-related quality of life in patients with advanced prostate cancer-current state and future perspectives. Cancers (Basel). 2021;14(1):147. [PubMed: 35008310]
7. Mager R, Savko O, Böhm K, et al. Comparative assessment of docetaxel for safety and efficacy between hormone-sensitive and castration-resistant metastatic prostate cancer. Urol Oncol. 2019;37(12):999–1005. [PubMed: 31377168]
8. Prostate Cancer Treatment (PDQ®)–Health professional version. National Cancer Institute. https://www.cancer.gov/types/prostate/hp/prostate-treatment-pdq. Accessed Nov 10, 2022.
9. Wenzel M, Würnschimmel C, Nocera L, et al. Overall survival after systemic treatment in high-volume versus low-volume metastatic hormone-sensitive prostate cancer: systematic review and network meta-analysis. Eur Urol Focus. 2022;8(2):399–408. [PubMed: 33853754]
10. Menges D, Yebyo HG, Sivec-Muniz S, et al. Treatments for metastatic hormone-sensitive prostate cancer: systematic review, network meta-analysis, and benefit-harm assessment. Eur Urol Oncol. 2022;5:605–16. [PubMed: 35599144]
11. HRQOL Concepts. Health-related quality of life (HRQOL). Centers for disease control and prevention. https://www.cdc.gov/hrqol/concept.htm. Accessed Nov 11, 2022.
12. Centers for Disease Control and Prevention. Measuring healthy days: population assessment of health-related quality of life. 2000.
13. Jörling M, Rutzner S, Hecht M, Fietkau R, Distel LV. Deterioration of health-related quality of life scores under treatment predicts longer survival. Biomed Res Int. 2020;2020:3565238. [PubMed: 32879881]
14. Macefield RC, Jacobs M, Korfage IJ, et al. Developing core outcomes sets: methods for identifying and including patient-reported outcomes (PROs). Trials. 2014;15(1):49. [PubMed: 24495582]
15. Morgans AK, van Bommel ACM, Stowell C, et al. Development of a Standardized set of patient-centered outcomes for advanced prostate cancer: an international effort for a unified approach. Eur Urol. 2015;68(5):891–8. [PubMed: 26129856]
16. Jones N 3rd, Jones SL, Miller NA. The Medicare Health Outcomes Survey program: overview, context, and near-term prospects. Health Qual Life Outcomes. 2004;2:33. [PubMed: 15248895]

17. History of the SEER-MHOS Linked Data Resource. Data & Tools. Healthcare delivery research program. Division of Cancer Contrl and Population Sciences. NCI.. https://healthcaredelivery.cancer.gov/seer-mhos/overview/history.html. Accessed Oct, 21, 2022.
18. Compare Original Medicare & Medicare Advantage.. https://www.medicare.gov/basics/get-started-with-medicare/get-more-coverage/your-coverage-options/compare-original-medicare-medicare-advantage. Accessed Nov 27, 2023.
19. NCI Dictionary of Cancer Terms. National Cancer Institute. https://www.cancer.gov/publications/dictionaries/cancer-terms/def/primary-cancer Accessed Jan 7, 2023.
20. Selim AJ, Rogers W, Fleishman JA, et al. Updated US population standard for the Veterans RAND 12-item Health Survey (VR-12). Qual Life Res. 2009;18(1):43–52. [PubMed: 19051059]
21. Schalet BD, Rothrock NE, Hays RD, et al. Linking Physical and Mental Health Summary Scores from the Veterans RAsssND 12-Item Health Survey (VR-12) to the PROMIS(®) Global Health Scale. J Gen Intern Med. 2015;30(10):1524–30. [PubMed: 26179820]
22. SEER-MHOS: Algorithms to Recode the 8 VR-12 Scales to Match SF-36. Boston University Bridge program.. http://healthcaredelivery.cancer.gov/seer-mhos/program/recode.html. Accessed Oct 12, 2022.
23. Prostate-Specific Antigen (PSA) Test. National Cancer Institute.. https://www.cancer.gov/types/prostate/psa-fact-sheet. Accessed Nov 10, 2023.
24. Guyatt GH, Feeny DH, Patrick DL. Measuring health-related quality of life. Ann Intern Med. 1993;118(8):622–9. [PubMed: 8452328]
25. Shevach J, Weiner A, Morgans AK. Quality of life-focused decision-making for prostate cancer. Curr Urol Rep. 2019;20(10):57. [PubMed: 31468212]
26. Vickers AJ, Roobol MJ, Lilja H. Screening for prostate cancer: early detection or overdetection? Annu Rev Med. 2012;63:161–70. [PubMed: 22053739]
27. Chen RC, Rumble RB, Loblaw DA, et al. Active surveillance for the management of localized prostate cancer (Cancer Care Ontario Guideline): American Society of Clinical Oncology Clinical Practice Guideline endorsement. J Clin Oncol. 2016;34(18):2182–90. [PubMed: 26884580]
28. Kato T, Sugimoto M. Quality of life in active surveillance for early prostate cancer. Int J Urol. 2020;27(4):296–306. [PubMed: 32141110]
29. Pham KN, Cullen J, Hurwitz LM, et al. Prospective quality of life in men choosing active surveillance compared to those biopsied but not diagnosed with prostate cancer. J Urol. 2016;196(2):392–8. [PubMed: 26976206]
30. Donovan JL, Hamdy FC, Lane JA, et al. Patient-reported outcomes after monitoring, surgery, or radiotherapy for prostate cancer. N Engl J Med. 2016;375(15):1425–37. [PubMed: 27626365]
31. Lardas M, Liew M, van den Bergh RC, et al. Quality of life outcomes after primary treatment for clinically localised prostate cancer: a systematic review. Eur Urol. 2017;72(6):869–85. [PubMed: 28757301]
32. Hormone Therapy for Prostate Cancer. Treating prostate cancer. Prostate Cancer. Cancer A-Z. https://www.cancer.org/cancer/prostte-cancer/treating/hormone-therapy.html. Accessed Nov 19, 2022.
33. Prostate Cancer Treatment (PDQ®)–Health Professional Version. Prostate cancer. Cancer Types.. https://www.cancer.gov/types/prostate/hp/prostate-treatment-pdq#_2938. Accessed Nov 19, 2022.
34. Morgans AK, Chen YH, Sweeney CJ, et al. Quality of life during treatment with chemohormonal therapy: analysis of E3805 chemohormonal androgen ablation randomized trial in prostate cancer. J Clin Oncol. 2018;36(11):1088–95. [PubMed: 29522362]
35. LeMasters T, Madhavan S, Sambamoorthi U, Kurian S. A population-based study comparing HRQoL among breast, prostate, and colorectal cancer survivors to propensity score matched controls, by cancer type, and gender. Psycho-Oncol. 2013;22(10):2270–82.
36. Zajdlewicz L, Hyde MK, Lepore SJ, Gardiner RA, Chambers SK. Health-related quality of life after the diagnosis of locally advanced or advanced prostate cancer: a longitudinal study. Cancer Nurs. 2017;40(5):412–9. [PubMed: 28282307]
37. Kretschmer A, Ploussard G, Heidegger I, et al. Health-related quality of life in patients with advanced prostate cancer: a systematic review. Eur Urol Focus. 2021;7(4):742–51. [PubMed: 32089495]

38. Pinkawa M, Fischedick K, Gagel B, et al. Impact of age and comorbidities on health-related quality of life for patients with prostate cancer: evaluation before a curative treatment. BMC Cancer. 2009;9:296. [PubMed: 19703300]

39. Bhojani N, Perrotte P, Jeldres C, et al. The effect of comorbidities and socioeconomic status on sexual and urinary function in men undergoing prostate cancer screening. J Sex Med. 2008;5(3):668–76. [PubMed: 18221289]

40. Bakitas M, Lyons KD, Hegel MT, et al. Effects of a palliative care intervention on clinical outcomes in patients with advanced cancer: the Project ENABLE II randomized controlled trial. Jama. 2009;302(7):741–9. [PubMed: 19690306]

41. Temel JS, Jackson VA, Billings JA, et al. Phase II study: integrated palliative care in newly diagnosed advanced non-small-cell lung cancer patients. J Clin Oncol. 2007;25(17):2377–82. [PubMed: 17557950]

42. Zimmermann C, Riechelmann R, Krzyzanowska M, Rodin G, Tannock I. Effectiveness of specialized palliative care: a systematic review. Jama. 2008;299(14):1698–709. [PubMed: 18398082]

43. Holm M, Doveson S, Lindqvist O, Wennman-Larsen A, Fransson P. Quality of life in men with metastatic prostate cancer in their final years before death - a retrospective analysis of prospective data. BMC Palliat Care. 2018;17(1):126. [PubMed: 30509249]

44. Mistry NA, Raza SJ, Siddiqui SA. Analysis of inpatient palliative care consultations for patients with metastatic prostate cancer. Am J Hospice Pall Med ®. 2020;37(2):136–41.

45. Espinosa Benítez QL, Jiménez Ayala VG, Bautista RIA. Palliative care in elderly adults with prostate cancer. Sapienza: Int J Interdiscip Stud. 2022;3(8):93–104.

46. Freed M, Biniek JF, Damico A, Neuman T. Medicare advantage in 2022: enrollment update and key trends. Kaiser. https://www.kff.org/medicare/issue-brief/medicare-advantage-in-2022-enrollment-update-and-key-trends/. Accessed Nov 11, 2022.

47. Jacobson G, Cicchiello A, Sutton JP, Shah A. Medicare advantage vs. traditional medicare: how do beneficiaries' characteristics and experiences differ?. https://www.commonwealthfund.org/publications/issue-briefs/2021/oct/medicare-advantage-vs-traditional-medicare-beneficiaries-differ. Accessed Nov 19, 2022.

48. Beneficiary experience, affordability, utilization, and quality in medicare advantage and traditional medicare: a review of the literature. https://www.kff.org/medicare/report/beneficiary-experience-affordability-utilization-and-quality-in-medicare-advantage-and-traditional-medicare-a-review-of-the-literature/. Accessed Nov 27, 2023.

49. SEER acknowledgment of treatment data limitations. https://seer.cancer.gov/data-software/documentation/seerstat/nov2022/treatment-limitations-nov2022.html. Accessed.

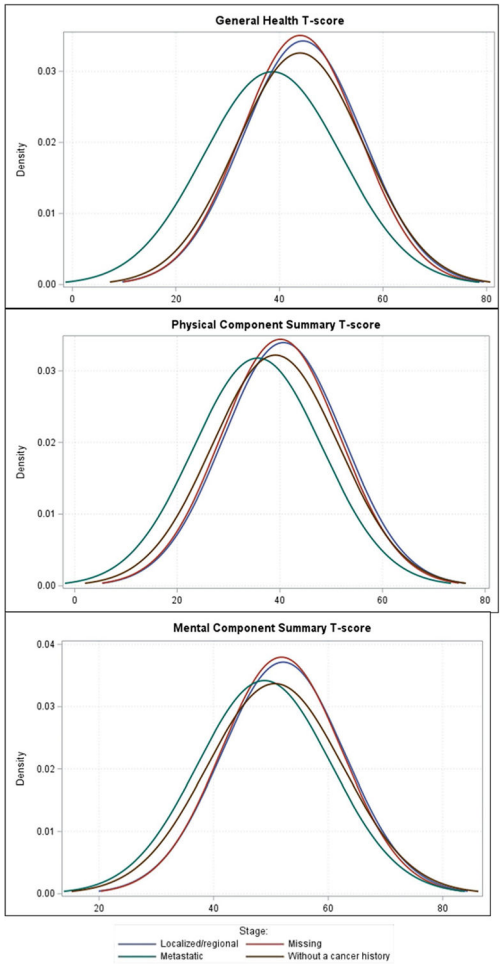

Fig. 1.

Unadjusted distribution of select health-related quality of life measures (VR-12 *T*-scores for general health, physical component summary, and mental component summary) among prostate cancer survivors by stage and men without a cancer history. The peak of the density curve represents the average *T*-score for a particular stage group. The green line represents the metastatic group, and its peak is lower than those of localized/regional group, missing group, and individuals without a cancer history for all three *T*-scores

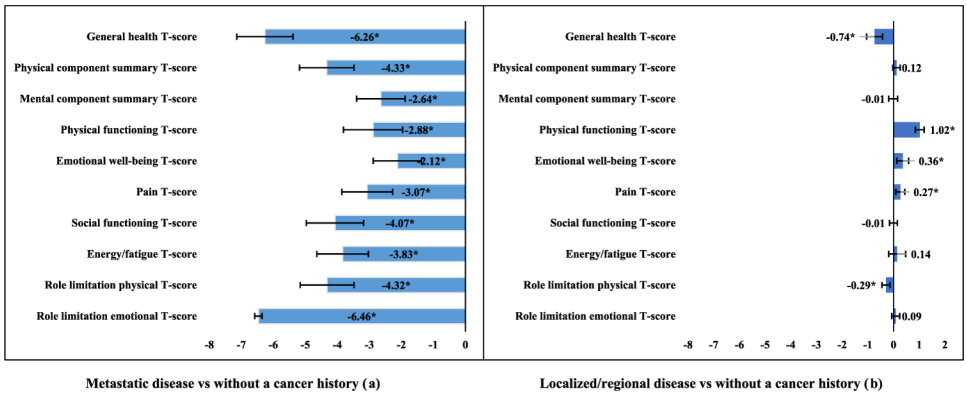

Fig. 2.

Adjusted differences in health-related quality of life measures between prostate cancer survivors and men without a cancer history (* means $p < 0.5$). All adjusted analyses controlled for age at time of the survey, stage, number of comorbid conditions, BMI, race/ethnicity, marital status, educational attainment, home ownership, SEER region, and survey years

Table 1

Distribution of person-survey record-level characteristics between prostate cancer survivors and men without a cancer history. Prostate cancer survivors were diagnosed (SEER-MHOS) from 1988 to 2017, and the Medicare Health Outcomes Survey (MHOS) was conducted from 1998 to 2019[a]

	Prostate cancer survivors (*n* = 42,277)		5% Non-cancer population (*n* = 1,313,323)
	Col %	*P b*	Col %
Cancer sequence number			
One primary only in the patient's lifetime	85.9		NA
First of two or more primaries	14.1		
Age at cancer diagnosis			
41 to 64	16.4	NA	NA
65 to 69	31.9		
70 to 74	27.0		
≥ 75	24.7		
Age at time of survey			
65 to 69	20.0	< .001	25.9
70 to 74	30.6		28.3
≥ 75	49.3		45.8
Time between year of diagnosis and survey year			
< 2 y	15.5	NA	NA
≥ 2 y and < 5 y	33.1		
≥ 5 y and ≤ 10 y	51.4		
Stage[c]			
Localized/regional (non-metastatic)	70.8	NA	NA
Missing	26.8		
Distant (metastatic)	2.5		
Prostate cancer treatment status at survey			
No	31.2	NA	NA
Yes	55.9		
Unknown	12.9		
Number of comorbid conditions[c]			
0	11.6	< .001	11.0
1	23.5		20.9
2	26.2		25.0
≥ 3	38.7		43.0
Body mass index (BMI)[d]			
Normal weight (≥ 18.5 and < 25)	19.7	< .001	23.9
Overweight (≥ 25 and < 30)	34.1		26.5
Obese (≥ 30)	18.0		19.4
Unknown	28.2		30.3
Race/ethnicity			

	Prostate cancer survivors (*n* = 42,277)		5% Non-cancer population (*n* = 1,313,323)
	Col %	*p b*	Col %
Non-Hispanic White	70.1	< .001	77.0
Non-Hispanic Black	13.0		9.9
Hispanic	8.5		3.5
Asian and others	7.0		9.1
Unknown	1.5		0.6
Marital status[e]			
Married	70.8	< .001	51.1
Others	29.2		48.9
Educational attainment			
≥ 4-year college graduate	25.3	< .001	17.6
Some college or 2-year degree	21.6		21.5
High school graduate	26.7		31.7
< High school	24.1		26.7
Unknown	2.3		2.5
Household income at the time of survey			
≤ $19,999	24.0	< .001	32.2
$20,000–$49,999	37.1		31.7
≥ $50,000	22.0		14.7
Unknown	16.8		21.3
Home ownership			
Owned or being bought	75.8	< .001	70.2
Rented for money	17.4		21.2
Unknown	6.9		8.6
SEER region			
California	22.1	< .001	22.2
Connecticut	3.9		4.7
Georgia	6.0		6.5
Hawaii	4.2		3.7
Idaho	3.6		3.0
Iowa	3.3		3.3
Kentucky	2.6		2.3
Louisiana	4.1		4.3
Massachusetts	6.9		5.1
Detroit (Metropolitan)	2.8		3.5
New Jersey	5.6		7.6
New Mexico	4.4		4.5
New York	23.0		20.4
Utah	3.3		4.2
Seattle (Puget Sound)	4.3		5.0
Year of diagnosis			
1988–2001	30.0	NA	NA

	Prostate cancer survivors (*n* = 42,277)		5% Non-cancer population (*n* = 1,313,323)
	Col %	*p b*	Col %
2002–2007	37.3		
2008–2013	28.2		
2014–2017	4.4		
Survey years			
1998–2003	19.6	< .001	21.3
2004–2008	18.6		16.5
2009–2013	37.7		34.1
2014–2019	24.2		28.2

[a] *MHOS* Medicare Health Outcomes Survey (https://healthcaredelivery.cancer.gov/seer-mhos/)

[b] The reference group were men without a cancer history from SEER enrolled in the same MA plans.

[c] Comorbid conditions included the following: osteoporosis, hypertension, any heart condition (angina pectoris/coronary artery disease, congestive heart failure, myocardial infarction, other heart conditions), stroke, emphysema/asthma/COPD, Crohn's disease/ulcerative colitis/Inflammatory bowel disease, arthritis (hip/knee, or hand/wrist), sciatica, and diabetes/high blood sugar/sugar in urine

[d] Underweight (BMI < 18.5) observations were excluded from Table 1

[e] Others included single, widowed, divorced, separated, unmarried, or unknown

Table 2

Adjusted clustered linear regression analysis of general health T-score among prostate cancer survivors vs men without a cancer history. Prostate cancer survivors were diagnosed (SEER-MHOS) from 1988 to 2017 and surveys (MHOS) were conducted from 1998 to 2019[a]

	T-score differences	95%CI		*p*
Age at time of survey				
65 to 69	Ref			
70 to 74	0.23	0.18	0.28	< .001
≥ 75	− 1.51	− 1.55	− 1.46	< .001
Stage				
Without a cancer history	Ref			
Localized/regional (non-metastatic)	− 0.99	− 1.11	− 0.88	< .001
Missing	− 0.74	− 1.05	− 0.43	< .001
Distant (metastatic)	− 6.26	− 7.14	− 5.38	< .001
Number of comorbid conditions				
0	Ref			
1	− 2.95	− 3.02	− 2.88	< .001
2	− 6.01	− 6.08	− 5.94	< .001
≥ 3	− 11.65	− 11.71	− 11.59	< .001
Body mass index (BMI)				
Normal weight (≥ 18.5 BMI < 25)	Ref			
Overweight (≥ 25 BMI < 30)	0.15	0.10	0.20	< .001
Obese (BMI ≥ 30)	− 1.67	− 1.73	− 1.61	< .001
Unknown	− 0.68	− 0.76	− 0.60	< .001
Race/ethnicity				
Non-Hispanic White	Ref			
Non-Hispanic Black	− 1.92	− 1.99	− 1.85	< .001
Hispanic	− 3.40	− 3.50	− 3.29	< .001
Asian and others	− 1.78	− 1.85	− 1.70	< .001
Unknown	− 0.57	− 0.81	− 0.33	< .001
Marital status				
Married	Ref			
Others	0.04	0.00	0.08	0.054
Educational attainment				
≥ 4-year college graduate	Ref			
Some college or 2-year degree	− 1.49	− 1.55	− 1.43	< .001
High school graduate	− 3.21	− 3.26	− 3.15	< .001
< High school	− 5.97	− 6.03	− 5.91	< .001
Unknown	− 3.97	− 4.10	− 3.84	< .001
Home ownership				
Owned or being bought	Ref			
Rented for money	− 2.52	− 2.57	− 2.47	< .001

	***T*-score differences**	**95%CI**		***p***
Unknown	− 2.48	− 2.55	− 2.40	< .001
Survey years				
1998–2003	Ref			
2004–2008	0.03	− 0.04	0.11	0.388
2009–2013	0.18	0.10	0.27	< .001
2014–2019	0.74	0.66	0.83	< .001

[a]Prostate cancer survivors with missing survey records $n = 405$ and men without a cancer history with missing survey records $n = 14,453$. All adjusted analyses controlled for age at time of the survey, stage, number of comorbid conditions, BMI, race/ethnicity, marital status, educational attainment, home ownership, SEER region, and survey years

Table 3

Adjusted clustered linear regression analysis of physical component summary *T*-score among prostate cancer survivors vs men without a cancer history. Prostate cancer survivors were diagnosed (SEER-MHOS) from 1988 to 2017 and surveys (MHOS) were conducted from 1998 to 2019[a]

	OR	95%CI		*p*
Age at time of survey				
65 to 69	Ref			
70 to 74	− 0.29	− 0.34	− 0.24	< .001
≥ 75	− 3.55	− 3.59	− 3.50	< .001
Stage				
Without a cancer history	Ref			
Localized/regional (non-metastatic)	0.12	− 0.02	0.27	0.094
Missing	− 0.37	− 0.57	− 0.17	< .001
Distant (metastatic)	− 4.33	− 5.18	− 3.48	< .001
Number of comorbid conditions				
0	Ref			
1	− 3.17	− 3.24	− 3.10	< .001
2	− 7.04	− 7.11	− 6.97	< .001
≥ 3	− 13.61	− 13.67	− 13.54	< .001
Body mass index (BMI)				
Normal weight (≥ 18.5 BMI < 25)	Ref			
Overweight (≥ 25 BMI < 30)	− 0.37	− 0.43	− 0.32	< .001
Obese (BMI ≥ 30)	− 3.52	− 3.58	− 3.46	< .001
Unknown	− 1.45	− 1.53	− 1.37	< .001
Race/ethnicity				
Non-Hispanic White	Ref			
Non-Hispanic Black	− 0.67	− 0.74	− 0.60	< .001
Hispanic	− 0.99	− 1.10	− 0.89	< .001
Asian and others	− 0.19	− 0.27	− 0.11	< .001
Unknown	0.03	− 0.22	0.28	0.811
Marital status				
Married	Ref			
Others	− 0.60	− 0.64	− 0.56	<.001
Educational attainment				
≥ 4-year college graduate	Ref			
Some college or 2-year degree	− 1.53	− 1.59	− 1.47	< .001
High school graduate	− 2.49	− 2.55	− 2.43	< .001
< High school	− 3.98	− 4.04	− 3.92	< .001
Unknown	− 2.39	− 2.53	− 2.25	< .001
Home ownership				
Owned or being bought	Ref			

Author Manuscript

Author Manuscript

Author Manuscript

	OR	95%CI		*p*
Rented for money	− 1.91	− 1.96	− 1.86	< .001
Unknown	− 1.71	− 1.79	− 1.64	< .001
Survey years				
1998–2003	Ref			
2004–2008	0.15	0.07	0.23	0.003
2009–2013	0.29	0.20	0.38	< .001
2014–2019	0.58	0.49	0.67	< .001

[a]Prostate cancer survivors with missing survey records $n = 1449$ and men without a cancer history with missing survey records $n = 46,415$.All adjusted analyses controlled for age at time of the survey, stage, number of comorbid conditions, BMI, race/ethnicity, marital status, educational attainment, home ownership, SEER region, and survey years

Table 4

Adjusted clustered linear regression analysis of mental component summary *T*-score among prostate cancer survivors vs men without a cancer history. Prostate cancer survivors were diagnosed (SEER-MHOS) from 1988 to 2017 and surveys (MHOS) were conducted from 1998 to 2019[a]

	OR	95%CI		*p*
Age at time of survey				
65 to 69	Ref			
70 to 74	0.77	0.72	0.82	< .001
≥ 75	0.15	0.10	0.20	< .001
Stage				
Without a cancer history	Ref			
Localized/regional (non-metastatic)	− 0.01	− 0.18	0.17	0.918
Missing	− 0.24	− 0.44	− 0.04	< .001
Distant (metastatic)	− 2.64	− 3.4	− 1.88	<.001
Number of comorbid conditions				
0	Ref			
1	− 0.85	− 0.92	− 0.78	< .001
2	− 1.82	− 1.89	− 1.75	< .001
≥ 3	− 5.10	− 5.17	− 5.04	< .001
Body mass index (BMI)				
Normal weight (≥ 18.5 BMI < 25)	Ref			
Overweight (≥ 25 BMI < 30)	0.59	0.54	0.65	< .001
Obese (BMI ≥ 30)	0.29	0.23	0.35	< .001
Unknown	− 0.04	− 0.12	0.04	0.367
Race/ethnicity				
Non-Hispanic White	Ref			
Non-Hispanic Black	− 0.72	− 0.79	− 0.65	< .001
Hispanic	− 2.76	− 2.86	− 2.65	< .001
Asian and others	− 1.18	− 1.26	− 1.11	< .001
Unknown	− 0.68	− 0.94	− 0.43	< .001
Marital status				
Married	Ref			
Others	− 0.78	− 0.82	− 0.74	< .001
Educational attainment				
≥ 4-year college graduate	Ref			
Some college or 2-year degree	− 0.55	− 0.61	− 0.49	< .001
High school graduate	− 1.51	− 1.57	− 1.45	< .001
< High school	− 3.96	− 4.03	− 3.90	< .001
Unknown	− 2.17	− 2.31	− 2.03	< .001
Home ownership				
Owned or being bought	Ref			
Rented for money	− 2.11	− 2.16	− 2.06	< .001

	OR	95%CI		*p*
Unknown	− 2.38	− 2.46	− 2.31	< .001
Survey years				
1998–2003	Ref			
2004–2008	0.07	−0.01	0.14	0.104
2009–2013	− 0.25	− 0.34	− 0.16	< .001
2014–2019	0.91	0.83	1.00	< .001

[a]Prostate cancer survivors with missing survey records $n = 1449$ and men without a cancer history with missing survey records $n = 46{,}415$. All adjusted analyses controlled for age at time of the survey, stage, number of comorbid conditions, BMI, race/ethnicity, marital status, educational attainment, home ownership, SEER region, and survey years

Table 5

Distribution of person-survey record-level characteristics between localized/regional and metastatic prostate cancer survivors. Prostate cancer survivors were diagnosed (SEER-MHOS) from 1988 to 2017, and the Medicare Health Outcomes Survey (MHOS) was conducted from 1998 to 2019[a]

	Metastatic prostate cancer (*n* = 996)		Localized/regional prostate cancer (*n* = 28,747)
	Col %	*P* [b]	Col %
Cancer sequence number			
One primary only in the patient's lifetime	89.2	0.126	87.5
First of two or more primaries	10.8		12.5
Age at cancer diagnosis			
41 to 64	13.2	< .001	16.5
65 to 69	25.6		32.8
70 to 74	25.4		27.1
≥ 75	35.8		23.7
Age at time of survey			
65 to 69	18.7	< .001	21.5
70 to 74	26.3		31.8
≥ 75	55.0		46.8
Time between year of diagnosis and survey year			
< 2 y	27.9	< .001	16.4
≥ 2 y and < 5 y	34.4		35.4
≥ 5 y and ≤10 y	37.7		48.3
Prostate cancer treatment status			
No	17.3	< .001	31.5
Yes	72.5		55.8
Unknown	10.2		12.7
Number of comorbid conditions[c]			
0	11.7	0.770	11.3
1	22.2		23.6
2	26.4		26.1
≥ 3	39.8		39.0
Body mass index (BMI)[d]			
Normal weight (≥ 18.5 and < 25)	18.7	< .001	21.9
Overweight (≥ 25 and < 30)	27.1		38.4
Obese (≥ 30)	12.1		20.9
Unknown	42.2		18.8
Race/ethnicity			
Non-Hispanic White	67.6	< .001	68.7
Non-Hispanic Black	12.9		13.6
Hispanic	8.0		9.0
Asian and others	10.8		7.4

	Metastatic prostate cancer (*n* = 996)		Localized/regional prostate cancer (*n* = 28,747)
	Col %	*P b*	Col %
Unknown	0.7		1.3
Marital status[e]			
Married	64.3	< .001	70.5
Others	35.7		29.5
Educational attainment			
≥ 4-year college graduate	20.8	< .001	26.8
Some college or 2-year degree	22.9		21.9
High school graduate	27.3		26.3
< High school	27.6		22.5
Unknown	1.4		2.4
Household income at the time of survey			
≤ $19,999	29.4	< .001	23.1
$20,000–$49,999	32.7		36.3
≥ $50,000	17.3		24.2
Unknown	20.6		16.4
Home ownership			
Owned or being bought	73.8	0.432	75.6
Rented for money	18.6		17.4
Unknown	7.6		7.0
SEER region			
California	26.9	< .001	21.1
Connecticut	5.8		5.0
Georgia	5.2		7.8
Hawaii	9.2		3.9
Idaho	2.1		3.0
Iowa	5.4		3.6
Kentucky	2.0		2.5
Louisiana	7.6		4.9
Massachusetts	2.0		4.6
Detroit (Metropolitan)	2.4		4.0
New Jersey	4.7		6.0
New Mexico	4.5		5.1
New York	9.9		18.1
Utah	3.7		5.1
Seattle (Puget Sound)	8.3		5.4
Year of diagnosis			
1988–2001	42.0	< .001	17.7
2002–2007	24.0		40.3
2008–2013	25.1		36.6
2014–2017	8.9		5.4
Survey years			

	Metastatic prostate cancer (*n* = 996)		Localized/regional prostate cancer (*n* = 28,747)
	Col %	*P b*	Col %
1998–2003	31.8	< .001	12.0
2004–2008	18.8		14.5
2009–2013	31.1		42.1
2014–2019	18.3		31.5

[a] *MHOS* Medicare Health Outcomes Survey (https://healthcaredelivery.cancer.gov/seer-mhos/)

[b] The reference group were localized or regional prostate cancer survivors

[c] Comorbid conditions included the following: osteoporosis, hypertension, any heart condition (angina pectoris/coronary artery disease, congestive heart failure, myocardial infarction, other heart conditions), stroke, emphysema/asthma/COPD, Crohn's disease/ulcerative colitis/Inflammatory bowel disease, arthritis (hip/knee, or hand/wrist), sciatica, and diabetes/high blood sugar/sugar in urine

[d] Underweight (BMI < 18.5) observations were excluded from the sample

[e] Others included single, widowed, divorced, separated, unmarried, or unknown