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Physician Visits and the Timing of Skeletal-related Events Among Men Newly-Diagnosed with Metastatic Prostate Cancer: A Cohort Analysis

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Abstract

Introduction: Men diagnosed with metastatic prostate cancer are at increased risk for skeletal complications which are associated with significant morbidity and enhanced mortality. Although both the urologist and the medical oncologist play important roles in the management of patients with advanced prostate cancer, there is limited information regarding their role in the context of skeletal complications. The current study investigated these relationships among newly diagnosed metastatic prostate cancer patients.

Methods and Materials: This retrospective cohort study utilized Surveillance, Epidemiology and End Results cancer registry data for incident stage IV metastatic (M1) cases diagnosed from 2000 to 2009 with linked Medicare claims. Post-diagnosis urologist and medical oncologist visits were identified using billing codes. We considered SREs that occurred after the urologist or medical oncologist visit. We used Cox proportional hazards models to examine the relationship between a physician visit and the timing of the first SRE with and without propensity-score matching to account for observable selection.

Results: The sample included 5,572 patients with stage IV M1 prostate cancer. Seventy-six percent of the patients were non-Hispanic White, 16% were non-Hispanic African American and 8% were of other races. Seventy-five percent of patients saw a urologist (median=19 days) and 44% saw an oncologist (median=80 days), while 41% experienced at least one SRE (median=309 days). Covariate-adjusted Cox models showed a longer time to an SRE for patients with only a

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medical oncologist visit (HR=0.53, 95% confidence interval 0.45 – 0.61), only a urologist visit (HR=0.35, 95% confidence interval 0.31 – 0.39) or both a urologist and medical oncologist visit (HR=0.34, 95% CI 0.31 – 0.38), compared to individuals without these visits. Among men with a urologist visit, a medical oncologist visit was not associated with the time to the first SRE (HR =0.97, 95% CI: 0.90 – 1.05). Among those without a urologist visit a medical oncologist visit was associated with a longer time to an SRE (HR =0.54, 95% CI: 0.46 – 0.64). Results were comparable using propensity-score matched samples.

Conclusion: Among men newly-diagnosed with metastatic prostate cancer, 4 out of 10 patients experienced an SRE. Patients experienced a delay in skeletal complications when managed by a urologist or a medical oncologist compared to patients who did not see either specialist.

Keywords

Prostate cancer; urologist; medical oncologist; skeletal-related events

Introduction

Excluding skin cancer, prostate cancer (PCa) is the most common cancer affecting men in the United States [1]. The American Cancer Society has projected an incidence of about 161,360 cases of PCa in 2017 [1]. Sixty-eight percent of the patients who die of PCa were shown to have metastasis to the bone [2]. Additionally, one and 5-year survival rates of PCa patients drop significantly in the presence of bone metastasis [3]. Bone metastasis predisposes patients to skeletal complications collectively termed skeletal-related events (SREs) [4, 5]. SREs include pathological fracture (PF), bone surgery (BS), radiation therapy to the bone (RtB) and spinal cord compression (SCC). These events significantly impact PCa patients in terms of economic burden, morbidity, reduced quality of life and reduced survival [4–10]. Therefore, SREs have become increasingly important as outcomes that are evaluated in the management of PCa [11, 12]. Clinical trials evaluating metastatic PCa treatments have examined the prevalence of SREs as a study outcome [13–16]. Time-to-SRE has been assessed as a primary endpoint in clinical trials of metastatic castrate-resistant [16, 17] and castrate-sensitive PCa [18]. Time-to-SRE has also been assessed as a secondary endpoint in clinical trials of advanced PCa [12, 13, 18,19].

There is limited work detailing how physician visits may impact both the prevalence and the timing of SREs. Specialist visits significantly influence the types of treatment regimens patients receive [19]. A study that evaluated physician preferences for selecting bone-targeting agents found that delaying SREs was a key consideration for the physicians when selecting a treatment regimen [20]. Therefore, understanding the prevalence and timing of SREs in the context of physician visits becomes particularly relevant to improving the care of advanced cancer patients with skeletal metastasis. We focused on the physician specialists generally most responsible for the management of men diagnosed with metastatic PCa, i.e., the urologist and the medical oncologist. To our knowledge, this is the first study to investigate the relationship between physician visits and the time to SRE among men diagnosed with incident metastatic PCa and at risk for skeletal complications.

Methods

The National Cancer Institute's Surveillance, Epidemiology, and End Results (SEER) database was used to obtain information on PCa incidence and stage at diagnosis between 2000 and 2009. SEER provides cancer surveillance data from 20 geographic areas covering around 28% of the U.S. population [21]. The data collected by the SEER registry includes demographic characteristics, tumor site, diagnosis date and cancer stage at diagnosis. Information on Medicare enrollees' utilization of health services before and after their diagnosis with cancer was integrated by linking Medicare enrollment and claims data to SEER data. The claims data available for this study covered the 1999 to 2010 time period for the included cases.

The study sample consisted of men older than 65 years who were diagnosed with incident stage IV metastatic (M1) PCa and had continuous enrollment in Medicare Parts A and B in the 12 months prior to PCa diagnosis in order to calculate baseline measures of comorbidity status. Patients were excluded if they were enrolled in a health maintenance organization (HMO) during the 12 months preceding the cancer diagnosis because their claims were incomplete. Also, patients were excluded if they had a history of cancer within the five years preceding PCa diagnosis, if their diagnosis month or year was unknown, or if they received a post mortem PCa diagnosis. Patients with an SRE claim prior to the PCa diagnosis were excluded since we were interested in SREs that occurred subsequent to diagnosis. Lastly, we excluded patients with survival less than 60 days after PCa diagnosis as early death might have modified their likelihood of receiving an SRE diagnosis. The follow up period ended on December 31, 2008, or earlier (whichever occurred first) if patients enrolled in a health maintenance organization, lost Medicare Parts A and B coverage or died during this time period.

Post-diagnosis SREs were identified using Medicare claims, including the International Classification of Diseases 9th version Clinical Modification and the Healthcare Common Procedure Coding System that indicated SCC, PF, BS, or RAD. We utilized a definition of SREs that has been used in the published literature [22] and is presented as Appendix Table 1. This definition emphasized specificity, i.e., we utilized codes for radiation therapy, pathologic fracture, bone surgery and spinal cord compression that were highly likely to identify SREs but which, as a result of the narrower focus, could potentially result in underestimating SREs. Physician visits that occurred following the incident stage IV M1 PCa diagnosis were identified using National Claims History (NCH) and self-reported Health Care Financing Administration (HCFA) specialty codes. The codes are presented here as Appendix Table 2. Physician visits of interest included medical oncologist and urologist visits. As a way to further characterize the sample, we also examined receipt of the following cancer-directed treatments: androgen deprivation therapy, radiation therapy, radiopharmaceuticals, and bisphosphonates using definitions from a prior study [22].

Statistical analysis

Continuous variables were compared using the Wilcoxon rank-sum test. Categorical variables were compared using chi-square tests. The following baseline variables were included in the regression models to control for the potential confounding role of

demographic, clinical, and contextual factors: age at diagnosis, race/ethnicity, marital status, comorbid conditions defined by the Charlson Comorbidity Index (CCI), single indicators for prevalent comorbidities (i.e., congestive heart failure, chronic obstructive pulmonary disease, and diabetes), a single indicator for receipt of preventive services (including cancer screening, flu shot, bone mineral density (BMD) test or preventive care physician visit), a single proxy measure for poor performance status (any use of wheelchair, walking aid, oxygen, skilled nursing facility service, or hospitalization in the year prior to diagnosis), an indicator for at least one month of state buy-in within 12 months prior to the diagnosis year, and SEER region fixed effects.

Cox proportional hazards models were used to examine the relationship between a physician visit and the timing of the first SRE following diagnosis of stage IV M1 PCa. The primary analysis included separate indicators for the mutually exclusive physician visit groups represented in Table 1: urologist visit only, medical oncologist visit only, both urologist and medical oncologist visit. The referent category was the 'no urologist or medical oncologist visit' group. In sensitivity analysis, separate time-to-event models investigated the relationship between a medical oncologist visit and the time to SRE among patients with and without a urologist visit. Each patient was followed until the occurrence of the first eligible SRE, death, or administrative censoring. Inverse probability weighting was applied to adjust for bias due to all-cause mortality in the time-to-event models.

The primary independent variables of interest were not randomly assigned and it is possible that the estimated coefficient would be biased due to the fact that factors associated with specialist visit are also associated with the time to SRE. We considered that, compared to a urologist visit, there is likely to be a larger potential for bias when estimating the coefficient associated with the indicator for a medical oncologist visit given that the medical oncologist as a cancer specialist would be involved in cases that are more clinically complex. We estimated the regression models using a propensity score-matched sample (i.e., matched on the propensity to visit a medical oncologist following diagnosis). Subgroup analyses, conditioned on whether or not the individual visited a urologist following diagnosis, utilized separate matched samples.

All statistical analysis was conducted using SAS 9.4 (SAS Institute, Cary, NC). The level of significance used in this study was $P < 0.05$. This study received approval from the University of Maryland Baltimore Institutional Review Board.

Results

Based on the inclusion and exclusion criteria, 5,572 patients with stage IV M1 PCa were identified. The median (mean, SD) age of the full sample was 78 (78, 7.2) years. Table 1 illustrates the descriptive statistics for the full sample of stage IV M1 PCa patients, stratified by physician visits. Seventy-six percent of the patients were non-Hispanic White, 16% were non-Hispanic African American and 8% were of other races. Patient characteristics differed across the subsamples defined by physician visit.

Among patients who died during the study period, over half (58%) died without recording an SRE. Eighteen percent (N=990) of patients diagnosed with M1 disease did not see a urologist or medical oncologist following diagnosis. Most patients either saw both a urologist and medical oncologist (45%, N= 2,072) or saw only a urologist (46%, N=2,115). Figure 1 illustrates the flow to urologists and medical oncologists following diagnosis.

Table 2a illustrates the descriptive statistics for the time (in days) to first urologist or medical oncologist visit for the full sample and then stratified by the physician visit groups represented in Table 1. The time to first physician visit differed across the physician visit categories: urologist visit (median=19); oncologist visit (median=36 for 'medical oncologist only' and 115 for 'urologist and medical oncologist').

The proportion of individuals with an SRE is presented in Table 2b for the full sample and subgroups defined by the physician visit categories. In addition, Table 2b includes the proportion of individuals within the physician visit subgroup who received ADT, chemotherapy, radiopharmaceuticals or bisphosphonates. Overall, 41% of the patients had an SRE. Comparing across the treatments received in the full sample, the majority of individuals received ADT (77%) followed by bisphosphonates (26%) and chemotherapy (18%). Among the physician visit categories, the proportion receiving ADT was highest among those with a visit to a urologist and medical oncologist (95%) followed by those with only a urologist visit (88%). The proportion receiving chemotherapy was highest among those with a visit to a urologist and medical oncologist (38%) followed by those with only a medical oncologist visit (24%). The proportion receiving bisphosphonates was lowest among those with only a urologist visit (8%) and higher among those with a visit to a urologist and medical oncologist (52%) followed by those with only a medical oncologist visit (45%).

Based on the covariate-adjusted models presented in Table 3, Model 1 showed a longer time to an SRE for patients with only a medical oncologist visit (HR=0.53, 95% confidence interval 0.45 – 0.61), only a urologist visit (HR=0.35, 95% confidence interval 0.31 – 0.39) or both a urologist and medical oncologist visit (HR=0.34, 95% CI 0.31 – 0.38), compared to individuals without these visits. From Model 2, a medical oncologist visit was not associated with the time to the first SRE among men with a urologist visit (HR =0.97, 95% CI: 0.90 – 1.05). Based on Model 3, a medical oncologist visit was statistically significantly associated with a longer time to the first SRE among men without a urologist visit (HR =0.54, 95% CI: 0.46 – 0.64). All models reported in Table 3 were adjusted for baseline covariates such as age, race, and comorbidity status.

The results using a propensity score-matched sample were qualitatively similar to the primary results, indicating a longer time to SRE amongst men with either a urologist and medical oncologist visit compared to those without such visits.

Discussion

We undertook this study to determine whether the time to an SRE was increased among those with urologist or medical oncologist visits compared to those who did not have a

specialist visit following diagnosis. The question is clinically significant among men diagnosed with metastatic PCa given that they are at risk of developing skeletal complications and would gain access to approved medications from a treating physician such as a urologist or medical oncologist. We disentangled the medical oncologist's role from the urologist's role via the use of regression analyses. We found that a urologist visit is important for the management of SREs in that the time to the first SRE was longer among individuals with a post-diagnosis urologist visit, compared to those without a post-diagnosis urologist visit. We also found that, in the absence of a urologist, there is a role for the post-diagnosis medical oncologist visit.

The findings regarding the longer time to an SRE among patients with a urologist visit could be explained by the treatment received. The study focused on M1 patients and the physician would initiate the patient on ADT, which presumably would treat the cancer and therefore decrease all cancer-related complications, including SREs. Compared to patients managed by urologists, patients managed by medical oncologists receive a broader array of therapies, including ADT, chemotherapy, and bone-targeting agents; receipt of these therapies would impact the time to SRE. The results in Table 2b suggest that urologists are less likely to use chemotherapy, radiopharmaceuticals and bisphosphonates in this patient population, while medical oncologists are more likely to provide these treatments. This is consistent with prior literature which notes that there is a strong correlation between visiting a cancer specialist and receiving the treatment that the specialist was trained to administer[23, 24]. It should be noted that the use of bone-targeting agents is not necessarily restricted to the medical oncologist, and an increasing number of urologists are likely to also offer them to their patients in the future. Skolarus et al. 2010[25] noted that more than 70% of prostate cancer-related healthcare claims among individuals diagnosed with distant prostate cancer were attributed to urologists and medical oncologists. Both specialties are relevant to the management of men diagnosed with stage IV prostate cancer, and this present study provides novel information regarding physician visits and the hazard of SREs in this population.

Studies on SREs to date have investigated the patient predictors of an SRE [26, 27], as well as the clinical [12, 28, 29] and cost [8–10, 12, 30–32] burden associated with SREs. There has been limited attention paid to understanding the patient flow between physicians among individuals diagnosed with metastatic disease and thus at risk of an SRE. In addition to evaluating these visit patterns, we investigated the implications for the timing of SREs. An understanding of physician visit patterns is important given the correlation between physician visits and treatment receipt [19, 33] and given that not all patients will see a physician despite the diagnosis of metastatic disease.

Table 1 provides information regarding characteristics of the individuals represented in the full sample and stratified by the physician visit categories. Due to the large sample size, many variables will be statistically significant based on bivariate descriptive statistics. In addition, the magnitude of the difference in proportions across physician visit groups is notable for age, marital status, extent of tumor differentiation, and baseline use of preventive services. However, we cannot draw conclusions regarding the clinical significance of these differences using the information that is available in SEER-Medicare. We found that 18

percent of the individuals in our sample did not visit a urologist or medical oncologist. Prior literature provides some useful context for considering this finding. Using SEER-Medicare data from 1992 to 2005, Skolarus et al. (2010)[25] reported that urologists were responsible for 45% of prostate cancer-related care while medical oncologists provided 9.6% of prostate cancer-related care. Radiation oncologists and ‘Other’ specialties accounted for 14% and 26% of prostate cancer-related care, respectively. Thus, individuals represented in our sample who did not receive care from a urologist or medical oncologist may have been under the care of another physician for their prostate cancer.

The study highlights the importance of considering the timing of an SRE, not only the reported proportion experiencing an SRE. In this study, the proportion reporting an SRE was lowest among those with no urologist or medical oncologist visit. This number already may be biased downward due to under-reporting of clinical events (e.g., pathological fracture) among individuals who did not visit a urologist or medical oncologist following diagnosis. Even under the assumption that all SREs were recorded, the burden of SREs also can be represented by the timing of the event. We find that individuals who do not visit a urologist or medical oncologist are burdened by SREs because they experience it sooner compared to individuals who visit the urologist and/or medical oncologist following diagnosis.

As with any retrospective analysis, the exposure variable (i.e., physician visit) is not randomly assigned and may be subject to selection. In the study sample used for this analysis, all individuals with SREs experienced the SRE after the urologist and/or medical oncology visit, limiting the threat of bias due to reverse causality. The matched results reported in the appendix adjusted for bias due to observable factors that are associated with a medical oncologist visit. Nevertheless, there may be bias due to other factors that are not captured in the dataset. For example, a medical oncologist visit may be a surrogate for poor health status whereby the medical oncologist visit occurs due to rising PSA or symptomology. If applicable, failure to control for these factors would result in an elevated hazard ratio on the indicator for a medical oncologist visit.

In order to investigate the potential for bias, we calculated differences in SREs conditional on ADT receipt and based on the physician visit patterns. The results, presented in Appendix Table 3, indicate that there is a difference. In the population of men with ADT, 45% experienced an SRE and the proportion was higher (i.e., 47% and 50% among those with only a medical oncologist visit and those with both a medical oncologist or urologist visit, respectively) when a medical oncologist was involved in the patient’s care. This result suggests that patients who see a medical oncologist are sicker and if true, we expect an upward bias in the estimated hazard ratio (i.e., that individuals would experience a faster time to an SRE) and, as a result, the estimated hazard ratio would be conservative. There could be a confounding role for the clinical presentation based on the site of metastasis. The SEER-Medicare data provide information on sites of metastasis starting in 2004. We have data available for a portion of the sample, which includes cases diagnosed from 2000 to 2007. In post-hoc analyses using data for 2004 to 2007, we included Gleason score and site of metastasis as covariates in the regression model. The addition of these variables did not change the estimated effect on the physician visit group measures. Thus, we concluded that

there was no confounding bias attributed to these variables and that the results based on the full sample (i.e. 2000 to 2007) likely are robust to this potential source of bias.

The SEER-Medicare database does not provide a field to identify individuals with castration-resistant prostate cancer (CRPC), nor does it contain the requisite information on prostate-specific antigen levels or radiographic data to select the individuals who are likely to have CRPC on androgen deprivation therapy. Although, overall, individuals who develop CRPC are likely managed differently compared to those without CRPC, and estimated relationships can be subject to confounding bias if there is an association between CRPC status and the physician visit as well as between CRPC status and time to SRE, this analysis demonstrates the potential impact of sub-specialist visits on skeletal complications in an aggregate advanced prostate cancer patient population in a more real-world setting than would be defined in the context of clinical trials. Lastly, these findings may not apply to men younger than 66 years at diagnosis or men who reside in rural areas.

Conclusion

Among men diagnosed with incident metastatic prostate cancer, we find that nearly 1 out of 4 men did not see a urologist and over half did not visit a medical oncologist. Four out of ten men experienced a skeletal complication. Older men diagnosed with incident metastatic prostate cancer and at risk of skeletal complications can experience a longer time to skeletal complications when managed by a urologist or a medical oncologist. The study highlights the importance of considering the timing of skeletal complications, not only the reported proportion experiencing a skeletal complication.

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Appendix

Appendix Table 1:

International Classification of Diseases, Ninth Revision (ICD-9) and Healthcare Common Procedure Coding System (HCPCS) codes for skeletal-related events.

SRE type	Code type	Code
Spinal cord compression	HCPCS	63050, 63051, 22551, 22552, 63064, 63066, 61343, s2348, 63075–8, s2350, s2351, 63195, 63197, 63199, 63001, 63003, 63005, 63011, 63015, 63016, 63017, 63170, 63012, 63045, 63046, 63047, 63048, 63040, 63042, 63043, 63044, 63020, 63030, 63035, 22224, 22222, 22214, 22212, 22207, 22206, 0274t, 0275t, c9729, 0202t, 22865, 0164t, 0094t, 0097t, 63057, 63056, 63055, 63081, 63082, 63087, 63088, 63101, 63102, 63103, 63090, 63091, 63086 and 63085
	ICD-9	3369, 7211, 7214, 72141, 72142, 72191, 7227, 72270, 72271 and 72273
Pathologic fractures	HCPCS	8202, 8208, 8210, 8212, 73311, 8120, 8122, 8124, 73312, 8130, 8132, 8134, 8138, 73316, 8230, 8232, 8238, 73313, 805, 806, 8200, 7331, 73310, 73319, 800, 807, 8080, 8082, 8084, 8088, 8100, 8240, 8242, 80701, 80702, 80703, 80704, 80705, 80706, 80707, 80708, 80709, 80841, 80842, 80843, and 80849
	ICD-9	7331, 73311, 73312, 73313, 73314, 73315, 73316, and 73319
Trauma/non-routine falls/accidents	HCPCS	-
	ICD-9	819, 828, 851, 852, 853, 854, 860, 861, 862, 863, 864, 865, 866, 867, 868, 869, 8074, 9584, 80712, 80713, 80714, 80715, 80716, 80717, 80718, 80719, E800–E848, E881, E882, E883, E884.0, E884.1, E884.5, E885.0, E885.1, E885.2, E885.3, E885.4, E886.0, E886.9, E888.0, and E888.1
Bone palliative radiotherapy	HCPCS	A9600, A9604, A9605, C9401, G0173, G0174, G0243, G0251, G0339, G0340, J3005, 0073T, 61793, 61796, 61797, 61798, 63620, 63621, 77371, 77372, 77373, 77401, 77402, 77403, 77404, 77406, 77407, 77408, 77409, 77411, 77412, 77413, 77414, 77416, 77418, 79005, 79101, 79200, 79300, 79400, 79403, 79440, 79445, and 79999
	ICD-9	9223, 9224, 9229, 9230, 9231, 9232, and 9239
Bone surgery	HCPCS	27187, 27235, 27236, 27244, 27245, 27248, 27269, 27495, 27506, 27507, 27509, 27511, 27513, 27514, 23615, 23616, 23630, 24498, 24515, 24516, 24538, 24545, 24546, 24566, 24575, 24579, 24582, 24586, 24587, 24635, 24665, 24666, 24685, 25490, 25491, 25492, 25515, 25525, 25526, 25545, 25606, 25607, 25608, 25609, 27535, 27536, 27745, 27756, 27758, 27759, 27766, 27769, 27784, 27792, 27826, 27827, 22325, 22326, 22327, 22328, 22520, 22521, 22522, 22532, 22533, 22534, 22548, 22550, 22554, 22555, 22556, 22558, 22565, 22585, 22590, 22595, 22600, 22610, 22612, 22614, 22615, 22625, 22630, 22632, 20982, 23490, 23515, 23585, 27215, 27216, 27217, 27218, 27226, 27227, 27228, 27524, 27540, 22523, 22524, 22525, 22526, 22527, 25574, and 25575
	ICD-9	7815, 7845, 7855, 7915, 7925, 7935, 7995, 7812, 7842, 7852, 7911, 7921, 7931, 7991, 7813, 7843, 7853, 7912, 7922, 7932, 7992, 7817, 7847, 7857, 7916, 7926, 7936, 7996, 0353, 8102, 8103, 8104, 8105, 8106, 8107, 8108, 7810, 7811, 7816, 7819, 7840, 7841, 7846, 7849, 7850, 7851, 7856, 7859, 7910, 7919, 7920, 7929, 7930, 7939, 7990, and 7999

Appendix Table 2:

HCFA physician codes

Physician Type	HCFA_SPEC	HCFA_SPEC Description
5Urology	34	Urology
2Medonc	83	Hematology/oncology
2MedOnc	82	Hematology
2MedOnc	90	Medical oncology
7PCP	01	General practice
7PCP	08	Family Practice
7PCP	11	Internal Medicine
7PCP	84	Preventative Medicine
7PCP	38	Geriatric medicine

Appendix Table 3:

Cross-tabulation of skeletal-related events and the physician visit categories

Table of SRE by physician visit group					
SRE [N Row percent Column percent]	Physician visit group				
	No urologist or MO	Urologist only	MO only	Both urologist and MO	Total N Col%
No	109	1127	165	989	2390
	4.56	47.15	6.90	41.38	55.43
	61.93	60.82	53.05	50.15	
Yes	67	726	146	983	1922
	3.49	37.77	7.60	51.14	44.57
	38.07	39.18	46.95	49.85	
Total N	176	1853	311	1972	4312
Row%	4.08	42.97	7.21	45.73	100.00

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Fig. 1:
Physician visits for the study sample (N=5,572)

Table 1:

Demographic and clinical characteristics of men diagnosed with stage IV M1 prostate cancer from 2000 – 2009 (N=5,572)^a

Variables	Full sample (N=5,572)		Men with no urologist or medical oncologist visit (N=990)		Men with urologist visit only (N=2,115)		Men with medical oncologist visit only (N=395)		Men with urologist and medical oncologist visits (N=2,072)		P- value
	N	Col %	N	Col %	N	Col %	N	Col %	N	Col %	
Age											<.01
66–74	1,854	33	272	27	618	29	136	34	828	40	
75–84	2,581	46	447	45	981	46	184	47	969	47	
>85	1,137	20	271	27	516	24	75	19	275	13	
Race											<.01
Non-Hispanic White	4,253	76	661	67	1,617	76	296	75	1,679	81	
Non-Hispanic African American	896	16	256	26	317	15	68	17	255	12	
Other	423	8	73	7	181	9	31	8	138	7	
Married *											<.01
Yes	3,250	62	459	49	1,191	61	237	63	1,363	70	
No	1,979	38	484	51	773	39	141	37	581	30	
Urban residence *											<.01
Yes	4,919	88	885	89	1,821	86	356	90	1,857	90	
No	652	12	105	11	294	14	39	10	214	10	
Poorly Differentiated Tumor											<.01
Yes	3,193	57	426	43	1,263	60	117	30	1,387	67	
No	2,379	43	564	57	852	40	278	70	685	33	
Charlson Comorbidity Index *											<.01
Zero	3,105	62	416	59	1,205	61	204	57	1,280	66	
One	1,056	21	135	19	454	23	77	22	390	20	
Two or higher	836	17	151	22	332	17	74	21	279	14	
Congestive Heart Failure											<.01
Yes	505	9	113	11	218	10	52	13	122	6	
No	5,067	91	877	89	1,897	90	343	87	1,950	94	
Diabetes											<.01
Yes	783	14	96	10	325	15	67	17	295	14	
No	4,789	86	894	90	1,790	85	328	83	1,777	86	
Chronic Obstructive Pulmonary Disease											0.58
Yes	569	10	97	10	229	11	43	11	200	10	

Variables	Full sample (N=5,572)		Men with no urologist or medical oncologist visit (N=990)		Men with urologist visit only (N=2,115)		Men with medical oncologist visit only (N=395)		Men with urologist and medical oncologist visits (N=2,072)		P- value
	N	Col %	N	Col %	N	Col %	N	Col %	N	Col %	
No	5,003	90	893	90	1,886	89	352	89	1,872	90	
Poor performance status proxy *											<.01
Yes	1,364	26	277	32	521	26	128	33	438	22	
No	3,928	74	583	68	1,503	74	256	67	1,586	78	
Use of preventive services *											<.01
Yes	1,895	36	181	21	777	38	119	31	818	40	
No	3,397	64	679	79	1,247	62	265	69	1,206	60	
State buy-in (at least 1 month)											<.01
Yes	786	14	170	17	352	17	51	13	213	10	
No	4,786	86	820	83	1,763	83	344	87	1,859	90	
Region of SEER registry											<.01
Northeast	1,156	21	165	17	412	19	77	19	502	24	
South	598	11	128	13	228	11	35	9	207	10	
Midwest	1,272	23	198	20	536	25	93	24	445	21	
West	2,546	46	499	50	939	44	190	48	918	44	

^aColumn percentages might not add to 100% due to rounding

* Totals do not add up to the sample size due to missing values

Table 2a:

Descriptive statistics for the time (in days) to first physician visit for patients diagnosed with stage IV M1 prostate cancer in 2000–2009 (N=5,572)

Group / physician	Time to physician visit (days)							
	N	Mean	SD	Min	Q1	Median	Q3	Max
No urologist or medical oncologist	990							
Urologist only	2,115	47	144.5	0	9	19	36	2,433
Medical oncologist only	395	89	183.6	0	20	36	63	1,635
Urologist and medical oncologist	2,072							
Urologist visit		51	137.8	0	9	19	37	2,118
Medical oncologist visit		323	443.9	0	40	115	449	3,323

Table 2b:

Descriptive statistics for the time (in days) to first skeletal-related event stratified by physician visit and treatment group for patients diagnosed with stage IV M1 prostate cancer in 2000–2009 (N=5,572)

	N (%)	Number of patients with SRE (%)
Full sample	5,572 (100)	2,258 (41)
ADT	4,312 (77)	
Chemotherapy	1,010 (18)	
Radiopharmaceuticals	167 (3)	
Bisphosphonate	1,461 (26)	
No medical oncologist or urologist	990 (18)	271 (27)
ADT	176 (18)	
Chemotherapy	*	
Radiopharmaceutical	*	
Bisphosphonate	24 (2)	
Urologist only	2,115 (38)	804 (36)
ADT	1,853 (88)	
Chemotherapy	123 (6)	
Radiopharmaceuticals	51 (2)	
Bisphosphonate	176 (8)	
Medical oncologist only	395 (7)	169 (43)
ADT	311 (79)	
Chemotherapy	93 (24)	
Radiopharmaceuticals	*	
Bisphosphonate	176 (45)	
Urologist and medical oncologist	2,072 (37)	1,014 (49)
ADT	1,972 (95)	
Chemotherapy	780 (38)	
Radiopharmaceuticals	104 (5)	
Bisphosphonate	1,085 (52)	

* Per data use agreement, cell sizes less than 11 are suppressed

Table 3:

Covariate-adjusted hazard ratios for the association between a physician visit and the time to a skeletal-related event following the diagnosis of stage IV M1 prostate cancer

HR for specialist visit	Hazard Ratio*	95% Hazard Ratio Confidence limits	Pr > ChiSq
Model 1: Medical oncologist (MO) and urologist visits (full sample) <0.01			
No urologist or MO visit (ref)	-		
Medical oncologist only	0.53	0.45	0.61
Urologist only	0.35	0.31	0.39
Both MO and urologist	0.34	0.31	0.38
Model 2: Among men with a urologist visit post-diagnosis			
Medical oncologist visit			
No (ref)	-		
Yes	0.97	0.90	1.05
Model 3: Among men with no urologist visit post-diagnosis			
Medical oncologist visit			
No (ref)	-		
Yes	0.54	0.46	0.64
			<.01

* All regression models adjusted for demographic, clinical and contextual characteristics.