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Risk of Hospitalization Following Primary Treatment for Prostate Cancer

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Abstract

Objective—To compare the risk of hospitalization and associated costs in patients following treatment for prostate cancer.

Patients and Methods—We identified 29,571 patients age 66–75 years without significant comorbidity from the Surveillance, Epidemiology, and End Results (SEER)-Medicare linked database who were diagnosed with localized prostate cancer between 2004 and 2009. We compared the rates of all cause and toxicity-related hospitalization that occurred within 1 year following initiation of definitive therapy. We used multivariable logistic regression analysis to identify determinants associated with hospitalization.

Results—Men who underwent surgery rather than radiotherapy had lower odds of being hospitalized for any cause following therapy (OR 0.80: 95% CI, 0.74–0.87). Patients who underwent surgery rather than radiotherapy had higher odds of being hospitalized for treatment-related complications (OR 1.15: 95% CI, 1.03–1.29). However, men who underwent external beam radiotherapy/IMRT (OR 0.84: 95% CI, 0.72-0.99) had 16% lower odds of hospitalization from treatment-related complications than patients undergoing surgery. Using propensity score weighted analyses, there was no significant difference in the odds of hospitalization from treatment-related complications for men who underwent surgery versus radiotherapy (OR 1.06:

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95% CI, 0.92–1.21). Patients hospitalized for treatment-related complications following radiotherapy were costlier than patients who underwent surgery (Mean $18,381 vs. $13,203, p<0.001).

Conclusions—With the exception of men who underwent external beam radiotherapy/IMRT, there was no statistically significant difference in the odds of hospitalization from treatment-related complications. Costs from hospitalization after treatment were significantly higher for men undergoing radiation therapy than surgery. Our findings are relevant in the context of penalties linked to hospital readmissions and bundled payment models.

Keywords

prostate cancer; treatments; hospitalization; costs; utilization; outcomes

Introduction

Prostate cancer remains the most commonly diagnosed solid organ tumor among U.S. men with an estimated 220,800 new cases and 27,540 deaths in 2015 [1]. Broadly speaking, curative treatment options for prostate cancer include surgery and radiation [2, 3]. Driven by intensive PSA screening over the last quarter century, prostate cancer has witnessed a marked stage migration[4], toward a more indolent course in the majority of newly diagnosed cases [5].

In recent years, there has been a concerted effort to maximize the value of health care delivery by improving the quality of medical outcomes and by reducing unnecessary costs [6]. Prostate cancer represents a high-yield target for value-based reform given the preponderance overtreatment as well as the expensive technologies required for radiation and surgery. Currently, the Centers for Medicare and Medicaid Services (CMS) has initiated a hospital readmission reduction program in accordance with the Affordable Care Act to reduce payments to hospitals with excessive readmissions for the following procedures and diagnoses: acute myocardial infarction, congestive heart failure, pneumonia, chronic obstructive pulmonary disease and elective total hip arthroplasty and total knee arthroplasty [7]. Similar payment reductions may ensue for readmissions after treatment for common malignancies, including prostate cancer. Prior studies have rigorously assessed complications, interventions to treat complications, as well as the time interval to first complication among patients who underwent surgery or radiotherapy [8-10]. While studies often report 30 and 90-day readmission rates, CMS uses readmission 30-days following intervention when discerning payment reductions [7]. However, the use of relatively short readmission time intervals may inaccurately assess delayed hospitalization rates following prostate cancer treatment [8]. In this context, the rate of hospitalization after prostate cancer treatment and the associated costs in the general population is currently unknown. The objective of this study was to assess the risk, predictors and costs of hospitalization following primary treatment for prostate cancer.

Patients and Methods

Data Sources

We used Surveillance, Epidemiology, and End Results (SEER)–Medicare data for analysis, which are composed of a linkage of population-based cancer registry data from 16 SEER areas with Medicare administrative data. The SEER program covers approximately 26% of the U.S. population, and the Medicare program provides benefits to 97% of Americans aged ≥65 years [11].

Study Population

Due to baseline differences between patient populations undergoing radiotherapy and surgery, we limited our analysis to only include patients expected to be candidates for either surgery or radiotherapy based on age and limited comorbid medical conditions. From the SEER-Medicare linked database, we identified 29,571 patients who met the following criteria: age 65–75 years, Charlson Comorbidity Index (CCI) scores of 0 or 1, localized prostate cancer (clinical stage T1/T2), diagnosed with prostate cancer between 2004 and 2009, and treated with radical prostatectomy or radiotherapy. To ensure data completeness and to allow enough follow-up time to evaluate treatment and hospitalization, we included only patients who had full medical insurance coverage provided by Medicare Part A and Part B during the 12 months before and after treatment and who were not Health Maintenance Organization members. Patients who received both radical prostatectomy and radiotherapy were excluded from analysis (n=192). Patients with a diagnosis of any other cancer prior or post to prostate cancer were excluded (Figure 1).

Study Variables

Patient demographics, tumor characteristics, and treatments—Patient demographics and tumor characteristics at the time of diagnosis were extracted from the SEER-Medicare Patient Entitlement and Diagnosis Summary File (PEDSF). Patient treatment information was extracted from Medicare claims files for durable medical equipment (DME), physician (NCH), inpatient service (MEDPAR), and outpatient service files (OUTPAT).

The primary exposure was the treatment received within 6 months after diagnosis, identified using International Classification of Diseases 9th edition (ICD-9) procedure codes and Current Procedural Terminology (CPT) codes in Appendix Table 1. The primary outcome of interest was the rate of hospitalizations within 12 months following initiation of treatment. Hospitalization for the index prostatectomy was not considered as part of the outcome.

For descriptive purposes, patients were classified into two, mutually exclusive categories based on the treatment received within this initial period: radical prostatectomy (open, minimally invasive or perineal) and radiotherapy (external beam, brachytherapy or both) with or without androgen deprivation therapy (ADT, luteinizing hormone-releasing hormone agonist or orchiectomy) (see Appendix Table 1). CPT-4 code 55899 (unspecified male genitourinary procedure) may sometimes be used with an open radical prostatectomy administrative code to specify minimally invasive radical prostatectomy with robotic

assistance for private health plans, but Medicare does not recognize this coding schema, and very few men had this combination of codes; therefore, this was not used to identify minimally invasive radical prostatectomy.

We obtained the age, race, geographic region, census variables (urban/rural, education, poverty level), diagnosis year, and stage (T1/T2) from the PEDSF file. Treatment variables including surgery, radiotherapy, and ADT use were determined from Medicare claims. Comorbidity was assessed using the Klabunde modification of the CCI during the year before diagnosis.[12] The Klabunde modification uses comorbid conditions identified by the CCI and incorporates the diagnostic and procedure data contained in Medicare physician (Part B) claims. Variables were categorized as in Table 1.

Statistical Analysis

We evaluated the rate of hospitalization for any cause as well as hospitalization for treatment-related complications that occurred within 12 months of treatment initiation. Prior adjusted analyses where sensitivity analyses performed excluded patients with preexisting conditions have demonstrated similar results. Based on prior studies [13], we derived our definition for recording hospitalization for treatment-related complication versus any cause. Conditions listed in the Appendix Table 2 that were not present in the Medicare claims during the 12 months preceding treatment were deemed treatment-related complications. We calculated and compared the hospitalization rates from a treatment-related complications for patients who underwent radiotherapy and surgery. The most common reasons for hospitalization from a treatment-related complication (categorized as urinary, gastrointestinal, etc) were identified. Total cost of hospitalization for all and treatment-related hospitalizations were calculated as the sum of the Medicare reimbursement, the amount that was made by a primary payer other than Medicare, total of all claims passed through for the stay, and patients' deductible and Part A coinsurance.

The rates of hospitalization and 95% confidence intervals were calculated and compared between two treatment groups. We used summary statistics to describe demographic information and disease characteristics between two treatment groups; differences were evaluated with the $\chi 2$ test for categorical variables and t-test for continuous variables. We used logistic regression models adjusted for patients' demographics, comorbidities, and tumor characteristics to compare the odds of hospitalization between patient groups. We used the Hosmer-Lemeshow test to check the goodness-of-fit of the models. We also performed a sensitivity analysis by logistic regression analysis with probability weighting, as the inverse of propensity score of treatment estimated from a generalized logit model. The variables used were age, race, geographic region, census variables (urban/rural, education, poverty level), comorbidity, diagnosis year, stage (T1/T2), marital status and Gleason score (Appendix Table 3). P values less than 0.05 were considered statistically significant. The SAS software program version 9.4 (SAS Institute, Cary, NC) was used to perform all data management and statistical analyses. This study was deemed exempt by the Institutional Review Board at the University of Texas MD Anderson Center.

RESULTS

Of the 29,571 patients who were included in the analysis, 21,301 patients received radiotherapy and 8,270 patients received surgery within 6 months of cancer diagnosis. ADT was used in over a third of patients who underwent radiotherapy (7,892, 37.1%). The demographics of our study population are summarized in Table 1. The 1,510 patients were excluded from analyses of the hospitalization with treatment-related complications because they had pre-existing conditions.

Patients were more frequently hospitalized for any condition within 1 year following radiotherapy than surgery (15.9% v 12.7%, $p<0.001$). However, there was no significant difference in hospitalization from treatment-related complications between treatment groups (6.3% v 6.5%, $p=0.523$) (Table 2). The most common diagnosis categories associated with hospitalization from treatment-related complications in decreasing order were: genitourinary (36.9%), respiratory (23.4%), gastrointestinal (18.9%), cardiac (15.8%), heterologous blood transfusions (15.7%), vascular (4.0%) and wound complications (0.9%). There was no significant difference between primary therapy and treatment-related complications requiring hospitalization: RP (6.4%), MIRP (6.5%), brachytherapy (6.1%), combined external beam radiotherapy/brachytherapy (6.1%) and external beam radiotherapy/IMRT (6.6%) (unadjusted, $p=0.704$).

In multivariable analysis, patients who underwent surgery rather than radiotherapy had lower odds of being hospitalized for any cause following therapy (OR 0.80: 95% CI, 0.74–0.87) (Table 3). Higher odds of hospitalization were also found among older men (aged 71–75 vs 66–70 years; OR 1.10: 95% CI, 1.03–1.18), unmarried (vs married; OR 1.10: 95% CI, 1.01–1.20), among men with a comorbidity (vs none; OR 1.47: 95% CI, 1.37–1.58), Gleason Score 8 (vs ≤6; OR 1.23: 95% CI, 1.11–1.36), and in those diagnosed in the West (vs Midwest; OR 1.27: 95% CI, 1.13–1.43). In propensity score weighted analysis, the difference was similar for risk of overall hospitalization following surgery versus radiotherapy (OR 0.75, 95% CI, 0.68-0.82). When compared with surgery, brachytherapy (OR 1.41: 95% CI, 1.26-1.58) and combined external beam radiotherapy/brachytherapy (OR 1.44: 95% CI, 1.29-1.60) had higher odds of hospitalization following treatment, while patients who underwent external beam radiotherapy/IMRT were not significantly different (OR 1.04: 95% CI, 0.93-1.17).

In multivariable analysis, patients who underwent surgery rather than radiotherapy had higher odds of being hospitalized for treatment-related complications (OR 1.15: 95% CI, 1.03–1.29). Higher odds of treatment-related complications were seen among older men (71–75 vs 66–70 years; OR 1.14: 95% CI, 1.03–1.26); black race (vs white; OR 1.36: 95% CI, 1.16–1.60), and those with a comorbid condition (vs none; OR 1.58: 95% CI, 1.43–1.76) (Table 4). Using propensity score weighted analyses, there was no statistically significant difference in the incidence of hospitalization from treatment-related complications for men who underwent surgery versus radiotherapy (OR 1.04: 95% CI, 0.91–1.19). Compared with surgery, the incidence of treatment-related complications were not significantly different for brachytherapy (OR 0.94: 95% CI, 0.80–1.11) and combined external beam radiotherapy/brachytherapy (OR 0.91: 95% CI, 0.77–1.07). However, patients who underwent external

beam radiotherapy/IMRT (OR 0.84: 95% CI, 0.72–0.99) had a 16% lower odds of hospitalization from treatment-related complications than patients undergoing surgery.

With regard to costs, we found that patients who underwent radiotherapy had greater healthcare expenditures for any hospitalization when compared with patients undergoing surgery (Mean $16,465 vs. $13,597, p<0.001). Similarly, patients hospitalized for treatment-related complications following radiotherapy were costlier than surgery patients (Mean $18,381 vs. $13,205, p<0.001) (Table 5).

DISCUSSION

Treatment options for clinically significant prostate cancer may include radical prostatectomy, external beam radiotherapy and brachytherapy with active surveillance reserved for men diagnosed with indolent disease [2, 3]. Prior research have shown varying complication rates and need for additional procedures following each treatment modality [9]. In recent years, there has been a concerted effort to maximize the value of health care delivery by improving the quality of medical outcomes through decreased readmissions and reducing unnecessary costs [7]. In the present study, of the 29,571 patients undergoing surgery or radiotherapy as their primary treatment for prostate cancer, with the exception of external beam radiotherapy/IMRT, there was no statistically significant difference in the odds of hospitalization from treatment-related complications. Moreover, costs from hospitalization after treatment were significantly higher for men undergoing radiation therapy than surgery. We provide one of the first population-based analyses to further discern determinants costs of hospitalization following primary treatment for prostate cancer.

Our study has several important findings. First, in a cohort of men who would theoretically be candidates for either surgery or radiotherapy because of age and good overall health, we found men who underwent radiotherapy more likely to be hospitalized for any reason. Prior studies have shown that men with advanced age and increased comorbidities were more likely to have complications following treatment for prostate cancer [14]. This is attributed to the variation in patient demographics undergoing radiotherapy compared with surgery—those undergoing radiotherapy are often sicker and more likely to have other competing risks for hospitalization [14-16]. Our results are relevant given the fact that we limited our cohort to those without significant comorbidities or advanced age. In addition, we were able to show that men without significant comorbidities and more recent year of surgery were less likely to be hospitalized, which is consistent with prior reports [14]. Furthermore, tumor biology was a significant determinant for risk of overall and treatment-related hospitalization. While we cannot conclude a cause and effect, there was an association between tumor biology and hospitalization risk. Taking these patient factors into account and as suggested by current guidelines, physicians should incorporate life expectancy and competing risks when counseling patients on appropriate treatments.

Second, we found geographic variability regarding hospitalization following primary treatment for prostate cancer. Specifically, men treated in rural areas and in the West were more likely to be hospitalized following primary treatment. While significantly different, the

absolute differences observed were small and comparative rate of hospitalization were close. Our geographic variability observed is consistent with other prior reports regarding costs of treatment where regional differences are not due to differences in the prices of medical services, levels of illness or the socio-demographic characteristics of a region, but rather secondary to a greater quantity of medical services delivered including greater propensity for readmission following treatments in high cost areas [17]. Quality of care may not necessarily be better in regions of higher utilization, and may in fact be significantly worse than quality of care in areas that utilize fewer resources [18]. The culture in medical communities is an important determinant of the quantity of medical care delivered [18], and may be the rate-limiting step when attempting to attenuate regional variation in hospitalization following treatment for prostate cancer.

Third, in multivariable analyses we found that men treated with surgery were more likely to be hospitalized due to a treatment-related complication than men treated with radiation therapy. Our findings are consistent with prior reports suggesting complications related to therapy following surgery occur sooner than that of radiotherapy patients [19]. However, while we identified a statistically significant difference in likelihood of hospitalization following treatment, the absolute difference was very small and may not be clinically relevant. Moreover, we attempted to provide a comparable group of men to discern potential differences in risk of treatment-related complications requiring hospitalization. There may be other confounding variables that we are unable to control and further determinants needed to be discerned regarding hospitalization risk. In the present study, propensity score weighted analyses identified no significant difference in treatment-related hospitalization except patients who underwent external beam radiotherapy/IMRT had an 18% lower odds of treatment-related hospitalization than patients undergoing surgery. These findings support prior studies confirming decreased side effect profile associated with three-dimensional conformal radiotherapy and IMRT [20]. To our knowledge, this is the first comparative effectiveness study to discern risk of hospitalization following primary treatment with surgery or radiotherapy for prostate cancer. Other studies have critically assessed complications and additional procedures following either surgery or radiotherapy [9, 10]. However, because patients treated with radiotherapy were older and more comorbid, selection bias limits the strength of conclusions that can be drawn from those studies.

Lastly, radiotherapy patients had higher attributable costs overall and related to complications when hospitalized when compared with surgery. Wallis et al. recently examined rates of interventions to manage complications following radiotherapy or surgery using SEER-Medicare data within the same time period as the present study [9]. While they did not evaluate associated costs, radiotherapy patients had significantly higher rates of urologic procedures and anal-rectal procedures following radiotherapy. Our analysis included diagnosis and procedure codes that further support the likelihood of increased complications requiring intervention, hospitalizations, and the associated increased costs after radiation therapy. These increased costs associated with radiotherapy should be balanced with individual risks of complication-related hospitalization associated with certain types of radiotherapy such as external beam radiotherapy/IMRT. These findings are important in the current healthcare climate with an ever increasing demand for comparative effectiveness research discerning high quality cost-effective care over the entire care cycle

[6]. In the hospital readmission reduction program, CMS currently uses 30-day readmission rates as a benchmark [7]. With payment penalties for increased readmissions in the setting of bundled payments and increased pressures to improve the value of care across the entire care cycle, there will be an increased need for comparative effectiveness research [21, 22]. Critical assessment of hospitalization risks for disease and treatments which may occur greater than 30 or even 90-days are imperative to understanding how best to allocate resources appropriately.

While our findings are policy relevant, they must be interpreted in the context of the study design. First, SEER-Medicare is limited to men aged 65 years of age and older and our results may not be generalizable to younger men diagnosed with prostate cancer. Second, neither SEER nor Medicare explicitly identifies those men who are being treated with robotic surgery. However, patients who undergo MIRP are more likely to have undergone robotic surgery, which was increasing during the study period [23]. Third, we excluded PSA values in the present study due to preliminary evaluation of SEER data uncovered problems with the quality and interpretation of the PSA value [24]. While this questions the validity of large datasets, prior studies have suggested the limited impact PSA may have on disease risk stratification with patients having similar tumor characteristics as those with complete data [25]. Fourth, claims data are primarily designed to provide billing information and may not accurately capture all clinical information [13]. However, prior studies have demonstrated a high degree of correlation between use of Medicare claims to detect complications following radical prostatectomy [26]. Fifth, our results may not reflect long-term risk of hospitalization following either treatment. Side-effects after radiotherapy treatment may take many years to become clinically apparent. However, recent long-term outcomes research have shown similar incidence of certain treatment related complications [27]. Lastly, while we attempted to control for known predictors for hospitalization, the findings are hypothesis-generating and there may be omitted variable bias. While we used the Charlson comorbidity index there may have been differences in health between surgery and radiotherapy groups that were not reflected in the Charlson comorbidity scores. However, observational studies reflect practice patterns and when compared with results from well-conducted randomized controlled trials they do not appear to overestimate treatment effects nor differ qualitatively [28, 29].

Conclusions

With the exception of men who underwent external beam radiotherapy/IMRT, there was no statistically significant difference in the odds of hospitalizations from treatment-related complications. Costs from hospitalizations after treatment were significantly higher for men undergoing radiation therapy than surgery. Our findings are relevant in the context of penalties linked to hospital readmissions and bundled payment models.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

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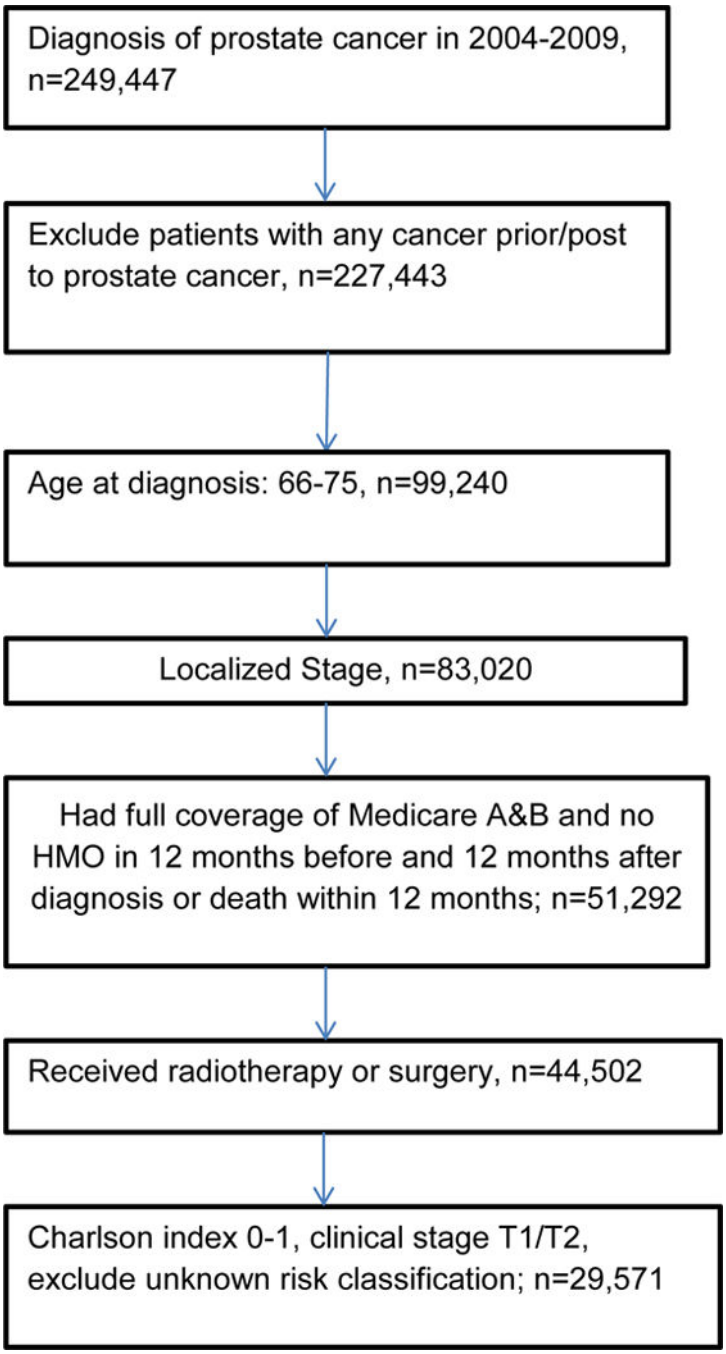

Figure 1.

Table 1

Characteristics of Patients With Prostate Cancer According to Treatment Regimen

Characteristic	Categories	Total	Radiotherapy N (%)	Surgery N (%)	p-value
Year of diagnosis	2004	5150	3785 (17.8)	1365 (16.5)	<0.001
	2005	4855	3592 (16.9)	1263 (15.3)	
	2006	5152	3773 (17.7)	1379 (16.7)	
	2007	5276	3770 (17.7)	1506 (18.2)	
	2008	4792	3352 (15.7)	1440 (17.4)	
	2009	4346	3029 (14.2)	1317 (15.9)	
Age (years)	66-70	16058	10150 (47.7)	5908 (71.4)	<0.001
	71-75	13513	11151 (52.3)	2362 (28.6)	
Charlson comorbidity index	0	22169	15543 (73.0)	6626 (80.1)	<0.001
	1	7402	5758 (27.0)	1644 (19.9)	
Race/ethnicity	White	23605	16805 (78.9)	6800 (82.2)	<0.001
	Black	2758	2232 (10.5)	526 (6.4)	
	Hispanic	1742	1205 (5.7)	537 (6.5)	
	Other	1466	1059 (5.0)	407 (4.9)	
Marital status	Unmarried	4939	3789 (17.8)	1150 (13.9)	<0.001
	Married	22005	15453 (72.6)	6552 (79.2)	
	Unknown	2627	2059 (9.7)	568 (6.9)	
Education: % of persons in census tract with < 12 years education	≥24.5%	7393	5649 (26.5)	1744 (21.1)	<0.001
	14.3-24.5%	7368	5399 (25.4)	1969 (23.8)	
	8.0-14.3%	7320	5273 (24.8)	2047 (24.8)	
	0-8.0%	7490	4980 (23.4)	2510 (30.4)	
Percent of tract residents living below the poverty level	≥13.9%	7419	5523 (25.9)	1896 (22.9)	<0.001
	7.3-13.9%	7458	5329 (25.0)	2129 (25.7)	
	3.9-7.3%	7321	5124 (24.1)	2197 (26.6)	
	0-3.9%	7373	5325 (25.0)	2048 (24.8)	
SEER Region	Midwest	3397	2420 (11.4)	977 (11.8)	<0.001
	Northeast	5988	4897 (23.0)	1091 (13.2)	
	South	8512	6521 (30.6)	1991 (24.1)	

Characteristic	Categories	Total	Radiotherapy N (%)	Surgery N (%)	p-value
	West	11674	7463 (35.0)	4211 (50.9)	
Residence	Urban	26105	18749 (88.0)	7356 (89.0)	0.021
	Rural	3466	2552 (12.0)	914 (11.0)	
Clinical Stage	T1	18022	13276 (62.3)	4746 (57.4)	<0.001
	T2	11549	8025 (37.7)	3524 (42.6)	
Gleason Score	≤6	14075	10564 (49.6)	3511 (42.5)	<0.001
	7	11808	7754 (36.4)	4054 (49.0)	
	>8	3304	2669 (12.5)	635 (7.7)	
	Unknown	384	314 (1.5)	70 (0.8)	

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Table 2

Rates of Hospitalization According to Treatment Type

a.

Variable	Total	Treatment		P-Value**
		Radiotherapy (N=21,301)	Surgery (N=8,270)	
Hospitalization any cause*, N (%)	4,441 (15.0)	3,393 (15.9)	1,048 (12.7)	<0.001
Hospitalization with treatment related complication*, N (%)	1,769 (6.3)	1,257 (6.3)	512 (6.5)	0.523

b.

Variable	Total	Surgical Treatment		Radiotherapy Treatment			P-Value**
		RP (N=4,544)	MIRP (N=3,726)	EBRT/IMRT (N=7,809)	Brachytherapy (N=5,978)	EBRT/IMRT/Brachytherapy (N=7,514)	
Hospitalization any cause*, N (%)	4,441 (15.0)	583 (12.8)	465 (12.5)	1,077 (13.8)	1,030 (17.2)	1,286 (17.1)	<0.001
Hospitalization with treatment related complication*, N (%)	1,769 (6.3)	279 (6.4)	233 (6.5)	439 (6.1)	350 (6.1)	468 (6.6)	0.704

RP: radical prostatectomy; MIRP: minimally invasive radical prostatectomy; EBRT: external beam radiotherapy; IMRT: intensity modulated radiotherapy

*Hospitalization defined as readmission within 365 days of initial treatment

**P-value from chi-square test for overall difference among treatments

Table 3

Multivariate Logistic Regression Analysis for Significant Predictors of Any Hospitalization Within One Year of Therapy Initiation*

Characteristic	Categories	OR	95% CI	p-value
Treatment subtypes	Radiotherapy	1.00		
	Surgery	0.80	0.74-0.87	<0.001
Year of diagnosis	2004	1.00		
	2005	0.93	0.83-1.03	0.154
	2006	0.91	0.82-1.02	0.092
	2007	0.86	0.78-0.96	0.007
	2008	0.83	0.74-0.92	0.001
	2009	0.77	0.68-0.86	<0.001
Age (years)	66-70	1.00		
	71-75	1.10	1.03-1.18	0.004
Charlson comorbidity index	0	1.00		
	1	1.47	1.37-1.58	<0.001
Race/ethnicity	White	1.00		
	Hispanic	0.87	0.75-1.01	0.070
	Black	1.07	0.95-1.20	0.2281
	Other	0.73	0.62-0.86	<0.001
Marital Status	Married	1.00		
	Unmarried	1.10	1.01-1.20	0.027
	Unknown	0.98	0.87-1.10	0.672
SEER Region	Midwest	1.00		
	Northeast	1.12	0.99-1.27	0.068
	South	1.00	0.88-1.12	0.960
	West	1.27	1.14-1.43	<0.001
Residence	Rural	1.00		
	Urban	0.79	0.71-0.88	<0.001
Clinical Stage	T1	1.00		
	T2	1.05	0.99-1.13	0.126
Gleason Score	≤6	1.00		
	7	1.04	0.97-1.11	<0.332
	>8	1.23	1.11-1.36	<0.001
	Unknown	1.08	0.82-1.42	0.594

*Adjusted for education, poverty.

Table 4

Logistic Regression Analysis for Significant Predictors of Hospitalization With Treatment Related Complication Within One Year of Therapy Initiation*

Characteristic	Categories	OR	95% CI	p-value
Treatment subtypes	Radiotherapy	1.00		
	Surgery	1.15	1.03-1.29	0.014
Year of diagnosis	2004	1.00		
	2005	0.94	0.80-1.11	0.445
	2006	1.02	0.87-1.19	0.843
	2007	0.89	0.75-1.05	0.155
	2008	0.90	0.76-1.07	0.231
	2009	0.93	0.78-1.10	0.370
Age, years	66-70	1.00		
	71-75	1.14	1.03-1.26	0.009
Charlson comorbidity	0	1.00		
index	1	1.58	1.43-1.76	<0.001
Race/ethnicity	White	1.00		
	Hispanic	1.14	0.92-1.40	0.237
	Black	1.36	1.16-1.60	<0.001
	Other	1.02	0.82-1.29	0.842
Marital Status	Married	1.00		
	Unmarried	1.12	0.98-1.27	0.089
	Unknown	1.16	0.98-1.37	0.088
SEER Region	Midwest	1.00		
	Northeast	1.10	0.91-1.33	0.333
	South	1.11	0.93-1.32	0.266
	West	1.08	0.91-1.29	0.378
Residence	Rural	1.00		
	Urban	0.87	0.74-1.03	0.098
Clinical Stage	T1	1.00		
	T2	1.02	0.92-1.13	0.743
Gleason Score	≤6	1.00		
	7	1.04	0.94-1.16	0.422
	>8	1.24	1.07-1.45	0.006
	Unknown	1.20	0.80-1.79	0.375

*Adjusted for education, poverty

Table 5

Associated Mean Medicare Costs of Hospitalization According to Treatment Type

Variable	Treatment		
	Radiotherapy	Surgery	P-Value**
Hospitalization any cause*, N (%)	$16,465	$13,597	<0.001
Hospitalization with treatment related complication*, N (%)	$18,381	$13,203	<0.001

* Hospitalization defined as readmission within 365 days of initial treatment

** P-value from T test for overall difference among treatments