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## Population-Based Assessment of Racial/Ethnic Differences in Utilization of Radical Cystectomy for Patients Diagnosed With Bladder Cancer

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### Abstract

**Purpose**—Radical cystectomy is a surgical treatment for recurrent non-muscle invasive and muscle-invasive bladder cancer, however, many patients may not receive this treatment.

**Methods**—A total of 27,578 patients diagnosed with clinical stage I to IV bladder cancer from January 1, 2007 to December 31, 2013 were identified from the Surveillance, Epidemiology, and End Results (SEER) registry database. We used multivariable regression analyses to identify

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**Ethical Standard:** This study has been approved by the appropriate ethics committee and have therefore been performed in concordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

**Conflict of Interest:** All authors declare they have no conflict of interest.

**Author contributions:**

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factors predicting use of radical cystectomy and pelvic lymph node dissection. Cox proportional hazards models were used to analyze survival outcomes.

**Results**—A total of 1,693 (6.1%) patients with bladder cancer underwent radical cystectomy. Most patients (92.4%) who underwent radical cystectomy also underwent pelvic lymph node dissection. When compared with white patients, non-Hispanic blacks were less likely to undergo a radical cystectomy (odds ratio [OR] 0.79, 95% confidence interval [CI] 0.64–0.96,  $p = 0.019$ ). Moreover, recent year of surgery 2013 vs. 2007 (OR 2.32, 95% CI 1.90–2.83,  $p < 0.001$ ), greater percentage of college education 36.3% vs. <21.3% (OR 1.23, 95% CI 1.04–1.44,  $p = 0.013$ ), Midwest vs. West (OR 1.64, 95% CI 1.39–1.94,  $p < 0.001$ ) and more advanced clinical stage III vs. I (OR 29.1, 95% CI 23.9–35.3,  $p < 0.001$ ) was associated with increased use of radical cystectomy. Overall survival was improved for patients who underwent radical cystectomy compared with those who did not undergo a radical cystectomy (hazard ratio 0.88, 95% CI 0.80–0.97,  $p = 0.008$ ).

**Conclusion**—There is significant underutilization of radical cystectomy in patients across all age groups diagnosed with bladder cancer, especially among older, non-Hispanic black patients.

### Keywords

Bladder Cancer; Radical cystectomy; Lymph Node Dissection; Disparities; Utilization

## INTRODUCTION

There were an estimated 74,000 new cases and 16,000 deaths from bladder cancer in the United States in 2015.<sup>1</sup> Bladder cancer represents the most common urinary tract malignancy. Radical cystectomy with extended pelvic lymphadenectomy is recommended for patients with muscle-invasive bladder cancer.<sup>2</sup> Despite these longstanding guidelines, radical cystectomy is markedly underused; only 19–21% of patients age 66 years of age and older with muscle-invasive disease are offered this potentially curative surgery.<sup>3,4</sup> Patients with muscle-invasive disease have 5-year survival rates of 26–64%.<sup>5,6</sup> Although the pathologic TNM classification is a durable prognostic variable, considerable heterogeneity in outcomes within stage groups has been reported.<sup>5,6</sup> Taking into account the unaltered survival outcomes in bladder cancer treatment over the last three decades,<sup>7</sup> an aggressive approach to optimizing treatment is needed.

While bladder cancer incidence is twice as high among whites compared with blacks there remains a disproportionately high rate of bladder cancer specific mortality among black patients.<sup>8</sup> Variability in quality of care indicators such as timing to radical cystectomy, provider volume and access to providers have been previously associated with inferior outcomes among bladder cancer patients.<sup>9</sup> Insurance status has also been implicated in variable access to care among cancer patients.<sup>10</sup> The Affordable Care Act may help mitigate this disparity by decreasing the uninsured patient population thereby increasing access to provider services.<sup>11</sup> Racial/ethnic variation and utilization of radical cystectomy according to insurance status remain to be determined. Moreover, cystectomy in patients younger than 66 years of age which healthcare reform may have a significant impact is of particular interest. We sought to characterize the utilization of radical cystectomy for patients diagnosed with bladder cancer in the United States across a wide age range.

## PATIENTS AND METHODS

### Patient Population

We used Surveillance, Epidemiology, and End Results (SEER) registry data from the National Cancer Institute. We restricted our analysis to patients with bladder cancer diagnosed as transitional cell or urothelial carcinoma from 2007 through 2013. Since complete insurance information was not made available in SEER until 2007, we excluded patients prior to this date to derive our cohort. SEER data are summarized; the database contains information on patient demographics, tumor characteristics, and follow-up information. According to published guidelines on the evaluation, treatment, and surveillance of bladder cancer, most patients with muscle-invasive bladder transitional cell carcinoma should undergo radical cystectomy.<sup>2</sup> Patients with high grade, recurrent of BCG refractory non-muscle invasive bladder cancer may be offered cystectomy as a treatment option.<sup>2</sup> Additionally, patients with clinical T3 and T4 bladder cancer may be offered cystectomy as well, either with neoadjuvant or adjuvant chemotherapy, or as a palliative treatment option.<sup>2</sup> The study was deemed exempt by the Institutional Review Board at The University of Texas MD Anderson Cancer Center.

We identified 123,609 patients diagnosed with bladder cancer (urothelial carcinoma and transitional cell carcinoma are synonymous) between 2007 and 2013 in the SEER database. We excluded patients for the following reasons: not diagnosed with urothelial carcinoma or transitional cell carcinoma (ICD-O-3 codes other than 8120 and 8130); not the first and only malignancy; age <18 or >90 years at the time of diagnosis; clinical stage unknown or stage Tis; or unknown insurance status. The final cohort consisted of 27,578 patients as shown in Supplementary Table 1.

The most recent release of the SEER dataset contained information on patients with newly diagnosed cancers in 18 US regions that are generalizable to the US population. Patients with bladder cancer, based on American Joint Committee on Cancer and International Union on Cancer TNM Classification and Stage groupings, were identified from the primary malignancy diagnosis codes and extent-of-disease codes in the SEER database. The cancer stage identified in the SEER database conformed to the standards of the North American Association of Central Cancer Registries, and case ascertainment in the SEER data was 98% complete.<sup>12</sup> SEER defines stage by best pathology defined by the transurethral resection of the bladder tumor or final cystectomy specimens. Given the potential clinical staging and pathology discrepancy with the aforementioned indications for radical cystectomy we included patients with clinical stage I–IV disease to describe utilization patterns. We specified the treatment group on the basis of the treatment codes in the SEER database. Patients who underwent radical cystectomy were identified by indicative procedure codes.

### Study Variables

From the SEER data, we determined patient age, race/ethnicity (White, Black, Hispanic, Asian, and Other), marital status (not married, married, and unknown), clinical stage (T1, T2, T3 and T4) and SEER region (Northeast, South, Midwest, and West). We imputed subject socioeconomic status by using SEER and the Area Health Resource File.<sup>13</sup>

Education was defined according to percent of residents that have at least four years of college education. Education and income are Census-derived variables at the county level. Median income was provided as an independent SEER variable. Subject age, sex, race/ethnicity, and marital status were derived from SEER demographic variables. Insurance status was defined as non-Medicaid insurance (“insured” or insured/no specifics”), Medicaid coverage (“any Medicaid”), or uninsured. Among patients who underwent radical cystectomy, use of pelvic lymph node dissection was defined as ‘yes’ or ‘no’. Patients who underwent pelvic lymph node dissection were grouped together by the following SEER variables ‘one to three regional lymph nodes removed’ and ‘three or more regional lymph nodes removed’ at the time of surgery.

To examine factors that are associated with undergoing radical cystectomy among patients who are newly diagnosed with bladder cancer, we created multivariable models that incorporated year of diagnosis, age, sex, race/ethnicity, marital status, insurance status, income, education, and region. We incorporated covariates that were associated with the use of radical cystectomy in univariate models at an alpha level of 0.05 or lower into our multivariable models.

### Statistical Analysis

We conducted univariate analyses to assess the association of surgeries (radical cystectomy and pelvic lymph node dissection) with patient demographic variables, including age, sex, marital status, race/ethnicity, socioeconomic status (income and education), insurance status (uninsured, Medicaid coverage, or non-Medicaid insurance), and clinical characteristics, using the Pearson chi-square test. Two multivariable logistic regression models were used to evaluate the factors associated with the use of radical cystectomy and pelvic lymph node dissection, adjusting for covariates that were clinically relevant and meaningful or had a p value less than 0.25 in the univariate analysis. Goodness of fit was assessed using the Hosmer-Lemeshow test. Cox proportional hazard models controlling for patient demographics and clinical covariates were performed to assess the relationship between the use of radical cystectomy and patients’ overall survival, as well as cause-specific survival. Kaplan-Meier curves were used to estimate bladder cancer specific and overall survival according to utilization of radical cystectomy.

All statistical tests were 2-sided, and all analyses were performed using SAS software (version 9.4; SAS Institute, Cary, NC). Statistical significance was defined as  $p < 0.05$ .

## RESULTS

Patient demographics are summarized in Table 1. Overall, 1,693 (6.1%) patients with bladder cancer underwent radical cystectomy during the study period. Patients who were younger, female and diagnosed in more recent years of the study more often underwent radical cystectomy (all  $p < 0.001$ ). Uninsured and unmarried patients also underwent radical cystectomy more often than other groups ( $p < 0.001$ ), as did patients residing in the Midwest ( $p < 0.001$ ). Socioeconomic status (median income percentage of college education) were notably associated with increased use among the second and third quartile patients (both

$p < 0.05$ ). More advanced stage of disease was associated with increased utilization of radical cystectomy ( $p < 0.001$ ).

Factors predicting the use of radical cystectomy identified in multivariable analysis are shown in Table 2. More recent year of surgery 2013 vs. 2007 (odds ratio [OR] 2.32, 95% CI 1.90–2.83,  $p < 0.001$ ) and greater percentage college education 36.3% vs. <21.3% (OR 1.23, 95% CI 1.04–1.44,  $p = 0.013$ ). Older patients >80 vs. <50 years of age (OR 0.23, 95% CI 0.18–0.30,  $p < 0.001$ ) and non-Hispanic black patients were less likely to undergo radical cystectomy than white patients (OR 0.79, 95% CI 0.64–0.96,  $p = 0.019$ ). Regional variation was also observed; patients residing in the Midwest were more likely to undergo radical cystectomy than those living in the West (OR 1.64, 95% CI 1.39–1.94,  $p < 0.001$ ). More advanced clinical stage III vs. I (OR 29.1, 95% CI 23.9–35.3,  $p < 0.001$ ) was associated with increased use of radical cystectomy.

Of the patients who underwent radical cystectomy, 1564 (92.4%) underwent pelvic lymph node dissection at the time of surgery (Table 3). Factor predicting the use of pelvic lymph node dissection at the time of radical cystectomy included more recent year of diagnosis 2013 vs. 2007 (OR 4.15, 95% CI 1.82–9.47,  $p < 0.001$ ), female versus male gender (OR 1.86, 95% CI 1.08–3.20,  $p = 0.026$ ) and advanced stage IV vs. I (OR 2.07, 95% CI 1.04–4.10,  $p = 0.037$ ). Non-Hispanic black versus non-Hispanic white (OR 0.53, 95% CI 0.29–0.97,  $p = 0.041$ ) were less likely to undergo pelvic lymph node dissection.

Figures 1 and 2 show the adjusted overall and bladder cancer-specific survival curves according to use of radical cystectomy and clinical stage, respectively. Results of the multivariable Cox regression analyses according to clinical stage and use of radical cystectomy for overall and bladder cancer-specific survival are shown in Tables 4 and 5. In the adjusted analyses, there were significantly improved overall survival outcomes across clinical stages except for stage I disease. The greatest overall (HR 0.46, 95% CI 0.44–0.49,  $p < 0.001$ ) and cancer-specific (HR 0.45, 95% CI 0.42–0.49,  $p < 0.001$ ) survival benefit was observed for patients who underwent pelvic lymph node dissection, respectively. We used product terms of potential interaction variables in the Cox proportional hazard model to evaluate the significance of interactions between receipt of radical cystectomy and patients' demographic variables, such as sex, race/ethnicity and insurance status, and these tests did not yield any significant interaction.

## DISCUSSION

Although radical cystectomy is recommended in published guidelines for patients diagnosed with muscle-invasive bladder cancer, the use of this procedure is markedly limited despite evidence demonstrating inferior outcomes with alternative therapies. In the present study, we provided an analysis of recent data showing continued decreased use of radical cystectomy in patients across a wide age range and according to race/ethnicity independent of insurance status.

Our study has several important findings. First, we observed only 6% of patients with muscle-invasive bladder cancer underwent a radical cystectomy. Prior studies have observed

decreased utilization of radical cystectomy in up to 21% of patients.<sup>4</sup> We recently noted only 19% of patients with clinical stage II disease underwent radical cystectomy.<sup>3</sup> While noteworthy studies, those rates were derived from an older cohort 66 years of age and older and those findings may not be applicable to a younger cohort across all clinical stages. In the present study, we provide a contemporary analysis in a larger cohort across a wide age range thus supporting the generalizability of our findings. Interestingly, patients 51–60 years of age were not significantly associated with decreased utilization. These younger patients are most susceptible to health care reform measures which are aimed at improving outcomes among this historically underserved population. Moreover, as depicted in Figures 1 and 2, we observed a significantly improved survival benefit among those patients with muscle-invasive bladder cancer with the greatest benefit observed among those with clinical stage II disease. At 5 years, the survival benefit among patients with clinical stage III and IV was minimal in comparison to patients with stage II disease consistent with other reports.<sup>6</sup> Patients with clinical stage I non-muscle invasive bladder cancer represent a heterogeneous population with current research efforts in identifying patients most likely to benefit from intravesical therapies versus more aggressive interventions. Thus, our findings represent a pooled cohort of these clinical stage I patients and any perceived oncologic benefit derived from radical cystectomy may be negated due to the limitations of using large cancer registry data.

Second, we found non-Hispanic black patients were less likely to undergo radical cystectomy as well as pelvic lymph node dissection after controlling for socioeconomic and insurance status. In the univariate analyses, the non-Hispanic black patients were slightly more likely to receive radical cystectomy, and this association was confounded by the fact that there were more non-Hispanic black patients diagnosed with stage IV bladder cancer than any other race/ethnicity in the study cohort. Socioeconomic status were census-derived and further individual level assessment of income and education are needed in order to accurately assess the impact of race/ethnicity on utilization patterns. That being said, racial/ethnic disparities have been previously implicated for the decreased survival outcomes of many cancers with determinants being lower utilization of experienced providers and institutions, which provide bladder cancer surgery.<sup>9</sup> While we were unable to control for provider volume including distance to provider<sup>4</sup> as determinants for the underutilization observed, we controlled for area-level socioeconomic (income and education) and insurance status and found that being black was an independent predictor for decreased use of the procedure. Further research is needed to determine how to improve these patients' access to providers that perform radical cystectomy.

Third, there was consistent and appropriate utilization of pelvic lymph node dissection at the time of radical cystectomy. Pelvic lymphadenectomy is the standard of care when performing radical cystectomy for muscle-invasive bladder cancer.<sup>2</sup> Prior research has suggested that variation in the use of racial cystectomy is surgeon-dependent and influenced by a number of factors.<sup>4</sup> Reluctance to perform radical cystectomy may be related to the complexity of the procedure, increased risk of perioperative morbidity and mortality, and decreased reimbursement in recent years.<sup>4</sup> These factors have contributed to the centralization of care to high-volume providers for a number of complex procedures.<sup>14</sup> Our study demonstrated that when radical cystectomy was performed, greater than 90% of

patients also underwent a pelvic lymph node dissection. This suggests that if a radical cystectomy is performed, then the vast majority of patients are appropriately undergoing a pelvic lymph node dissection.

Fourth, insurance status was not a significant predictor for use of radical cystectomy. This finding has important implications for current health policy decision making aimed at improving health care through the current and potential repeal and replacement of the Affordable Care Act (ACA).<sup>11</sup> Over the next 10 years, the current ACA will bring in 37 million newly insured individuals, many of which had limited access to insurance, cancer diagnosis, and treatment options as well as those with more-advanced cancer.<sup>11</sup> Our finding suggests that merely obtaining insurance may not be enough to improve the care received, especially among younger patients. Prior research has suggested patients with Medicaid insurance often have significant comorbid conditions and present with advanced disease which may lead to increased complications following treatment.<sup>15</sup> Thus, there may be an inherent selection bias among providers to limit treatment among these patients.

While our findings are policy relevant, they must be interpreted within the context of the study design. First, SEER does not record comorbidity information which may limit patients from undergoing radical cystectomy.<sup>4</sup> Moreover, given there was no statistical correction for comorbidity included as a covariate this may have influenced survival results in favor of surgery. Being an uncontrolled confounder, comorbidity status may significantly influence utilization patterns observed in the present analysis including race/ethnicity. Second, the insurance variable is relatively new to SEER and the validity of this variable has not been established.<sup>10</sup> In an effort to control for patients with unknown insurance status, we excluded these patients from the present study. Third, SEER does not identify providers, surgical volumes, and travel distance, which are previously recognized determinants of the quality of care and can be used to help optimize outcomes.<sup>9, 16</sup> Fourth, the use of perioperative chemotherapy is not recorded in SEER. However, prior research has shown that only 4% of patients with muscle-invasive bladder cancer receive neoadjuvant chemotherapy, thus potentially limiting this as a significant unmeasured confounding variable.<sup>17</sup> Finally, specifics regarding surgery such as anatomical extent of pelvic lymph node dissection are not captured in SEER which is an important determinant regarding surgical quality.<sup>18</sup>

## CONCLUSIONS

There is significant underutilization of radical cystectomy in all patients diagnosed with bladder cancer, especially among older non-Hispanic black patients. Further research evaluating how providers discuss bladder cancer and treatments as well as how patients interpret physician recommendations will be useful to elucidate disparities in bladder cancer care.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.



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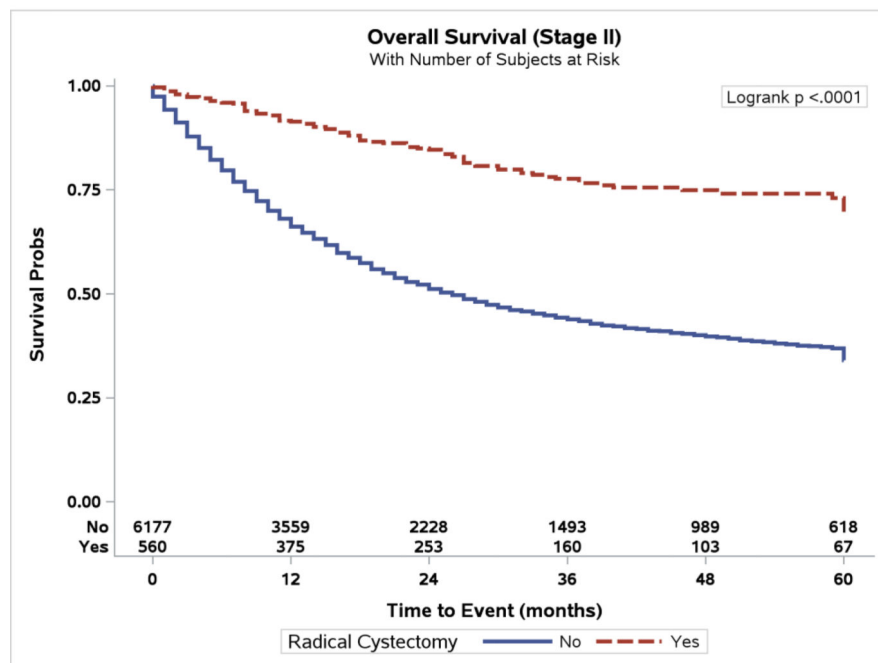
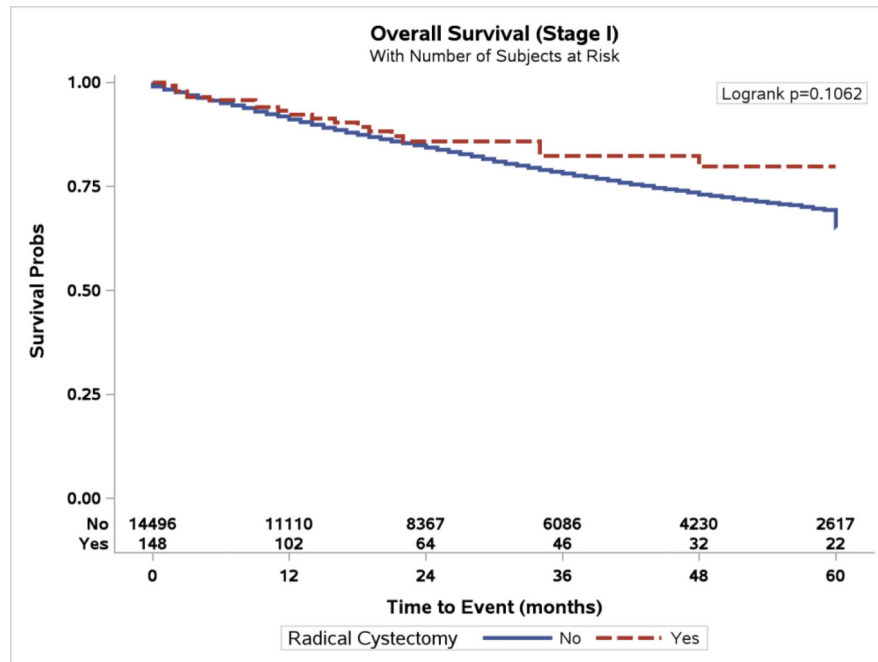
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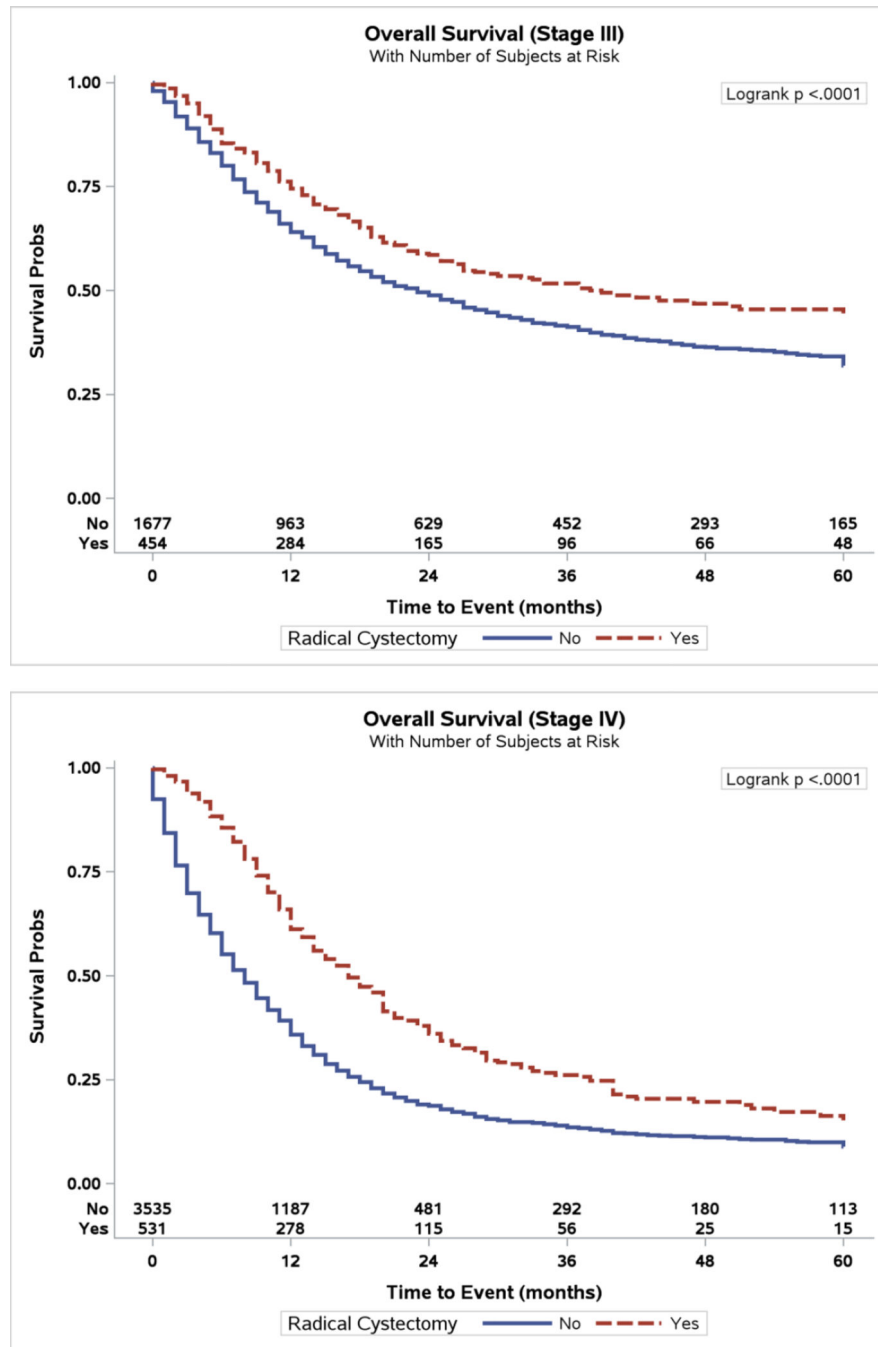
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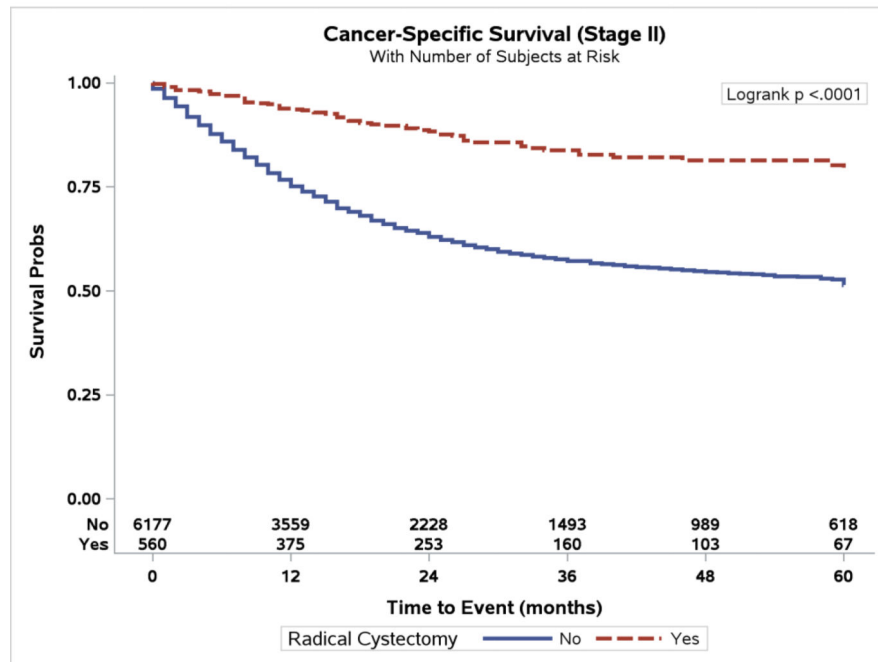
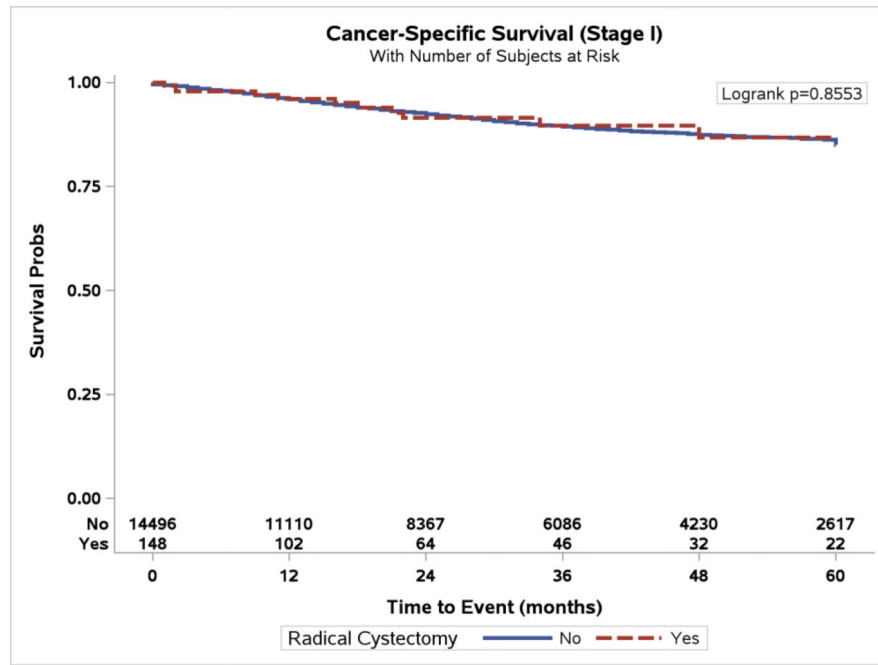
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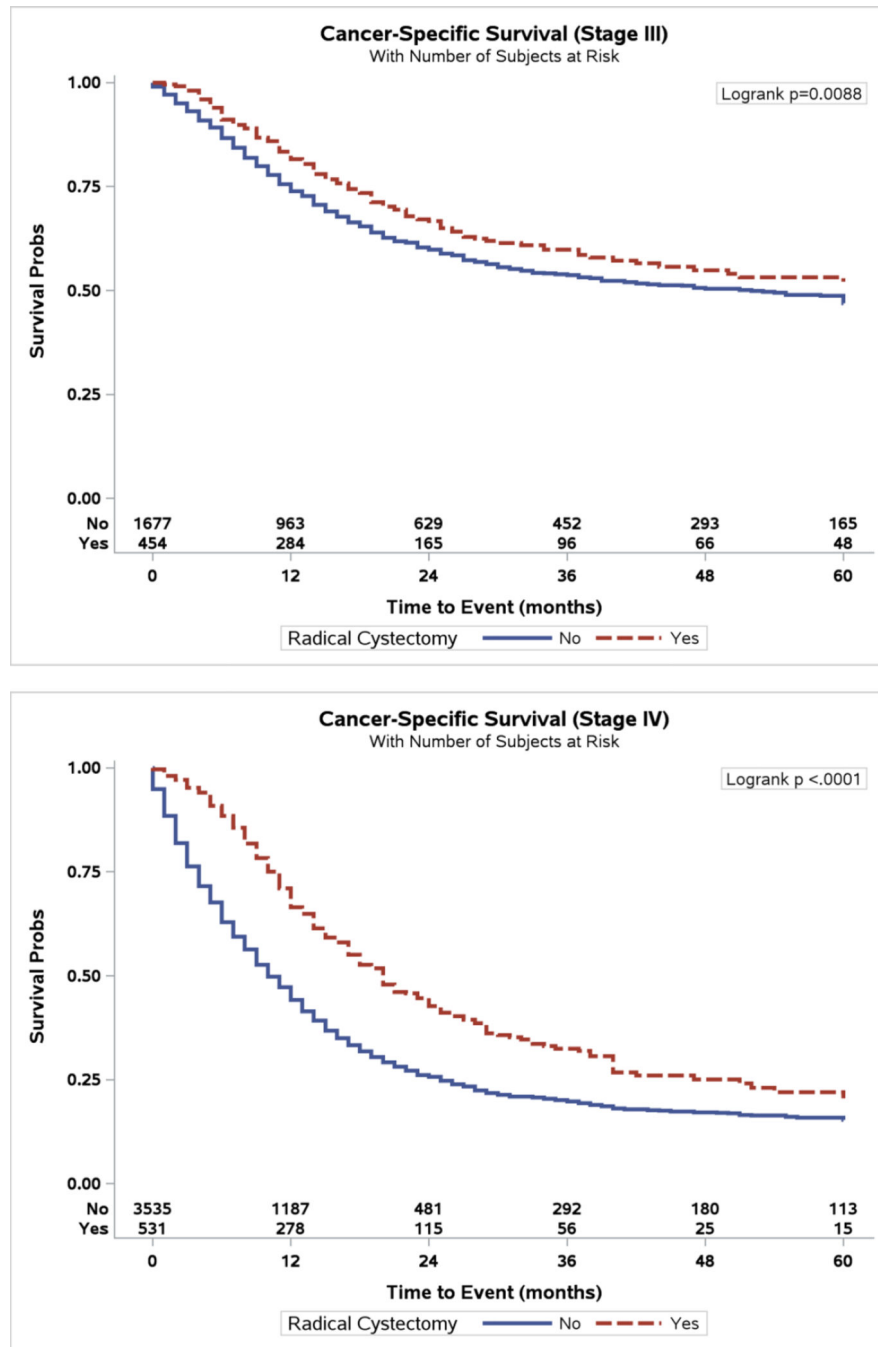
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**Figure 1.** Kaplan-Meier curves of overall survival in patients with bladder cancer treated with and without radical cystectomy





**Figure 2.** Kaplan-Meier curves of bladder cancer-specific survival in patients with bladder cancer treated with and without radical cystectomy.

**Table 1**

Demographics of patients diagnosed with bladder cancer (n = 27,578)

Category	Radical cystectomy				p-value	
	Total	No	%	Yes		%
Year of diagnosis						
2007	3699	3533	95.5	166	4.5	<0.001
2008	3809	3638	95.5	171	4.5	
2009	3761	3611	96.0	150	4.0	
2010	3947	3715	94.1	232	5.9	
2011	3923	3647	93.0	276	7.0	
2012	4232	3898	92.1	334	7.9	
2013	4207	3843	91.4	364	8.7	
Age group						
18–50 years	1410	1274	90.4	136	9.7	<0.001
51–60 years	4189	3807	90.9	382	9.1	
61–70 years	7691	7114	92.5	577	7.5	
71–80 years	7984	7555	94.6	429	5.4	
81–90 years	6304	6135	97.3	169	2.7	
Sex						
Male	20616	19894	96.5	722	3.5	<0.001
Female	6962	5991	86.1	971	14.0	
Race/ethnicity						
Non-Hispanic White	22548	21186	94.0	1362	6.0	0.458
Non-Hispanic black	1812	1688	93.2	124	6.8	
Hispanic	1785	1673	93.7	112	6.3	
Other	1433	1338	93.4	95	6.6	
Marital status						
Unmarried	6223	5764	92.6	459	7.4	<0.001
Married	15865	14951	94.2	914	5.8	
Other	5490	5170	94.2	320	5.8	
Insurance						

Category	Radical cystectomy				p-value	
	Total	No	Yes	%		
Uninsured	719	655	64	91.1	8.9	<0.001
Medicaid	2531	2333	198	92.2	7.8	
Insured	24328	22897	1431	94.1	5.9	
County-Level Annual Median Household income						
<\$47,068	6788	6388	400	94.1	5.9	0.047
\$47,068–\$55,265	7036	6564	472	93.3	6.7	
\$55,265–\$66,147	6806	6377	429	93.7	6.3	
\$66,147	6948	6556	392	94.4	5.6	
County-Level Education, % with at least 4 years of college						
<21.3%	7501	7086	415	94.5	5.5	<0.001
21.3%–29.7%	7369	6870	499	93.2	6.8	
29.7%–36.3%	5926	5518	408	93.1	6.9	
>36.3%	6782	6411	371	94.5	5.5	
SEER region						
West	13891	13064	827	94.1	6.0	<0.001
Northeast	5008	4735	273	94.6	5.5	
Midwest	2849	2614	235	91.8	8.3	
South	5830	5472	358	93.9	6.1	
Stage						
I	14644	14496	148	99.0	1.0	<0.001
II	6737	6177	560	91.7	8.3	
III	2131	1677	454	78.7	21.3	
IV	4066	3535	531	86.9	13.1	



**Table 2**

Factors predicting the use of radical cystectomy

Covariate	OR	95% CI		p-value
Year of diagnosis				
2007	1.00			
2008	1.05	0.84	1.32	0.667
2009	0.93	0.74	1.18	0.544
2010	1.39	1.12	1.72	0.003
2011	1.77	1.44	2.18	<.001
2012	2.12	1.73	2.59	<.001
2013	2.32	1.90	2.83	<.001
Age group				
18–50 years	1.00			
51–60 years	0.88	0.70	1.09	0.241
61–70 years	0.71	0.58	0.88	0.002
71–80 years	0.50	0.40	0.61	<.001
81–90 years	0.23	0.18	0.30	<.001
Race/ethnicity				
Non-Hispanic White	1.00			
Non-Hispanic black	0.79	0.64	0.96	0.019
Hispanic	0.98	0.79	1.22	0.878
Other	1.21	0.96	1.53	0.103
County-Level Education, % with at least 4 years of college				
<21.3%	1.00			
21.3%–29.7%	1.47	1.27	1.70	<.001
29.7%–36.3%	1.52	1.29	1.78	<.001
36.3%	1.23	1.04	1.44	0.013
SEER region				
West	1.00			
Northeast	0.99	0.85	1.15	0.850
Midwest	1.64	1.39	1.94	<.001
South	1.13	0.98	1.31	0.094
Stage				
I	1.00			
II	9.87	8.21	11.88	<.001
III	29.06	23.91	35.32	<.001
IV	14.45	11.98	17.43	<.001

OR, odds ratio; CI, confidence interval. The variables included initially in the model selections were: Year of diagnosis, Age group, Sex, Race/ethnicity, Marital status, Insurance, County-Level Annual Median Household income, County-Level Education, % with at least 4 years of college, SEER region, and Stage.

**Table 3**

Factors predicting the use of lymph node dissection at the time of radical cystectomy

Covariate	OR	95% CI		p-value
Year of diagnosis				
2007	1.00			
2008	0.68	0.36	1.31	0.250
2009	0.73	0.37	1.43	0.353
2010	1.72	0.83	3.56	0.143
2011	3.17	1.40	7.15	0.006
2012	3.79	1.67	8.60	0.001
2013	4.15	1.82	9.47	<.001
Sex				
Male	1.00			
Female	1.86	1.08	3.20	0.026
Age group				
18–50 years	1.00			
51–60 years	1.72	0.80	3.70	0.169
61–70 years	1.20	0.60	2.41	0.603
71–80 years	0.96	0.48	1.94	0.910
81–90 years	0.62	0.28	1.35	0.228
Race/ethnicity				
Non-Hispanic White	1.00			
Non-Hispanic black	0.53	0.29	0.97	0.041
Hispanic	1.78	0.70	4.55	0.228
Other	2.64	0.81	8.59	0.108
Stage				
I	1.00			
II	1.33	0.69	2.53	0.393
III	1.22	0.63	2.35	0.562
IV	2.07	1.04	4.10	0.037

OR, odds ratio; CI, confidence interval. The variables included initially in the model selections were: Year of diagnosis, Age group, Sex, Race/ethnicity, Marital status, Insurance, County-Level Annual Median Household income, County-Level Education, % with at least 4 years of college, SEER region, and Stage.

**Table 4**

Analysis of overall survival following diagnosis of bladder cancer

Covariate	HR	95% CI		p-value
<b>All patients</b>				
Radical cystectomy				
No	1.00			
Yes	0.88	0.80	0.97	0.008
Pelvic lymph node dissection				
No	1.00			
Yes	0.46	0.44	0.49	<.001
<b>Stage I</b>				
Radical cystectomy				
No	1.00			
Yes	1.02	0.62	1.68	0.942
Pelvic lymph node dissection				
No	1.00			
Yes	0.95	0.74	1.23	0.690
<b>Stage II</b>				
Radical cystectomy				
No	1.00			
Yes	0.68	0.54	0.86	0.001
Pelvic lymph node dissection				
No	1.00			
Yes	0.38	0.34	0.44	<.001
<b>Stage III</b>				
Radical cystectomy				
No	1.00			
Yes	0.82	0.67	0.99	0.041
Pelvic lymph node dissection				
No	1.00			
Yes	0.54	0.48	0.62	<.001
<b>Stage IV</b>				
Radical cystectomy				
No	1.00			
Yes	0.90	0.78	1.03	0.130
Pelvic lymph node dissection				
No	1.00			
Yes	0.42	0.38	0.46	<.001

Overall survival adjusted for year, age, sex, race/ethnicity, marital status, insurance status, income, education, and region.

HR, hazard ratio; CI, confidence interval.

The variables included initially in the model selections were: Year of diagnosis, Age group, Sex, Race/ethnicity, Marital status, Insurance, County-Level Annual Median Household income, County-Level Education, % with at least 4 years of college, SEER region, and Stage.

**Table 5**

Analysis of bladder cancer-specific survival following diagnosis of bladder cancer

Covariate	HR	95% CI		p-value
<b>All patients</b>				
Radical cystectomy				
No	1.00			
Yes	0.87	0.78	0.97	0.014
Pelvic lymph node dissection				
No	1.00			
Yes	0.45	0.42	0.49	<0.001
<b>Stage I</b>				
Radical cystectomy				
No	1.00			
Yes	0.94	0.48	1.82	0.847
Pelvic lymph node dissection				
No	1.00			
Yes	1.20	0.85	1.70	0.309
<b>Stage II</b>				
Radical cystectomy				
No	1.00			
Yes	0.68	0.52	0.90	0.007
Pelvic lymph node dissection				
No	1.00			
Yes	0.37	0.31	0.44	<.001
<b>Stage III</b>				
Radical cystectomy				
No	1.00			
Yes	0.85	0.68	1.06	0.153
Pelvic lymph node dissection				
No	1.00			
Yes	0.56	0.48	0.66	<.001
<b>Stage IV</b>				
Radical cystectomy				
No	1.00			
Yes	0.95	0.81	1.10	0.472
Pelvic lymph node dissection				
No	1.00			
Yes	0.41	0.37	0.45	<.001

Overall survival adjusted for year, age, sex, race/ethnicity, marital status, insurance status, income, education, and region.

HR, hazard ratio; CI, confidence interval.

The variables included initially in the model selections were: Year of diagnosis, Age group, Sex, Race/ethnicity, Marital status, Insurance, County-Level Annual Median Household income, County-Level Education, % with at least 4 years of college, SEER region, and Stage.