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# 30-day all-cause hospital readmission after cystectomy: no worse for rural Medicare residents

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## Abstract

**Objective:** To evaluate rural/urban disparities in 30-day all-cause hospital admission after cystectomy.

**Materials and methods:** We used the SEER-Medicare database to identify all Medicare beneficiaries who underwent radical cystectomy (ICD-9 codes 57.7, 57.71, 57.79, and 68.8) between the years 1991 and 2009, yielding a total sample size of 15,572. Our primary outcome was 30-day hospital readmission rate. Rural Urban Continuum Codes were used to designate county-level rural status based on patient residence. Location of surgery was not a variable considered in this analysis. A multivariable regression model was constructed with demographic and clinical variables as covariates.

**Results:** A total of 2,003 rural and 2,904 urban patients (31.1% vs. 31.8%, $P = 0.33$) were readmitted within 30 days of discharge. In the multivariable model, older age, unmarried status, lower socioeconomic status, higher Charlson comorbidity score, shorter index admission hospital stay, and discharge to a skilled nursing facility were associated with higher odds of readmission. The variables for gender, race, cancer stage, tumor grade, and type of urinary diversion were not significant. The odds ratio for readmission was not significant for patients from rural counties in the final model.

**Conclusions:** Rural Medicare residents were not at higher risk for 30-day all-cause hospital readmission after cystectomy after accounting for various demographic and clinical variables. © 2017 Elsevier Inc. All rights reserved.

*Keywords:* Urinary bladder neoplasms; Cystectomy; Patient readmission; Rural health

## 1. Introduction

Bladder cancer is the fourth commonest cancer among males in the United States with an estimated 74,690 new cases and 15,580 deaths in 2014 [1]. Over 70% of new cases of bladder cancer occur in patients 65 years and over with an average lifetime cost of $65,158 [2]. Known risk factors predisposing to bladder cancer include modifiable elements, including smoking and workplace exposures, and nonmodifiable elements, which include age, white race, male gender, and genetic components [3]. The gold standard treatment for muscle invasive disease without metastasis is radical cystectomy with pelvic lymph node dissection. In addition to removal of the bladder, radical cystectomy includes removal of the prostate and seminal vesicles in men, and the uterus, ovaries, and part of the anterior vaginal wall in women. This complex surgery also requires the use of bowel to create a urinary diversion.

In spite of efforts that have decreased index hospital length of stay after cystectomy by 21% when comparing 1992 to 1993 and 2004 to 2005 data, the 30-day all-cause readmission rate has remained relatively unchanged at 25.2% [4]. Of patients readmitted within 30 days after radical cystectomy, over 50% were readmitted within the first week and 77% by the end of the second week [5]. A follow-up study found the top four causes of 30-day readmission to be infections, failure to thrive, gastrointestinal and genitourinary causes, respectively [4].

Not only does the burden of postoperative complications weigh heavily on patients, they also significantly effect the cost of care for the health care system. A study by Konety and Albreddy found the median cost increase in patients with at least one complication postcystectomy was $15,000. Most complications were related to surgery, in spite of patient comorbidities [6]. This added cost burden is of particular importance under the Affordable Care Act Section 3025 Hospital Readmissions Reduction Program [7]. Though currently the policy is limited in scope (heart failure, pneumonia, chronic obstructive pulmonary disease, and total knee and hip arthroplasty), it demonstrates the push for new quality measures by which payors can grade medical institutions.

Previous work by Odisho et al. [8] found metropolitan counties to be associated with a lower bladder cancer mortality (9.1%, 95% CI: 5.6%–12.6%). Similarly, an Australian study showed mean bladder cancer 5-year survival to be significantly decreased in rural Australia [9]. Access to care may impact patient outcomes. One study showed rural residents with colorectal cancer traveled a median distance of nearly 50 miles or more for medical care [10]. In spite of the evidence describing the negative long-term outcomes, there is a paucity of data in the literature exploring rural residence as a risk factor for postoperative complications and readmission rates after cystectomy. Our study examines whether rural Medicare residents are at increased risk for 30-day all-cause hospital readmission following cystectomy.

## 2. Materials and methods

We used the SEER-Medicare database to identify all Medicare beneficiaries who underwent radical cystectomy (ICD-9 codes 57.7, 57.71, 57.79, and 68.8) between the years 1991 and 2009, yielding a total sample size of 15,572. Our primary outcome was 30-day all-cause hospital readmission rate.

United States Department of Agriculture 2003 Rural Urban Continuum Codes (RUCC) were used to categorize count-level rural/urban status based on patient residence, not where treatment was received. RUCC designates counties on a continuum of 1 to 9 by county population size and adjacency to a metropolitan area; counties coded as 1 to 3 are urban and counties coded 4 to 9 are rural [11].

We used Deyo's coding algorithm to calculate the Charlson comorbidity index [12]. Following an algorithm developed by Ananthakrishnan and colleagues, we calculated a county-level socioeconomic deprivation (SED) score incorporating median income, % living in poverty, % uninsured, and % over the age of 25 who graduated high school from the 2010 US census. Scores ranged from 0 to 8, with higher scores related to greater deprivation [13].

Demographic variables included in analyses were age, gender, race/ethnicity, marital status, disability, and SED score. Cancer characteristics included pathologic stage (TNM system) and tumor grade for bladder cancer. Clinical variables encompassed various surgery characteristics (robotic, type of diversion, and lymph node dissection), patient characteristics (Charlson comorbidity index and obesity), length of hospital stay, discharge disposition, and hospital course during index hospitalization (intensive care unit [ICU] stay, computed tomography [CT] scan, and blood transfusions).

The descriptive statistics for Table 1 were generated using PROC FREQ in SAS 9.4. Logistic regression was used to generate odds ratios for the multivariate regression model using the PROC LOGISTIC procedure in SAS 9.4, constructed with demographic and clinical variables as covariates. Significance was determined at the 0.05 level. Normality assumptions were checked for all analyses. The IRB at Southern Illinois University reviewed this project and determined it does not meet criteria for research involving human subjects.

## 3. Results

The results of descriptive statistics for our sample of patients who underwent cystectomy comparing urban and rural cohorts can be found in Table 1. A total of 6,445 rural and 9,127 urban Medicare recipients underwent a radical cystectomy from 1991 to 2009 and were included in the sample. Among them, 2,003 rural and 2,904 urban patients (31.1% vs. 31.8%, $P = 0.33$) were readmitted within 30 days of discharge. Compared to the rural population, urban cystectomy patients had a greater proportion over age 80, a larger percentage of white race and Hispanic ethnicity, more obesity, fewer with disability, and a greater proportion of high-grade disease. Pathologic staging between the groups was not significantly different. Socioeconomic status (SED score) was lower for counties of rural residents. There was no significant difference in comorbidities, measured by the Charlson comorbidity index. Rural residents were less likely to have a robotic procedure done, receive lymph node dissection, and get a urinary diversion other than ileal conduit. Rural residents were more likely to have received a CT scan during their index hospitalization, while they were less likely to have been admitted to the ICU. There was no difference in the index length of hospitalization, discharge to a skilled nursing facility (SNF), or readmission length of hospitalization between urban and rural populations.

Regression model results are shown in Table 2. When controlling for covariates, younger age, being married, higher socioeconomic status, lower comorbidity score, longer index length of stay, not having an ICU stay, getting a CT scan during index hospitalization, and being discharged to a place other than a SNF are all associated with a decreased readmission rate ($R^2 = 22.0\%$). Gender, race, being disabled, rural status, obesity, cancer stage, tumor grade, type of urinary diversion, having a lymph node