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Causes, Timing, Hospital Costs, and Perioperative Outcomes Of Index vs. Non-Index Hospital Readmissions Following Radical Cystectomy: Implications For Regionalization of Care

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Abstract

Purpose—To compare the timing, causes, hospital costs, and perioperative outcomes of index vs. non-index hospital readmissions following radical cystectomy.

Materials and Methods—The 2013 Nationwide Readmissions Database was queried for bladder cancer patients undergoing cystectomy. Sociodemographic characteristics, hospital costs, and causes of readmission were compared among index and non-index readmitted patients. Univariable and multivariable logistic regression models were used to identify predictors of non-index readmissions, mortality during the first readmission, and subsequent readmission.

Results—Among 4991 patients identified, 29%(1447/4991) and 11%(571/4991) experienced an index and non-index readmission, respectively. Compared to index readmissions, non-index readmissions were more likely late readmissions ($p<0.001$) of older patients ($p=0.047$) that had cystectomies at higher volume hospitals ($p=0.02$) and were readmitted to hospitals located in less populated areas ($p<0.001$). Compared to index readmissions, the percentage of non-index readmissions for cardiovascular complications was higher (7.6% vs. 2.9%, $p=0.003$) while the percentage of non-index readmissions for gastrointestinal (6.0% vs. 11.0%, $p=0.04$) and wound (5.3% vs. 16.7%, $p=0.0001$) complications was lower. Predictors of non-index readmission included longer length of stay ($OR=1.02$ 95%CI[1.001,1.04]), patient location in less populated areas, non-teaching hospital ($OR=0.52$, 95%CI[0.31,0.86]), and discharge to facility ($OR=2.82$ 95%CI[1.75,4.55]) or with home health ($OR=1.49$, 95%CI[1.05,2.10]). Non-index readmissions had comparable mean readmission hospital costs (\$14,147 vs. \$15,102, $p=0.7$), in-hospital mortality ($OR=1.11$, 95%CI[0.42, 2.87]), and subsequent readmission ($OR=1.32$, 95%CI[0.87, 2.00]) to index readmissions.

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Disclosures: None

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Conclusions—This nationally representative study of cystectomy patients demonstrated comparable perioperative outcomes and hospital costs between index and non-index readmitted RC patients, which supports the continued regionalization of cystectomy care.

Keywords

bladder cancer; cystectomy; patient readmissions; postoperative care; continuity of care

Introduction

The gold standard treatment for muscle-invasive bladder cancer is radical cystectomy (RC) with pelvic lymph node dissection. Numerous studies have demonstrated high perioperative complications and hospital readmission rates following RC ranging from 19–64% and 25–41%, respectively.{1–5} The urologic community has focused on identifying methods to improve perioperative outcomes for RC patients, and much of this focus has been on the regionalization (or centralization) of RC to tertiary care centers.{6–8}

While regionalization of treatment to high volume centers and surgeons is associated with improved perioperative survival, there are also associated harms. Regionalization results in increased travel distances for patients to receive care, which is associated with increased rates of care fragmentation defined by non-index readmissions.{4,7,9–12} A non-index readmission is a readmission to a hospital where the initial procedure was not performed. Several studies in surgical populations have shown care fragmentation is associated with worse short and long-term outcomes such as increased in-hospital mortality, longer length of stay during readmission, higher 90-day post-readmission mortality, subsequent readmissions, increased cost of readmission, and 1-year mortality.{12–18}

Therefore, the objectives of this study were to compare the causes of index and non-index hospital readmissions, to determine patient and hospital-level predictors of non-index readmissions, and to investigate the effect of non-index hospital readmissions on perioperative outcomes in a contemporary, nationally representative database of RC patients in the United States.

Methods

Data Source

The Nationwide Readmissions Database (NRD) is a stratified, single-stage clustered sample of hospital discharges created from 21 State Inpatient Databases by the Healthcare Cost Utilization Project, Agency for Healthcare Research and Quality.{19} The database provides hospital and patient identification numbers to track inpatient encounters for an individual throughout hospitals across the state.

Patient Cohort

With Johns Hopkins Medical Institution IRB approval the 2013 NRD was queried using ICD-9 codes to identify bladder cancer patients (188.x, 233.7) undergoing cystectomy (57.71, 57.79). Patients with metastatic disease (19.7x, 19.8x) and who died during the

initial hospitalization were excluded. Additionally, non-residents of the state in which their RC was performed were excluded, as they would be more likely to be readmitted in their home state, which would not be captured in the NRD. Patients discharged after October were excluded to ensure all individuals would have 90-day follow-up in the NRD.

Index and Non-Index Readmissions

Index readmissions were defined as readmissions to the same hospital the RC took place at, while non-index readmissions were defined as readmissions to a different hospital than the one the RC took place at. Readmissions with a transfer from a non-index to index hospital were defined as non-index readmissions since the patient initially presented to the non-index hospital.{15}

Early and Late Readmissions

Early and late readmissions were defined as readmissions happening 30 days and 31–90 days after discharge from the initial hospitalization, respectively.{3} For patients with multiple readmissions, only the first readmission was used for analyses. Next, we graphed the proportion of index and non-index readmissions occurring on each day in the follow-up period with a moving average of 4 days, which is an average of that day and the next 3 days in order to allow easier visualization of data trends.

Sociodemographic and Hospital Variables

Patient- and hospital-level exposure variables included age, gender, primary payer, median household income national quartile for patient's home zip code, initial hospitalization length of stay, hospital location, hospital teaching status, hospital bed size, and initial hospitalization patient discharge disposition. Hospital procedure volume was categorized as low (1–8 cystectomies), intermediate (9–30 cystectomies), or high (31 cystectomies) so that when weighted a similar percentage of RCs would be in each category.{20} Using a previously validate algorithm, a Charlson comorbidity index was calculated for each patients using ICD-9 codes from the initial hospital discharge.{21} This was modified to exclude points attributable to cancer diagnoses as all patients in this cohort had cancer diagnoses.

Surgical and Complication Variables

The surgical approach was assumed to be open unless ICD-9 codes indicated a minimally invasive surgical approach (54.21, 54.51, 17.4x).{22} Urinary diversion was categorized as an ileal conduit (56.51, 56.71), continent diversion (57.87), or unknown.{22} Complications during the initial hospitalization were identified with ICD-9 codes (Supplementary Table 1).{22}

Causes of Readmission

The cause of readmission was determined by the principal ICD-9 diagnosis code for each readmission (Supplementary Table 2).{23}

Outcomes Following Readmission

The two outcomes investigated following readmission were mortality during the readmission and subsequent readmission during the 90-day follow-up period, as these were used by previous studies. {12,15}

Cost Outcomes

Charges were converted into costs using hospital-specific cost to charge ratios provided by the NRD. Inpatient hospital costs were calculated for the initial hospitalization, readmission, 30-day, and 90-day follow-up.

Statistical Analysis

Sociodemographic variables, hospital-level variables, causes of readmission, and costs were compared among index vs. non-index readmissions using the student's t-test, chi-squared test, and linear regression as appropriate. Costs were compared using log transformation with gamma distribution modeling to account for the skewness of cost data. {24} Univariable and multivariable logistic regression models were used to determine predictors of non-index readmissions, index readmissions, mortality during the first readmission, and subsequent readmission. For the non-index and index readmission multivariable multinomial logistic regression, a sensitivity analysis was conducted treating the hospital volume variable as a continuous variable, and the qualitative results were comparable with the same variables maintaining statistical significant so those results are not presented. For all analyses sample weights were used to create nationally representative estimates with the hospital as the sampling unit. All analyses were conducted using STATA version 14 (StataCorp, College Station, Texas). All reported p-values were 2 sided and a p-value 0.05 was considered statistically significant for all tests.

Results

When weighted, 4991 patients underwent cystectomy for bladder cancer. Among them, 29% (1447/4991) had an index hospital readmission and 11% (571/4991) had a non-index readmission. Less than 1% (18/2017) of readmitted patients were transferred from a non-index to index hospital. Comparisons of baseline patient-level, hospital-level, and hospital costs for index and non-index readmission are listed in Tables 1 and 2. Non-index readmissions were more likely than index readmissions to be late readmissions ($p<0.001$) of older patients ($p=0.047$) that had their RC performed at higher RC volume hospitals ($p=0.02$), and were more likely to occur at hospitals located in less populated areas ($p<0.001$). Of note, there was no difference between index and non-index readmissions in the length of stay ($p=0.6$) of the readmission, cost ($p=0.7$) of the readmission, and follow-up costs at both 30 ($p=0.9$) and 90 ($p=0.9$) days.

Timing of First Readmission

The proportion of index and non-index readmissions by days after discharge from initial hospitalization is shown in Figure 1. Of note, a higher proportion of non-index readmissions occurred in the late period compared to index readmissions, especially in the 30–50 day follow-up time period.

Causes of Readmission

The percentages of non-index vs. index readmissions attributable to common causes of readmission after RC are listed in Table 3. Compared to non-index readmissions, index readmissions had a higher percentage of readmissions for wound (16.7% vs. 5.3%, $p=0.0001$) and gastrointestinal (11.0% vs. 6.0%, $p=0.04$) complications, but a lower percentage for cardiovascular complications (2.9% vs. 7.6%, $p=0.003$).

Predictors of Index and Non-Index Readmission

Predictors of non-index readmission are listed in table 4, which included longer length of stay (OR=1.02 95%CI[1.001,1.04]), patient location in less populated areas, and discharge to facility (OR=2.82 95%CI[1.75,4.55]) or with home health (OR=1.49, 95%CI[1.05,2.10]). Of note, discharge to facility was also associated with index readmissions, while a longer length of stay and residence in less populated areas was associated with lower odds of index readmission.

Predictors of Mortality During First Readmission

No predictors of mortality during the first readmission were identified in univariable and multivariable logistic regression models (Supplementary Table 3).

Predictors of Second Readmission

Univariable and multivariable logistic models to identify predictors of a second readmission are listed in Supplementary Table 4. On univariable analysis, index readmission was associated with increased odds (OR=1.42 95%CI[1.02, 1.98], $p=0.04$) of subsequent readmission, but after controlling for timing of the first readmission (early vs. late), the association between index readmission and subsequent readmission was not significant in both the nested (OR=1.24 95%CI[0.89, 1.73], $p=0.2$) and full (OR=1.32 95%CI[0.87, 2.00], $p=0.2$) multivariable models.

Discussion

This is the first study in a nationally representative database investigating the timing, causes, and importance of index and non-index readmissions on short-term outcomes in RC patients. Consistent with previous studies, non-index readmissions were more likely than index readmissions to be late readmissions (31–90 days following initial discharge) and from higher RC volume centers (≥ 31 cystectomies).{3,9,15} Twenty-eight percent (571/2018) of readmissions occurred at non-index hospitals, raising concern for care fragmentation. Specifically, the association of higher RC volume hospitals with increased non-index readmissions highlights one of the concerns associated with regionalization of RC. As regionalization occurs, the rate of care fragmentation increases, which previous studies have demonstrated can lead to worse perioperative outcomes such as increased in-hospital mortality, longer length of stay during readmission, higher 90-day post-readmission mortality, subsequent readmissions, increased cost of readmission, and increased length of stay upon readmission.{12–18}

However, in the current study we found all of these cost and outcome metrics were comparable between patients that were readmitted to index vs. non-index hospitals. As a result, patients traveling long distances to undergo RC at centers of excellence would likely prefer to be readmitted locally since our results demonstrate costs and outcomes associated with that readmission are comparable to a readmission at the index hospital. Future studies are warranted to investigate patient and hospital-level characteristics that can be used to identify specific patients for whom the non-index readmission may be associated with more harm than an index readmission. In this study, the comparable in-hospital mortality between index and non-index readmitted patients is consistent with a previous study conducted by Pak et al. in RC patients, while the comparable rate of subsequent readmissions, cost of readmission, and readmission length of stay are not consistent.{15} This discrepancy could be related to differences in the patient cohort, as Pak et al. utilized a dataset of only New York state patients, while this study was conducted in a nationally representative dataset of 21 states that was specifically designed to address these types of hypotheses.

In this study, we demonstrate controlling for the timing of the first readmission is important when determining predictors of subsequent readmission, as the association between index readmissions and increased odds of subsequent readmission was no longer present when timing of the readmission was included in models. Therefore, as readmissions continue to be an important quality of care metric, it is imperative for studies to take into account both the timing (early vs. late) and location (index vs. non-index) of readmissions in their analyses.

Of note, predictors of non-index hospital readmission included longer initial hospitalization length of stay, patient residence in less populated locations, patient residence in higher income areas, and discharge with home health or to a facility. It is likely that the increased odds of non-index readmission among patients with residences in less populated areas is due to increased travel distance to the index hospital for these patients, as it has been previously demonstrated that increased travel distance is associated with non-index readmissions.{4} This explanation is further supported by the fact that, compared to index readmissions, non-index readmissions were more likely to be at non-metropolitan hospitals. These hospitals are likely closer to patients residing in rural areas that would require traveling long distances to their index hospital. It is also possible the effect of length of stay of the initial hospitalization is also mediated by travel distance, as patients that travel longer distances have been shown to have longer initial hospital length of stays in other surgical cohorts.{25–26} Transfer to a facility was associated with both index and non-index readmissions, which suggests these patients are overall at a higher risk of readmission, which is consistent with previous studies.{27} Of note, diversion type, which has previously been associated with readmission was not associated with either index or non-index readmissions in this study.{28}

Regionalization of RC occurred as a natural byproduct of the high perioperative burden associated with the procedure. From a clinical standpoint, the practice of referring RC patients to high-volume, tertiary care centers should continue. Even though patients that are referred may require longer travel distances that predispose them to a higher risk of care fragmentation, our findings suggest there are comparable costs and no perioperative harms associated with non-index vs. index readmissions. Moreover, as new technologies such as telemedicine and regional online medical record exchange are adopted there is an increased

potential for continuity of care and improved healthcare at non-index hospitals with mitigation of the harmful effects of care fragmentation, especially for patients residing in rural areas far from their index hospital. From a payer's perspective, these findings suggest that regionalization of RC to high-volume, tertiary care centers with follow-up care at local hospitals is in fact a viable model with comparable hospital costs and short-term perioperative outcomes. Of note, we were unable to evaluate differences in outpatient healthcare costs, but hospital costs represent the overwhelming majority of perioperative costs associated with RC.{29} From the patient perspective, the effect of index vs. non-index readmissions on long-term health related quality of life is currently unknown and future studies to investigate the potential association are warranted. Moreover, as more institutions continue to adopt enhanced recovery after surgery protocols for cystectomy patients, the effect of these protocols on readmission rates and causes of readmission warrants investigation. Additionally, future research efforts should focus on examining potential differences in 1–2 year survival between index and non-index readmitted RC patients as previous studies in gastrectomy and urinary diversion patients have demonstrated survival differences at the 1 or 2-year postoperative time point.{14,17}

This study has limitations that should be acknowledged. Due to the nature of the database, there is no information on travel distance from patient residence to nearest hospital or index hospital, neoadjuvant chemotherapy, or bladder cancer staging so these variables could not be controlled for. However, previous studies have reported no difference on perioperative morbidity and mortality with neoadjuvant chemotherapy.{30} Additionally, this study excluded patients with metastatic disease, and since the patients in this study were undergoing RC the majority of patients in this cohort likely had clinically staged muscle-invasive disease. This study only included patients that were residents of the state in which they had their RC, so that readmissions would be captured more accurately. Therefore, these results should not be extrapolated to patients that are non-residents of the state in which their RC is performed. Moreover, the only mortality data provided is in-hospital mortality. Deaths occurring after discharge from the readmission in settings outside of the hospital are not captured. As a result, we are not able to evaluate the effect of non-index readmissions on survival at later time points.

Conclusions

This nationally representative study of RC patients suggests index and non-index readmissions are associated with comparable perioperative outcomes and hospital costs. The inability to demonstrate an association of increased costs or harms with non-index readmissions compared to index readmissions provides support for the regionalization of RC.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Abbreviations

RC	radical cystectomy
NRD	National Readmissions Database
ICD-9	International Statistical Classification of Diseases and Related Health Problems
SE	standard error
IQR	interquartile range
OR	odds ratio
CI	confidence interval
NOS	not otherwise specified

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Figure 1.
Proportion of index and non-index readmissions for each day following initial hospital discharge during 90-day follow-up period.

Table 1

Patient and hospital-level characteristics of index readmitted, non-index readmitted, and all cystectomy patients.

	Index Readmission (n=1447)	Non-index Readmission (n=571)	p-value	All Cystectomy Patients w/ 90-day follow-up (n=4991)
Mean Age (SE)	68.5 (0.5)	70.0 (0.6)	0.047	68.5 (0.2)
Readmission Timing				
- Early	76.8%	61.0%	<0.001	29.0%
- Late	23.2%	39.0%		11.4%
- No Readmission	N/A	N/A		59.6%
Sex				
- Male	80.6%	84.5%	0.2	81.6%
- Female	19.4%	15.5%		18.4%
Initial Hospitalization Length of Stay (SE)	10.1 (0.3)	11.6 (0.7)	0.054	10.1 (0.2)
Insurance Primary Payer				
- Medicare	63.3%	70.5%	0.5	64.8%
- Medicaid	5.6%	4.0%		5.0%
- Private	27.6%	21.7%		26.3%
- Self-Pay	1.2%	1.3%		1.5%
- No Charge	<1% *	0.5%		0.5%
- Other/Unknown	1.6%	1.9%		1.9%
Patient Location				
- Center counties (>1 million)	27.4%	18.8%	0.046	22.4%
- Fringe counties (>1 million)	27.4%	28.0%		26.2%
- 250,000–1 million	19.3%	25.3%		21.5%
- 50,000–250,000	10.5%	10.5%		11.8%
- Metropolitan	10.0%	7.4%		10.4%
- Not Metro/Micropolitan	5.3%	10.0%		7.7%
Median Household Income National Quartile for Patient's ZIP code				
- 1 st quartile (\$1–\$37,999)	18.1%	16.3%	0.7	21.2%

	Index Readmission (n=1447)	Non-index Readmission (n=571)	p-value	All Cystectomy Patients w/ 90-day follow-up (n=4991)
- 2 nd quartile (\$38,000–\$47,999)	26.8%	30.9%		26.7%
- 3 rd quartile (\$48,000–\$63,999)	27.1%	28.0%		26.5%
- 4 th quartile (\$64,000+)	26.4%	23.3%		24.5%
- Unknown	1.5%	1.5%		1.2%
Index Hospital Bed Size				
- Small	11.3%	16.0%	0.2	10.2%
- Medium	15.5%	17.7%		17.8%
- Large	73.2%	66.3%		72.0%
Index Hospital Location				
- Metropolitan +1 million	64.2%	69.6%	0.4	61.6%
- Metropolitan <1 million	32.8%	27.6%		35.5%
- Micropolitan	2.6%	2.2%		2.5%
- Other	0.4%	0.6%		0.4%
Readmission Hospital Location				
- Metropolitan +1 million	64.2%	48.3%	<0.001	24.1%
- Metropolitan <1 million	32.8%	38.9%		14.0%
- Micropolitan	2.6%	8.6%		1.7%
- Other	0.4%	4.2%		0.6%
- No Readmission	N/A	N/A		59.6%
Index Hospital Teaching Status				
- Metropolitan Teaching	81.4%	87.9%	0.053	80.6%
- Metropolitan Non-teaching	15.6%	9.4%		16.5%
- Non-metropolitan	3.0%	2.8%		2.9%
Charlson Index				
- 0	44.4%	43.8%	0.8	49.6%
- 1	24.5%	26.7%		24.4%
- 2	31.1%	29.4%		26.0%
Approach				

	Index Readmission (n=1447)	Non-index Readmission (n=571)	p-value	All Cystectomy Patients w/ 90-day follow-up (n=4991)
- Open	75.1%	76.4%	0.7	76.0%
- Minimally Invasive	24.9%	23.6%		24.0%
Urinary Diversion				
- Ileal Conduit	87.7%	89.2%	0.7	88.8%
- Continent	6.9%	6.8%		6.3%
- Unknown	5.4%	4.0%		4.8%
Complication During Initial Hospitalization				
- No	53.4%	59.6%	0.2	58.3%
- Yes	46.6%	40.4%		41.7%
Index Hospital Radical Cystectomy Volume				
- Low	33.2%	25.7%	0.02	32.5%
- Intermediate	35.8%	31.5%		34.3%
- High	31.0%	42.8%		33.2%
Disposition Upon Discharge				
- Routine	28.0%	23.4%	0.3	29.8%
- Transfer To Facility	15.0%	19.2%		12.1%
- Home Health	57.0%	57.4%		58.1%
Mean Readmission Length of Stay (SE)	7.5 (1.2)	6.9 (0.5)	0.6	7 (0.4)
Median Readmission Length of Stay [IQR]	4 [3, 7]	4 [3, 8]		4 [3, 7]
Mean Number of Readmissions during 90-day follow-up (SE)	1.5 (0.05)	1.5 (0.03)	0.3	0.6 (0.02)
Death During First Readmission	2.4%	2.1%	0.8	0.9%

* Exact number of patients is not reported to maintain patient confidentiality.

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Table 2

Initial and follow-up hospital costs of index readmission, non-index readmissions, and all patients.

	Index Readmission (n=1447)	Non-index Readmission (n=571)	p-value	All Cystectomy Patients w/ 90-day follow-up (n=4991)
Mean Initial Hospitalization Costs (SE)	\$35845 (2221)	\$33546 (1157)	0.3	\$33202 (1066)
Median Initial Hospitalization Costs [IQR]	\$28407 [21320, 43925]	\$28047 [20998, 40338]		\$27872 [20366, 39462]
Mean Cost of Readmission (SE)	\$15102 (2521)	\$14147 (1256)	0.7	\$14417 (1159)
Median Cost of Readmission [IQR]	\$7727 [4664, 15549]	\$8132 [4903, 13982]		\$8023 [4831, 14200]
Mean Thirty Day Follow-Up Costs (SE)	\$12328 (2541)	\$11824 (895)	0.9	\$4840 (377)
Median Thirty Day Follow-Up Costs [IQR]	\$4323 [0, 13796]	\$6709 [1800, 13613]		\$0 [0, 4102]
Mean Ninety Day Follow-Up Costs (SE)	\$20760 (2730)	\$20529 (1376)	0.9	\$8330 (541)
Median Ninety Day Follow-Up Costs [IQR]	\$11783 [5992, 21941]	\$11826 [5972, 23534]		\$0 [0, 8422]

Table 3

Causes of index and non-index readmission using principal ICD-9 diagnosis code.

	Index Readmission (n=1447)	Non-index Readmission (n=571)	p-value
Infectious	31.9%	35.5%	0.4
- C. Diff	1.7%	<2% *	0.4
- Sepsis	15.5%	20.4%	0.1
- Pyelonephritis	4.2%	2.9%	0.3
- Urinary Tract Infection	7.9%	8.3%	0.8
- Abscess	0.8%	<2% *	0.6
- Fever	1.3%	<2% *	0.6
- Bacteremia	<1% *	<2% *	0.1
Wound	16.7%	5.3%	0.0001
- Dehiscence	3.1%	<2% *	0.04
- Seroma	1.1%	<2% *	0.3
- Surgical Site Infection	12.2%	3.9%	0.001
Genitourinary	12.3%	11.7%	0.8
- Acute Renal Failure	5.6%	6.3%	0.6
- Hydronephrosis	<1% *	<2% *	0.9
- Ureteral Stricture	<1% *	0%	0.4
- Urethral Stricture	0%	<2% *	0.1
- Catheter Related Infection or Mechanical Obstruction	3.2%	<2% *	0.08
- Fistula	<1% *	0%	0.2
- Not Specified	2.3%	3.4%	0.3
- Stoma	<1% *	0%	0.4
Gastrointestinal	11.0%	6.0%	0.04
- Obstruction	4.5%	4.1%	0.8
- Nausea/Vomiting	0.8%	<2% *	0.5

	Index Readmission (n=1447)	Non-index Readmission (n=571)	p-value
- Not Specified	5.7%	<2% *	0.006
Cardiovascular	2.9%	7.6%	0.003
- Pulmonary Embolism	1.8%	4.6%	0.03
- Deep Vein Thrombosis	<1% *	<2% *	0.2
- Myocardial Infarction or Coronary Artery Disease	<1% *	<2% *	0.1
Electrolyte Abnormality	2.2%	2.9%	0.7
Bleeding	1.6%	3.3%	0.1
- Hemorrhage/Hematoma	<1% *	<2% *	0.4
- Hematuria	<1% *	0%	0.5
- Anemia	1.2%	2.8%	0.1
Cancer Related	3.6%	2.5%	0.4
- Bladder cancer	1.3%	<2% *	0.4
- Recurrence	<1% *	0%	0.4
- Metastatic disease	1.5%	<2% *	0.9
- Chemotherapy	<1% *	<2% *	0.7
Failure to Thrive	<1% *	0%	0.3

* Exact number of patients is not reported to maintain patient confidentiality.

++ Odds Ratio unable to be calculated because of empty cell

CI- confidence interval

Table 4

Multivariable multinomial logistic regression to identify predictors of non-index hospital readmission among all cystectomy patients.

	Index vs. No Readmission	Multivariable	p-value	Non-Index vs. No Readmission	Multivariable	p-value
Mean Age (per year)	1.00 [0.99, 1.01]		0.6	1.01 [0.99, 1.03]		0.2
Sex						
- Male	Ref			Ref		
- Female	1.10 [0.84, 1.44]		0.5	0.76 [0.50, 1.16]		0.2
Initial Hospitalization Length of Stay (per day)	0.98 [0.97, 0.999]		0.04	1.02 [1.001, 1.04]		0.04
Insurance Status						
- Medicare	Ref			Ref		
- Medicaid	1.28 [0.77, 2.12]		0.3	1.07 [0.47, 2.42]		0.9
- Private	1.25 [0.94, 1.66]		0.1	0.98 [0.63, 1.52]		0.9
- Self-Pay	1.01 [0.39, 2.59]		0.98	1.57 [0.49, 5.01]		0.4
- No Charge	2.16 [0.49, 9.63]		0.3	1.61 [0.18, 14.77]		0.7
- Other/Unknown	0.99 [0.45, 2.17]		0.99	1.10 [0.38, 3.17]		0.9
Patient Location						
- Center counties (>1 million)	Ref			Ref		
- Fringe counties (>1 million)	0.83 [0.62, 1.11]		0.2	1.26 [0.85, 1.86]		0.2
- 250,000–1 million	0.66 [0.46, 0.94]		0.02	2.05 [1.29, 3.26]		0.002
- 50,000–250,000	0.62 [0.40, 0.94]		0.03	1.33 [0.76, 2.33]		0.3
- Micropolitan	0.62 [0.36, 1.08]		0.09	1.00 [0.52, 1.91]		0.99
- Not Metro/Micropolitan	0.50 [0.30, 0.86]		0.01	2.42 [1.19, 4.90]		0.01
Median Household Income National Quartile for Patient's ZIP code						
- 1 st quartile (\$1–\$37,999)	Ref			Ref		
- 2 nd quartile (\$38,000–\$47,999)	1.31 [0.97, 1.78]		0.08	1.87 [1.28, 2.72]		0.001
- 3 rd quartile (\$48,000–\$63,999)	1.32 [0.98, 1.79]		0.07	1.69 [1.15, 2.49]		0.008
- 4 th quartile (\$64,000+)	1.32 [0.89, 1.97]		0.2	1.42 [0.94, 2.14]		0.1
- Unknown	1.89 [0.70, 5.11]		0.2	2.17 [0.39, 12.07]		0.4

	Index vs. No Readmission	Multivariable	p-value	Non-Index vs. No Readmission	Multivariable	p-value
Index Hospital Bed Size						
- Small	Ref			Ref		
- Medium	0.58 [0.37, 0.91]		0.02	0.59 [0.35, 1.01]		0.055
- Large	0.71 [0.50, 1.02]		0.06	0.51 [0.31, 0.83]		0.007
Index Hospital Location						
- Metropolitan >1 million	Ref			Ref		
- Metropolitan <1 million	1.11 [0.78, 1.57]		0.6	0.52 [0.33, 0.83]		0.005
- Micropolitan	1.40 [0.54, 3.62]		0.5	0.87 [0.30, 2.54]		0.8
- Not Metro or Micropolitan	1.50 [0.13, 17.14]		0.7	0.67 [0.03, 17.14]		0.8
Index Hospital Teaching Status						
- Teaching	Ref			Ref		
- Non-teaching	0.75 [0.52, 1.10]		0.1	0.52 [0.31, 0.86]		0.01
Charlson Index						
- 0	Ref			Ref		
- 1	1.25 [0.97, 1.60]		0.08	1.23 [0.82, 1.84]		0.3
- 2	1.64 [1.25, 2.14]		<0.001	1.34 [0.88, 2.04]		0.2
Approach						
- Open	Ref			Ref		
- Minimally Invasive	1.03 [0.78, 1.34]		0.9	0.93 [0.65, 1.32]		0.7
Urinary Diversion						
- Ileal Conduit	Ref			Ref		
- Unknown	1.17 [0.69, 2.00]		0.6	0.99 [0.50, 1.95]		0.97
- Continent	1.27 [0.82, 1.97]		0.3	1.15 [0.58, 2.27]		0.7
Disposition Upon Discharge						
- Routine	Ref			Ref		
- Transfer To Facility	1.82 [1.21, 2.73]		0.004	2.82 [1.75, 4.55]		<0.001
- Home Health	1.10 [0.90, 1.35]		0.4	1.49 [1.05, 2.10]		0.02
Complication During Initial Hospitalization						

	Index vs. No Readmission	Multivariable	p-value	Non-Index vs. No Readmission	Multivariable	p-value
- No	Ref			Ref		
- Yes	1.41 [1.11, 1.81]		0.006	0.88 [0.64, 1.22]		0.5
Index Hospital Cystectomy Volume						
- Low	Ref			Ref		
- Intermediate	0.99 [0.70, 1.39]		0.9	1.11 [0.70, 1.76]		0.7
- High	0.85 [0.59, 1.23]		0.4	1.33 [0.85, 2.08]		0.2

** Not included because non-metro is captured in the hospital location variable

++ Sensitivity analysis has the same result with cystectomy as a continuous variable