



DEPARTMENT OF  
**UROLOGY**

VANDERBILT  UNIVERSITY  
MEDICAL CENTER

# The impact of hospital volume on short-term and long-term outcomes for patients undergoing radical nephroureterectomy for upper tract urothelial carcinoma

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# Disclosures

- none

# Introduction

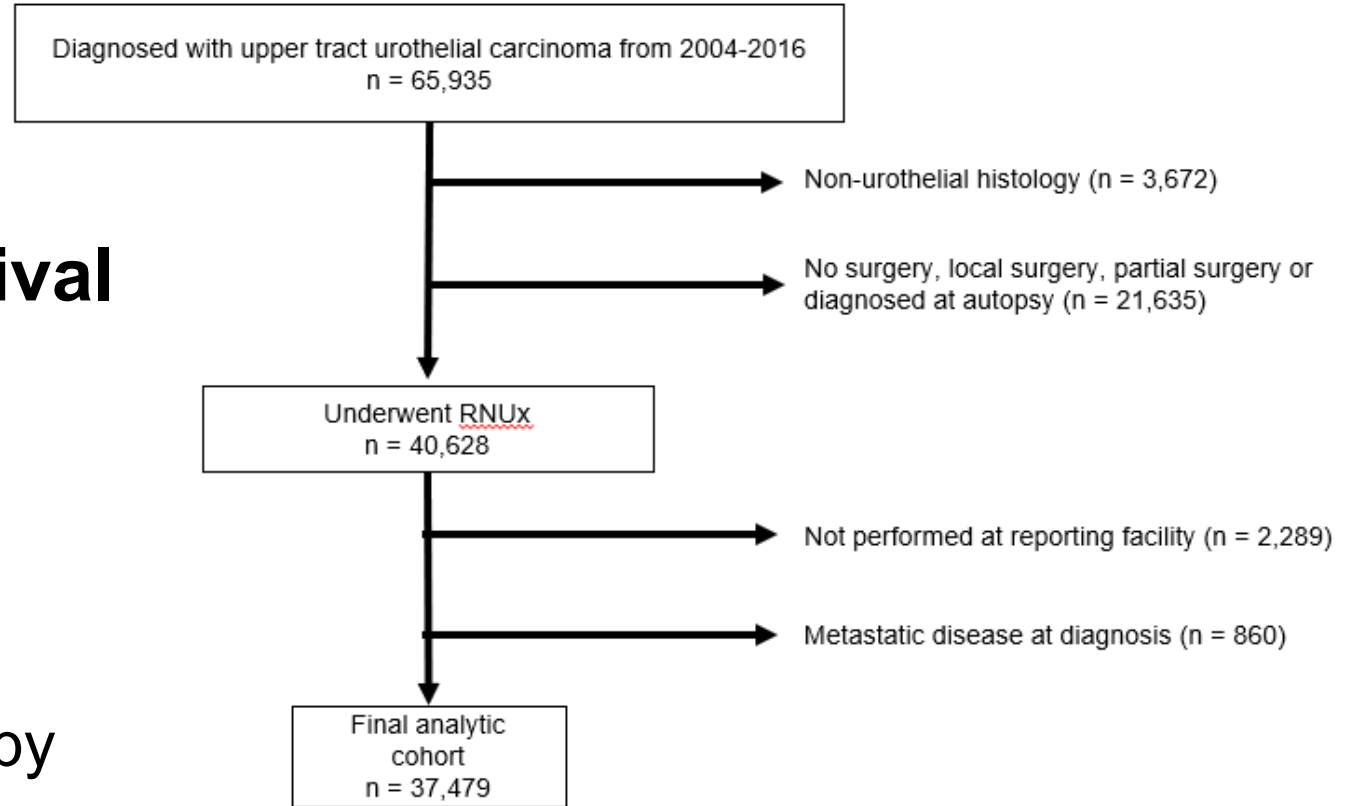
- Upper tract urothelial carcinoma (UTUC) is a **rare genitourinary malignancy**
- Radical nephroureterectomy (RNUx) is the gold standard for high-risk disease
- The **surgeon/hospital volume-outcome relationship** has been well established

# Objective

To determine the relationship between hospital volume and clinical outcomes for patients undergoing RNUx.

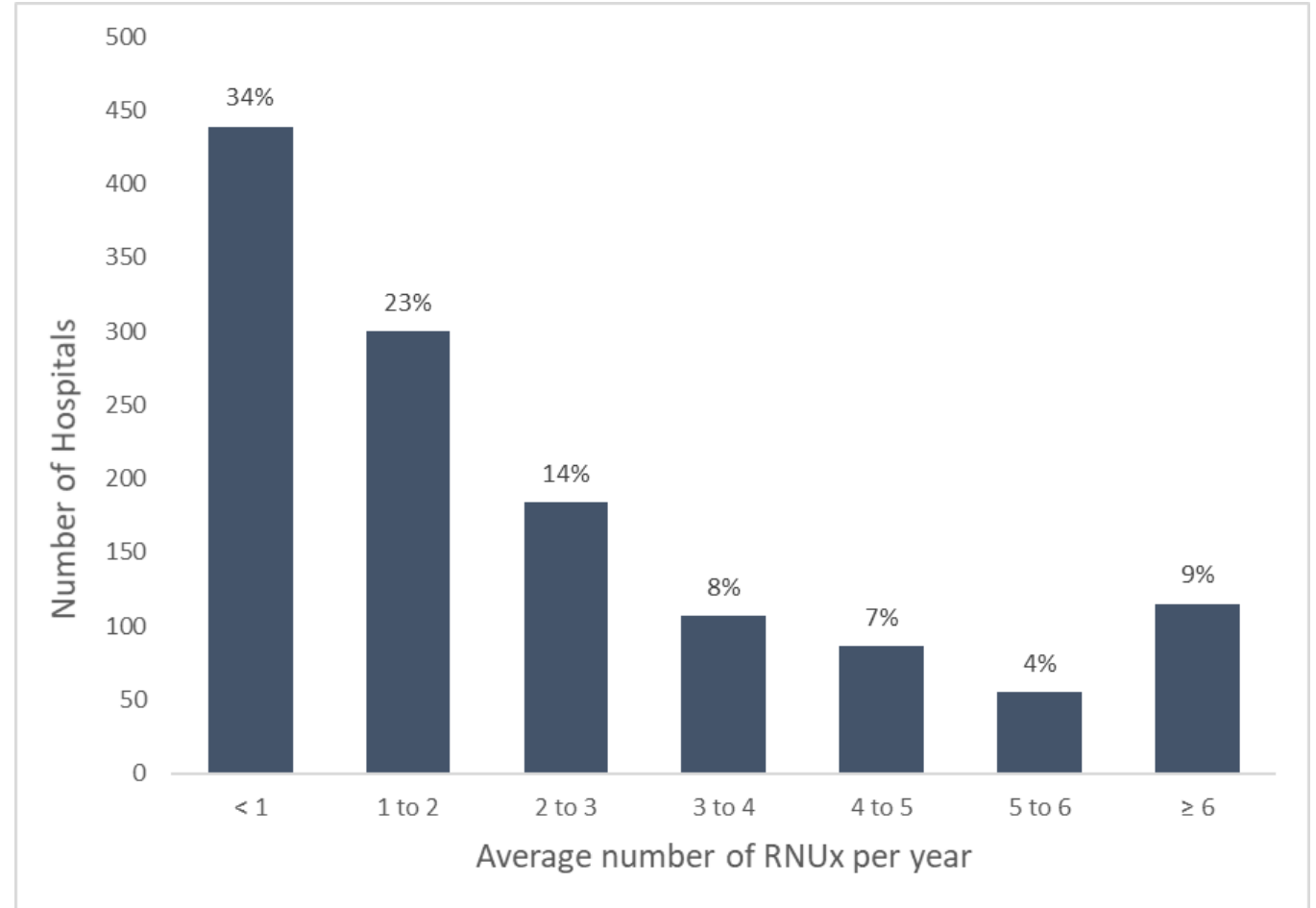
# Materials and Methods

- National Cancer Database
- Primary outcome: **overall survival**
- Secondary outcomes
  - Readmission rate
  - Lymph node yield
  - Margin status
  - 30- and 90- day mortality
  - Use of perioperative chemotherapy



# Analyses

- Hospital level data
  - **Tertiles**
  - Sub-analysis of bottom 50<sup>th</sup>, top 50<sup>th</sup>-25<sup>th</sup>, top 25-10<sup>th</sup> and top 10<sup>th</sup> percentiles
- Statistical analysis:
  - Univariate: chi-square and students' t-tests
  - Multivariable logistic regression



# Results

- N = 26,026 patients treated at low volume (< 6 RNUx/year) vs n = 11,453 at high volume centers (≥6 RNUx/year)
- Slightly older and more likely to be white and female at low volume centers
- High volume centers were more commonly **academic** and patients **traveled farther**

**Table 1** Demographic and clinical characteristics of the study cohort

Variable	Low volume hospitals (<6	High volume hospitals (≥6	p-value
	RNUx/year % (n = 26,026)	RNUx/year % (n = 11,453)	
Age			0.001
< 50	3 (784)	3.2 (372)	
50 - 59	10.7 (2,793)	10.8 (1,236)	
60 - 69	25.2 (6,566)	26.9 (3,081)	
70 - 79	36.2 (9,412)	35.7 (4,084)	
≥ 80	24.9 (6,471)	23.4 (2,680)	
Gender			0.009
Male	59.5 (15,476)	60.9 (6,975)	
Female	40.5 (10,550)	39.1 (4,478)	
Race			0.008
White	92.1 (23,979)	91.9 (10,521)	
Black	4.4 (1,135)	4 (458)	
Other	2.7 (705)	3.1 (358)	
Unknown	0.8 (207)	1 (116)	
Charlson/Deyo Score			0.204
0	64.3 (16,733)	65 (7,449)	
1	24.3 (6,326)	24.1 (2,765)	
>1	11.4 (2,967)	10.8 (1,239)	
Type of Facility			<0.001
Community	10.2 (2,648)	0 (0)	
Comprehensive Community	51.7 (13,384)	18.8 (2,145)	
Academic/Research	22.9 (5,929)	69.9 (7,968)	
Integrated Network	15.2 (3,946)	11.2 (1,281)	
Distance traveled			<0.001
Short (< 12.5)	60.4 (15,635)	39.6 (4,518)	
Intermediate (12.5 - 49.9)	30.3 (7,856)	35.3 (4,026)	
Long (50 - 249.9)	8.6 (2,231)	21.5 (2,450)	
Very long (>249.9)	0.7 (175)	3.7 (421)	
Insurance Status			<0.001
Uninsured	1.6 (411)	1 (116)	
Private	25.2 (6,566)	25.9 (2,971)	
Medicaid	2.6 (683)	2.2 (249)	
Medicare	68.4 (17,813)	66.8 (7,652)	
Other government	1 (249)	0.9 (99)	
Other/Unknown	1.2 (304)	3.2 (366)	
Year of diagnosis			0.113
2004-2010	49.8 (12,973)	49 (5,607)	
2011-2016	50.2 (13,053)	51 (5,846)	
Grade			<0.001
Unknown	12.7 (3,313)	13 (1,487)	
1	11.8 (3,076)	8.7 (998)	
2	17.9 (4,653)	14.9 (1,710)	
3	31.3 (8,140)	28.9 (3,310)	
4	26.3 (6,844)	34.5 (3,948)	
T stage (pathologic)			0.063
Tx	24 (6,253)	23.4 (2,679)	
T0	0.4 (93)	0.6 (63)	
Ta	20.1 (5,231)	20.7 (2,371)	
Tis	2.7 (690)	2.9 (327)	
T1	16.2 (4,217)	15.9 (1,821)	
T2	9.6 (2,493)	9.4 (1,080)	
T3	23.2 (6,033)	23 (2,633)	
T4	3.9 (1016)	4.2 (479)	
N stage (pathologic)			<0.001
Nx	56.9 (14,807)	52.4 (6,001)	
N0	38.6 (10,052)	41.3 (4,733)	
N1	2.1 (534)	2.7 (310)	
N2	2.3 (594)	3.3 (382)	
N3	0.1 (39)	0.2 (27)	

# Results: perioperative outcomes

- High volume hospitals ( $\geq 6$  RNUx/year) had....
  - More peri-operative chemotherapy
  - Lower readmission rate
  - Lower positive margins
  - Higher LN yield
  - Shorter inpatient stay
  - Low 30- and 90- day mortality

**Table 2.** Surgical and short-term perioperative outcomes

Variable	Low volume hospitals ( $< 6$ RNUx/year) % (n = 26,026)	High volume hospitals ( $\geq 6$ RNUx/year) % (n = 11,453)	p-value
Use of perioperative chemotherapy			<0.001
RNUx alone	87.6 (21,946)	84.0 (8,356)	
RNUx + perioperative chemotherapy	12.4 (3,101)	16.0 (1,781)	
Time to surgery			<0.001
> 30 days	41.4 (10,623)	49.6 (5,599)	
$\leq 30$ days	58.6 (15,012)	50.4 (5,693)	
Readmission within 30 days			<0.001
None	93.9 (24,066)	95.4 (10,857)	
Yes	6.1 (1566)	4.6 (525)	
Margin status			0.045
Negative	90.8 (23,214)	91.5 (10,144)	
Positive	9.2 (2347)	8.5 (946)	
Lymph node yield			<0.001
0 or none examined	80.3 (20,495)	67.8 (7,629)	
$\geq 1$	19.7 (5,032)	32.2 (3,624)	
Inpatient stay (mean $\pm$ sd, days)	5.5 $\pm$ 5.7	5.4 $\pm$ 6.4	0.011
30-day mortality			<0.001
Alive or died >30 days after surgery	98.0 (23,125)	98.6 (10,186)	
Died $\leq 30$ days after surgery	2.0 (463)	1.4 (144)	
90-day mortality			0.001
Alive or died >90 days after surgery	95.6 (22,333)	96.4 (9,863)	
Died $\leq 90$ days after surgery	4.4 (1,016)	3.6 (364)	



# Results

**Table 3.** Logistic regression of surgical and short-term perioperative outcomes

	Any chemo use§		Time to surgery <30 days†		Readmission†		Positive Margin†		LN Yield*		30 day mortality†		90 day mortality†	
	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value
Hospital volume														
Low	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref
High	1.288 (1.177 - 1.409)	<0.001	0.754 (0.711 - 0.8)	<0.001	0.868 (0.76 - 0.991)	0.036	0.818 (0.734 - 0.913)	<0.001	1.688 (1.578 - 1.806)	<0.001	0.725 (0.559 - 0.94)	0.015	0.802 (0.676 - 0.951)	0.011

†adjusted for age, sex, race, insurance status, travel distance, charlson/deyo score, history of prior malignancy, pathologic T and N stage, tumor grade and perioperative chemotherapy

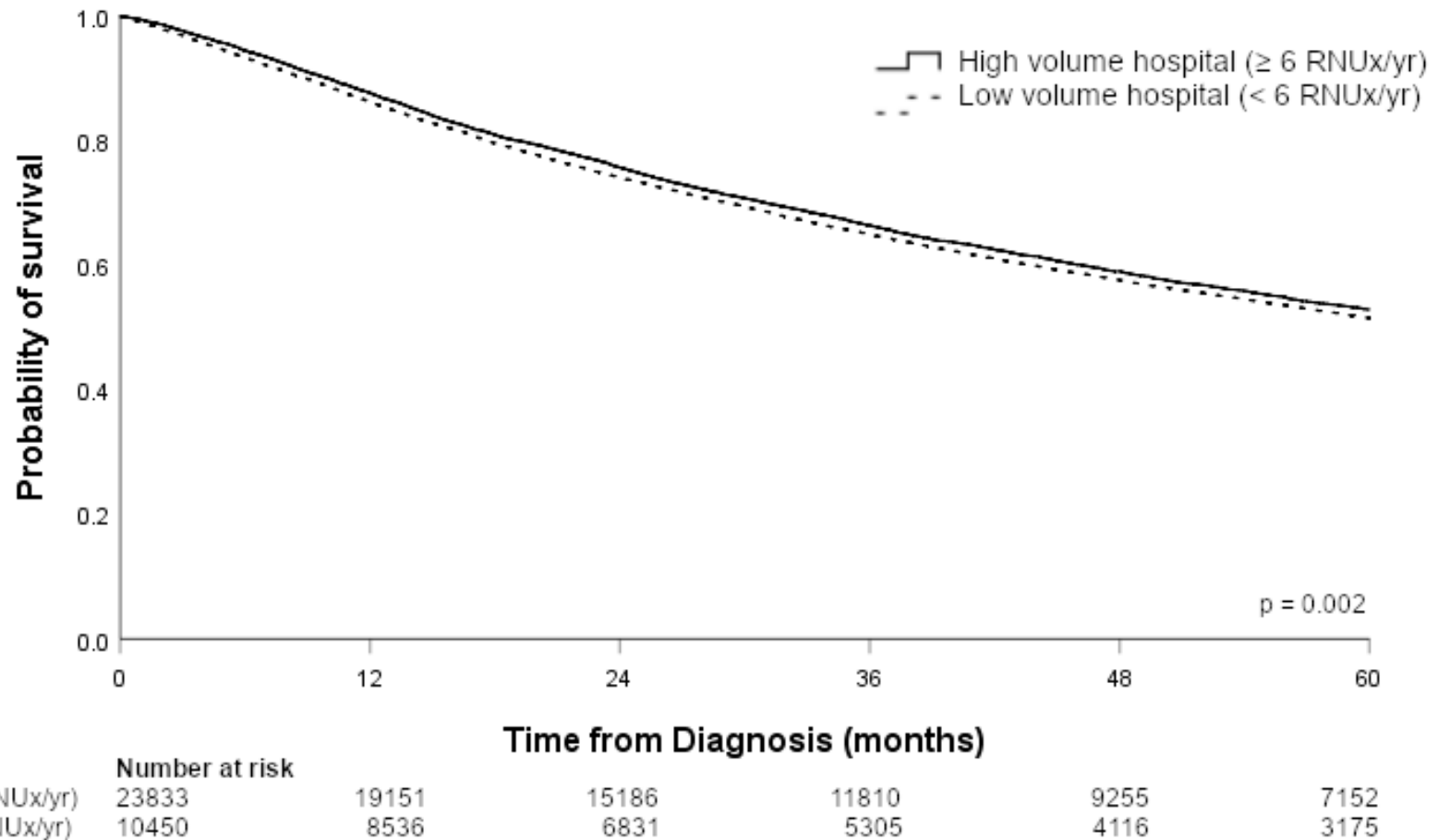
§adjusted for the above except for peri-operative chemotherapy

\*adjusted for the above except for pathologic node status

- The univariate findings were confirmed on multivariable logistic regressions
  - More peri-operative chemotherapy
  - Lower readmission rate
  - Lower positive margins
  - Higher LN yield
  - Shorter inpatient stay
  - Low 30- and 90- day mortality

# Results

- Treatment at high volume hospital was associated with a **higher median survival (66.2 vs 63.6 months, p = 0.002)**



# Results

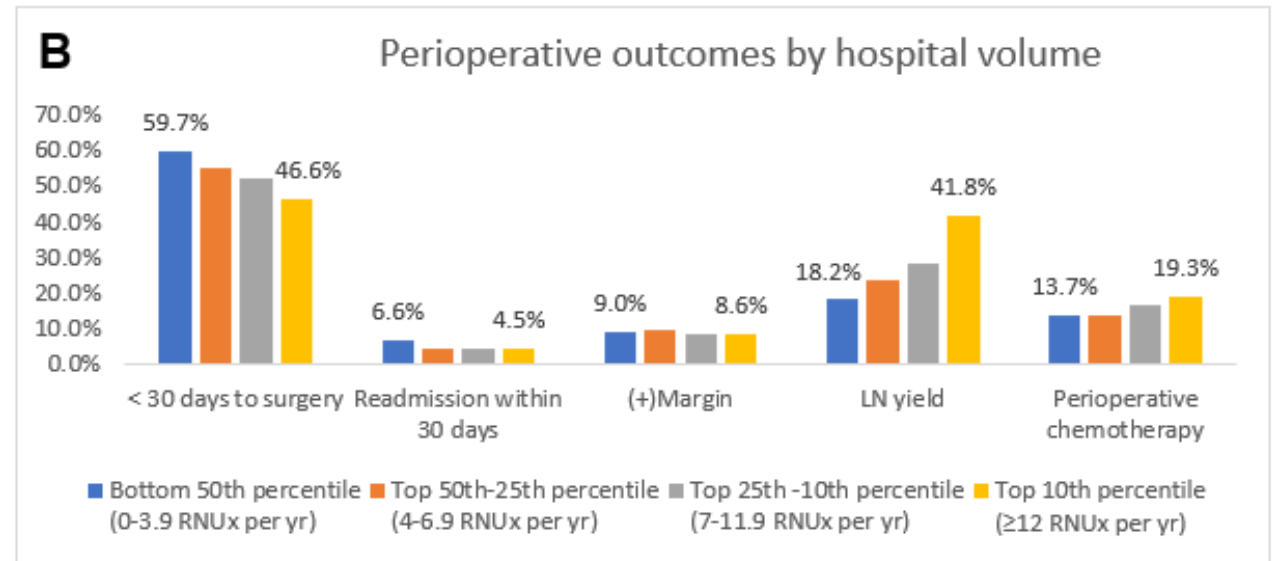
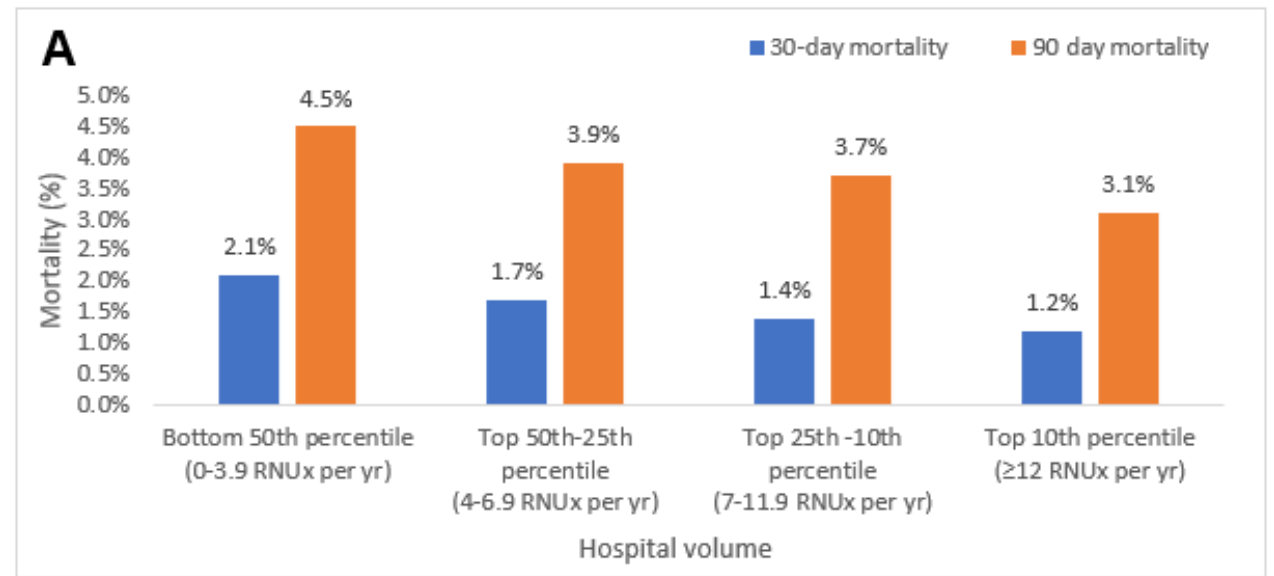
- Treatment at high volume hospital was also associated with **lower hazards of mortality (HR 0.914, p = 0.004)**
- Same results on landmark analysis

**Table 4.** Cox proportional hazards analysis for patients who underwent RNUx for UTUC

	HR (95% CI)	p-value
Age (continuous)	1.044 (1.041 - 1.046)	<0.001
Sex		
Male	ref	ref
Female	0.928 (0.89 - 0.968)	<0.001
Race		
White	ref	ref
Non-white	1.031 (0.949 - 1.12)	0.466
Insurance status		
Private	ref	ref
Medicare	1.003 (0.945 - 1.065)	0.915
Other	1.192 (1.063 - 1.337)	0.003
Travel distance		
Short (<12.5mi)	ref	ref
Interm (12.5-49.9)	1.003 (0.958 - 1.05)	0.901
Long (50-249.9)	1.042 (0.976 - 1.113)	0.219
Charlson/Deyo score		
0	ref	ref
1	1.102 (1.057 - 1.148)	<0.001
>1	1.184 (1.129 - 1.242)	<0.001
History of prior cancer		
None	ref	ref
Yes	1.588 (1.493 - 1.689)	<0.001
Grade		
Low	ref	ref
High	1.267 (1.201 - 1.336)	<0.001
T Stage		
≤T1	ref	ref
T2	1.547 (1.447 - 1.654)	<0.001
≥T3	2.521 (2.395 - 2.653)	<0.001
N Stage		
N0/X	ref	ref
N(+)	2.021 (1.882 - 2.169)	<0.001
Treatment		
RNUx alone	ref	ref
Perioperative chemo	0.914 (0.873 - 0.957)	<0.001
Hospital type		
Low volume (≤6)	ref	ref
High volume (>6)	0.914 (0.859 - 0.972)	0.004

# Results

- Sub-analysis stratified by the top 10<sup>th</sup>, top 25<sup>th</sup>-10<sup>th</sup>, top 50<sup>th</sup>-25<sup>th</sup> bottom 50<sup>th</sup> hospitals
- Consistent **dose response relationship** with all peri-operative outcomes



# Conclusions

- RNUx at high volume centers was associated with improved short-term and long-term outcomes
- Likely multifactorial
  - Better surgical expertise?
  - Better inpatient/outpatient infrastructure?

# Conclusions

- Questions for future research
  - Where do we draw the line and how do we get there?
  - Is there a way to improve outcomes for low-volume hospitals or increase access to high volume centers?

# Acknowledgements

- Dr. Laviana
- Drs. Penson, Chang, Barocas, Resnick, Luckenbaugh, Wallis and the rest of the Vanderbilt Department of Urology