

## Rural-Urban Differences in Esophagectomy for Cancer

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### ABSTRACT

**Introduction.** Patients who are disadvantaged socioeconomically or live in rural areas may not pursue surgery at high-volume centers where outcomes are better for some complex procedures. The objective of this study was to compare rural and urban patient differences directly by location of residence and outcomes after undergoing esophagectomy for cancer.

**Methods.** An analysis of the Healthcare Cost and Utilization Project National Inpatient Sample (HCUP-NIS) database was performed, capturing adult patients with esophageal cancer who underwent esophagectomy. Patients were stratified into rural or urban groups by the National Center for Health Statistics Urban-Rural Classification Scheme. Demographics, hospital variables, and outcomes were compared.

**Results.** A total of 2,877 patients undergoing esophagectomy for esophageal cancer were captured by the database, with 228 (7.92%) rural and 2,575 (89.50%) urban patients. The rural and urban groups had no differences in age, race, and insurance status, and shared many common comorbidities. Major outcomes of mortality (3.95% versus 4.27%,  $p = 0.815$ ) and length of stay ( $15.75 \pm 13.22$  vs.  $15.55 \pm 14.91$  days,  $p = 0.828$ ) were similar for both rural and urban patients. There was a trend for rural patients to more likely be discharged home (35.96% vs. 29.79%, OR 0.667 [95% CI 0.479 - 0.929];  $p = 0.0167$ ).

**Conclusions.** This retrospective administrative database study indicated that rural and urban patients received equivalent postoperative care after undergoing esophagectomy. The findings were reassuring as there did not appear to be a disparity in major outcomes depending on the location of residence, but further studies are necessary to assure equitable treatment for rural patients. *Kans J Med* 2021;14:292-297

### INTRODUCTION

Multiple studies have captured the differences between patients with surgical problems who reside in rural versus urban environments.<sup>1-5</sup> Unfortunately, there are fewer data on rural-urban differences within the U.S. on the subject of esophageal cancer and esophagectomy outcomes. Substantial evidence supports decreased mortality in those patients undergoing high-risk surgical procedures at high-volume hospitals compared to low-volume hospitals, which would suggest rural patients should receive their complex surgery at high-volume centers.<sup>6</sup> While some worry the centralization of complex surgeries would impact

the financial security of rural institutions negatively, this impact may be negligible.<sup>7</sup> Others described this regionalization leading to difficulty in receiving complex cancer care.<sup>8,9</sup> Fuchs et al.<sup>10</sup> studied the Nationwide Inpatient Sample, but did not include an analysis of rural patients, finding mortality elevated among low and intermediate-volume hospitals compared to high-volume hospitals. Schlottmann and colleagues<sup>11</sup> concluded that centralization of care occurred in the U.S., but did not analyze patients residing in rural areas. While increased travel distance has been associated with improved survival, the reason for this is not well defined.<sup>12</sup> Additionally, Song et al.<sup>13</sup> reported on trends in complex cancer operations nationally using the NIS database, but like other studies, it did not dive into the problem of rural-urban outcomes and differences. Instead, they looked at hospital and procedure-based outcomes rather than patient populations.

Direct comparisons of rural and urban patient populations are lacking. A Canadian study found that patients from rural areas had similar outcomes regardless of the volume of the surgical center, but they were more likely to travel farther for esophageal surgery, indicating regionalization.<sup>14</sup> The epidemiologic trends in esophageal cancer in China have been studied, noting rural-urban differences in incidence and mortality.<sup>15,16</sup> Within the U.S., those who are disadvantaged socioeconomically and live in rural areas may not pursue surgery for esophageal cancer at high-volume cancer accredited centers, where outcomes were better for some procedures.<sup>17</sup> While center volume and travel distance have been used as surrogates for rural patient outcomes and to indicate the best treatment pathway for rural patients, little direct comparison of rural and urban patients exists, especially in the esophageal cancer population.

### METHODS

Data from 2010 to 2014 from the Health Care Cost and Utilization Project National Inpatient Sample (HCUP-NIS) were used.<sup>18</sup> These were adult patients (at least 18 years of age), undergoing esophagectomy for esophageal cancer, as identified by the International Classification of Diseases (ICD) codes.<sup>19</sup> Patients in a rural setting were compared to patients residing in an urban setting using the National Center for Health Statistics (NCHS) Urban-Rural Classification Scheme, a system stable over the study period, to find differences in outcomes such as mortality, length of stay, and cost of hospital care.<sup>20</sup> Those from non-core counties (not metropolitan or micropolitan counties) were designated as rural patients to create a comparison of very rural patients to those from more metropolitan areas. The rural patients were compared to patients from counties considered micropolitan (counties with a population of 10,000 - 50,000), small metro (counties in metro areas with a population of 50,000 - 249,999), medium metro (counties in metro areas with a population of 250,000 - 999,999), large fringe metro (fringe counties with a population greater than 1,000,000), or large central metro (large central counties with a population greater than 1,000,000); these counties were all considered urban. This created two groups, one from more rural areas and one from the more metropolitan areas based upon the county populations. ICD coding was not used to designate comorbidities or complications as there is no way to define when a code is used for a pre- or postoperative diagnosis.

The NIS data were drawn from all states participating in HCUP, or

about 96% of the U.S. population. It approximated 20% of discharges from U.S. hospitals, excluding long-term acute care and rehabilitation hospitals. State and hospital identifiers were not used. Sample sizes were typically large except for rare diagnoses, uncommon treatments, and unique patient populations. The NIS data were representative of the national population.

Statistical analysis and data management were performed using SAS (SAS Institute, Cary, NC), SPSS (IBM® Corp. Released 2015. IBM SPSS Statistics for Windows®, Version 23.0. Armonk, NY: IBM® Corp.), and Excel® (Microsoft® version 16.32). Significance was indicated by  $p < 0.05$ . Chi-square tests and Satterthwaite or pooled  $t$ -tests were used where appropriate. Multivariate regression analysis was carried out using modeling based upon significantly different variables where  $p < 0.05$ .

## RESULTS

From 2010 to 2014, HCUP identified a total of 37,312,324 patients; 2,675,783 (7.17%) were rural and 34,146,602 (91.52%) were urban (Figure 1; Table 1). This was an expected distribution of patients, with more patients within the urban group and less within the rural group. Within these groups, some patients had no NCHS rural-urban code, hence a small portion of non-coded and non-grouped patients were kept out of statistical analysis. Of these, 12,476 patients were captured who had a diagnosis code of esophageal cancer or carcinoma in situ of the esophagus; 982 (7.87%) were rural and 11,275 (90.37%) were urban. Of these, 2,877 patients diagnosed with esophageal cancer underwent esophagectomy; 228 were rural patients (7.92%) and 2,575 were urban (89.50%). Seventy-four (2.57%) patients had no NCHS rural-urban code and were left within the groups but not within statistical sub-group analysis.

In comparing baseline characteristics, rural patients, as compared to urban patients, had no differences in age, sex, or insurance status (Table 1). There were significant differences in income, with rural patients being more likely to fall into a lower income quartile than urban patients (53.07% rural patients in the first quartile compared to 19.26% urban patients,  $p < 0.0001$ ). The urban patients were a more racially diverse population, though rural patients were more likely to be Native American (2.63% compared to 0.39%,  $p < 0.0001$ ).

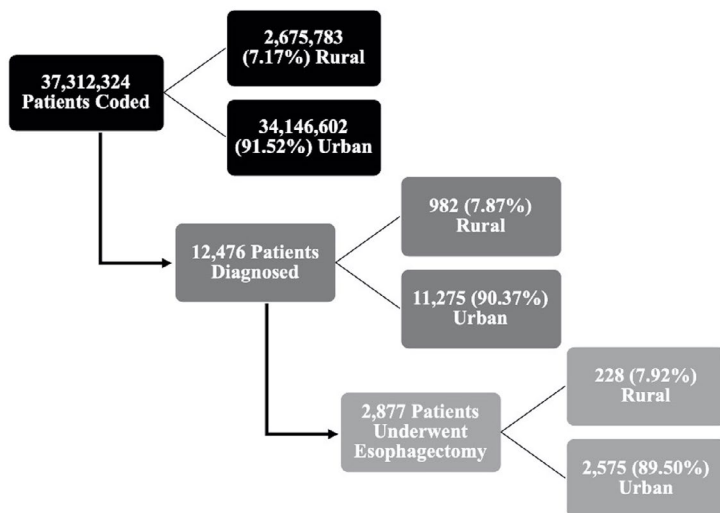


Figure 1. Patient selection was from the Healthcare Cost and Utilization Project database and included all patients coded within the database, those diagnosed with esophageal cancer, and those who underwent esophagectomy for cancer. Only patients who underwent esophagectomy were studied.

Rural patients were more likely than urban patients to have diabetes (24.56% vs. 18.56%,  $p = 0.0271$ ) and fluid and electrolyte disorders (45.61% vs. 35.53%,  $p = 0.0024$ ), while urban patients were more likely to have anemia (13.16% vs. 35.53%,  $p = 0.0299$ ; Table 2). History of drug abuse between rural and urban patient population was not statistically significant ( $p = 0.0855$ ).

There was no difference between rural and urban patients with respect to the treating hospital bed size, urban teaching status, or volume of total hospital discharges (Table 3). While rural patients were more likely to be treated at rural hospitals (4.39% vs. 1.35%,  $p = 0.0010$ ), there was no difference in the percent of rural and urban patients treated at urban teaching hospitals. Rural patients were more likely to live in the Midwest (40.79% vs. 26.37%) and Southern U.S. (39.04% vs. 34.80%), while urban patients were more likely to live in the Northeast (11.40% vs. 23.96%) and Western (8.77% vs. 14.87%) regions ( $p < 0.0001$ ).

A description of major outcomes was carried out and described (Table 4). No difference was found in length of stay between rural and urban patients. No difference existed between in-hospital mortality or total charges. Discharge disposition did not reach statistical significance on univariate analysis, but there was a trend for rural patients to more likely be discharged home compared to urban patients, who were more often discharged home with home health services. Both groups appeared to go home with home health services more often than they were discharged to home. Multivariate analysis showed rural patients may be statistically more likely than urban patients to be discharged home than other dispositions (35.96% vs. 29.79%, OR 0.667 [95% CI 0.479 - 0.929];  $p = 0.0167$ ).

## DISCUSSION

This study showed that within a nationally representative group of patients with esophageal cancer undergoing esophagectomy, living in a rural setting did not portend a higher risk of inpatient mortality, a longer length of stay, discharge to a higher level of care, or higher cost of care. While a minority of patients may be receiving complex esophageal surgery for cancer at rural hospitals, the majority of the rural-urban population received their cancer care at urban teaching institutions. The clinical significance of the rural patient receiving surgery at rural centers was unable to be answered with this study, but other studies attempted to study this problem using travel distance to hospitals, hospital location, or hospital volume as surrogates for rurality of patient and outcome. However, there was a consensus that patients should receive complex operations requiring extended recoveries at high-volume centers with teams experienced in their perioperative care.

Within our study, the urban population was more likely to be more diverse and have a higher income. Urban populations historically have been more diverse than rural populations and our findings concur with this. While rural patients were more likely to receive care at a rural hospital, the majority of patients received care at an urban teaching facility. This was reassuring that complex care is sought at large facilities that are likely tertiary/quaternary referral centers with multiple studies

**Table 1. Demographics of patients undergoing esophagectomy for cancer.**

	Total	Rural (n; %)	Urban (n; %)	p Value
All HCUP patients 2010 - 2014	37,312,324	2,675,783 (7.17%)	34,146,602 (91.52%)	
Diagnosed with esophageal cancer	12,476	982 (7.87%)	11,275 (90.37%)	
<b>Underwent esophagectomy</b>	<b>2,877</b>	<b>228 (7.92%)</b>	<b>2,575 (89.50%)</b>	0.7858
<b>Mean age, years (± SD)</b>	64 (9.72)	63.11 (10.01)	63.62 (9.70)	0.4511
<b>Male (n; %)</b>	2,351 (81.72%)	192 (84.21%)	2,098 (81.48%)	0.3060
<b>Race (n; %)</b>				
White	2,262 (78.62%)	176 (77.19%)	2,027 (78.72%)	< 0.0001
Black	166 (5.77%)	10 (4.39%)	148 (5.75%)	
Hispanic	111 (3.86%)	3 (1.32%)	104 (4.04%)	
Asian or Pacific Islander	25 (0.87%)	0 (0.00%)	25 (0.97%)	
Native American	16 (0.56%)	6 (2.63%)	10 (0.39%)	
Other	60 (2.09%)	2 (0.88%)	55 (2.14%)	
<b>Insurance status (n; %)</b>				
Medicare	1,336 (46.44%)	110 (48.25%)	1,194 (46.37%)	0.4667
Medicaid	221 (7.68%)	23 (10.09%)	194 (7.53%)	
Private insurance	1,203 (41.81%)	87 (38.16%)	1,080 (41.94%)	
Self-pay	34 (1.18%)	1 (0.44%)	32 (1.24%)	
No charge	6 (0.21%)	0 (0.00%)	6 (0.23%)	
Other	72 (2.50%)	7 (3.07%)	64 (2.49%)	
<b>Income quartile (n; %)</b>				
0 to 25th percentile	626 (21.76%)	121 (53.07%)	496 (19.26%)	< 0.0001
26th to 50th percentile	740 (25.72%)	68 (29.82%)	663 (25.75%)	
51st to 75th percentile	743 (25.83%)	31 (13.60%)	693 (26.91%)	
76th to 100th percentile	710 (24.68%)	1 (0.44%)	683 (26.52%)	

HCUP: Healthcare Cost and Utilization Project

**Table 2. Comorbidities of population undergoing esophagectomy for cancer.**

	Total 2,877	Rural (n; %) 228 (7.92%)	Urban (n; %) 2,575 (89.50%)	p Value
<b>AHRQ comorbidities (n; %)</b>				
Fluid and electrolyte disorders	1,048 (36.43%)	104 (45.61%)	915 (35.53%)	0.0024
Anemia	542 (18.84%)	30 (13.16%)	497 (19.30%)	0.0229
Diabetes, uncomplicated	554 (19.26%)	56 (24.56%)	478 (18.56%)	0.0271
Drug abuse	35 (1.22%)	0 (0.00%)	33 (1.28%)	0.0855
Acquired immunodeficiency syndrome	5 (0.17%)	0 (0.00%)	3 (0.12%)	0.6061
Alcohol abuse	145 (5.04%)	12 (5.26%)	125 (4.85%)	0.7838
Rheumatoid arthritis	45 (1.56%)	6 (2.63%)	39 (1.51%)	0.1984
Chronic blood loss anemia	49 (1.70%)	4 (1.75%)	45 (1.75%)	0.9940
Congestive heart failure	145 (5.04%)	15 (6.58%)	126 (4.89%)	0.2643
Chronic pulmonary disease	640 (22.25%)	58 (25.44%)	575 (22.33%)	0.2820
Coagulopathy	214 (7.44%)	21 (9.21%)	187 (7.26%)	0.2820
Depression	231 (8.03%)	18 (7.89%)	207 (8.04%)	0.9388
Diabetes, with chronic complications	65 (2.26%)	5 (2.19%)	58 (2.25%)	0.9537
Hypertension	1,613 (56.07%)	134 (58.77%)	1,434 (55.69%)	0.3689
Hypothyroidism	218 (7.58%)	12 (5.26%)	201 (7.81%)	0.1649
Liver disease	83 (2.88%)	5 (2.19%)	72 (2.80%)	0.5933

**Table 2. Comorbidities of population undergoing esophagectomy for cancer. continued.**

	Total 2,877	Rural (n; %) 228 (7.92%)	Urban (n; %) 2,575 (89.50%)	p Value
<b>AHRQ comorbidities (n; %)</b>				
Lymphoma	16 (0.56%)	2 (0.88%)	14 (0.54%)	0.5217
Metastatic cancer	487 (16.93%)	45 (19.74%)	424 (16.47%)	0.2047
Neurological disorders	90 (3.13%)	12 (5.26%)	78 (3.03%)	0.0666
Obesity	279 (9.70%)	25 (10.96%)	246 (9.55%)	0.4894
Peripheral vascular disorders	145 (5.04%)	13 (5.70%)	131 (5.09%)	0.6871
Psychoses	80 (2.78%)	5 (2.19%)	73 (2.83%)	0.5722
Pulmonary circulation disorders	68 (2.36%)	3 (1.32%)	64 (2.49%)	0.2678
Renal failure	154 (5.35%)	8 (3.51%)	143 (5.55%)	0.1900
Valvular heart disease	106 (3.68%)	7 (3.07%)	96 (3.73%)	0.6128
Weight loss	662 (23.01%)	47 (20.61%)	591 (22.95%)	0.4198
<b>APR DRG risk of mortality (n; %)</b>				
Minor likelihood of dying	854 (29.68%)	59 (25.88%)	782 (30.37%)	0.4312
Moderate likelihood of dying	807 (28.05%)	73 (32.02%)	716 (27.81%)	
Major likelihood of dying	762 (26.49%)	59 (25.88%)	670 (26.02%)	
Extreme likelihood of dying	454 (15.78%)	37 (16.23%)	407 (15.81%)	
<b>APR DRG severity of illness (n; %)</b>				
Moderate loss of function	510 (17.73%)	39 (17.11%)	466 (18.10%)	0.8815
Major loss of function	1,602 (55.68%)	126 (55.26%)	1,431 (55.57%)	
Extreme loss of function	765 (26.59%)	63 (27.63%)	678 (26.33%)	
<b>Elective admission (n; %)</b>	2,690 (93.50%)	207 (90.79%)	2,413 (93.71%)	0.0698

AHRQ: Agency for Healthcare Research and Quality; APR DRG: All Patients Refined Diagnosis Related Group

**Table 3. Hospital variables of patients undergoing esophagectomy for cancer.**

	Total 2,877	Rural (n; %) 228 (7.92%)	Urban (n; %) 2,575 (89.50%)	p Value
<b>Hospital size, beds (n; %)</b>				
Small	259 (9.00%)	23 (10.09%)	236 (9.17%)	0.8473
Medium	400 (13.90%)	32 (14.04%)	368 (14.29%)	
Large	2,126 (73.90%)	167 (73.25%)	1,959 (76.08%)	
<b>Location/teaching status of hospital (n; %)</b>				
Rural	45 (1.56%)	10 (4.39%)	35 (1.36%)	0.0010
Urban non-teaching	337 (11.71%)	21 (9.21%)	314 (12.19%)	
Urban teaching	2,477 (86.10%)	191 (83.77%)	2,214 (85.98%)	0.3598
<b>Urban-rural classification of county (n; %)</b>				
"Central" counties of metro areas ≥ 1 million population	654 (22.73%)	0 (0.00%)	654 (25.40%)	< 0.0001
"Fringe" counties of metro areas ≥ 1 million population	756 (26.28%)	0 (0.00%)	756 (29.36%)	
Counties in metro areas of 250,000 - 999,999 population	561 (19.50%)	0 (0.00%)	561 (21.79%)	
Counties in metro areas of 50,000 - 249,999 population	282 (9.80%)	0 (0.00%)	282 (10.95%)	
Micropolitan counties	322 (11.19%)	0 (0.00%)	322 (12.50%)	
Not metropolitan or micropolitan counties	228 (7.92%)	228 (100.00%)	0 (0.00%)	
<b>Hospital region (n; %)</b>				
Northeast	711 (24.71%)	26 (11.40%)	617 (23.96%)	< 0.0001
Midwest	774 (26.90%)	93 (40.79%)	679 (26.37%)	
South	989 (34.38%)	89 (39.04%)	896 (34.80%)	
West	403 (14.01%)	20 (8.77%)	383 (14.87%)	
<b>Total hospital discharges (mean; SD)</b>	1,914.344 (21,011.52)	1,769.26 (17,764.30)	18,553.60 (20,990.50)	0.4905

**Table 4. Outcomes of patients undergoing esophagectomy for cancer with regression analysis.**

	Total 2,877	Rural (n; %) 228 (7.92%)	Urban (n; %) 2,575 (89.50%)	p Value	Odds ratio	95% CI	p Value
<b>Mean length of stay, days (± SD)</b>	15.62 (14.82)	15.75 (13.22)	15.55 (14.91)	0.8278	N/A	(-7.39 - 2.28)	0.3650
<b>Died during hospitalization (n; %)</b>	119 (4.14%)	9 (3.95%)	110 (4.27%)	0.8149	1.64	(0.694 - 3.887)	0.2995
<b>Disposition</b>							
Short-term hospital for inpatient care	855 (29.72%)	82 (35.96%)	767 (29.79%)	0.4911	0.667	(0.479 - 0.929)	0.0167
Discharged to designated cancer center	42 (1.46%)	4 (1.75%)	28 (1.09%)				
Home health service	493 (17.14%)	38 (16.67%)	446 (17.32%)				
Left against medical advice or discontinued care	1,362 (47.34%)	95 (41.67%)	1,218 (47.30%)				
Expired	4 (0.14%)	0 (0.00%)	4 (0.16%)				
Discharged alive	119 (4.14%)	9 (3.95%)	110 (4.27%)				
Destination unknown	1 (0.03%)	0 (0.00%)	1 (0.04%)				
<b>Total charges, dollars (± SD)</b>	194,606.02 (218,991.47)	179,462.28 (203,208.39)	194,581.40 (221,433.01)	0.3214	N/A	(-66,708 - 75,990)	0.8980

describing improved outcomes at these high-volume centers.<sup>6,7,9,10</sup> A multivariate regression analysis showed rural patients may be more likely than urban patients to be discharged home. This was difficult to describe further and may be an excellent area of research; why are patients from rural areas undergoing complex surgery discharged home more often urban patients? Possible theories are that if they are at an urban facility a half-day or days drive from their home, then they might stay slightly longer to rehabilitate before a direct discharge to home compared to discharge to a local rehabilitation facility. More research in this area is needed. Unsurprisingly, rural patients were more likely to be from the south and Midwest regions compared to urban patients from the west and northeast regions of the U.S.

Patients in rural areas with cancer diagnoses may face multiple challenges in obtaining the same care as urban patients. This includes barriers to transportation, finance issues, limited trials, and even access to oncologists, as only 3% of the nation's oncologists work in rural areas.<sup>21,22</sup> Solutions often include telemedicine (i.e., consultation, tumor boards), outreach clinics, incentivizing work or education in these areas, and traveling screening options. For cancer screening, some advocate imaging or laboratory-based screening over procedure-based screening, when possible, for example in colorectal cancer screening.<sup>23</sup>

Few epidemiologic data existed on the rural-urban differences in esophageal cancer in North America. Wang et al.<sup>24</sup> studied the Surveillance, Epidemiology, and End Results (SEER) Program, finding similar incidence of esophageal cancer in metropolitan, urban, and rural patients, as well as similar survival and late-stage diagnosis. Disagreement on whether SEER was generalizable to populations of certain geographic locations and caution must be used in interpreting such results.<sup>25</sup> Studies from China and other countries described the differences in the rate of esophageal cancer incidence and presentation stage depending on rural status or region of residence.<sup>15,16,26</sup> Location data were not available for other large databases such as the National Surgical Quality Improvement Program or Society of Thoracic Surgeons,

limiting our comparison to other large databases using procedures.<sup>1</sup> An epidemiologic study of esophageal cancer using this database was outside the scope of our study. While esophageal cancer is typically squamous cell subtype in these regions compared to adenocarcinoma subtype in Western populations, this observation of epidemiologic rural-urban difference is important.

Treatment of the rural and urban esophageal cancer populations varies and may lead to different outcomes. Wasif and colleagues<sup>17</sup> used the National Cancer Database to find a correlation between the decreased use of high-volume centers for esophagectomy in populations of African American patients, the uninsured, and patients residing in low educational zip codes. High-volume was defined by some as greater than 20 cases per year.<sup>12</sup> Cushman and colleagues<sup>27</sup> used the same database to study the T4b esophageal cancer population, finding rural patients significantly more likely to undergo surgery, possibly due to travel distance or surgeon concern that surveillance would be difficult. Lin et al.<sup>28</sup> found rural patients possibly may use radiation therapy less than urban patients, but this result did not reach statistical significance.

The findings of this study showed minimal differences in outcomes between rural and urban patient populations and should be interpreted cautiously considering the limitations of its retrospective analysis of administrative data. Our level of evidence was inferior to a prospective study that would enroll rural and urban patients. The administrative nature of the data created possible misclassification and was subject to recall bias. With cancer diagnoses within the NIS, it was difficult to study the stage and severity of oncologic burden. Furthermore, the database lacked the ability to study conditions that were comorbidities versus diagnoses that arose or were discovered during hospitalization (complications). Along these same lines, the database lacked granular clinical data, such as that which existed in other surgical databases or oncologic databases.

Additionally, there was the limitation of the ICD system, which changed in 2015 to its tenth edition.<sup>18,20</sup> This created major issues for

those who would want to look at trends over time, specifically those looking at procedure codes. The NIS database also changed in 2012 to include a sample of all hospital discharges, instead of a sample of hospitals and all their discharges.<sup>18</sup> This change primarily affected those looking at trends over time and should not have affected this study. Finally, while the database was large enough to detect small differences in a population, the question often was raised whether it was clinically relevant for the thoracic surgeon or oncologist. Within our own study, a 5 - 10% difference in anemia, electrolyte disorders, or diabetes likely had little effect on outcomes after surgery and treatment between the rural and urban populations.

The advantages and strengths of this study were inherent in the direct comparison of the two populations of patients, rather than using hospitals or distance to describe rurality. The NIS database allowed for a large sample size, giving the study more power. Since the database was representative of all inpatient hospitalizations in the U.S., it was useful in describing costs, observing trends over time, and creating basic descriptive studies and estimates. The database was an acceptable representation of a national population.

## CONCLUSIONS

This study was unique in its direct comparison of rural and urban patients undergoing esophagectomy for esophageal cancer. While it lacked in the ability to provide granular data, oncologic staging, or long-term outcomes, it was novel in that it demonstrated a difference in two populations of patients with respect to their income, race, and nationwide region of residence, and was reassuring in demonstrating what appeared to be little difference in outcomes between rural and urban patients. Within the rural population, further research is necessary to understand access to esophageal cancer treatment and surgery as well as epidemiologic disparities and long-term follow up and surveillance. The study findings should provide motivation to understand differences in populations of patients undergoing complex surgery and multidisciplinary treatment for cancer. Specific research questions should look at disposition after complex oncologic surgery and access to care for rural and remote populations.

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