

Sara E. A. Nunnally, MD<sup>1</sup>; Charles D. Logan, MD<sup>1,2</sup>; Catherine Valukas, MD<sup>1,2</sup>; Samantha Warwar, MD<sup>1</sup>; Joanna T. Swinarska, MD<sup>1</sup>; Frances T. Lee, MD<sup>1</sup>; David J. Bentrem, MD MS<sup>1</sup>; David D. Odell, MD MMSc<sup>1,2</sup>; Dina M. Elaraj, MD<sup>1</sup>; Cord Sturgeon, MD<sup>1</sup>

<sup>1</sup>Northwestern Quality Improvement, Research, & Education in Surgery (NQUIRES), Department of Surgery, Northwestern Medicine, Chicago, IL  
<sup>2</sup>Canning Thoracic Institute, Department of Surgery, Northwestern Medicine, Chicago, IL

## Introduction

Regionalization of care is associated with improved perioperative outcomes after adrenalectomy but may lead to increased travel distance for patients. However, the relationship between travel distance and treatment of adrenocortical carcinoma (ACC) is unknown. Our objective is to investigate the association between travel distance, treatment, and overall survival (OS) among patients with ACC.

## Methods

Patients diagnosed with ACC between 2004-2017 were identified with the National Cancer Database (NCDB). Long distance was defined as the highest quintile of patient travel (>42.2 miles). Likelihood of surgical versus non-surgical management (chemotherapy, chemoradiation, radiotherapy, or observation) and receipt of adjuvant chemotherapy were determined. The association between travel distance, treatment, and OS was evaluated.

## Results

Of 3,492 patients with ACC included, 2,337 (66.9%) had surgery and 1,155 (33.1%) had non-surgical management. In covariate adjusted models, surgery was associated with improved OS versus non-surgical management (HR 0.50, 95% CI 0.45-0.55).

Rural residents were more likely to travel long distances for surgical treatment than metropolitan residents (65.8% versus 15.5%,  $p < 0.001$  [TABLE 3]). Median travel distance for surgical treatment was higher for rural versus metropolitan residents (54.5, IQR 33.5-87.0 versus 11.0, IQR 5.2-26.1 miles;  $p < 0.001$  [TABLE 3]).

Among patients treated near their home (<4.4 miles), rural residents were less likely to receive surgery than metropolitan residents (IRR 0.35, 95% CI 0.13-0.96). Overall, 807 (23.1%) patients received adjuvant chemotherapy with rates decreasing approximately 1% for every 4-mile increase in travel distance (FIGURE 1).

For rural residents who travel long-distance, surgery was associated with superior OS (HR 0.67, 95% CI 0.48-0.92) versus rural residents who received non-surgical management. However, among surgically treated patients overall, long-distance travel was associated with worse OS (HR 1.21, 95% CI 1.05-1.40 [FIGURE 2]).

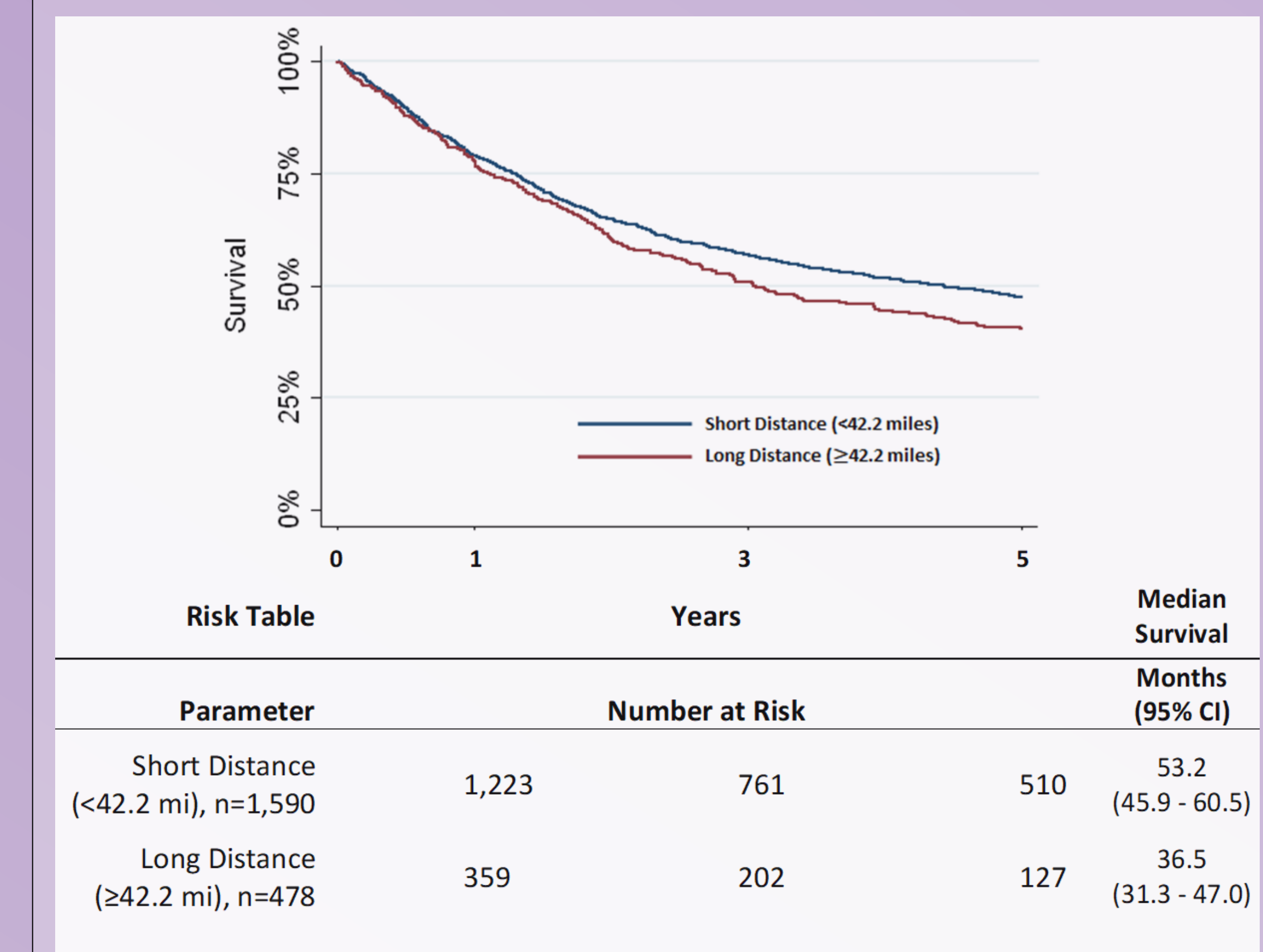
**Table 1. Characteristics of surgically treated patients by rurality: 2004-2017**

	Total	Non-rural	Rural	
	2,072*	1,759	313	
<i>Parameter</i>	%	%	%	<i>P-value</i>
Travel distance, median (IQR)	14 (6-38)	11 (5-26)	54 (33-87)	<0.001
Age, median (IQR)	55 (44-66)	55 (44-66)	56 (46-66)	
<i>Sex</i>				0.44
Female	39.6	39.2	41.5	
Male	60.4	60.8	58.5	
<i>Travel distance (miles)</i>				<0.001
<42.2	76.9	84.5	34.2	
≥42.2	23.1	15.5	65.8	
<i>Treatment</i>				0.08
Surgical resection	68.7	67.9	72.8	
Surgery w/ adjuvant therapy	31.3	32.1	27.2	

IQR, Interquartile range

\*Defined as "surgery at reporting facility" per NCDB database

**Figure 2. Association between long travel distance (≥ 42.2 miles) and overall survival for surgically treated patients**



**Figure 1. Association between travel distance and receipt of adjuvant chemotherapy**

<b>Distance (miles)</b>	<b>IRR (95% CI)*</b>	For approximately every <b>four-mile increase</b> in travel distance, the <b>rate of adjuvant chemotherapy decreases approximately 1%.</b>
<42.2 miles	Reference	
≥42.2 miles	<b>0.997 (0.996-0.999)</b>	



\*Likelihood of receipt of adjuvant chemotherapy

IRR, Incidence Rate Ratio; CI, Confidence Interval

## Conclusions

Surgery was associated with improved OS compared to non-surgical management, but only 17.6% of rural residents who sought care close to home were treated surgically. 63.6% of rural residents treated surgically traveled greater than 42.2 miles for care. Unfortunately, among those treated surgically, increased travel distance was associated with decreased overall survival and lower likelihood of receipt of adjuvant therapies. Continued efforts to understand the reasons for rural and travel distance disparities in access to oncological services and patient survival may yield targets for future improvement initiatives.