

# Outcomes After Endovascular Stroke Therapy in High Versus Low Volume Centers

Hamidreza Saber, Babak Navi, Hooman Kamel, Conrad W. Liang, Peng Roc Chen, Spiros L. Blackburn, Albert J. Yoo, Farhaan S. Vahidy, Sean I. Savitz, **Sunil A. Sheth**

Assistant Professor  
Department of Neurology  
UT Health McGovern School of Medicine  
Houston, Texas

Stroke

JOURNAL OF THE AMERICAN HEART ASSOCIATION



# Disclosures

## **Grants/Research Support:**

- American Academy of Neurology, Society for NeuroInterventional Surgery Foundation, Society for Vascular and Interventional Neurology Career Development Award
- The University of Texas Rising STARs Award

## **Unlabeled/Unapproved Uses Disclosures:**

None

I **do not** have relevant financial relationships with commercial interests related to the content of this presentation.

# Introduction

- Stroke systems of care are faced with the daunting task of ensuring that patients with AIS have access to EST screening and treatment.
- The evidence of benefit for EST that emerged from these trials was derived from treatments rendered almost exclusively at high volume stroke centers.
- Given the rapid decrement in outcome with treatment delays, there has been an increase in demand for dissemination of the treatment away from tertiary-care referral centers into the community
- Little is known about real-world practice and outcomes of EST. In this study, we examined practice patterns of EST over a 10-year period in a large cohort, and evaluated the association between clinical outcomes and hospital treatment volumes.

# Methods

**Study Design:** Retrospective cross-sectional study, using HCUP State Inpatient Database (SID) and State Emergency Department Database (SEDD) on all discharges from nonfederal acute care hospitals in Florida from 2006 - 2016. And Nationwide Inpatient Sample from 2012 - 2016.

## **Methods:**

Patients were identified using ICD-9 and ICD-10 diagnosis and procedure codes. Ischemic stroke was defined using previously validated codes. EST was defined as procedure code 39.74 or 03CG3ZZ and a corresponding code for ischemic stroke. IV tPA treatment was defined as procedure code 99.10 or 3E03317 and a corresponding code for ischemic stroke

Patients in the FL cohort were identified in SID and then cross-referenced in SEDD to identify any patients that received IV tPA at a different hospital or were transferred from one hospital to another for EST.

Patients were excluded if they had any diagnosis or treatment of AVM, AV fistula, prior ICH or SAH or trauma.

**Outcomes:** Primary endpoint was discharge disposition.

# Statistical Analysis

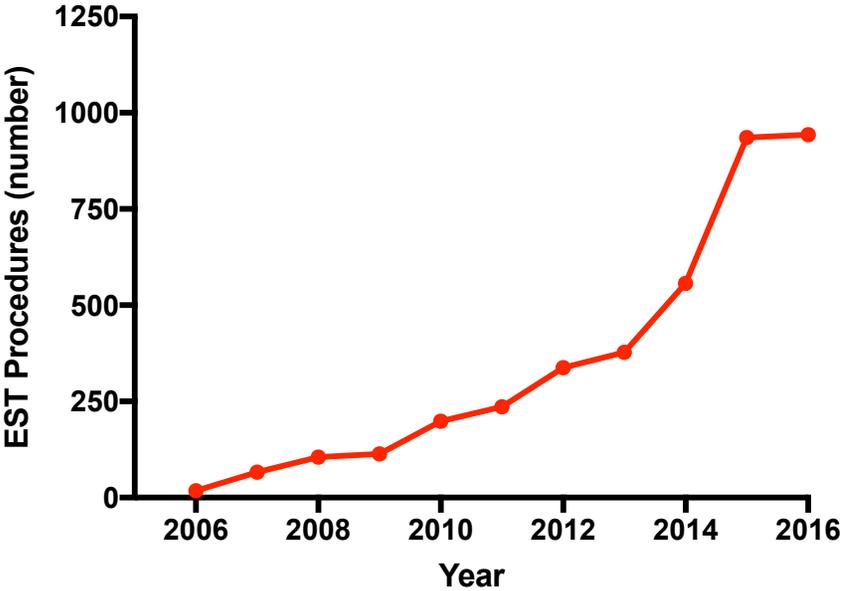
- Analyses using the NIS data were performed using survey design methods, accounting for sampling weights.
- Multivariate logistic regression analyses adjusting for age (in quartiles), sex, race, Charlson index and IV tPA usage were used to evaluate the association between year of treatment and annual EST volume on outcomes.
- Regressions were also adjusted for annual total ischemic stroke discharges, to adjust for non-EST related benefits of higher volume centers.
- Data from 2008 onwards were used in the logistic regression models because annual hospital EST volumes were low before this year.

# Patient Cohort - FL

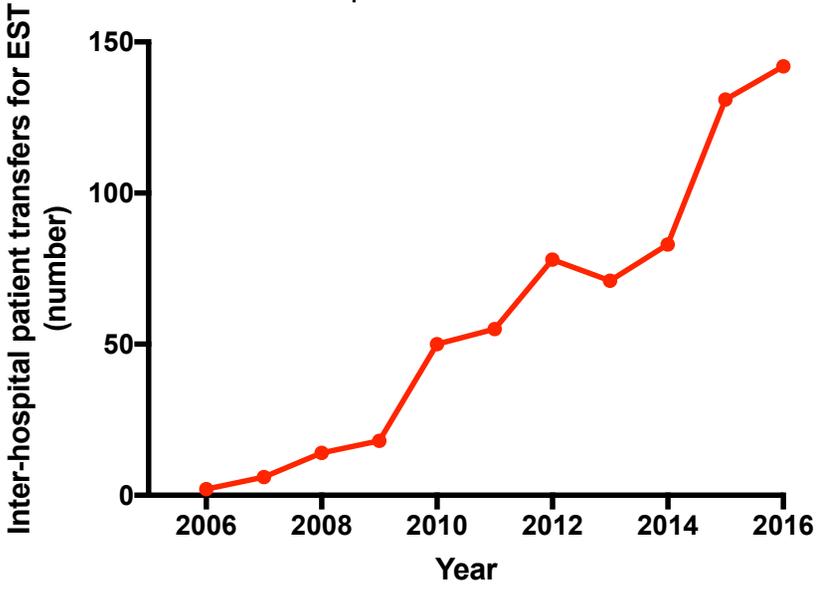
	<b>All Patients (n=3890)</b>	<b>Patients treated at Lower Annual Volume Centers (&gt; 24) (n=1974)</b>	<b>Patients Treated at Higher Annual Volume Centers (≤ 24) (n=1916)</b>
Age (median [IQR])	73 [61 - 82]	72 [60 - 81]	73 [62 - 82]
Female Sex	1997 (51%)	984 (50%)	1013 (53%)
Race			
- White	2311 (61%)	1290 (66%)	1021 (55%)
- Black	612 (16%)	305 (16%)	307 (17%)
- Hispanic	749 (20%)	298 (15%)	451 (24%)
IV tPA	1704 (44%)	983 (50%)	721 (38%)
Comorbidities			
- Hypertension	1815 (47%)	925 (47%)	890 (47%)
- Smoking	359 (9%)	196 (10%)	163 (9%)
- Dyslipidemia	1017 (26%)	487 (25%)	530 (28%)
- Renal Failure	318 (8%)	159 (8%)	159 (8%)
- Diabetes	1056 (27%)	521 (26%)	535 (28%)
- Charlson Index	3 [3-4]	3 [3-4]	3 [2-4]

# Annual Trends - FL

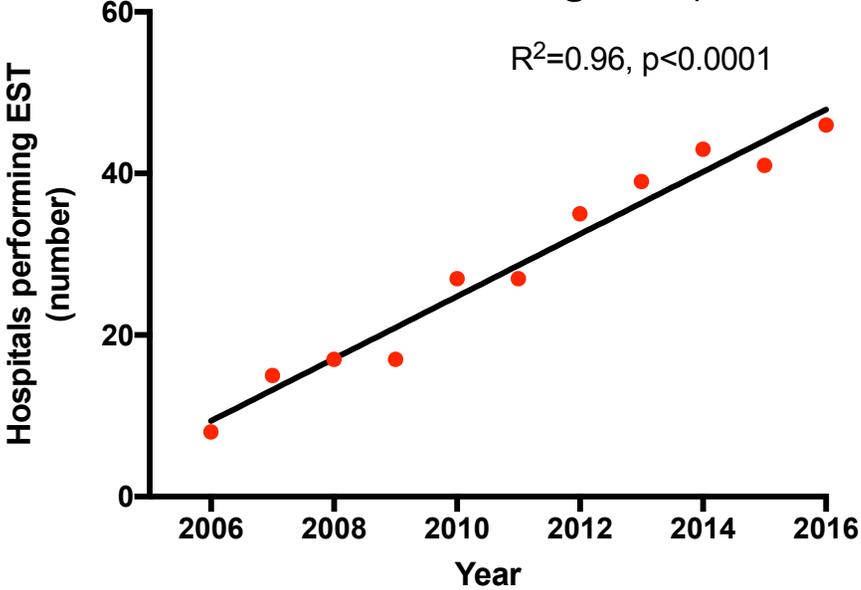
### Annual EST Procedures



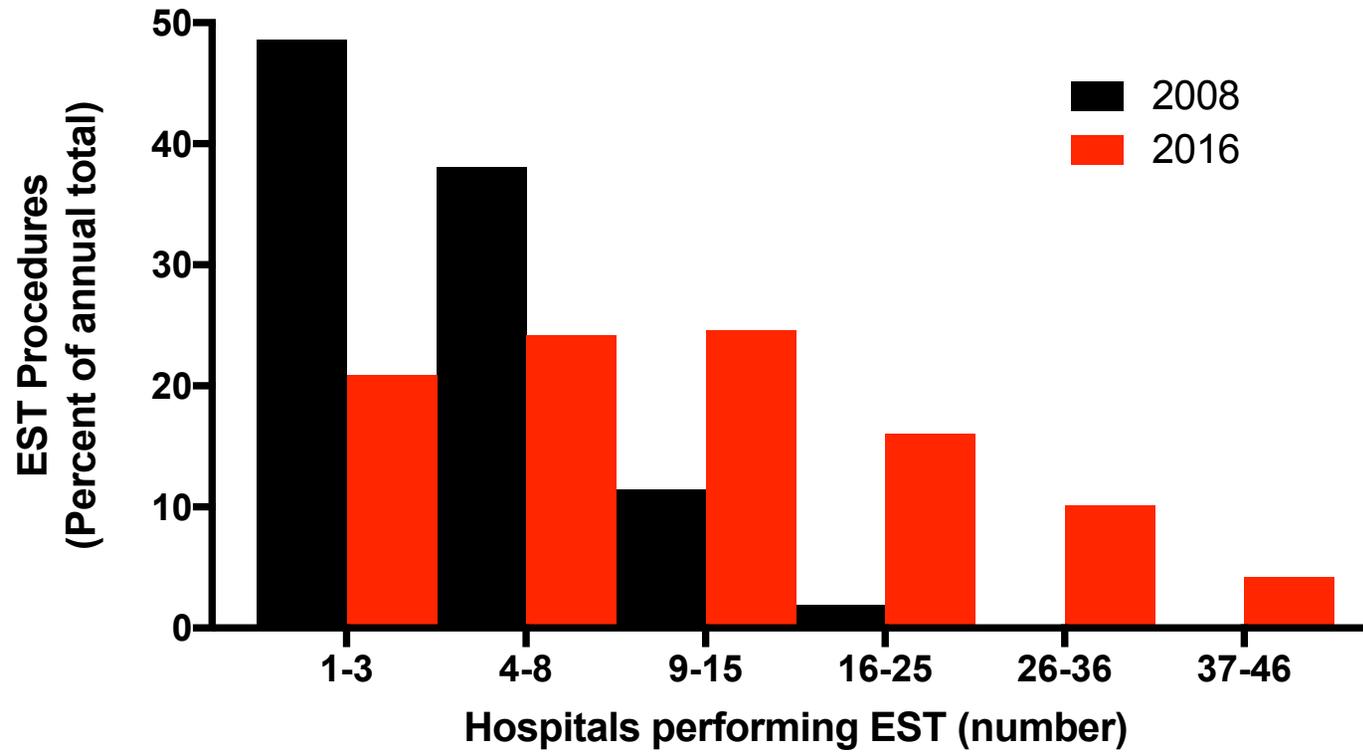
### Inter-hospitals transfers for EST



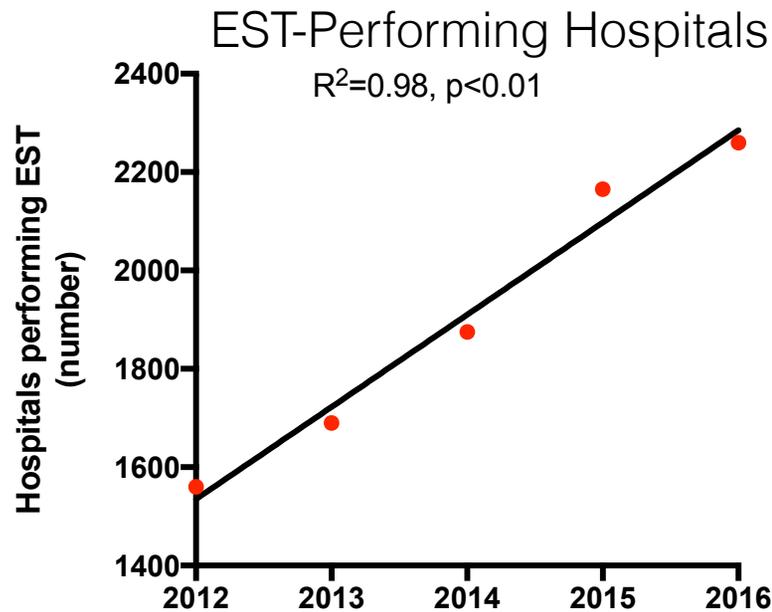
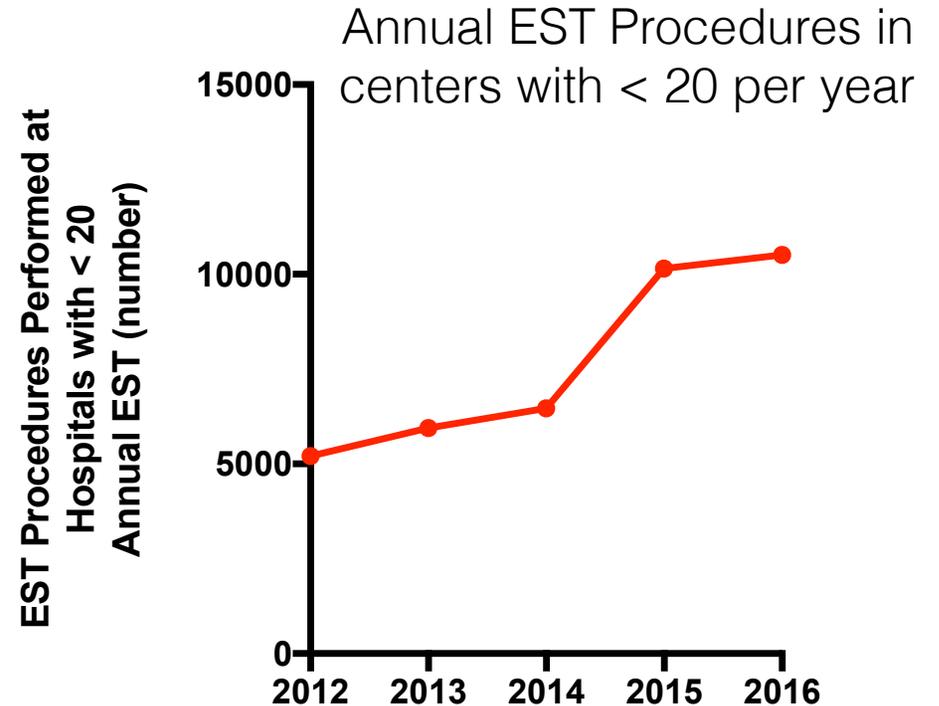
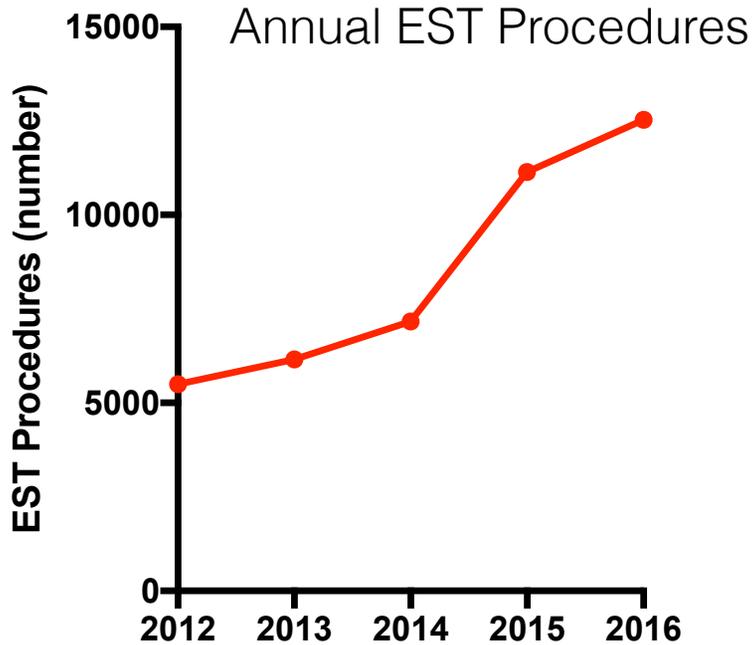
### EST-Performing Hospitals



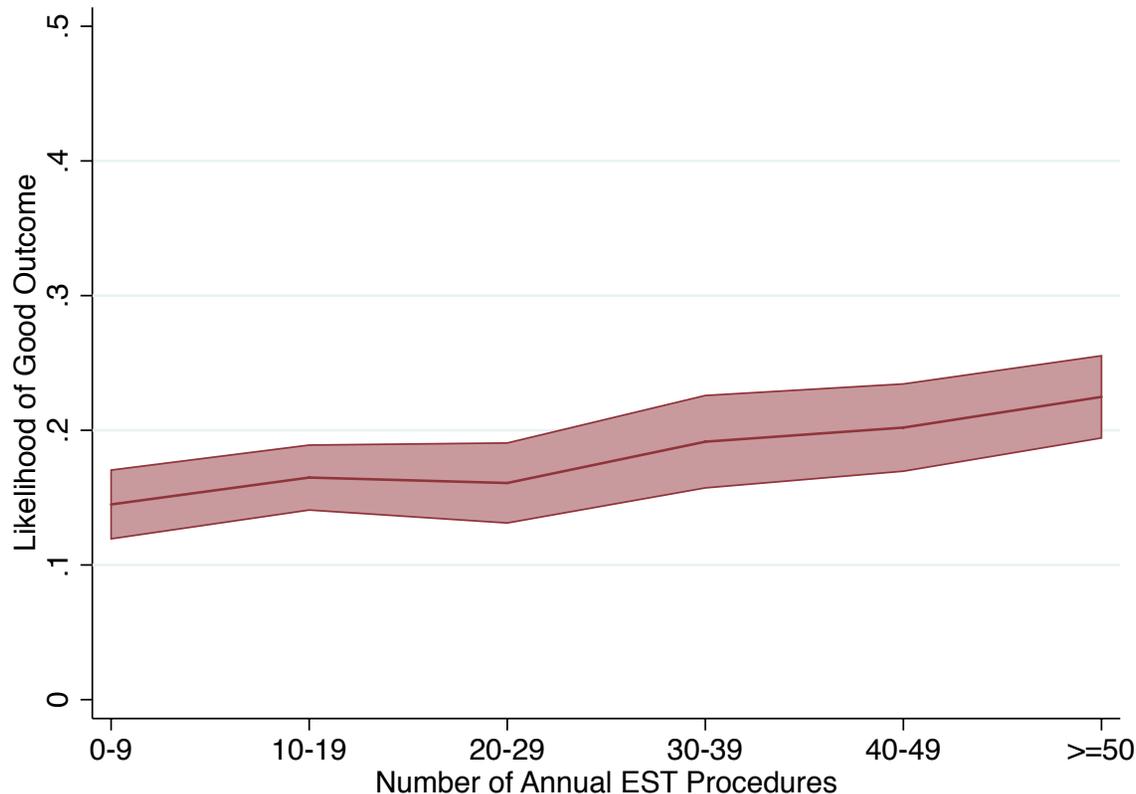
# Annual Trends - FL



# Annual Trends - Nationwide



# Annual Trends - Florida



These findings were maintained in the nation-wide cohort (OR, 1.3; 95% CI, 1.2-1.4). For AIS patients evaluated at EST-capable centers who were not treated with EST in the FL cohort, there was no effect on discharge outcomes by annual hospital EST volume (OR, 0.93; 95% CI, 0.83-1.1).

# Discussion

- There are many proposed solutions to the challenge of how to best deliver EST care: hub-and-spoke, trip-and-treat, thrombectomy-capable, mobile stroke units. Here, we find the number of hospitals providing EST as continuously increasing.
- These are real “real world” data, and we observed a significant effect of hospital volume on discharge outcomes (OR 1.3 per 10 additional annual EST treatments).
- These findings support the idea that the results of the recent EST trials may not be generalizable to every clinical setting.

# Limitations

- Beyond EST volume, there are MANY hospital-specific that affect outcomes after LVO.
- We are unable to account for many patient-specific factors including time of onset, occlusion location, recanalization grade, infarct volume, and others.
- Discharge disposition is not the best outcome measure.

# Conclusions

- In this large population-level study of patients treated with EST from 2006 - 2016, we observed a continuous increase in annual treatment rates and EST-performing hospitals.
- We observed a shift in procedural volume across a substantially greater number of hospitals.
- Patients treated with EST in hospitals with greater annual procedural volume had better discharge outcomes.

# Original Contribution

## Real-World Treatment Trends in Endovascular Stroke Therapy

Hamidreza Saber, MD; Babak B. Navi, MD; James Grotta, MD; Hooman Kamel, MD;  
Arvind Bambhroliya, MBBS; Farhaan S. Vahidy, MBBS; Peng Roc Chen, MD;  
Spiros Blackburn, MD; Sean I. Savitz, MD; Louise McCullough, MD; Sunil A. Sheth, MD

*(Stroke. 2019;50:00-00. DOI: 10.1161/STROKEAHA.118.023967.)*