

# The Economic Impact of the VA National Telestroke Program (NTSP)

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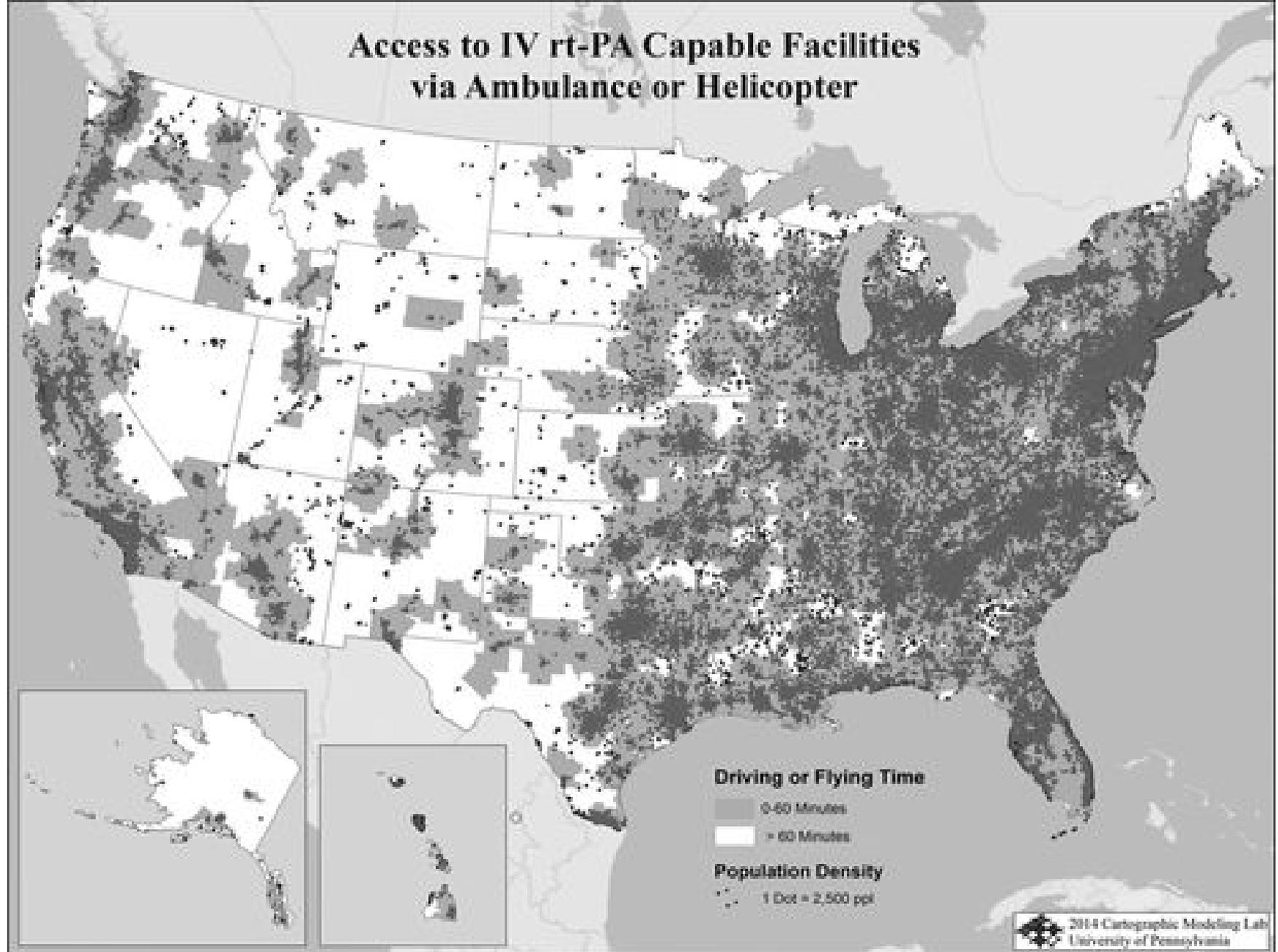
# Acknowledgements

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# Optimal Stroke Care

- Tissue plasminogen activator (tPA) and thrombectomy are the primary treatment options for patients who have an ischemic stroke
- Guidelines recommend that tPA be administered to all eligible acute stroke patients within 3 hours of last known.
- Hospitals should attempt to achieve door-to-needle times of <60 minutes in  $\geq 50\%$  of stroke patients treated with IV tPA.

# Access to IV rt-PA Capable Facilities via Ambulance or Helicopter



# Goals

- Access: within 120 minutes, 99% of the population had access to both intravenous and endovascular hospitals via air or ground.
  - By ground, 81% to tPA, 56% to endovascular-capable hospitals.
  - By air, 97% to tPA and 85% had access to endovascular hospitals.

# Gap

- Routine 3-7% of patients receive tPA according to Medicare data.\*
- The numbers are going up over time (unpublished research).
- Many reasons why:
  - Patient education
  - Urgent routing (EMS, ED)
  - Stroke care at hospital

# Implementation Activities

- Public service announcements
- County and state policies
  - EMS transport to stroke centers
- Programs in the hospital to route patients more urgently

# Stroke in Veterans

- Many Veterans struggle to access specialty health care, because they live far from a VA medical center.
- Veterans may have multiple insurance / benefit options
  - VA
  - Medicare

# Access to Stroke Care

- When Veterans with stroke symptoms arrive at a VA medical center, particularly small and rural hospitals, it may have limited or no access to stroke specialists.
- Not all people with stroke symptoms are having a stroke
  - Stroke
  - Mimics (seizures, migraine, low or high blood sugar, Bell's palsy, tumors / lesions, infections)

# VA National Telestroke Program (NTSP)

- Created in March 2016 to establish a nationwide telestroke program
- NTSP serves Veterans with acute stroke symptoms at VA emergency departments, urgent care centers, and hospitals via hub and spoke model
- When a Veteran presents at a spoke site with acute stroke symptoms, front-line staff call a neurologist at a hub site and then use an iPad to FaceTime a telestroke neurologist.
- The remote neurologist:
  - Examines patient
  - Reviews medical record and CT images
  - Advises local treating physician on diagnosis and recommended treatment
  - Documents recommendations in patient record

# NTSP Growth

- As of February 2021, there are 42 live sites
  - Site #43 scheduled to be live February 9, 2021
- Telestroke consults have grown
  - FY2018: 350 consults
  - FY2019: 1,136 consults
  - FY2020: 1,667 consults

# NTSP Sites (through FY21)

Mather, CA	Atlanta, GA	Bay Pines, FL
Muskogee, OK	Alexandria, LA	Lebanon, PA
Martinsburg, WV	Wilmington, DE	Biloxi, MS
Fort Meade, SD	Reno, NV	White River Junction, VT
Clarksburg, WV	Little Rock, AR	Tucson, AZ
Augusta, ME	New Orleans, LA	Dallas, TX
Marion, IL	Fresno, CA	Phoenix, AZ
San Juan, PR	Albany, NY	Prescott, AZ
Las Vegas, NV	San Antonio, TX	Birmingham, AL
Shreveport, LA	Sioux Falls, SD	Columbia, SC
Orlando, FL	Charleston, SC	Richmond, VA
Washington, DC	Murfreesboro, TN	Nashville, TN
Wilkes-Barre, PA	Long Beach, CA	Albuquerque, NM
Fayetteville, AR	Beckley, WV	Des Moines, IA

# Objectives

- Evaluate the economic impact of NTSP on stroke patients
- Does the NTSP save the VA money in the short term (first year) by providing better stroke care?

# Cohort

- All people who use the NTSP can be categorized in one of two groups
  - Stroke patients
  - Stroke mimics
- These two groups may have very different costs and outcomes

# PRIS-M QUERI

- The Precision Monitoring to Transform Care (PRIS-M) QUERI is based out of the Indianapolis VA
- PRIS-M QUERI conducted chart reviews and some follow-up interviews of patients who used NTSP services
- Created a cohort of patients who had a telestroke consult and had a diagnosis of stroke

# Methods

- All patients had a confirmed stroke through chart review
- The NTSP group included 471 patients who were treated by the NTSP between October 9, 2017 and February 28, 2019 (FY2017-FY2019)
- The control group included 529 patients that arrived at the same VA facilities in the year prior to the site's NTSP activation and were diagnosed with a stroke between October 1, 2016 and September 30, 2018 (FY2017-FY2018).

# Sample

- The 1,000 patients represent 1,023 unique person-strokes with baseline information on the NIH stroke scale at baseline.
- We analyzed person-strokes as the unit of analysis but did a sensitivity analysis keeping only the first stroke of each person; the results are robust.

# Data

- VA cost data from the Managerial Cost Accounting (MCA) database
- VA community care data (purchased care) data were from the Fee files and the PIT files
- For each person, we extracted data for 360 days before and after the stroke
- We summed costs into 24 30-day periods (removing NTSP associated costs)

# Methods

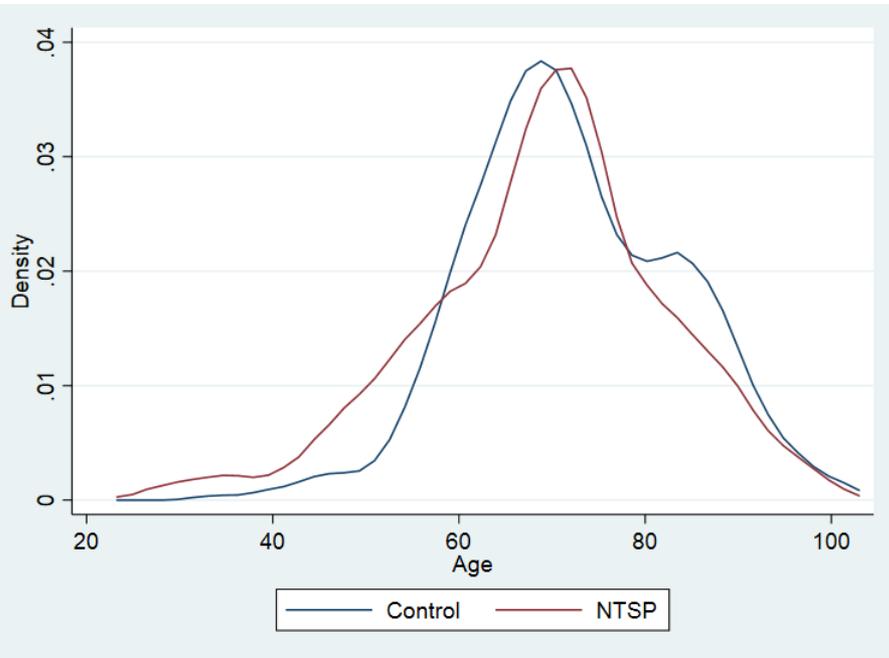
- Graphically examined trends in care over time between NTSP and control patients
- Panel data models
  - Linear model with person fixed effect
  - Linear model with person random effect
  - GEE models (log gamma)

# Patient Characteristics

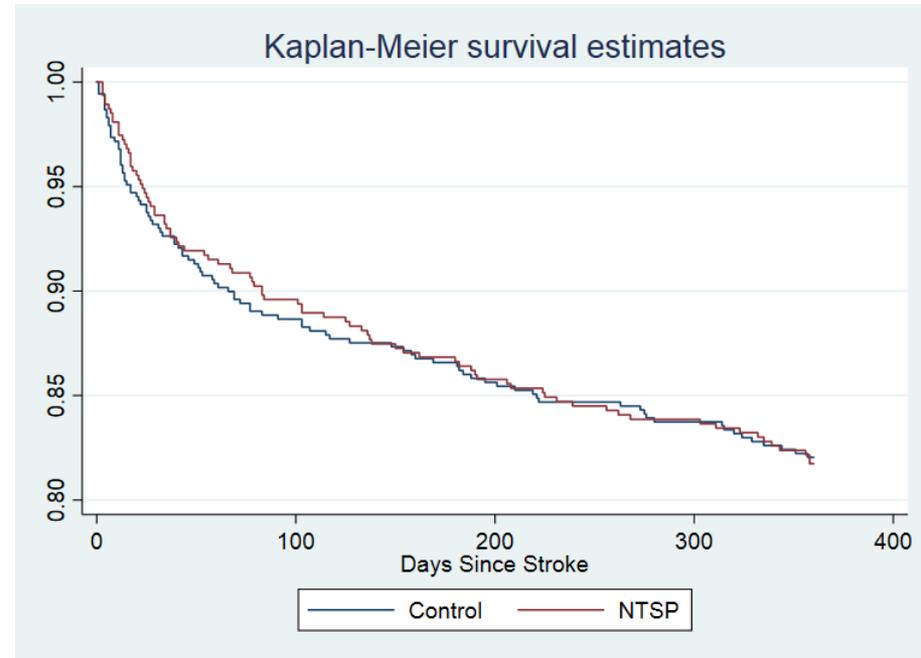
Characteristic	NTSP Group (N=471)	Control Group (N=529)	P-Value
Female sex, # (%)	41 (8.7)	23 (4.35)	0.005***
Avg. age at stroke (SD)	69.1 (13)	72.3 (11)	<0.001***
Ethnicity, Latino, # (%)	47 (9.98)	137 (25.9)	<0.001***
Race, # (%)			
White	304 (64.54)	370 (69.94)	0.07**
Black	117 (24.84)	123 (23.25)	0.56
Asian/Pacific Islander	14 (2.97)	7 (1.32)	0.11
Other	36 (7.64)	29 (5.48)	0.13
Deaths, # (%)	86 (18.3)	96 (18.1)	0.96
Number of Comorbidities	4.18	4.21	0.85
NIH stroke scale at admission			
Mild	305 (64.8)	371 (70.1)	0.07**
Moderate	85 (18.1)	91 (17.5)	0.81
Severe	80 (17.0)	61 (11.3)	0.02**

\*\*p< 0.01 \*\*\*p<0.001

# Age and Mortality

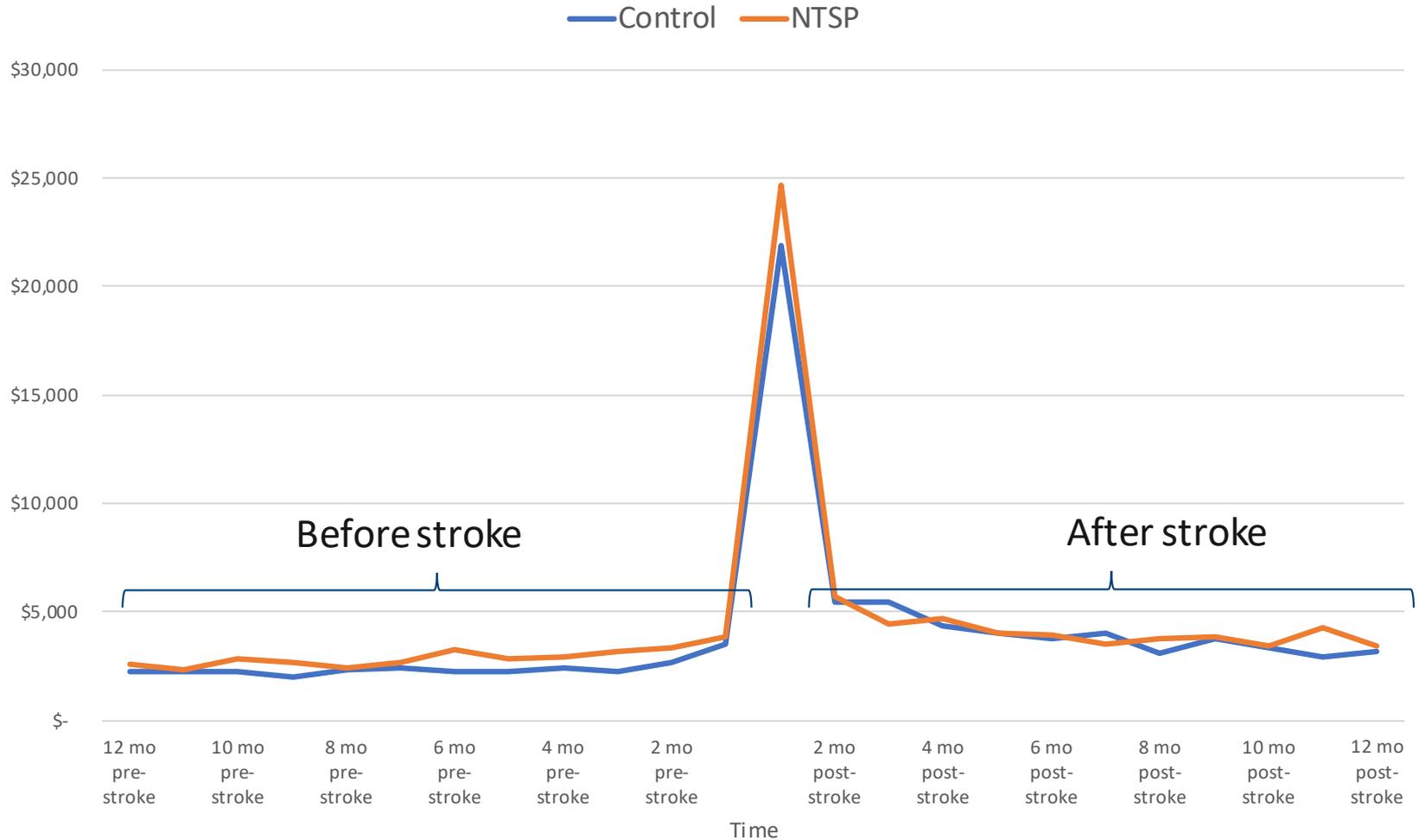


Age

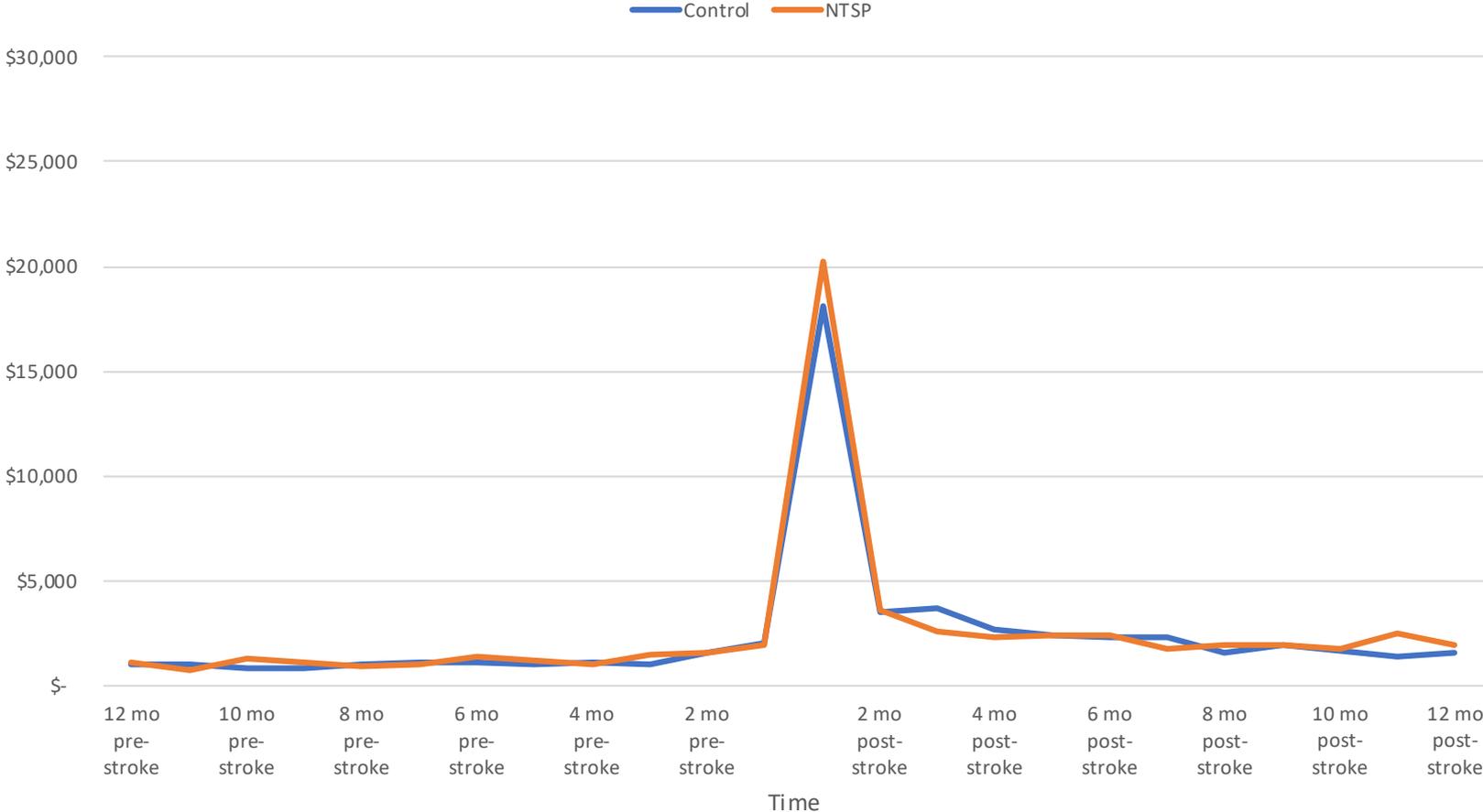


Mortality

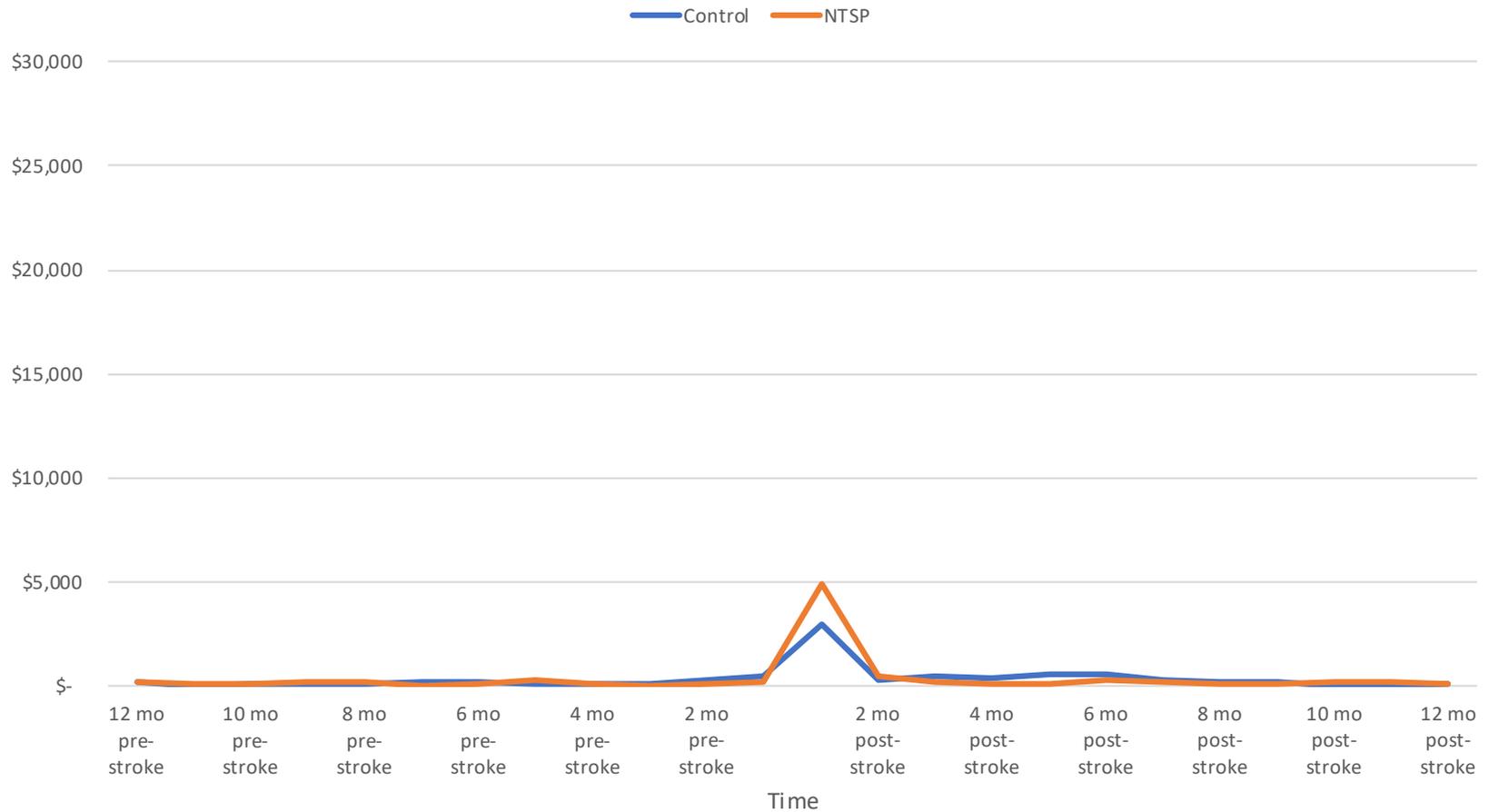
# Unadjusted Total VA Costs



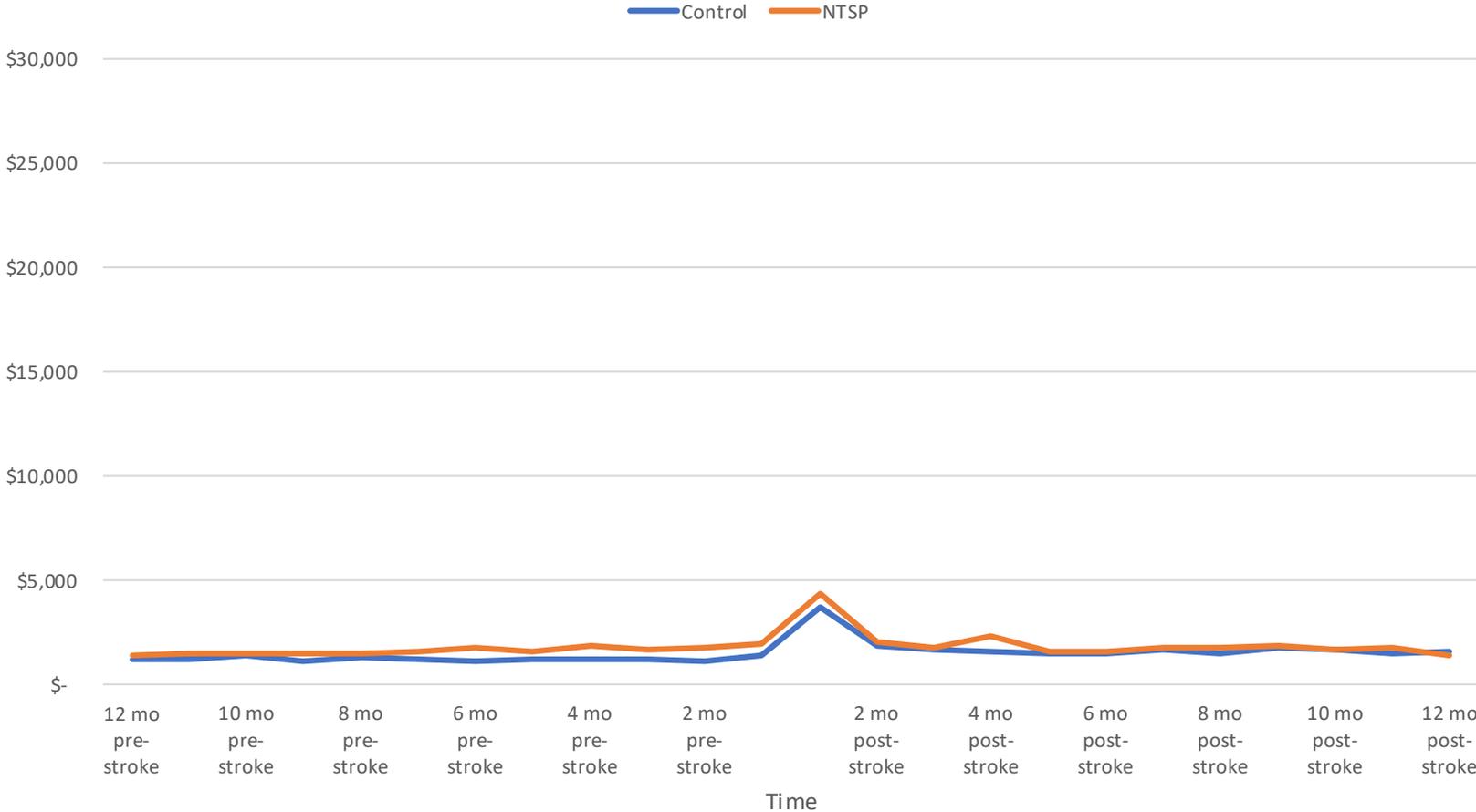
# Unadjusted VA Inpatient Costs



# Unadjusted VA ICU Costs

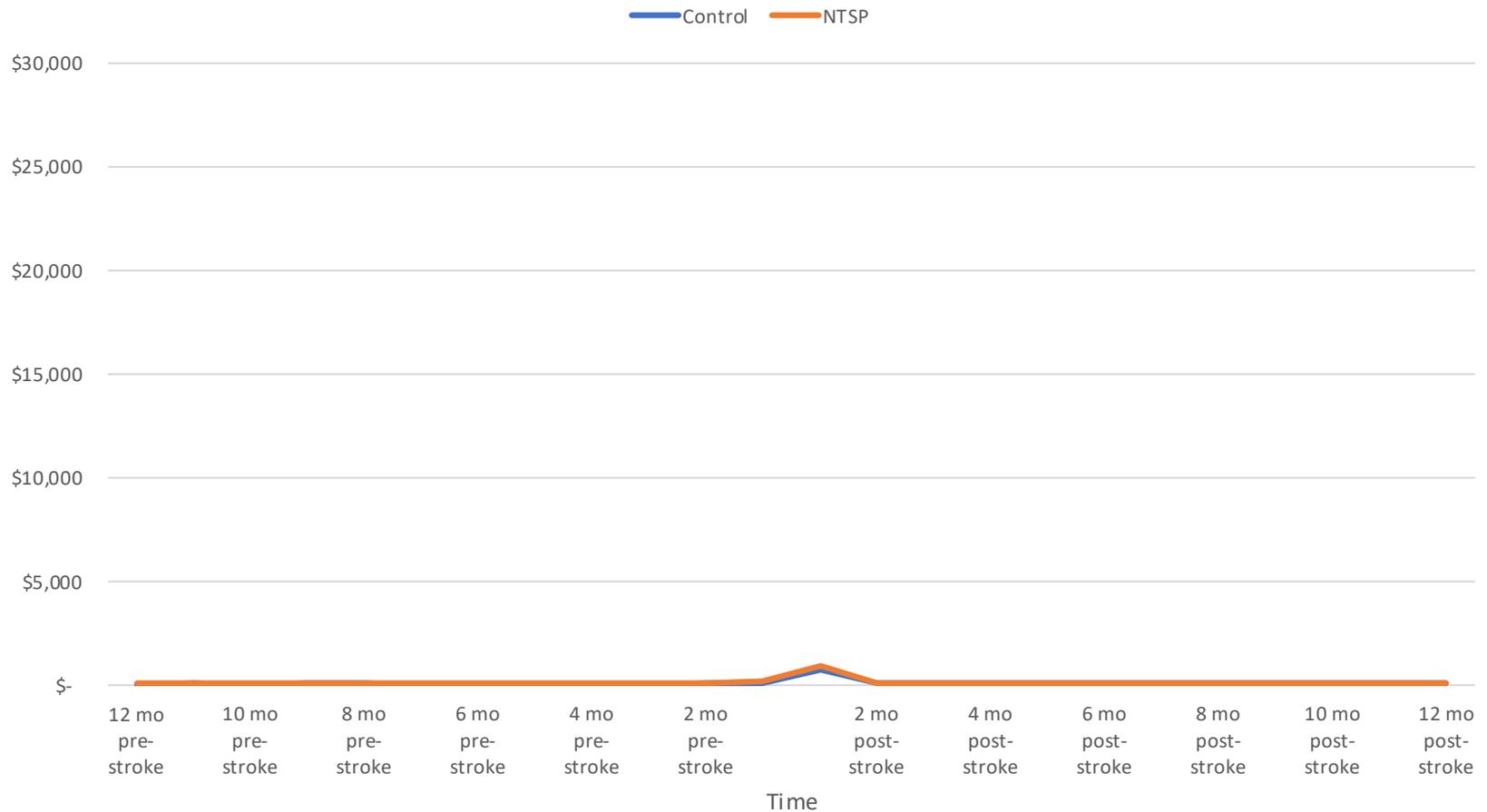


# Unadjusted VA Outpatient Costs\*



\*Note: Outpatient care excludes the cost of NTSP care.

# Unadjusted VA ED Costs



# Adjusted Costs in first 30 Days: Total and Inpatient

	Days 0-30	
	<i>Marginal Cost (\$)</i>	<i>SE</i>
<b>All Costs</b>	4,821.21*	1,879.94
<b>Inpatient</b>		
<b>Total</b>	2,208.61***	562.42
<b>Neurology</b>	-338.60***	50.39
<b>Intensive Care Unit (ICU)</b>	1,889.29***	247.49
<b>Med/surg</b>	1,381.91***	333.97
<b>Rehabilitation</b>	233.10	151.08

\*p<0.05, \*\*p<0.01, \*\*\*p<0.001 (two tailed tests)

# Adjusted Costs in first 30 Days: Outpatient

	Days 0-30	
	<i>Marginal Cost (\$)</i>	<i>SE</i>
<b>Outpatient</b>		
<b>Total</b>	166.29	201.92
<b>Neurology</b>	202.12***	9.04
<b>Radiology</b>	76.53***	13.47
<b>Med/surg</b>	100.06	104.06
<b>Emergency Medicine</b>	92.92***	25.08
<b>Home health</b>	-15.71	19.82
<b>Home and Community Based Care</b>	3.47***	0.92

\*p<0.05, \*\*p<0.01, \*\*\*p<0.001 (two tailed tests)

# Adjusted Costs in first 30 Days: Community Care

	Days 0-30	
	<i>Marginal Cost (\$)</i>	<i>SE</i>
<b>Community Care</b>		
<b>Total</b>	2,446.31 <sup>^</sup>	1,801.99
<b>Inpatient</b>	6,469.19 <sup>***</sup>	1,102.01
<b>Outpatient</b>	-164.46	92.29
<b>Home health</b>	28.63	23.20
<b>Emergency Medicine</b>	-4,205.02 <sup>**^^</sup>	1,415.67
<b>Skilled Nursing Facility care</b>	253.54 <sup>***</sup>	39.09
<b>Transportation</b>	95.38 <sup>***</sup>	6.45

<sup>^</sup>results were sensitive to the methods for measuring community care costs. One method resulted in significantly more costs.

<sup>^^</sup>results were sensitive to the methods for measuring community care costs. Results in one model were significantly more costly.

\*p<0.05, \*\*p<0.01, \*\*\*p<0.001 (two tailed tests)

# Adjusted Costs in First Year

	Days 91-180	Days 181-270	Days 271-360
	Marginal Cost (\$)	Marginal Cost (\$)	Marginal Cost (\$)
<b>Inpatient</b>			
<b>Total</b>	-727.97	-1,171.30	647.99
<b>Neurology</b>	223.12*	85.20	3.54
<b>Med/surg</b>	170.62	244.56	-69.86
<b>Rehabilitation</b>	1,046.60*	31.50	-72.27
<b>Outpatient</b>			
<b>Total</b>	-735.79	-951.46	-1,046.41*
<b>Neurology</b>	-2.72	7.27	-3.60
<b>Radiology</b>	-63.18*	-28.19	-2.37
<b>Med/surg</b>	-181.66	-559.04*	-125.56
<b>Emer. Medicine</b>	-191.15***	-111.96*	-123.93*
<b>Home health</b>	-115.77*	-105.19*	-158.31**
<b>HCBC#</b>	6.74	6.74	6.74
<b>Community Care</b>			
<b>Outpatient</b>	-136.79	-61.62	-31.59
<b>Home health</b>	-14.59	-66.92	-192.00**
<b>Emer. Medicine</b>	-556.70	-2,601.26	-620.86
<b>Skilled Nursing</b>	178.39	54.09	-171.88

\*p<0.05, \*\*p<0.01, \*\*\*p<0.001 (two tailed tests)

# Stroke Processes of Care

- Patients in NTSP were more likely to receive tPA and a thrombectomy scan or procedure

	<b>NTSP Group N=471 N(%)</b>	<b>Control Group N=529 N(%)</b>	<b>P-value</b>
tPA administered	81 (17.8)	18(3.5)	<0.0001
Thrombectomy scan or procedure	24 (5.3)	5 (0.9)	<0.0001
Either of the two	93 (19.8)	23 (4.4)	<0.0001

# Last Known Well Improved Too

	<b>NTSP Group</b> N=471 n (%)	<b>Control Group</b> N=529 n (%)	<b>P value</b>
<b>Last know well &lt;8 hours</b>	29 (6.4)	2 (.4)	<0.0001

Is that a function of patient awareness or better record keeping?

# Adjusted Costs in First Year (excluding patients with tPA or thrombectomy)

	Days 0-30		Days 91-180		Days 181-270		Days 271-360	
	Marginal Cost (\$)	SE						
<b>All costs</b>	-2,540.95	-1,878.62	-5,327.34	-4,353.85	-5,948.62	-4,408.79	-2,360.99	-4,478.39
<b>Inpatient</b>	2,253.40***	-604.5	-1,184.20	-1,618.85	-1,186.71	-1,639.28	1,273.56	-1,665.16
<b>Outpatient</b>	177.24	-203.74	-1,311.84*	-542.59	-1,163.41*	-549.44	-1,026.75	-558.11
<b>Community Care</b>	-4,971.58**	-1,785.92	-2,831.30	-3,995.62	-3,598.49	-4,046.04	-2,607.80	-4,109.91

\*p<0.05, \*\*p<0.01, \*\*\*p<0.001 (two tailed tests)

# Top Findings

1. In the 30 days following a stroke, patients exposed to the NTSP program had higher average costs than the control group. This excludes the cost of NTSP care.
2. Between 90 and 360 days, we observed a decrease in emergency medicine and home health costs. These differences were relatively small (<\$200 per person per 90-day period).
3. We found no evidence to suggest that the NTSP would pay for itself in the first year after the stroke because tPA and thrombectomies are expensive and outweigh.

# Limitations

- No functional outcome data
- No cost data beyond 1 year
- Pre-post design and changes in VA community care databases over time
- Sample was restricted to patients with a stroke; no information on stroke mimics

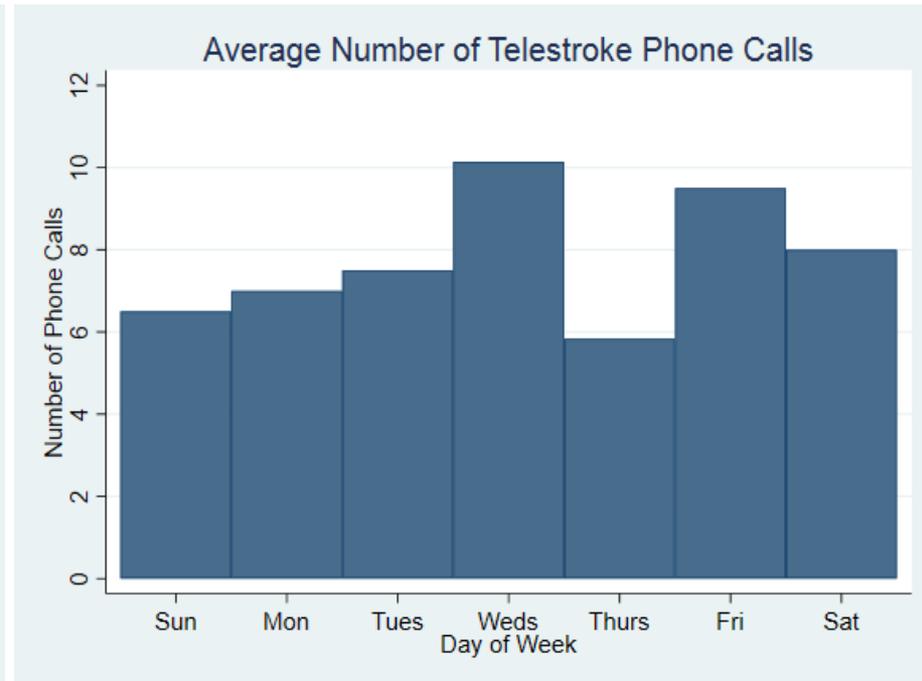
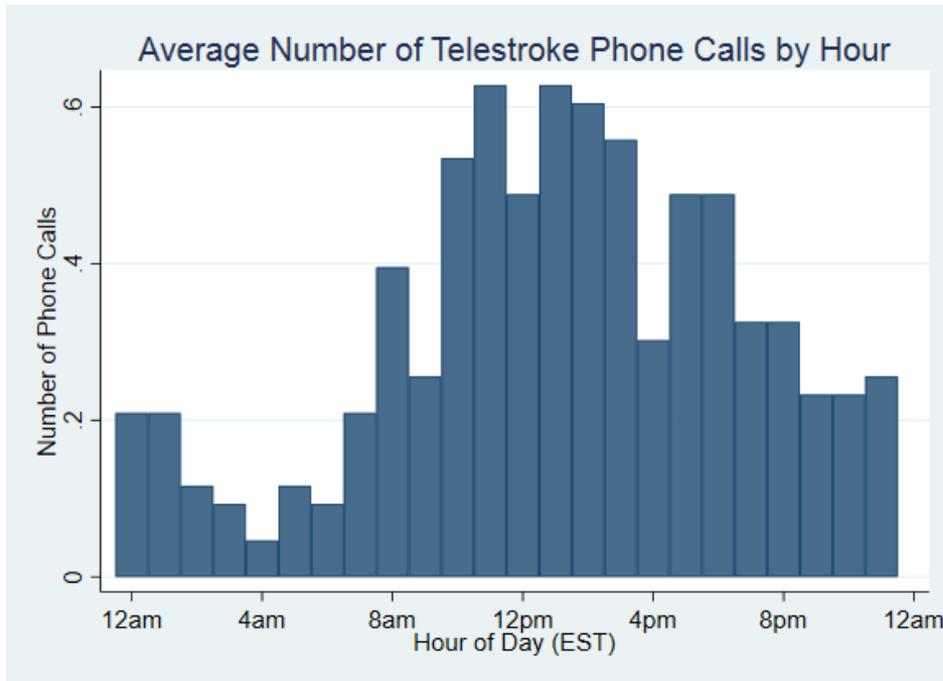
# Remaining Questions

- Long term effects (beyond a year)
  - Patient outcomes
  - Costs
- Treatment of mimics
- Effect on how clinicians learn
- Optimization of the NTSP

# Mimics

- The NTSP program improved the accurate and timely diagnosis of stroke cases
  - We show added costs for stroke patients
  - What was the effect on the mimic patients?
- Mimics
  - We struggled to identify mimics in the administrative data
  - Would need chart review or a valid and accurate algorithm for extracting administrative data

# Optimization of the NTSP Program



# Non-VA Implications

- Motivation: cost, outcomes, revenue?
- Fee for service hospitals, especially those in competitive markets, may feel a pressure to develop regional systems of stroke care in order to maintain referrals for stroke patients who will need thrombectomy and other specialty stroke care. (maintain revenue)

# Questions?

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