

# Racial/Ethnic and Geographic Disparities in Stroke Care —What can we do?



Shumei Man MD, PhD

Associate Professor of Neurology, CCLCM/CWRU

Director, Cleveland Clinic Fairview Hospital Stroke Center

Section Leader, Teleneurology

Neurological Institute

Cleveland Clinic

## Disclosures

- The Get With The Guidelines®–Stroke (GWTG-Stroke) program is provided by the American Heart Association/American Stroke Association.
- GWTG-Stroke is sponsored, in part, by Novartis, Novo Nordisk, AstraZeneca, Bayer, and HCA Healthcare.
- No other related disclosures

# Contents

- Racial and Ethnic Disparities in Thrombolytic Treatment
- Geographic/Rural-Urban Disparities in Stroke Care
- Findings, Practical Implications, and Future Directions

# Why is Thrombolytic Treatment Important?

- Intravenous thrombolytic treatment with tPA or Tenecteplase within 4.5 hours of stroke onset improve functional outcomes.

Kwiatkowski TG et al. NEJM 1999; Emberson J, et al. Lancet. 2014; Menon et al. Lancet, 2022

- Faster thrombolytic treatment, namely Door-to-Needle (DTN) times, are associated with better functional outcomes, more time at home, lower mortality and readmission in a year.

JAMA | Original Investigation

## Association Between Thrombolytic Door-to-Needle Time and 1-Year Mortality and Readmission in Patients With Acute Ischemic Stroke

Shumei Man, MD, PhD; Ying Xian, MD, PhD; Dajuanicia N. Holmes, MS; Roland A. Matsouaka, PhD; Jeffrey L. Saver, MD;  
Circulation

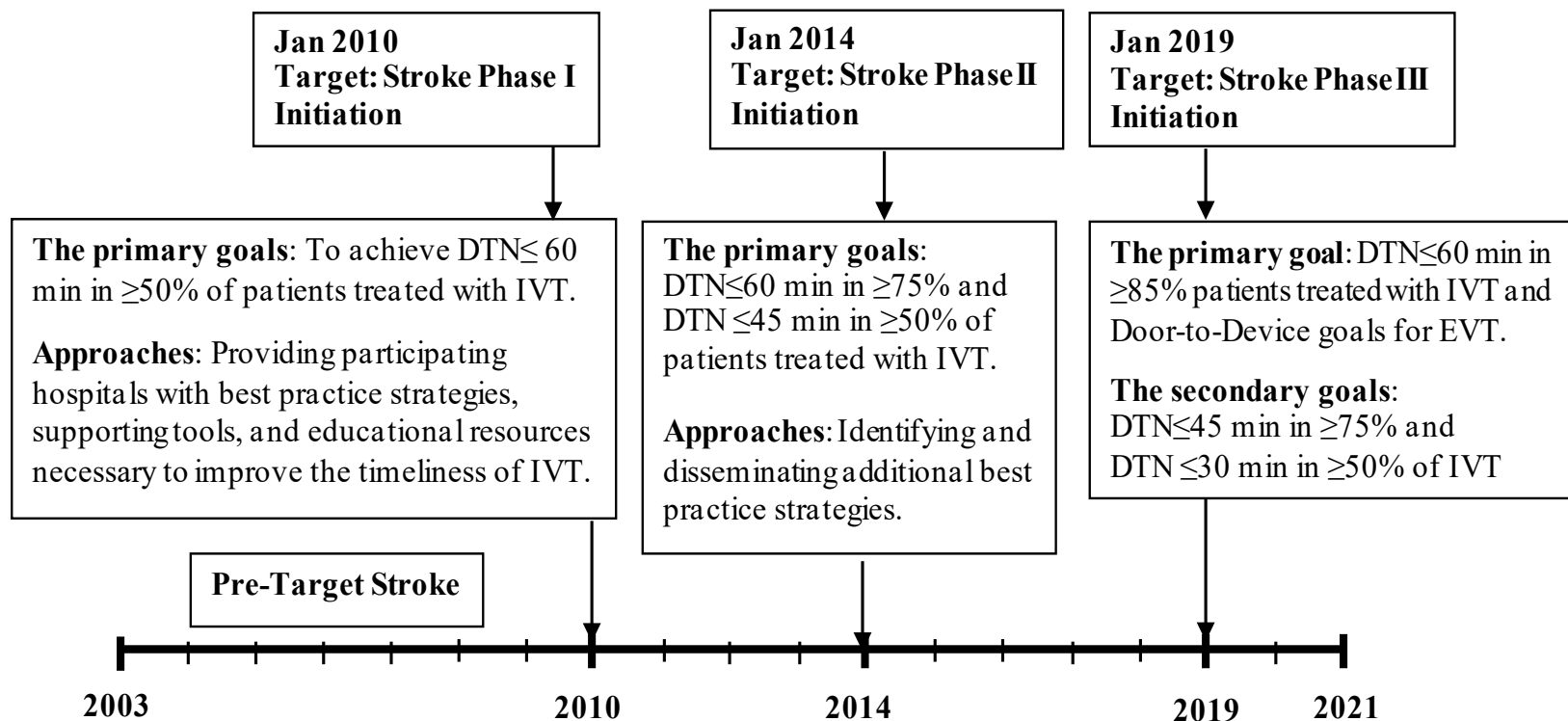
### ORIGINAL RESEARCH ARTICLE

Shorter Door-to-Needle Times Are Associated With Better Outcomes After Intravenous Thrombolytic Therapy and Endovascular Thrombectomy for Acute Ischemic Stroke

Shumei Man<sup>1</sup>, MD, PhD; Nicole Solomon<sup>2</sup>, PhD; Brian Mac Grory<sup>3</sup>, MB BCh BAO, MHS, MRCP; Brooke Alhanti<sup>4</sup>, PhD; Ken Uchino<sup>5</sup>, MD; Jeffrey L. Saver<sup>6</sup>, MD; Eric E. Smith<sup>7</sup>, MD, MPH; Ying Xian<sup>8</sup>, MD, PhD; Deepak L. Bhatt<sup>9</sup>, MD, MPH; Lee H. Schwamm<sup>10</sup>, MD; Muhammad Shazam Hussain, MD; Gregg C. Fonarow<sup>11</sup>, MD

- Why DTN times: under complete control of hospital care team.

# Target: Stroke: a National Quality Initiative Focusing on DTN Times



# Target: Stroke improved DTN times overall

**Circulation: Cardiovascular Quality and Outcomes**








Volume 13, Issue 12, December 2020

<https://doi.org/10.1161/CIRCOUTCOMES.120.007150>

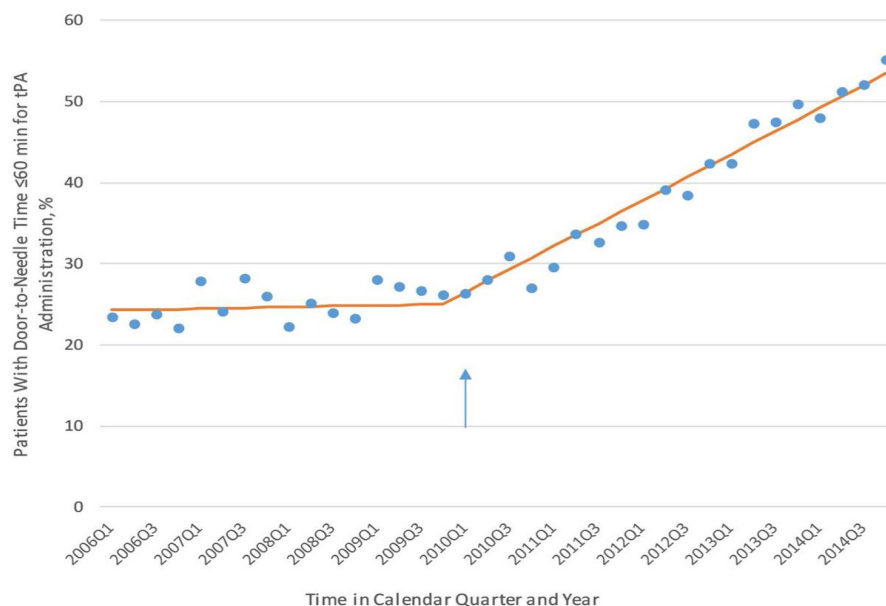


## ORIGINAL ARTICLE

### Target: Stroke Was Associated With Faster Intravenous Thrombolysis and Improved One-Year Outcomes for Acute Ischemic Stroke in Medicare Beneficiaries

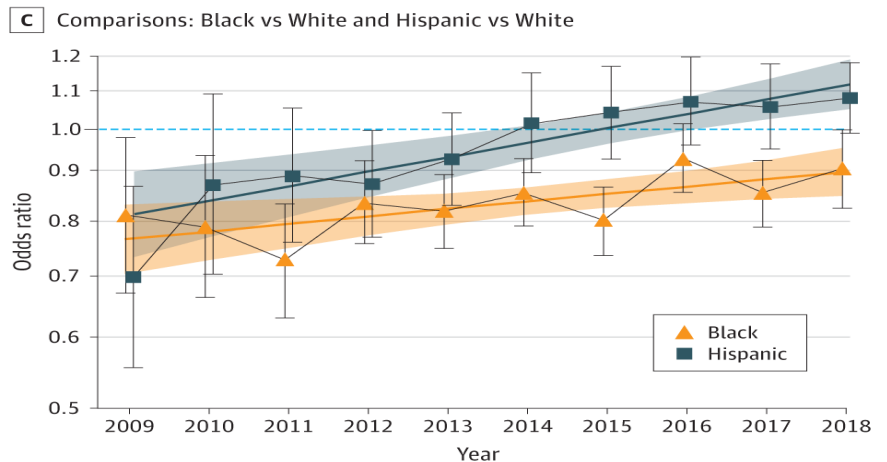
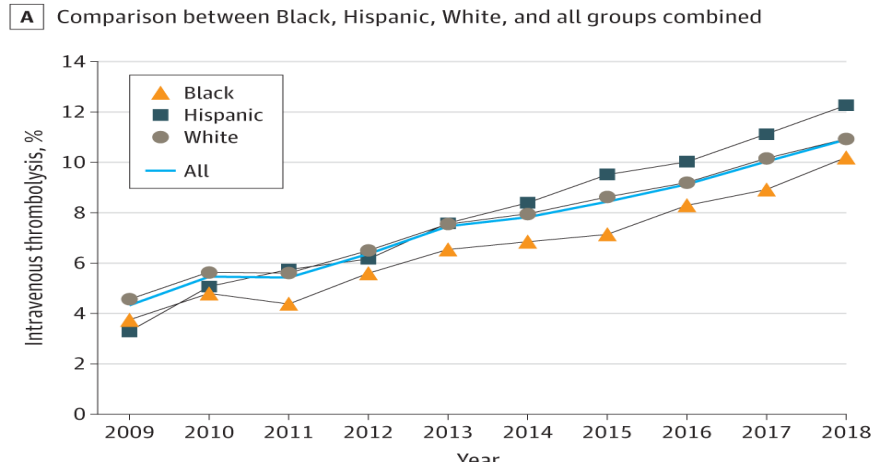
Shumei Man, MD, PhD , Ying Xian, MD, PhD , DaJuanicia N. Holmes, MS , Roland A. Matsouaka, PhD , Jeffrey L. Saver, MD , Eric E. Smith, MD, MPH , Deepak L. Bhatt, MD, MPH , Lee H. Schwamm, MD, and Gregg C. Fonarow, MD

- Target: Stroke was associated with
  - shorter median DTN from 80 min to 68min
  - more patients received tPA with DTN $\leq$ 60, 45, and 30min
  - lower 1-year all-cause mortality and cardiovascular readmissions.



# Racial and Ethnic Disparity in Thrombolysis Utilization

- Racial disparity in thrombolysis utilization persisted, with Black patients less likely to receive thrombolytic treatment
- Meaning: Missed treatment opportunity may cause outcome disparity
- Limitations:
  - Administrative data does not contain time of presentation or treatment
  - Cannot distinguish pre-hospital delay vs lack of treatment provision by hospitals/caregivers



Suolang et al. JAMA 2021

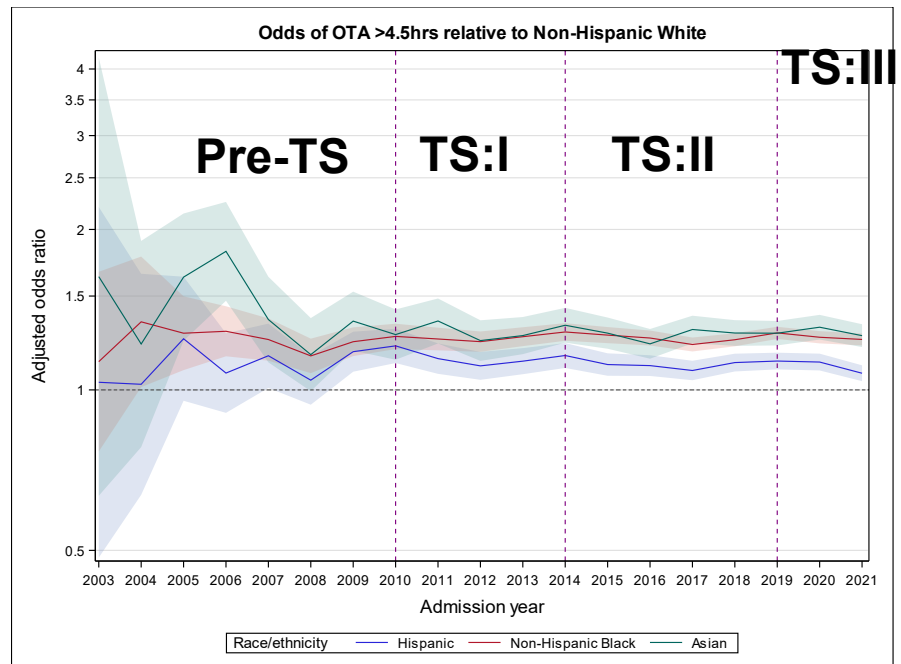
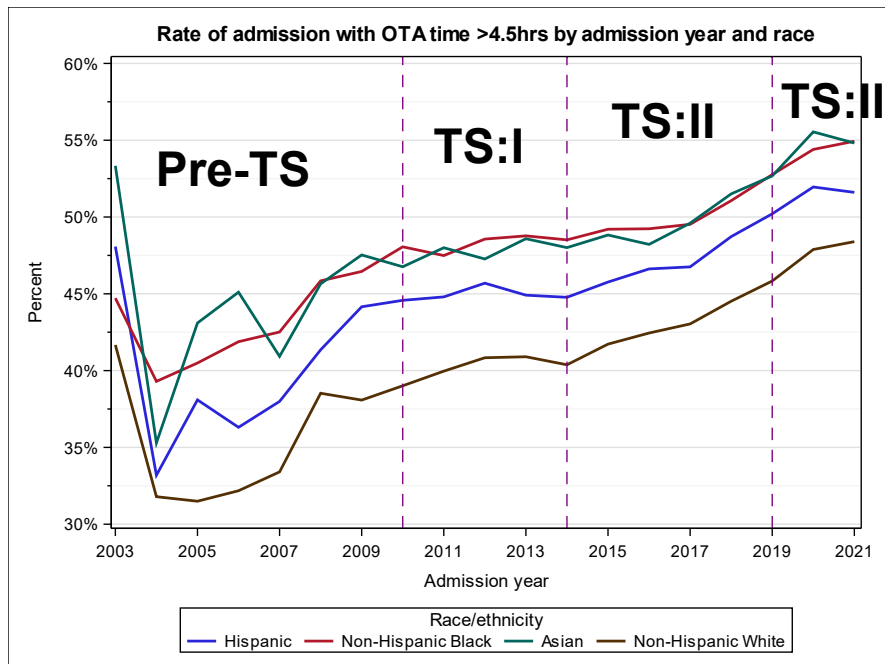
## Meaningful Questions for Health Equity Interventions

- Did the racial and ethnic disparity in thrombolysis derive from:
  - I. **delayed arrival** beyond 4.5 hrs of stroke onset
  - or
  - II. **hospital treatment provision** for those arriving within 4.5 hrs?
- Did thrombolysis rates, DTN times, and outcomes improve for **ALL** races and ethnicities following the launch and advance of Target: Stroke.



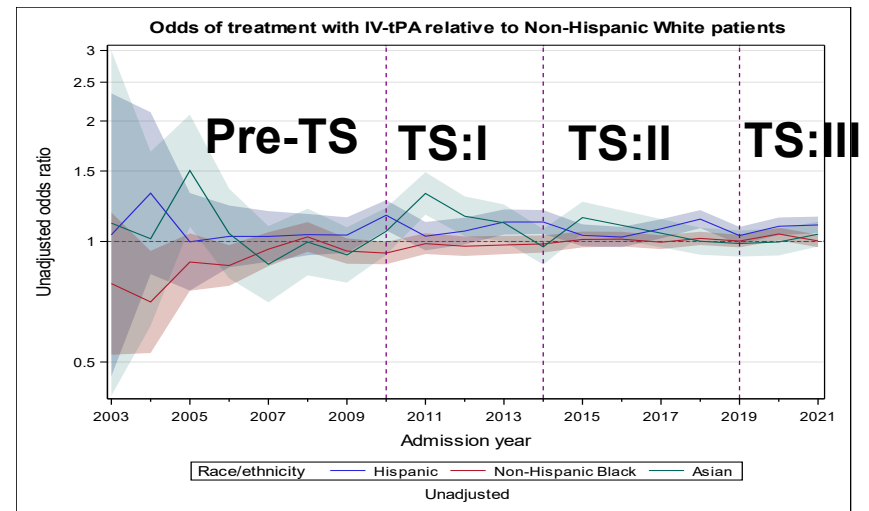
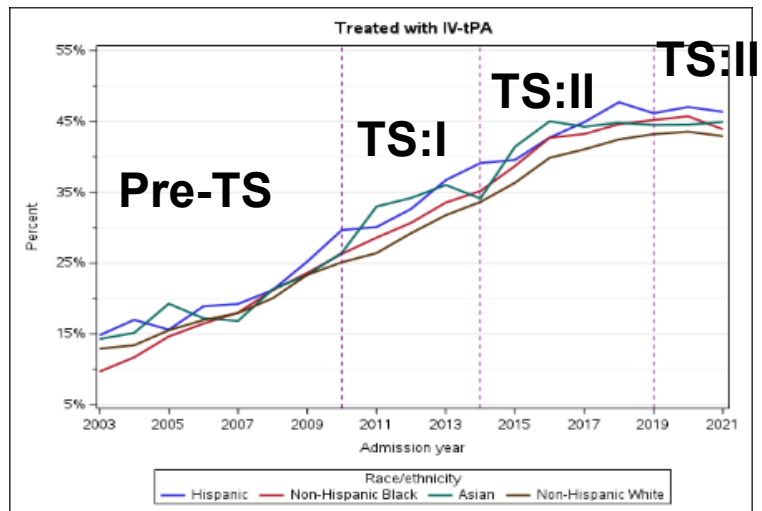
## Process I: Delayed Hospital Arrival

Asian, Black, and Hispanic patients had more delayed arrival than White patients  
--an automatic exclusion for thrombolytic treatment



# Process II: Hospital Thrombolytic Treatment Provision

## No disparities in unadjusted thrombolysis rates in GWTG-Stroke participating hospitals



JAMA Network **Open**

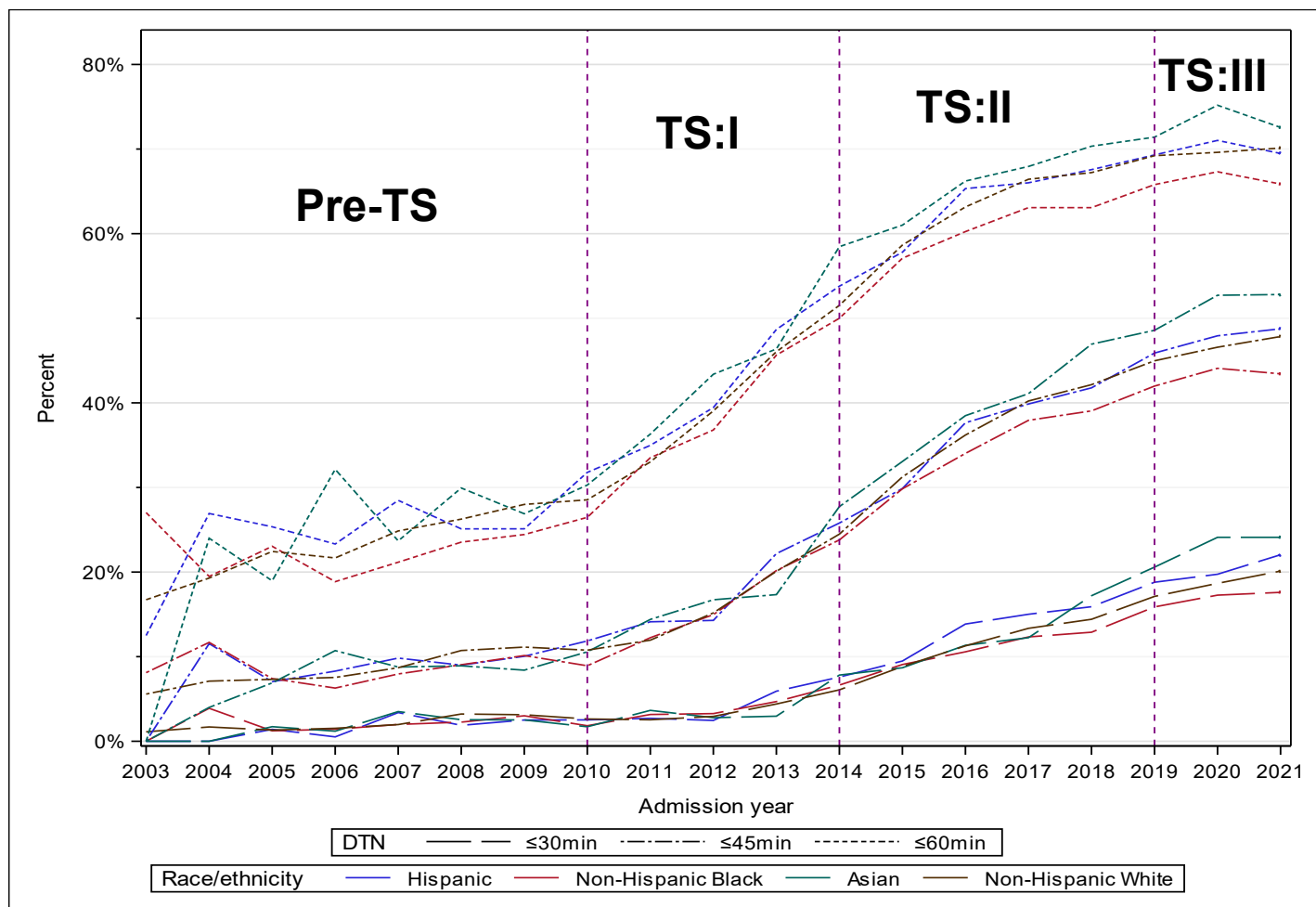


Original Investigation | Neurology

### Trends in Stroke Thrombolysis Care Metrics and Outcomes by Race and Ethnicity, 2003-2021

Shumei Man, MD, PhD; Nicole Solomon, PhD; Brian Mac Grory, MB BCH BAO, MHSc; Brooke Alhanti, PhD; Jeffrey L. Saver, MD; Eric E. Smith, MD, MPH; Ying Xian, MD, PhD; Deepak L. Bhatt, MD, MPH; Lee H. Schwamm, MD; Ken Uchino, MD; Gregg C. Fonarow, MD

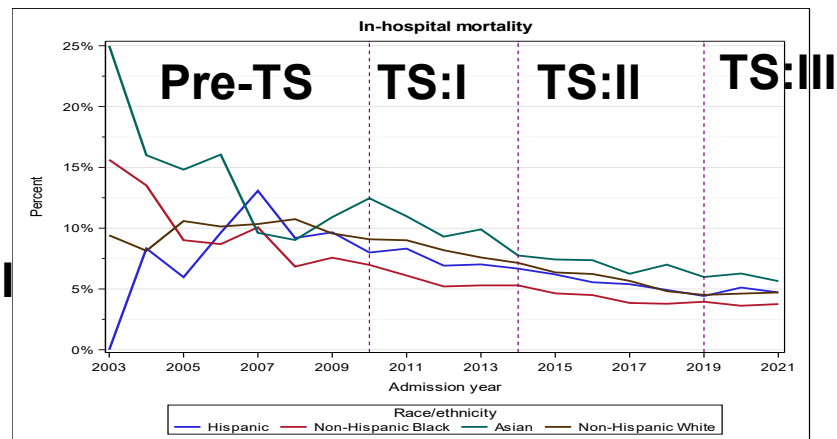
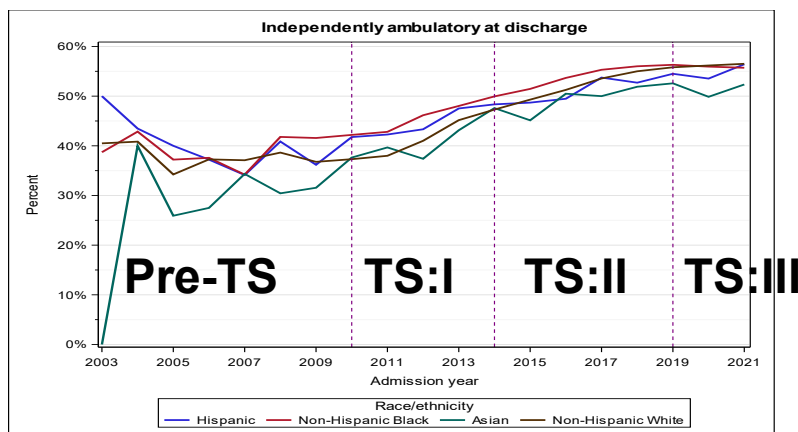
# Unadjusted DTN times improved in all races and ethnicities



## TS was associated with improved thrombolysis frequency and timeliness in all races and ethnicities

Outcome	TS Phase I	TS Phase II	TS Phase III	Adjusted OR (95% CI)  Reference: Pre-TS (2003-2009) of each race/ethnicity  Biggest Improvement  Smallest Improvement  Improved
Thrombolytic treatment rate for arrival≤4.5hr				
Asian	1.39 (1.21–1.60)	1.79 (1.56, 2.06)	1.92 (1.66–2.22)	
Black	1.24 (1.18–1.32)	1.66 (1.56–1.76)	1.84 (1.73–1.96)	
Hispanic	1.31 (1.20–1.43)	1.71 (1.57–1.87)	2.00 (1.82–2.19)	
White	1.20 (1.17–1.23)	1.49 (1.45–1.53)	1.68 (1.63–1.72)	
DTN ≤30min				
Asian	0.96 (0.52–1.77)	3.75 (2.11–6.66)	8.14 (4.57–14.50)	
Black	1.19 (0.92–1.55)	3.45 (2.69–4.42)	6.11 (4.75–7.85)	
Hispanic	1.36 (0.93–1.99)	4.74 (3.29–6.83)	9.35 (6.48–13.51)	
White	1.03 (0.92–1.15)	3.24 (2.93–3.59)	6.10 (5.50–6.76)	
DTN ≤45min				
Asian	1.59 (1.14–2.22)	5.17 (3.73–7.16)	8.64 (6.21–12.02)	
Black	1.41 (1.23–1.62)	3.86 (3.38–4.42)	5.79 (5.05–6.65)	
Hispanic	1.62 (1.32–1.98)	4.36 (3.58–5.32)	7.60 (6.21–9.30)	
White	1.35 (1.28–1.44)	3.86 (3.64–4.08)	6.26 (5.90–6.64)	
DTN ≤60min				
Asian	1.48 (1.18–1.86)	4.01 (3.20–5.02)	5.67 (4.49–7.16)	
Black	1.62 (1.47–1.78)	3.73 (3.39–4.12)	4.94 (4.46–5.46)	
Hispanic	1.71 (1.48–1.98)	4.21 (3.64–4.86)	6.00 (5.16–6.97)	
White	1.52 (1.46–1.58)	3.75 (3.60–3.92)	5.35 (5.11–5.60)	

# TS was associated with improved in-hospital outcomes



Outcome	TS Phase I	TS Phase II	TS Phase III
Adjusted OR (95% CI), Reference: Pre-TS of each race/ethnicity			
Independent ambulation at discharge			
Asian	1.48 (1.15–1.90)	1.72 (1.34–2.20)	1.86 (1.44–2.40)
Black	1.06 (0.95–1.17)	1.42 (1.28–1.57)	1.48 (1.33–1.65)
Hispanic	1.24 (1.06–1.45)	1.47 (1.26–1.72)	1.55 (1.32–1.82)
White	1.01 (0.97–1.06)	1.34 (1.27–1.40)	1.42 (1.34–1.49)
In-hospital mortality			
Asian	1.00 (0.71–1.42)	0.81 (0.57–1.14)	0.72 (0.50–1.04)
Black	0.76 (0.65–0.90)	0.65 (0.55–0.77)	0.61 (0.51–0.73)
Hispanic	0.83 (0.66–1.05)	0.74 (0.58–0.93)	0.68 (0.53–0.88)
White	0.89 (0.83–0.95)	0.76 (0.71–0.82)	0.69 (0.63–0.74)

**Biggest Improvement**

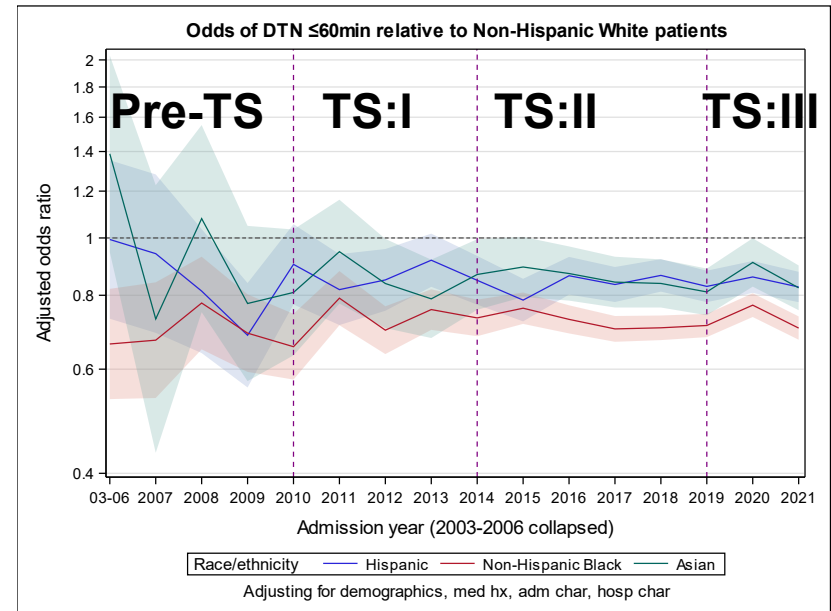
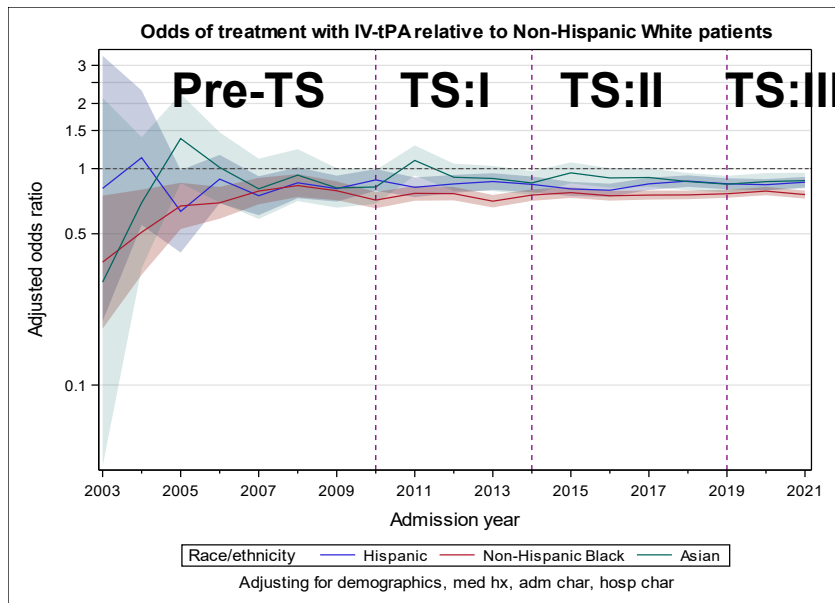
**Smallest Improvement**

**Improved**



# Disparity in Thrombolytic Treatment Emerged after adjusting for patient/hospital factors

Black, Asian, and Hispanic Patients had lower odds of  
--Receiving thrombolysis  
--Being treated within guideline recommended DTN times



# Summary of Current Racial and Ethnic Disparities in Thrombolytic Treatment

- Target: Stroke was associated with continuous improvement in thrombolysis frequency, timeliness, and outcomes for all race and ethnicities in GWTG-Stroke participating hospitals.
- Racial and ethnic disparities were not evident in unadjusted quality metrics but emerged after risk adjustment.
- Black, Asian, and Hispanic patients are more likely to arrive at the hospital after the 4.5-hour thrombolysis time window

## What Should We Do Next?

- Further racial-ethnic health equity intervention should focus on
  - Continued and improved pre-hospital culturally-tailored community stroke education and readiness for each and all racial and ethnic groups, especially non-White population
  - Understanding and resolution of sources of slower post-arrival decision-making among non-White patients
  - Incorporation of risk adjusted quality measure reporting by race and ethnicity



## Rural-Urban Disparity in Stroke Care

- Rural: 97% of US land, 66 million people, 1800 (35%) hospitals
- Stroke incidence: 23-30% higher in rural areas than urban areas.
- Rural stroke patients:-receive less thrombolytic treatment
  - have higher case fatality than their urban counterparts.
- Rural hospitals:-low operating margins,
  - 52% with negative margins.
  - 60% are Critical Access Hospitals
- Rural hospitals:-shortage of stroke and quality expertise.
  - the only resource for local residents to receive timely acute stroke diagnosis, treatment, and preventions.

## Meaningful Questions for Further Interventions

- Are the rural-urban disparities in thrombolytic utilization due to

I: delayed arrival-unable to arrive within 4.5 hrs due to long transportation time or delayed 911 activation?

or

II: rural hospitals not providing treatment?

- Are there gaps in rural hospitals in providing evidence-based thrombolysis and secondary prevention treatments?

Stroke

### ORIGINAL CONTRIBUTION

Rural Hospital Performance in Guideline-Recommended Ischemic Stroke Thrombolysis, Secondary Prevention, and Outcomes

Shumei Man<sup>1</sup>, MD, PhD; David Bruckman<sup>2</sup>, MS; Ken Uchino<sup>3</sup>, MD; Bing Yu Chen<sup>4</sup>, MD; Jarrod E. Dalton, PhD; Gregg C. Fonarow<sup>5</sup>, MD

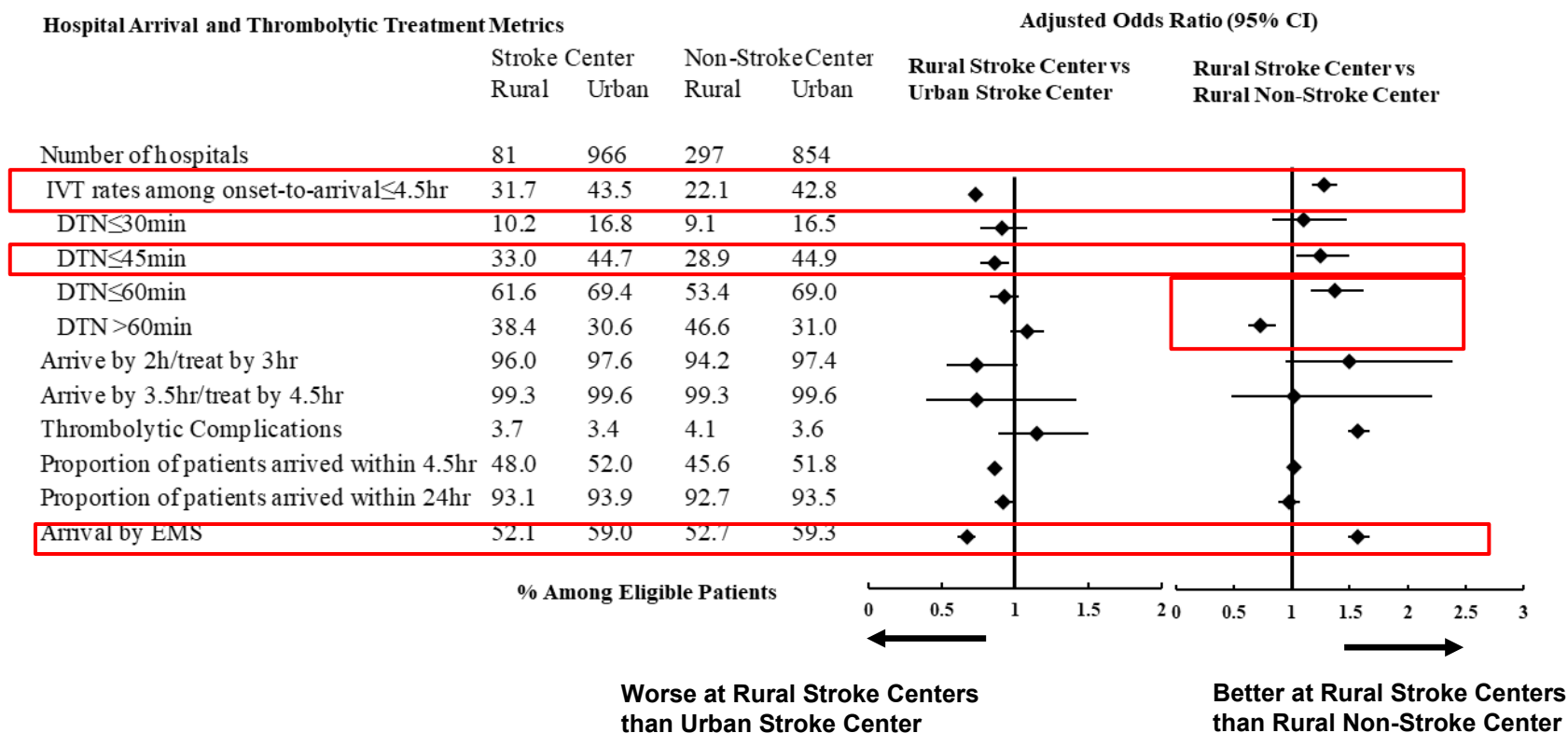
## Rural-Urban Patient and Hospital Characteristics

	Rural hospital	Urban hospital	Std. Diff
N	31,492	661,347	
Age, mean±SD	72±14	71±14	0.10
Female (%)	15772 (50.1)	328387 (49.6)	0.01
Race/Ethnicity			
Asian	247 (0.8)	21647 (3.3)	0.18
Black	4158 (13.2)	124584 (18.8)	0.15
Hispanic	441 (1.4)	54263 (8.2)	-0.32
Native American	174 (0.6)	2118 (0.3)	0.04
Pacific Islander	156 (0.5)	1664 (0.2)	0.04
White	25751 (81.8)	435545 (65.9)	0.37
Other/Unknown	565 (1.8)	21526 (3.2)	0.09
Arrival Information			
Arrival via EMS	16520 (52.5)	389258 (58.9)	0.13
EMS pre-notification	10851 (34.5)	238907 (36.1)	0.17
Arrival during off-hours*	15050 (47.8)	331840 (50.2)	0.05
Onset to Arrival, min	308 [90, 799]	240 [73, 742]	0.12
NIHSS	3 [1, 7]	3 [1, 8]	0.08
Hospital Characteristics, n	378	1820	2198
Bed number			
0-100	219 (57.9)	217 (11.9)	1.10
101-300	144 (38.1)	949 (52.2)	0.29
≥301	15 (4.0)	654 (35.9)	0.87
Teaching Hospitals	29 (7.7)	614 (33.7)	0.68
Annual ischemic stroke volume	52 [26, 98]	168 [97, 259]	1.39
Annual IVT volume	7 [4, 13]	17 [9, 30]	1.03

## Rural hospitals under-performed urban hospitals in key thrombolysis metrics

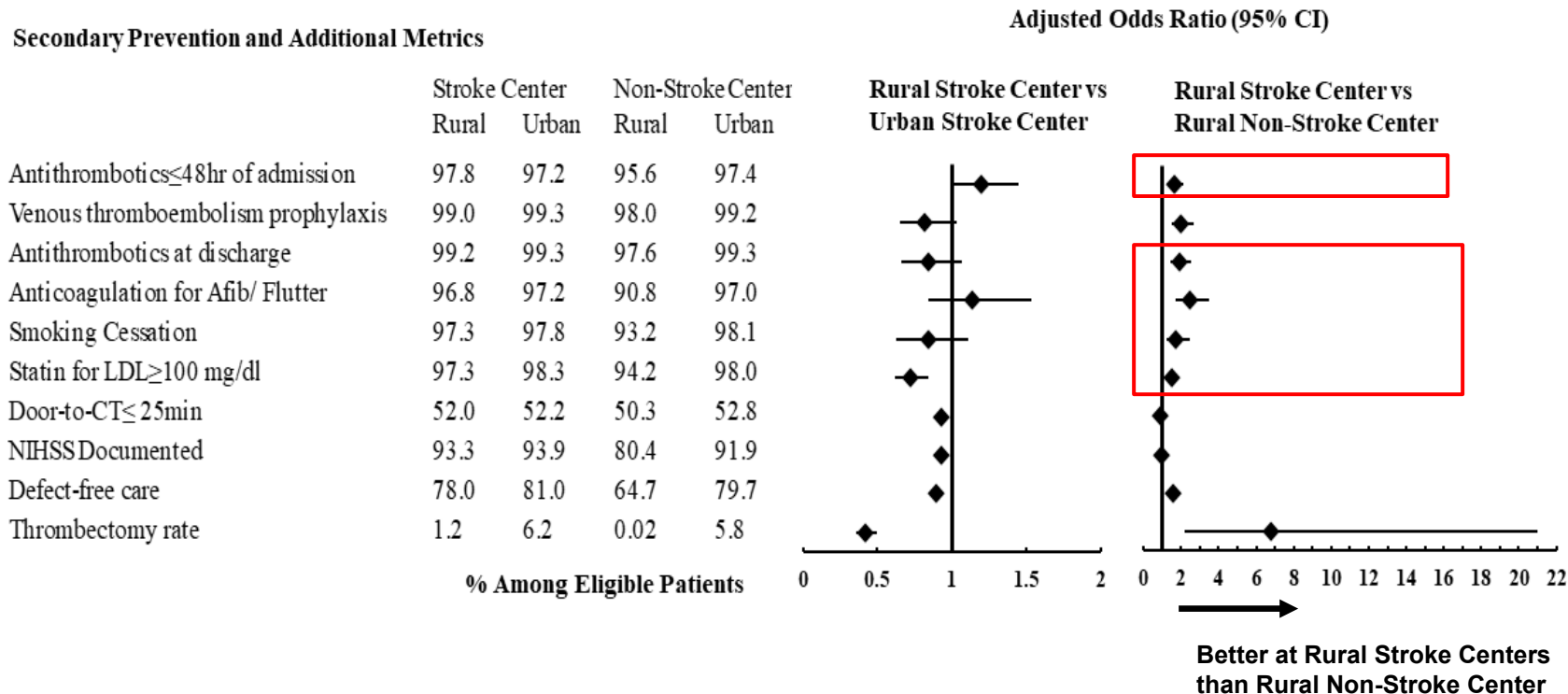
	Rural*	Urban*	Unadjusted		Adjusted	
	n (%)	n (%)	OR (95% CI)	p	OR (95% CI)	p
Proportion of patients arrived within 4.5 hr	10,548 (46.6)	252,864 (51.9)	0.81 (0.79, 0.83)	<0.001	0.85 (0.83, 0.88)	<0.001
Proportion of patients arrived within 24 hr	29,249 (92.9)	619,710 (93.7)	0.88 (0.84, 0.92)	<0.001	0.92 (0.87, 0.96)	<0.001
Arrival by EMS	16,520 (52.5)	389,258 (59.1)	0.76 (0.74, 0.78)	<0.001	0.63 (0.59, 0.67)	<0.001
IVT among patients arriving within 4.5 hr	2,814 (26.5)	109,860 (43.2)	0.49 (0.47, 0.51)	<0.001	0.64 (0.61, 0.66)	<0.001
DTN ≤30min	273 (9.7)	18,281 (16.6)	0.54 (0.47, 0.61)	<0.001	0.84 (0.73, 0.95)	0.008
DTN ≤45min	876 (31.1)	49,201 (44.8)	0.56 (0.51, 0.60)	<0.001	0.78 (0.72, 0.85)	<0.001
DTN ≤60min	1629 (57.9)	76,010 (69.2)	0.61 (0.57, 0.66)	<0.001	0.81 (0.75, 0.88)	<0.001
DTN >60min	1185 (42.1)	33,850 (30.8)	1.63 (1.51, 1.76)	<0.001	1.23 (1.14, 1.34)	<0.001

# Rural stroke centers under-performed urban stroke centers in thrombolytic treatment but exceeded rural non-stroke centers.



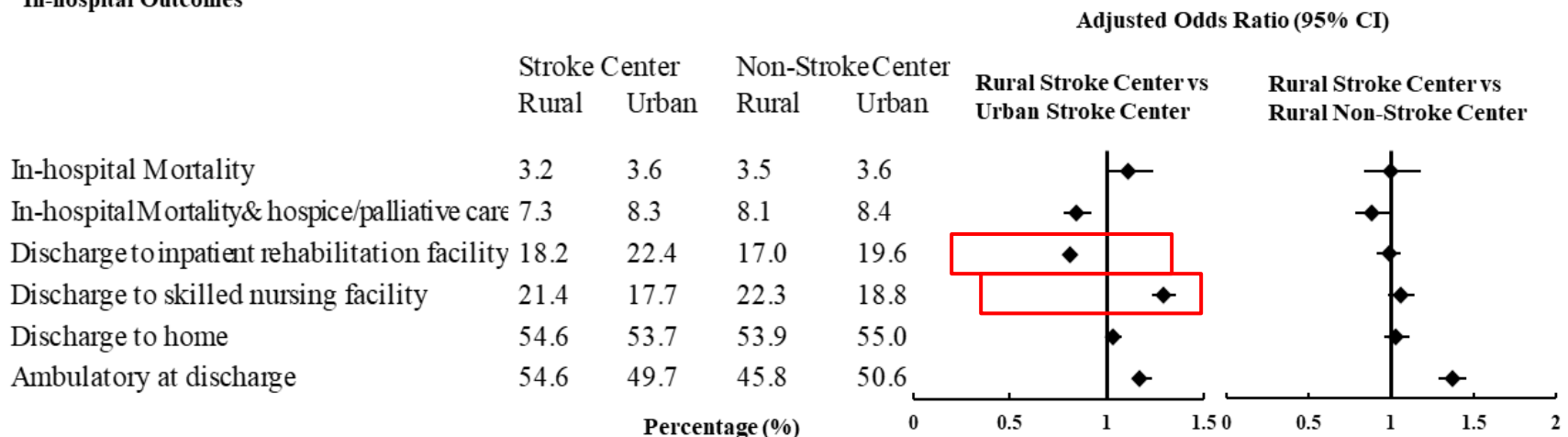
# Secondary stroke prevention metrics

## rural non-stroke centers underperformed rural stroke centers and urban stroke centers



# Patients at rural hospitals were less likely to be discharged to inpatient rehabilitation facilities and more likely to skilled nursing facilities

## In-hospital Outcomes



## Targetable Rural-Urban Gaps in Stroke Care

- Patients arriving at rural hospitals within 4.5 hours received thrombolytic treatment at only half the rate of patients at urban hospitals.
- The speed of thrombolytic administration in rural stroke centers are slower than urban stroke centers, but faster than rural non-stroke centers.
- Rural non-stroke centers provide less secondary stroke prevention treatment than rural stroke centers.
- Rural patients are less likely to be discharged to inpatient rehabilitation facilities after acute ischemic stroke
- Gap remains in delayed hospital arrival (47% vs 52%).



## Further Interventions on Rural Hospitals

- Integrate existing rural hospitals into the regional and national stroke networks with policy, staffing, and financial support but to avoid unrealistic administrative burdens.
- Innovative strategies: e.g. telehealth, stroke center certification-rural pathway, partnership with larger hospital networks.
- Focused efforts on helping rural hospitals in providing consistent and timely evidence-based stroke care
- Supported quality improvement programs, e.g. AHA Rural Initiative, to provide rural hospitals with no-cost access to GWTG quality programs and data feedback--Target: Stroke Rural?

# Acknowledgement



Gregg C Fonarow, MD (UCLA)



Ken Uchino, MD (Cleveland Clinic)

- Neurological Institute, Center for Populations Health Research, Cleveland Clinic
- The American Heart Association/American Stroke Association GWTG-Stroke program
- Duke Clinical Research Institute (DCRI)
- Nicole Solomon, PhD; Brooke Alhanti, PhD; Lena Sun PhD, Brian Mac Grory, MB BCh BAO (DCRI)
- David Bruckman, MS; Jerrod Dalton, PhD; Jesse D. Schold, PhD; (CPHR, Cleveland Clinic)
- Jeffrey L Saver, MD (University of California, Los Angeles)
- Eric E Smith, MD, MPH (University of Calgary)
- Ying Xian, MD, PhD (University of Texas Southwestern Medical Center)
- Deepak L Bhatt, MD, MPH (Mount Sinai Fuster Heart Hospital)
- Lee H Schwamm, MD (Yale New Haven Health)
- All our patients

Questions, Suggestions, and Collaborations?

