Integration of Telemedicine in Acute Stroke are

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VA National Telestroke Program

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Disclosures

- No financial disclosures related to industry

- Salary support through NIH StrokeNet including ARCADIA/ARCADIA CSI

- Will be showing examples of telehealth service through the American Well platform

Learning Objectives

- Be able to understand current standards in acute stroke care

- Be able to describe how to incorporate acute stroke care telemedicine in a health system

- Discuss performance metrics in stroke telehealth

Outline

- Stroke Care through Telemedicine

- Tracking Quality in Telestroke

- Patient and Provider Perceptions

- Impact on Disparities

- Telestroke at Ascension

A Case

Mr. G

76 year old resident who lives with his wife on a lake in rural Alabama.

He was working on his property with his son when he suddenly collapsed. His son was unable to get him to stand and then discovered that his father was "talking non-sense."

Mr. G

The patient's son was able to get him back to their house and 9-1-1 was activated.

The patient was transported to their nearest hospital (a Level III stroke capable hospital).

Mr. G

On arrival, the ED physician is concerned that Mr. G is suffering from a stroke.

He discovers that the patient has possible bladder cancer and recently had biopsy. The patient's son arrives and states that his father also has a blood disorder that might make him bleed.

The patient has arrived within the window for thrombolytic treatment but the ED physician is concerned that this would not be a safe option for the patient given his medical history.

Mr. G

There is no local neurology coverage at the hospital.

The ED physician is informed by the nursing team that a video telehealth platform has recently been set up at the hospital.

The physician decides to use this service over telephone consultation.

History of Telehealth in Acute Stroke Care

History of Telestroke

- In 1996, IV alteplase was approved by the FDA for use in patients experiencing an acute ischemic stroke.

- Complications were more common when alteplase was administered by untrained/inexperienced providers.

- Given the large number of contraindications and risk of hemorrhage, many ED providers were not comfortable making this treatment decision without guidance from a neurologist.

Katzan IL, Furlan AJ, Lloyd LE, et al. Use of Tissue-Type Plasminogen Activator for Acute Ischemic Stroke: The Cleveland Area Experience. JAMA. 2000;283(9):1151–1158. doi:10.1001/jama.283.9.1151

History of Telestroke

- Connecting patients with stroke providers by means of video teleconferencing was first proposed in 1999.

- Telemedicine was intended to be able to assist in stroke diagnosis, determination of secondary prevention, selection of patients for clinical trials, and use of alteplase or other neurovascular interventions.

Levine SR, Gorman M. "Telestroke" : the application of telemedicine for stroke. Stroke. 1999 Feb;30(2):464-9.

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History of Telestroke

Between 2000-2010, telestroke systems moved from being a theoretical construct to reality as networks started to appear across the country.

Heinrich Audebert, Telestroke: effective networking, The Lancet Neurology ,Volume 5, Issue 3, 2006,

Telestroke Models

Hub and Spoke

Distributed Network

Telestroke Models

Hub and Spoke

- More common with academic based regional telestroke models with networks developed within a catchment area

- Built based on local transfer networks and knowledge of local resources

- Facilitates acute treatment decisions and rapid transfer
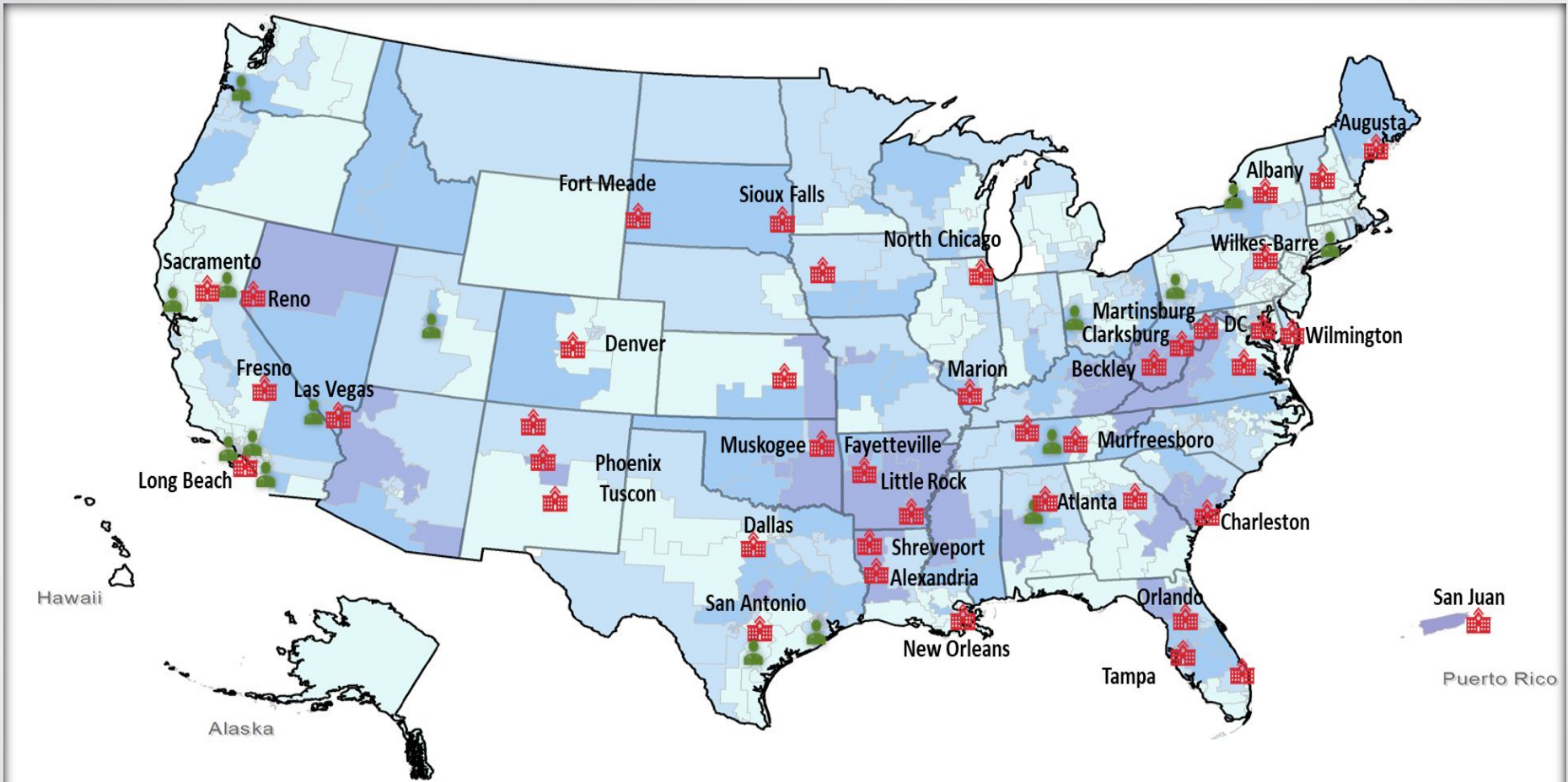
Telestroke Models

Distributed Hub

- Used in national telestroke networks
- Physicians are not necessarily based at facilities within the network
- Emphasis is on expanding access to care in underserved regions but is typically not integrated into the regional transfer network

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ALABAMA
Counties with No Names

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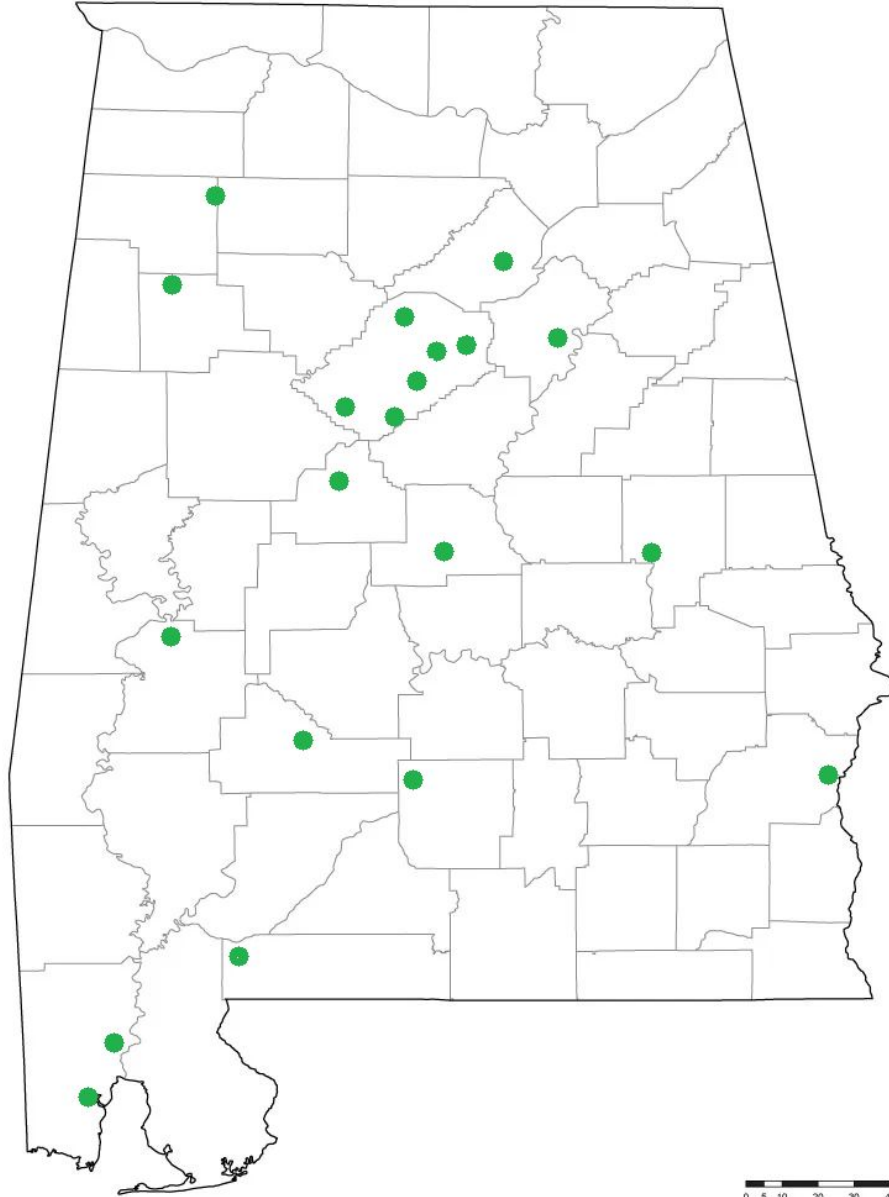
Shading reflects unique Veterans with a primary diagnosis of AIS in FY18

VAMC Participating in Telestroke

VA Telestroke Neurologist

Unique Veterans by Home Congressional District

Count: 1 - 15 | 16 - 29 | 30 - 51 | 52 - 125 | 126 - 340

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Stroke Care through Telemedicine

Mr. G

A stroke specialist at UAB connects in with the patient as he returns from getting a CT scan.

The family is interviewed and it is found that the patient has anemia for which he receives regular iron transfusions. He had a bladder biopsy 3 weeks previously but has not had any urinary bleeding since then.

The time of onset is confirmed to be within two hours.

Mr. G

The stroke specialist is able to interact with and examine Mr. G.

He is alert but unable to meaningfully communicate. He is not moving his right arm and unable to hold he right leg off the bed.
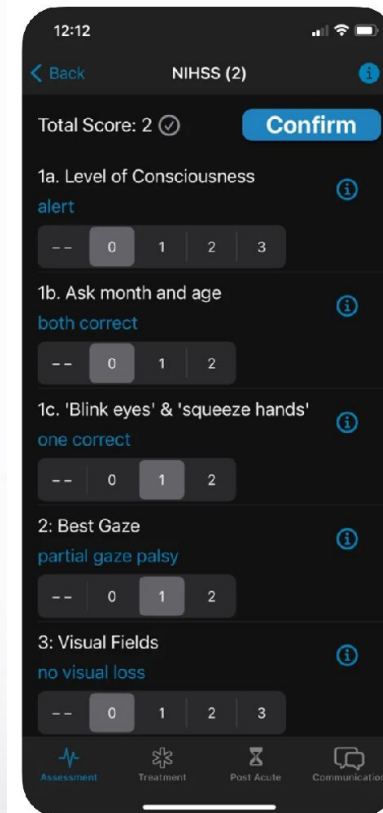
His NIH Stroke Scale is 18.

Accuracy of the Telestroke Evaluation

- Remote ascertainment of the NIHSS has similar reliability to in person examination

- Has been operationalized within apps to allow interactive completion among care team members
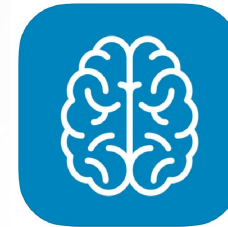
Stroke Code [12+]
VA Telestroke - Stroke Code
US Department of Veterans Affairs (VA)
Designed for iPad
★★★★★ 5.0 • 6 Ratings
Free

Wang S, et al. Stroke, 2003.

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Mr. G

- The telestroke specialist was able to assess Mr. S's eligibility for IV alteplase.

- The recent bladder biopsy was felt to be a minor risk for hemorrhage.

- Given his history of anemia of unknown source, the team obtained a CBC to ensure that his red blood cell levels were not too low or suggestive of active bleeding.

Alteplase Administration

- Telestroke physicians can make recommendations for alteplase and supervise bedside reconstitution

- Compared to patients treated directly at a stroke center, remotely guided administration of alteplase:

  - Is safe

  - Demonstrates improved accuracy of treatment

  - Associated with higher utilization rates

 - Has similar outcomes

Pervez, MA et al. *Stroke*, 2010.
Switzer, J et al. *J Emerg Med*, 2009.
Choi, J.Y., et al., Jt Comm J Qual Patient Saf, 2006.
Meyer, B.C., et al. Lancet Neurol, 2008.

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Patients needing a Higher Level of Care

- Telestroke can also help identify patients needing transfer for thrombectomy or malignant cerebral edema.

- Patients transferred following a telestroke consult have faster door to groin puncture times and better outcomes.

Pedragosa A, et al. *Cerebrovasc Dis*. 2012.
Audebert HJ, et al. *Cerebrovasc Dis*. 2005
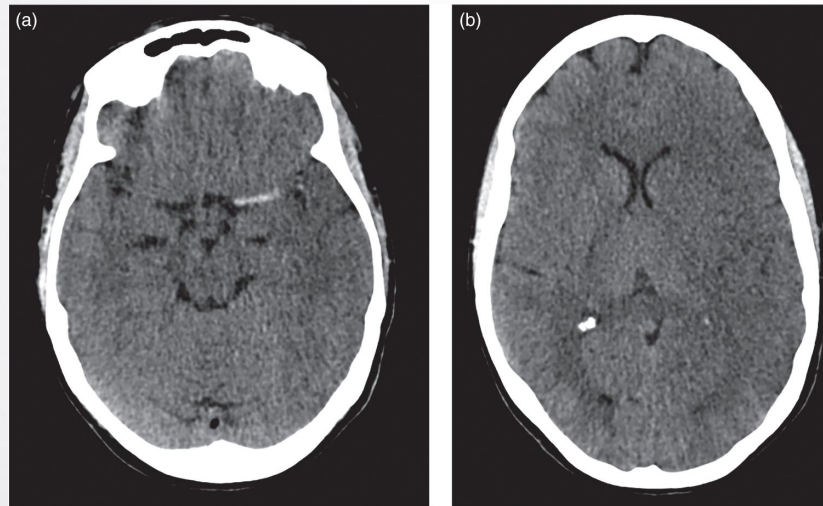
Mr. G

- The telestroke physician reviewed alteplase criteria with the patient's family along with risks and benefits

- Alteplase was reconstituted at bedside with the assistance of the telestroke physician and delivered within 3 hours from symptom onset

- Given the severity of his stroke scale, he was transferred to UAB for consideration of endovascular thrombectomy
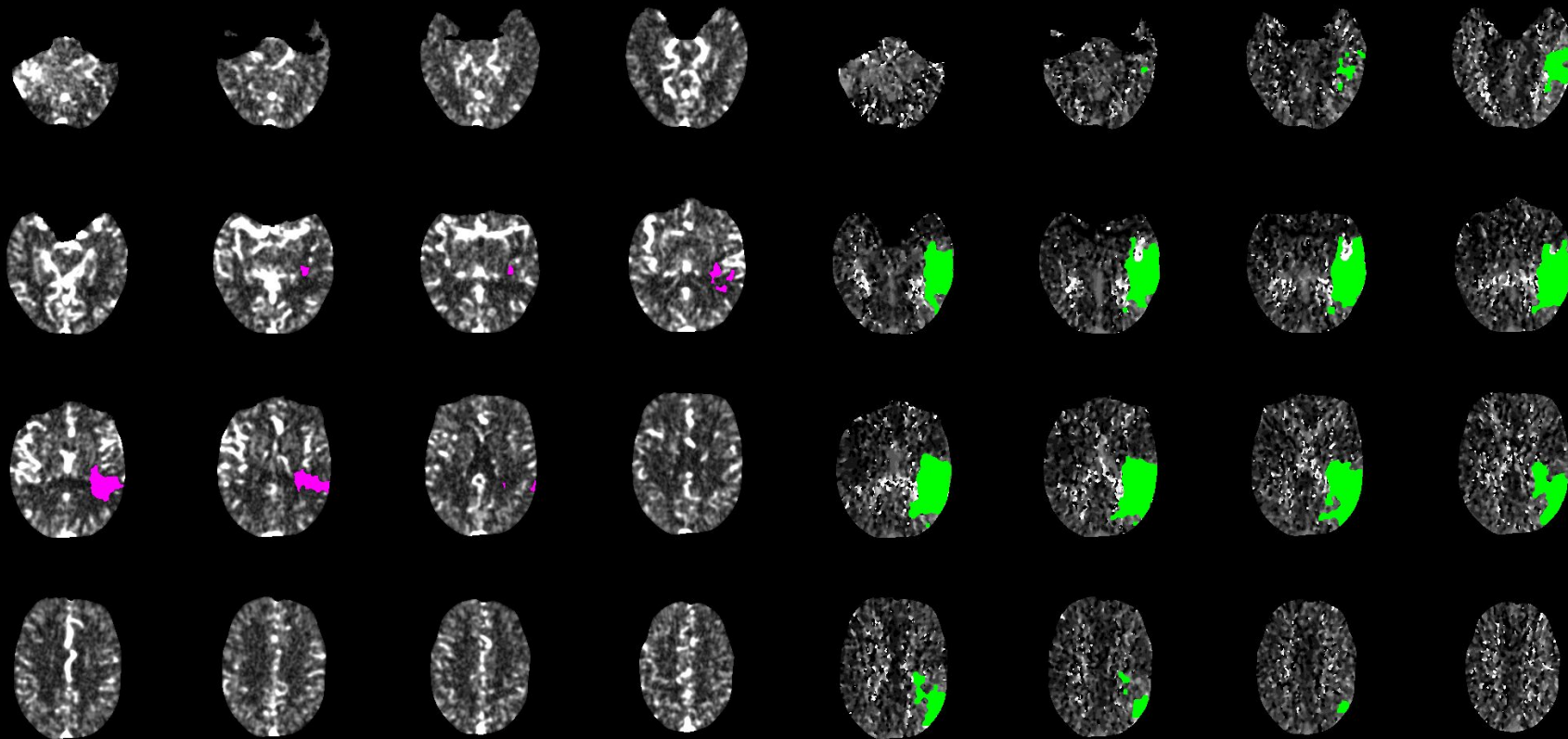
Mr. G

- Air transport was arranged and he arrived at UAB approximately 5 hours from symptom onset.

- CT angiography confirmed occlusion of the left middle cerebral artery
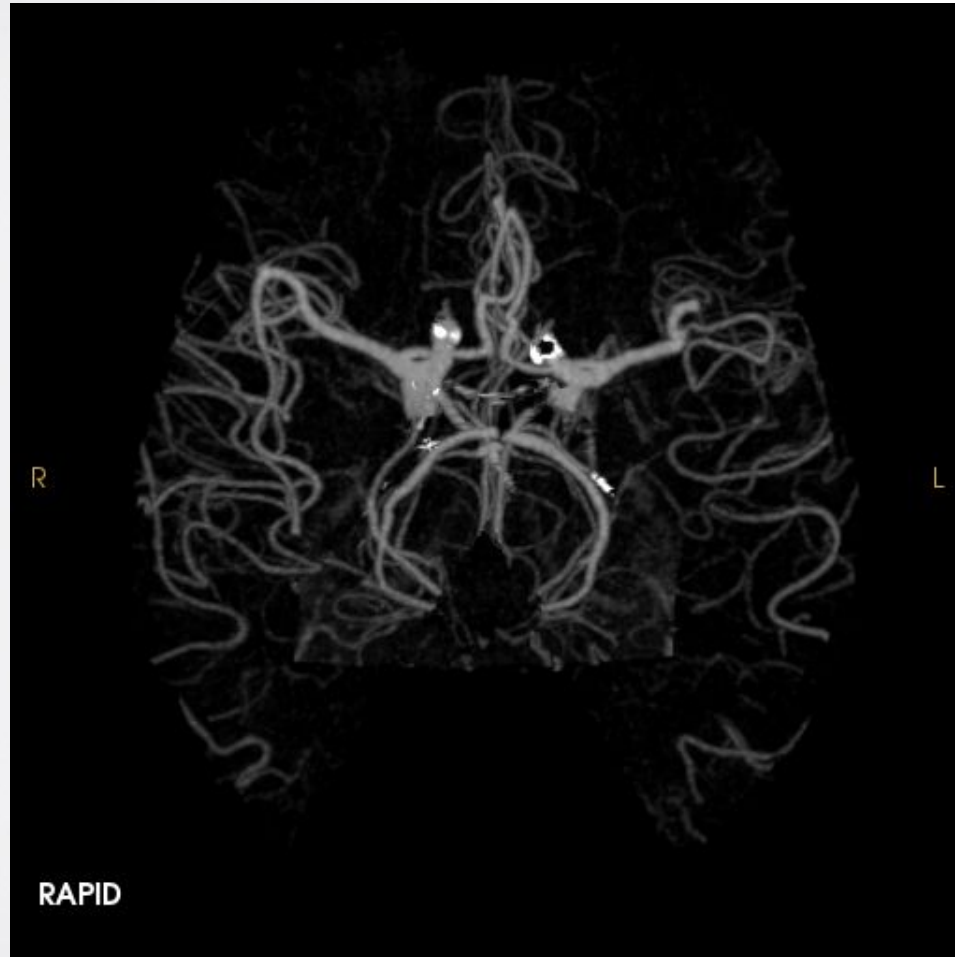
CBF

Tmax

● CBF<30%: 10 ml

● Tmax>6.0s: 98 ml

Mismatch volume: 88 ml
Mismatch ratio: 9.8

RAPID

Mr. G

- He underwent thrombectomy with partial recanalization of the occluded vessel

- Right sided weakness significantly improved after the procedure although he continued to have some residual aphasia

Tracking Quality in Telestroke

Guidelines for the Early Management of Patients With Acute Ischemic Stroke: 2019 Update to the 2018 Guidelines for the Early Management of Acute Ischemic Stroke: A Guideline for Healthcare Professionals From the American Heart Association/American Stroke Association

American Heart Association.

	COR	LOE	Comment
3. The use of telemedicine/telestroke resources and systems should be supported by healthcare institutions, governments, payers, and vendors as one method to ensure adequate 24/7 coverage and care of acute stroke patients in a variety of settings.	I	C-EO	Recommendation reworded for clarity from 2013 Stroke Systems of Care. COR and LOE added to conform with ACC/AHA 2015 Recommendation Classification System. See Table XCV in online Data Supplement 1 for original wording.
4. Telestroke/teleradiology evaluations of AIS patients can be effective for correct IV alteplase eligibility decision making.	IIa	B-R	New recommendation.
The STRokEDOC (Stroke Team Remote Evaluation Using a Digital Observation Camera) pooled analysis supported the hypothesis that telemedicine consultations, which included teleradiology, compared with telephone-only resulted in statistically significantly more accurate IV alteplase eligibility decision-making for patients exhibiting symptoms and signs of an acute stroke syndrome in EDs.[58]			See Table XI in online Data Supplement 1.
5. Administration of IV alteplase guided by telestroke consultation for patients with AIS can be beneficial.	IIa	B-NR	New recommendation.
A systematic review and meta-analysis was performed to evaluate the safety and efficacy of IV alteplase delivered through telestroke networks in patients with AIS. sICH rates were similar between patients subjected to telemedicine-guided IV alteplase and those receiving IV alteplase at stroke centers. There was no difference in mortality or in functional independence at 3 months between telestroke-guided and stroke center–managed patients. The findings indicate that IV alteplase delivery through telestroke networks is safe and effective in the 3-hour time window.[59]			See Table XII in online Data Supplement 1.
6. Telestroke networks may be reasonable for triaging patients with AIS who may be eligible for interfacility transfer in order to be considered for emergency mechanical thrombectomy.	IIb	B-NR	New recommendation.

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Telemedicine Quality and Outcomes in Stroke: A Scientific Statement for Healthcare Professionals From the American Heart Association/American Stroke Association

- Site Metrics
  - Door to ED Physician
  - Door to CT
  - Door to Drug
  - Staff Education

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Telestroke Metrics

- Door to Consultation Time
- Consultation Time to Video Initiation
- Consultation Duration
- Alteplase utilization

Going Forward: Tracking Quality

- Treatments
  - Alteplase Rates
- Transfers
  - Rates
  - Door In-Door Out
- Stroke Mimic Rates

- Patient Outcomes
  - Persisting deficits
  - Symptomatic Hemorrhage
  - Complications
  - Disposition
  - Length of Stay
  - Mortality

Telestroke Outcomes

Perspectives from Providers, Patients, and Systems

Provider Satisfaction

- Telestroke services generally receive positive feedback from providers

- More satisfaction is seen among ED providers in under-resourced areas

- Less is known about overall satisfaction of telestroke providers
  - They rate the service that they provide as high
  - Unclear if this is valued over other clinical activities.

Patient Satisfaction

- Early studies in this area focused on technological aspects.

- Patients may both embrace or resist change with age being an important factor

CLINICAL AND POPULATION SCIENCES

Provider Communication and Telepresence Enhance Veteran Satisfaction With Telestroke Consultations

Michael Lyerly, MD (iD) , Griffin Selch, BS, Holly Martin, MPH, Michelle LaPradd, MS, Susan Ofner, MS, Glenn Graham, MD, PhD, Jane Anderson, DNS, Sharyl Martini, MD, PhD, and Linda S. Williams, MD

- Analysis of patients treated within the VA National Telestroke Network (distributive model)
- 208 post-telestroke encounter interviews
- Patients and caregivers were asked a structured interview about their perceptions of telehealth can quality of care
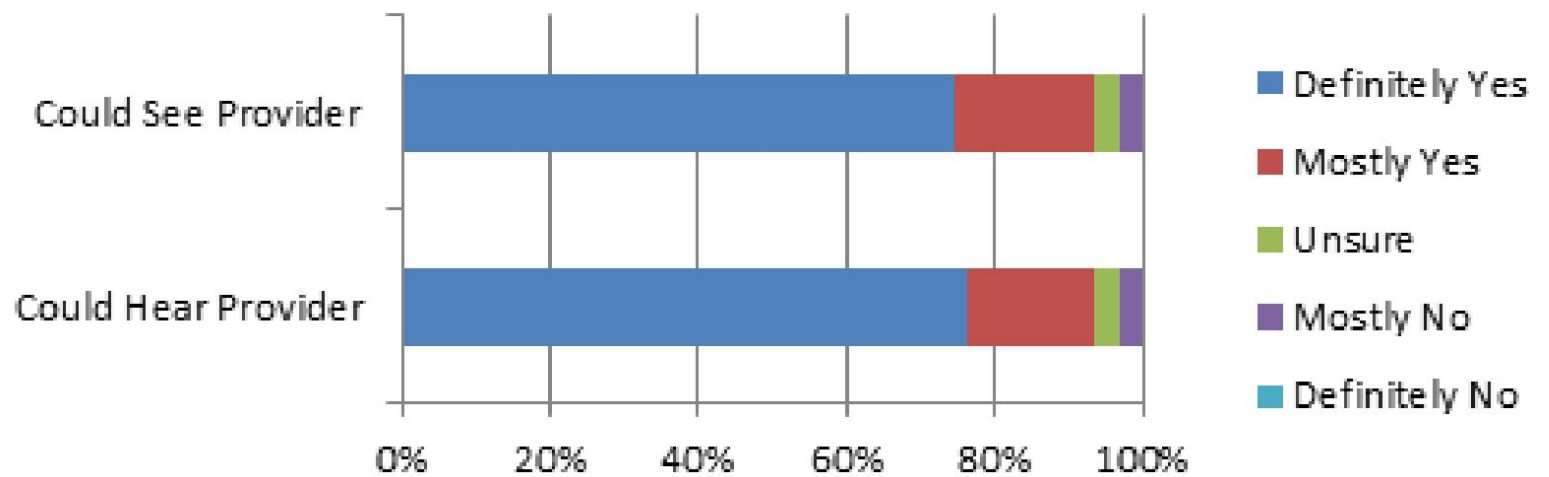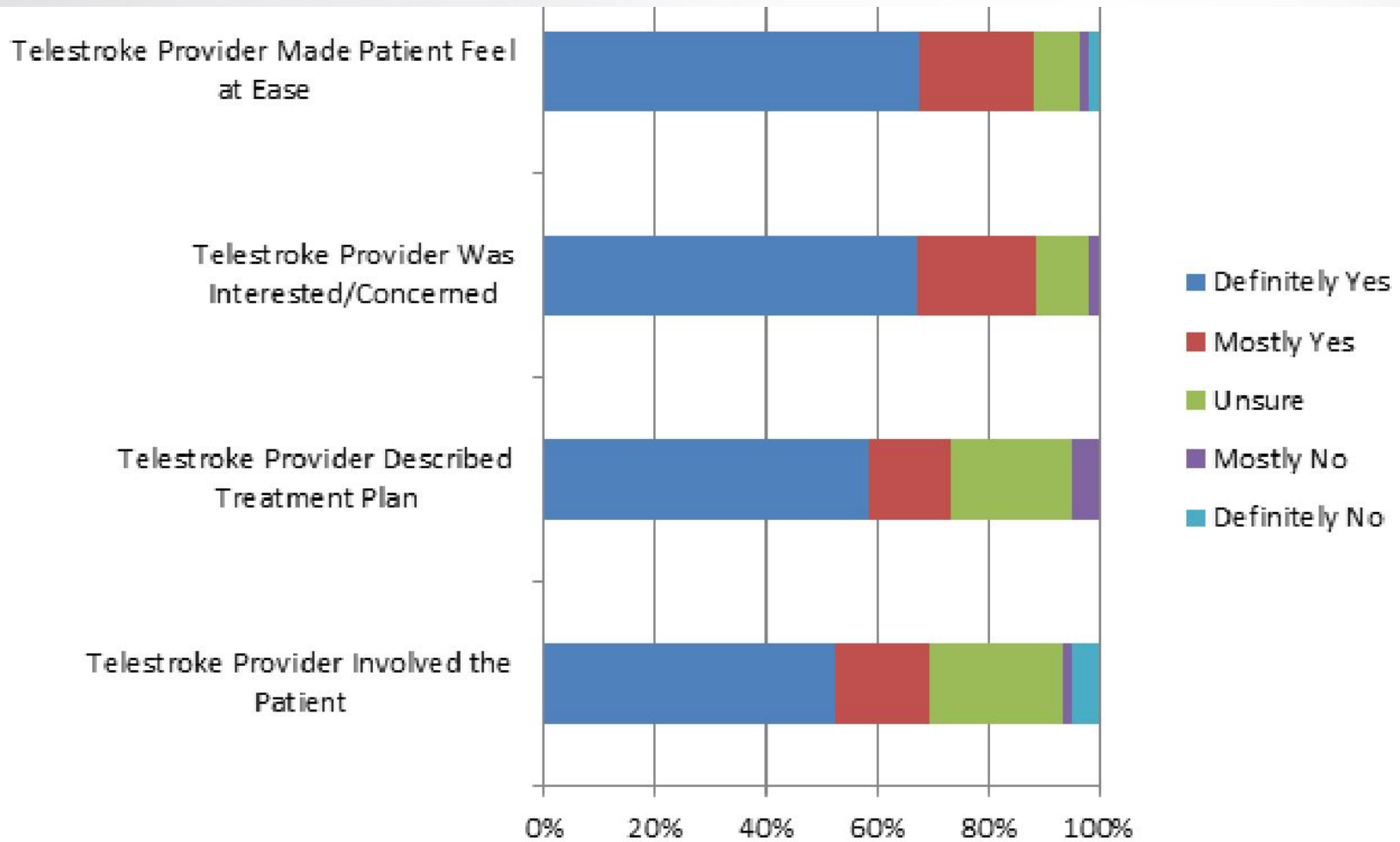
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Predictors of Patient Satisfaction

Relatively high telepresence ratings: 69-70% felt the Telestroke encounter was very much like a real encounter and they were intensely engaged (rating of 6 or 7 on a 1-7 scale)

To what extent did it feel like you were intensly engaged with the onscreen Telestroke doctor? (N=354) — 57%, 13%, 14%, 7%

To what extent was the Telestroke experience like a face-to-face meeting? (N=354) — 54%, 15%, 18%, 6%

Legend: To an extreme extent | 6 | 5 | 4 | 3 | 2 | Not at all

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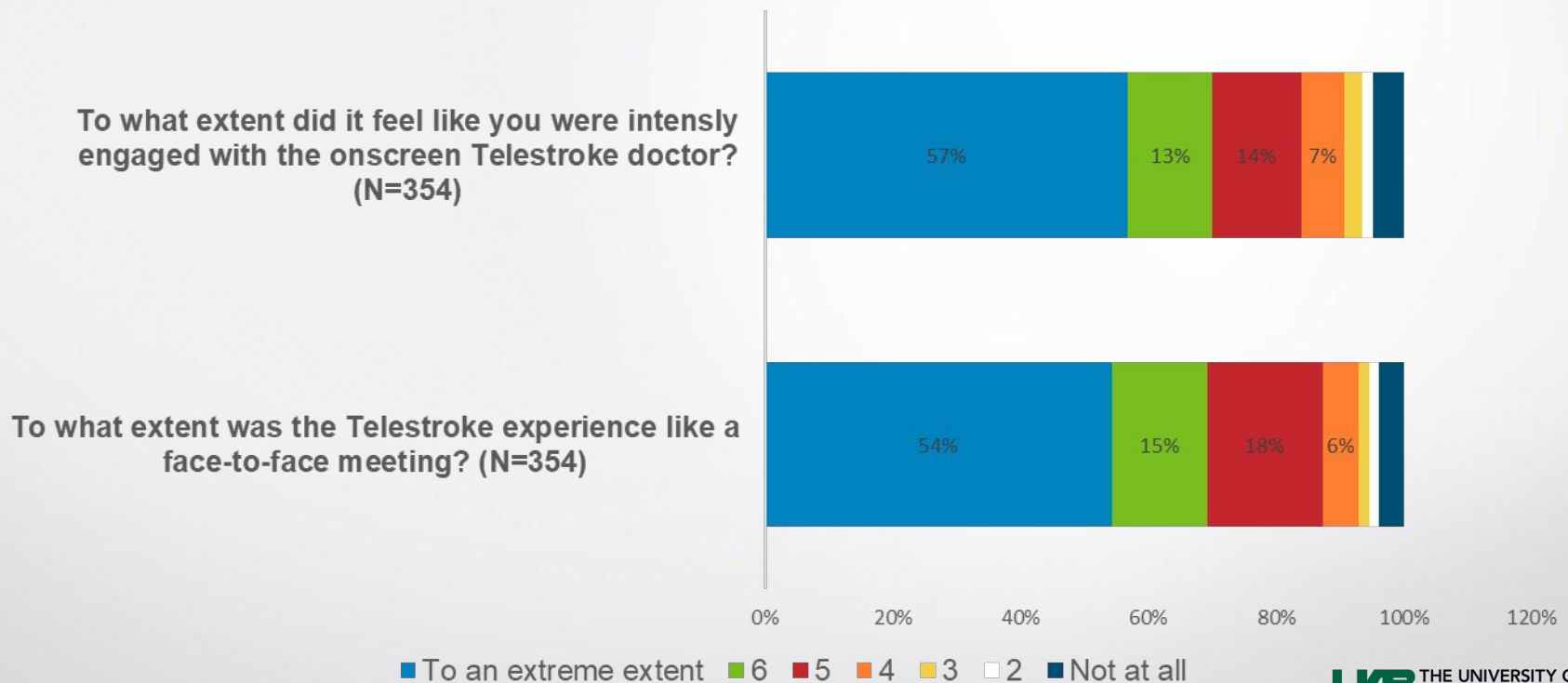
Predictors of Patient Satisfaction

- The emerging theme is that patient satisfaction is driven by:
    - Provider communication
    - Telepresence
- These factors are to some extent modifiable through provider training
- Although important considerations, technological aspects (A/V quality, prior experience with telehealth) had less influence on overall satisfaction

The Patient is the Center of the Consultation

"I didn't have any input…he [Telestroke doctor] was talking to the other doctor."

Enhancing Communication and Telepresence

- The telestroke provider frequently has divided attention
  - the patient
  - family members
  - local care providers
  - robotic camera controls
  - electronic medical records
  - neuroimaging interfaces.
- It is easy to lose focus on the patient which may be perceived as disengagement.

Cost Effectiveness

- Telestroke networks are cost-effective from both a societal and a hospital perspective.

- Facilitates rapid delivery of acute reperfusion therapies and early transfer

- May also help identify patients who may qualify for clinical trials

Demaerschalk BM, et al. Am J Manag Care. 2013
Switzer JA, et al. Circ Cardiovasc Qual Outcomes. 2013

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Cost Effectiveness

- 90 Day Horizon
  - ICER $108,363/QALY

- Lifetime Horizon
  - ICER $2,449/QALY

- Simulation Models: 99.7% of Monte Carlo simulations demonstrate a lifetime horizon ICER <$50,000 (below accepted threshold in the US)

Nelson RE, Saltzman GM, Skalabrin EJ, Demaerschalk BM, Majersik JJ. The cost-effectiveness of telestroke in the treatment of acute ischemic stroke. Neurology. 2011 Oct 25;77(17):1590-8.

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Interhospital Transfer

- Another anticipated benefit of an effective telestroke network is improved disposition recommendations to the appropriate level of care.

- Some patients may be best served by staying at a community facility while others warrant transfer to a higher level of care such as a primary or comprehensive stroke center.

- Interhospital transfer for stroke has increased over the past two decades, particularly with the expansion of eligibility for endovascular thrombectomy.

- This has the potential to overburden tertiary centers with stroke mimics or thrombectomy-ineligible patients as well as to increase healthcare expenditures.

Interhospital Transfer

- Telestroke consultation has been associated with improved accuracy of diagnosis which potentially may avoid the unnecessary transfer of a patient with a stroke mimic to a stroke center while at the same time appropriately selecting those who need a higher level of care.

- There is limited available data on how telestroke programs impact interhospital transfers
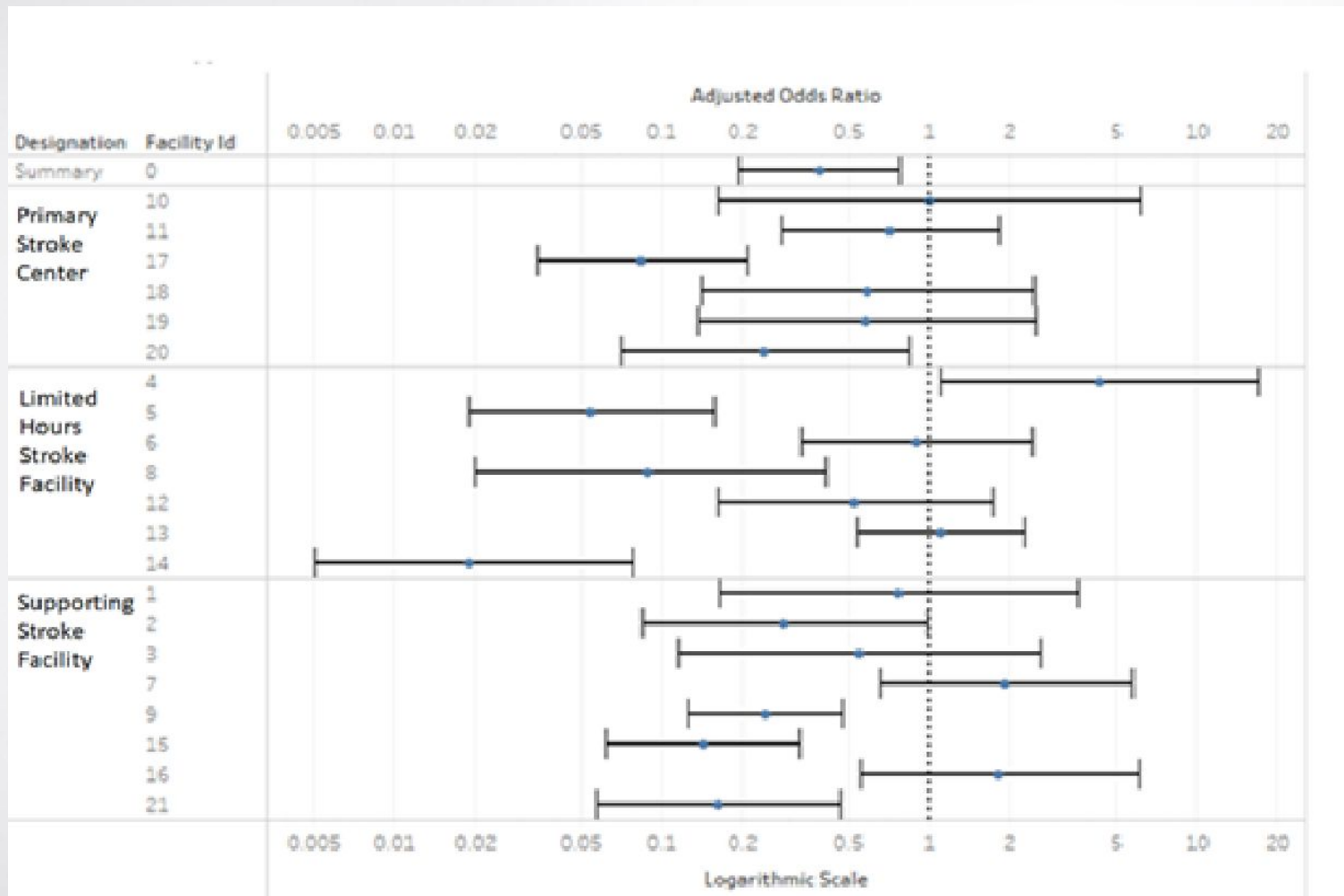
Lyerly MJ, Daggy J, LaPradd M, Martin H, Edwards B, Graham G, Martini S, Anderson J, Williams LS. Impact of Telestroke Implementation on Emergency Department Transfer Rate. Neurology. 2022 Feb 28:10.1212

Covariate		Odds Ratio [95% CI]	P value
Odds Ratios for Transfer from Multiple Logistic Regression Model			
Presentation Post-Telestroke Program		0.39 [0.19, 0.77]	0.007
Age	(5 year decrement)	0.93 [0.89, 0.98]	0.008
NIHSS	(1 point increase)	1.13 [1.10, 1.15]	<0.0001
Last known well	< 8 h vs > 24 h	3.23 [2.49, 4.19]	<0.0001
	8 - 24 h vs > 24 h	1.02 [0.69, 1.49]	0.934
Facility annual stroke volume	(per 10 stroke encounters)	0.85 [0.79, 0.92]	0.001

Lyerly MJ, Daggy J, LaPradd M, Martin H, Edwards B, Graham G, Martini S, Anderson J, Williams LS. Impact of Telestroke Implementation on Emergency Department Transfer Rate. Neurology. 2022 Feb 28:10.1212

Impact on Disparities

Disparities in Stroke

- Racial disparities have been reported at nearly every level of stroke management, from EMS triage to rehabilitation

- Despite having a higher incidence of stroke, African Americans:
  - have reduced access to stroke care
  - experience longer ED wait times
  - are less likely to receive acute stroke therapies
- Geographic Disparities
  - Rural versus Urban
 - Stroke Belt

Howard VJ et al. *Ann Neurol*. 200.

Karve SJ, et al. *Journal of stroke and cerebrovascular diseases*. 2011.

Hsia AW et al. *Stroke*. 2011.

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Disparities in Stroke

- Telemedicine has the potential to bridge gaps in acute stroke care
  - Affords timely access to neurologic expertise in disadvantaged regions
  - Overcome geographic obstacles
  - Facilitate appropriate disposition to a higher level of care
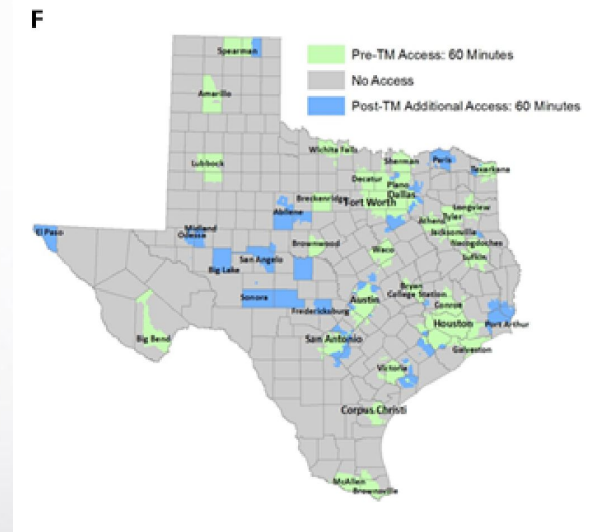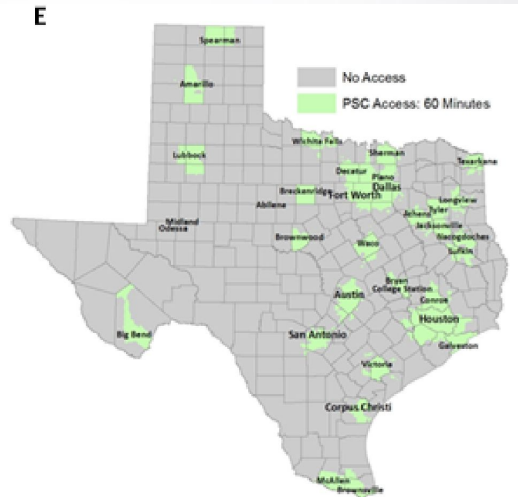
Telestroke at Ascension

UAB Has been partnering with Ascension since the Summer of 2021 to implement telestroke services

	Go-Live	December	January	February	March	April
Birmingham	12/13/21	2	5	6	19	23
East	12/13/21	3	1	8	8	13
Chilton	3/21/22				0	4
Blount	4/25/22					0
St. Clair	4/25/22					2

Our Program

- 24/7 Access to a UAB Credentialed Vascular Neurologist

- 10 Board Certified vascular neurologists in the call pool

- Goal: Face to Face consultation within 10 minutes of notification

- Timely diagnosis, treatment, and disposition decision

Typical Work Flow

- ED Team initiates consult via web based notification
- Telestroke Provider will interview the patient, family, and/or care team
- Partnered NIH Stroke Scale Examination
- Review of neuroimaging
- Alteplase decision
  - Telestroke provider will have risk/benefit discussion with patient and family
  - ED physician will order the medication
- Endovascular decision
- Disposition decision

Ascension St. Vincent's Health System Stroke Algorithm
SYSTEM VERSION 3 - updated 02/17/2022
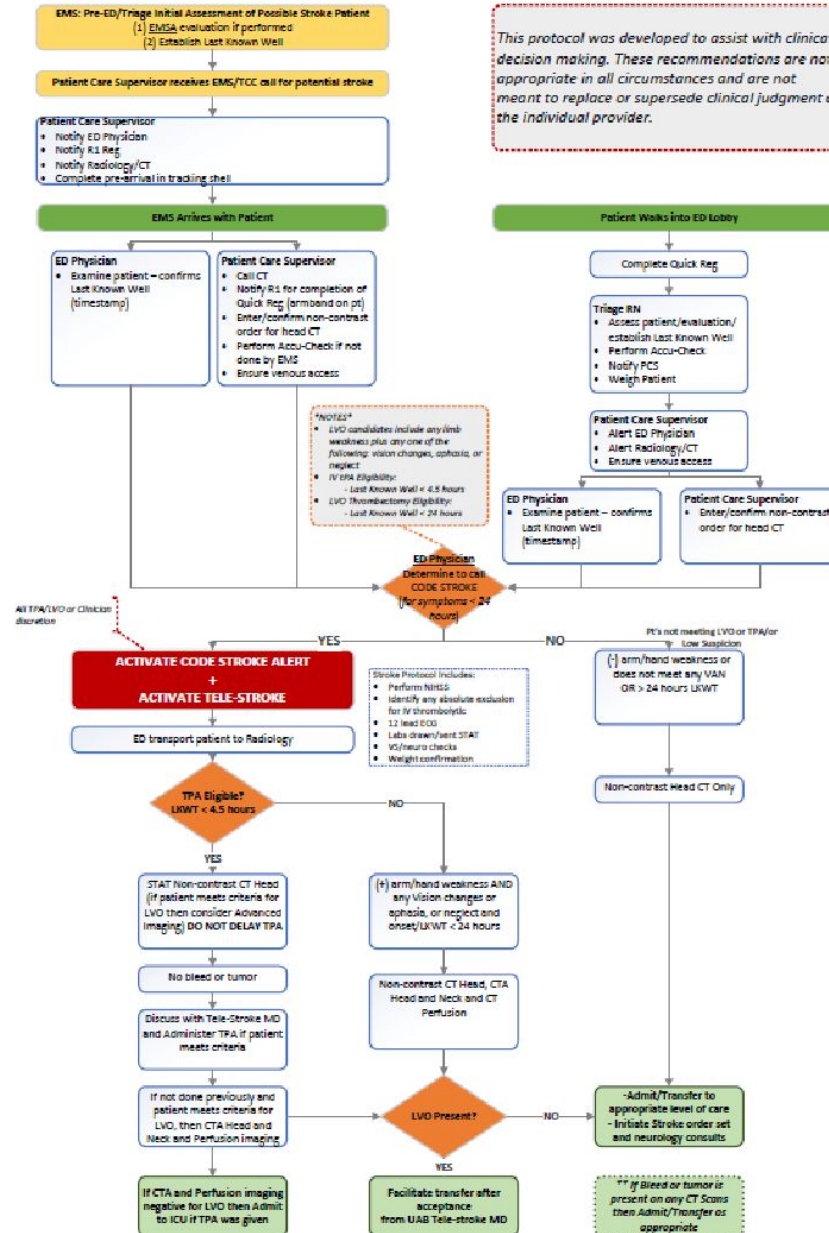
Workflow Location Device Callback 4 **Patient** 5 Intake

Add Patient

General ⌃

First Name ⚠

Middle Name

Last Name ⚠

Date Of Birth
YYYY-MM-DD ⚠ 📅

Gender ⚠ ⌄

Biological Sex ⌄

Gender Identity

Preferred Language ⌄

Race/ethnicity ⌄

Social Security Number

Intake data

Case Priority

▼

Referring Provider Name

Callback Phone Number

🇺🇸 ▼

Referring Notes

Is stroke onset time known?　　　　　　　○ Yes　　　○ No

ED Arrival Date and Time (24 Hour Format)

MM/DD/YYYY HH:mm 📅

Is patient currently on Anticoagulants?　　○ Yes　　　○ No　　　○ Unknown

Patient Location

Room Number　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　▼

Admitted/Observation　　　　　　　　　　　○ Yes　　　○ No

The patient is:　　　　　　　　　　　　　○ Left Handed　　○ Right Handed　　○ Both

The Consult

- One a case is entered, the on call physician receives a notification and calls in, typically within 5-10 minutes.

- Start with introductions

  - Identify yourself and your role

  - Identify the patient and their family members

  - Identify care team members in the room

- Be mindful of "blindspots"

The Consult

- We request that at least one member of the care team be in the patient room during the consultation

- Be prepared to provide a brief history of the patient

  – Key History Information

  – Last Known Normal Time

  – Progression of Symptoms

  – Any witnessed seizure activity

  – Past Medical History

  – Medications (particularly antithrombotics, insulin, seizure meds)

  – Glucose and blood pressure

  – ED Course

The Consult

- The examination will center around the National Institutes of Health Stroke Scale (NIHSS)

- This is an 11 point scale that can typically be completed in just a few minutes

- The telestroke consultant will be able to perform much of the exam without assistance but there will be some aspects that will require some partnering

- The NIHSS will be documented in the telestroke note.

The Consult

- If alteplase is recommended, the consultant will assist with:
  - Dose confirmation
  - Monitoring drug reconstitution
  - Reviewing risks and benefits of the medication
  - Reviewing relative and absolute contraindications

- It is a good idea to do a "time out" before delivering drug
  - Confirm agreement on no exclusions
  - Confirm dose
  - Confirm glucose, blood pressure, coags (if needed)
  - Consent

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The Consult

- The consultant will also review recommendations with the patient and their family including if transfer is recommended or if the patient may be a candidate for endovascular therapy.

- For endovascular eligible patients, the consultant will have access to the CTA and will help guide the ED team in determining if the patient is eligible for transfer.

Conclusions

- Telemedicine for stroke is a well established care model for acute stroke care

- The role of telemedicine will continue to expand over the next 5-10 years throughout Alabama

- Care delivered through telemedicine is similar to in-person care and superior to that which can be delivered by telephone alone

- Patient satisfaction is high but ongoing work is needed to optimize the experience for both the provider and patient