

# VALIDATE

## Validation of Artificial Intelligence to Limit Delays in Acute Stroke Treatment and Endovascular Therapy



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# DISCLOSURES

Thomas Devlin, MD, PhD - speakers bureau, equity interest in VIZ  
Morgan Figurelle, DO - none  
Amanda Avila, MD - none  
Gregory Heath, DHSc, MPH - none  
Caitlyn Boyd, MHA, MSN, RN - none  
Lani Gao, PhD - none  
Hira Ayub - none  
Theresa Sevilis, DO - none

# Viz.ai is in 1300 hospitals Worldwide Based on Single Center Data

**TABLE 1. PREVIOUS STUDIES ON VIZ.AI**

HOSPITAL	AUTHORS	TITLE	STUDY DESIGN	STUDY PERIOD	SAMPLE SIZE	MAIN RESULTS	REFERENCE
1	Mount Sinai, New York, NY, Morey, R...Efil, JT.	Impact of Viz LYO on Time-to-Treatment and Clinical Outcomes in Large Vessel Occlusion Stroke Patients Presenting to Primary Stroke Centers	Single Center Hub - Spoke model comparing metrics before and after VIZ LYO implementation.	Pre-Viz: July 1, 2018, and March 15, 2019 / Post-Viz: July 1, 2019, and March 15, 2020	55 patients (29 pre-Viz cohort / 26 post-Viz cohort)	Post-Viz implementation: (1) faster door-to-NIV notification (delta = 15 min (40 vs 25 min, p=0.01) with less variation (p<0.05); (2) door-to-puncture time was shorter but not significant (delta = 25 min shorter in Viz cohort, p= 0.15, NS ).	medRxiv preprint doi: <a href="https://doi.org/10.1101/2020.07.02.20143334">https://doi.org/10.1101/2020.07.02.20143334</a> ; this version posted July 5, 2020.
2	University of California, San Diego, CA, Figurella ME... Meyer BC.	(VISION): Viz.ai Implementation of Stroke Augmented Intelligence and Communication Platform to Improve Indicators and Outcomes for a Comprehensive Stroke Center and Network	Single Center Hub - Spoke model comparing metrics before and after VIZ LYO implementation. Assessed effect of day vs night shift arrival	Pre-Viz.ai period (June 10, 2020, to January 17, 2021) vs. Post Viz.ai deployment period (January 18, 2021, to June 17, 2021)	82 NTR cases total. (pre-Viz-post-Viz) Direct to Hub day (7/7), direct to Hub night (10/5). Spoke arrival day (13/6). Spoke arrival night (17/7).	Post-VIZ implementation: (1) faster door to groin times for both patients presenting to the Spoke and Hub (HUB-DTG-24hr = 32% reduction, 127 min vs 86 min (delta = 41); p=0.006; SPOKE-DTG-24hr: 33% reduction, 42 min vs 28 min; (delta = 14), p=0.036).	ANR Am J Neuroradiol 2023, <a href="http://dx.doi.org/10.3171/ajnr.A7716">http://dx.doi.org/10.3171/ajnr.A7716</a>
3	Eranger Health System - Unit of Tennessee, Chattanooga, TN, Devlin T... Sawyer J.	(DISTINCTION): Utilization of Applied Artificial Intelligence to Facilitate LYO Detection and Synchronizing Workflow to Improve Time to Treatment in High-Volume Hub & Spoke Networks	Single Center Hub - Spoke model comparing metrics before and after VIZ LYO implementation.	Nov, 2017 - Jul, 2019	Pre Viz: 11 patients ; Post Viz: 4 patients	Post-Viz LYO implementation significant improvement in Spoke door-in to hub groin puncture (mean = 218 vs. 141, p=0.02); and in Spoke CT to groin puncture time (mean = 200 vs. 132, p = 0.04).	World Stroke Organization, 2020, Abstract #3069 - AS38.
4	Stemmes-Nurphley Clinic, University of Tennessee, Memphis, TN, Eljovich L... Hot D.	Automated emergent large vessel occlusion detection by artificial intelligence improves stroke workflow in a hub and spoke stroke system of care	Single Center Hub - Spoke model comparing metrics before and after VIZ LYO implementation.	Dec, 2018 - Dec, 2019	104 patients	Post-Viz: Significant improvement in median time from CTA completion to NIV contact (delta = 19 min (26 min V.7), p<0.001) and Spoke door in to arterial puncture for patients transferred from spoke to hub for EVT (delta 44 min, 185 vs 141, p=0.027).	J Neurointerv Surg. 2022 Jul;14(7):704-708. doi: 10.1136/neurintsurg-2021-017714
5	Valley Baptist medical Center, Harlingen, Texas, Hassan AE... Wondwossen GT	The implementation of artificial intelligence significantly reduces door-in-door-out times in a primary care center prior to transfer	Single Center Hub - Spoke model comparing metrics before and after VIZ LYO implementation.	Pre-Viz: Feb 2017 to Nov 2018 / Post Viz: Nov 2018 - June 2020	Pre Viz = 28; Post-Viz = 35	Post Viz.ai median CTA time at PSC to door-in at CSC was significantly reduced by an average of 22.5 min. (132.5 min versus 110 min; p = 0.0470).	Interv. Neuroradiol. - 2022 Aug 25;15910199221122848. doi: 10.1177/15910199221122848.
6	Valley Baptist medical Center, Harlingen, Texas, Hassan AE... Tekle WG	Artificial Intelligence-Parallel Stroke Workflow Tool Improves Reperfusion Rates and Door-in to Puncture Interval	Single Center -Hub and Spoke Model	Pre-Viz: Nov 2016 - Nov 2018, Post-Viz: Dec 2018 - May 2020	Pre-Viz: 86 patients; Post-Viz: 102 pts	Mean Door-in to Puncture time at the Hub improved (delta = 86.7 min; 206.6 vs 119.9 min; p<0.001). Significant improvement in rate of reperfusion TICI 2b-3 (p=0.036).	Stroke Vasc Interv Neurol. 2022;2:e00024. DOI: 10.1161/SVHN.121.00024

15 min Faster Door-to NIR Contact

Faster Door-to-Table (Spoke = 42 min / Hub =14 min)

Faster Spoke door-in- & spoke CT- to Table

Faster spoke CTA to NIR call (19 min) Spoke door to Table (44 min)

Faster Spoke CTA to Hub Door-in (22.5 min)

Faster Hub Door to Puncture (86.7 min) Higher Rate of TICI2b-3 Reperfusion (9.2%)

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# Critique of past Studies on Viz.ai

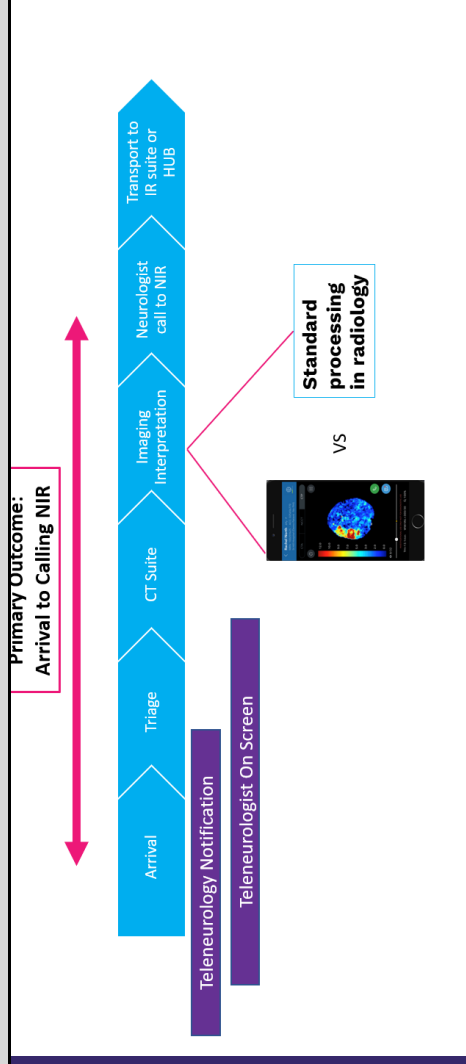
*While the studies to date have been small, the fact that many found statistically significant improvements in stroke workflow after Viz.ai installation suggests the technology may be highly impactful.*

## LIMITATIONS of Previous Viz.ai Studies

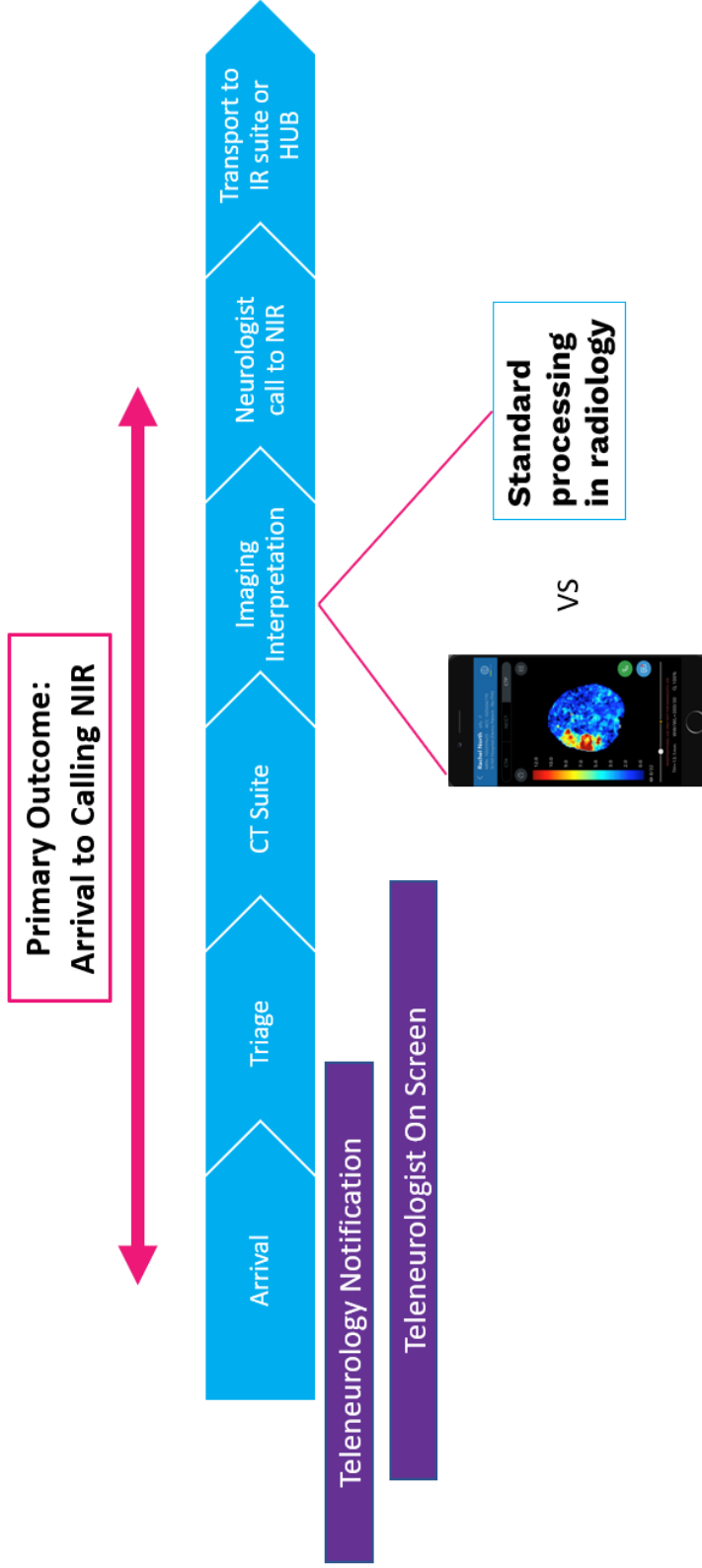
1. Small sample size questions generalizability & reproducibility of results.
2. All were serial cohort studies with significant time between cohorts.
3. Many metrics were assessed not directly controlled by Viz.ai.

# VALIDATE TRIAL DESIGN

Statistical analysis was done by an independent team of biostatisticians at the University of Tennessee Chattanooga.



# VALIDATE WORKFLOW

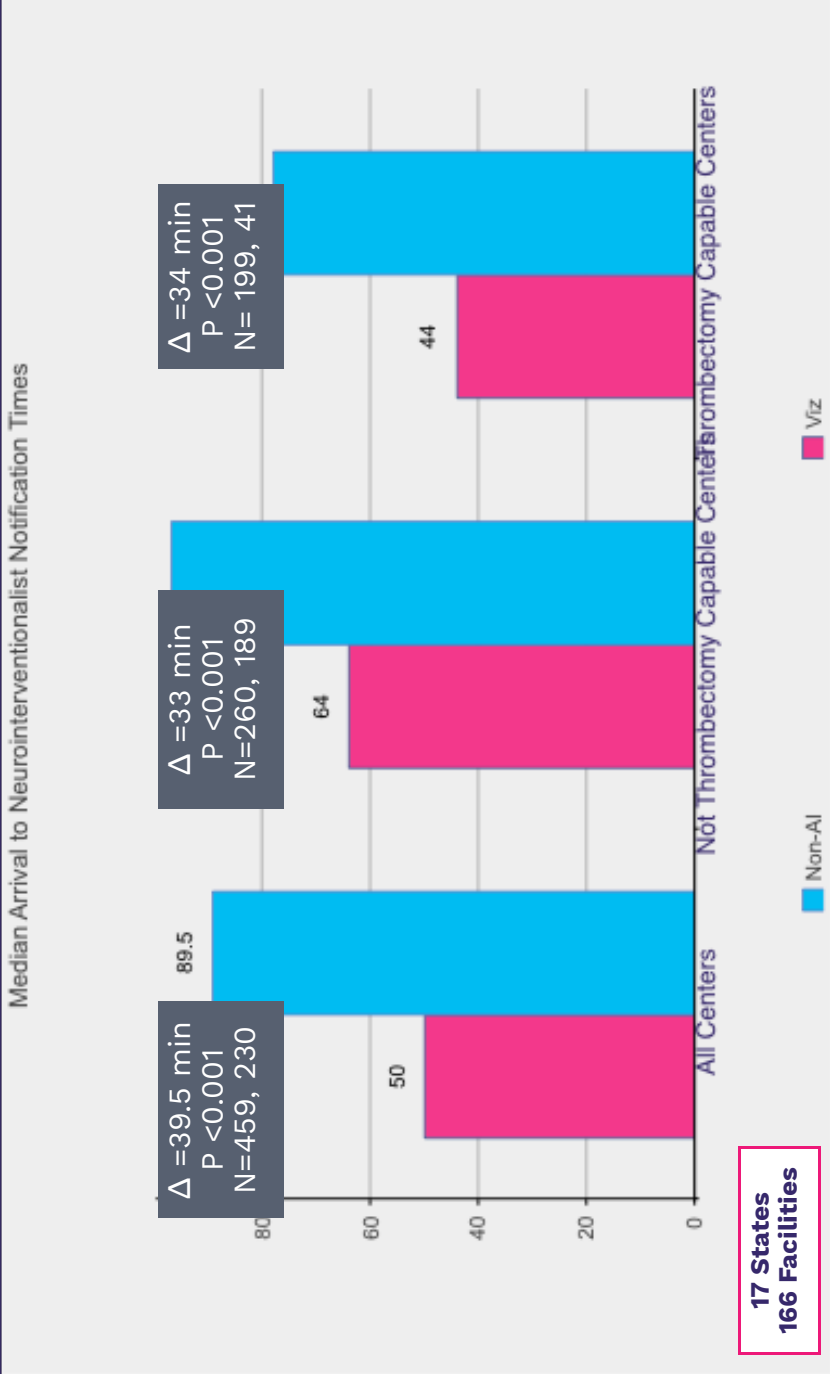


# VALIDATE RESULTS

**14,116 patients enrolled - 17 states - 166 facilities**  
**Viz cohort - 8,557 patients, 76 hospitals**  
**Non-AI cohort - 5,559, 90 hospitals**

	Non-AI (5,559)	VIZ (8,557)	P value
Sex, Female n(%)	2,961 (53.3%)	4,624 (54.0%)	0.3776
Age mean, sd	65.5 ± 15.9	66.8 ± 16.3	< 0.001
Median NIHSS (IQR)	2 (1.0, 6.0)	2 (0.0, 6.0)	<0.001
Median Pre-mRS (IQR)	0 (0.0, 1.0)	0 (0.0, 1.0)	0.2602
Prenotification (%)	997 (17.9%)	2,134 (24.9%)	< 0.001

# Patient Arrival to Call To NIR



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# Results

OVERALL ANALYSIS: NON-AI vs VIZ		
STEP BY STEP TIME INTERVAL COMPARISON		
	Non-AI (n=5,559)	Viz (n = 8,557) P value
<b>Patient Arrival to NIR Notification Time, Median(IQR)</b>	89.5 (59.2,122.0)	50 (40.0, 82.0) p < 0.001, delta = -39.5
<b>Patient Arrival to TeleNeuro Call Center Start, Median(IQR)</b>	12.6 (6.2, 26.3)	10.3 (4.8, 20.9) p < 0.001, delta = -2.3
<b>TeleNeuro Call Center Start to First TeleNeurologist Login</b>	3 (2, 5)	2 (1,4) p < 0.001, delta = -1
<b>TIME ADJUSTED VIZ-SPECIFIC EFFECT (CALL TO NIR) = 36.2 min</b>		

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# Results

## SUBGROUP ANALYSIS: NON-AI vs VIZ AT Thrombectomy vs Non-thrombectomy Centers

### STEP BY STEP TIME INTERVAL COMPARISON

	Non-Thrombectomy Centers			Thrombectomy Centers		
	Non-AI (N = 4,962)	VIZ (N = 5,737)	P value	Non-AI (N = 597)	VIZ (N = 2,820)	P value
Patient Arrival to NIR Notification Time, Median (IQR)	97 (62.00, 126.50)	64 (46.00, 91.00)	p < 0.001, delta = -33	78 (55.00, 95.00)	44.00 (33.75, 59.00)	p < 0.001, delta = -34
Patient Arrival to TeleNeuro Call Center Start, Median(IQR)	12.38 (5.97, 25.76)	10.97 (5.23, 21.67)	p < 0.001, delta = -1.41	14.62 (7.31, 28.80)	8.53 (3.81, 17.54)	p < 0.001, delta = -6.09
TeleNeuro Call Center Start to First TeleNeurologist Login	3 (2.0,5)	2 (1.0,4)	p < 0.001, delta = -1	3(2.0,5.0)	2.0(1.0,4.0)	p <0.001, delta = -1

**TIME ADJUSTED VIZ-SPECIFIC EFFECT (CALL TO NIR): SPOKE = -30.59 min / HUB = -26.91 min**

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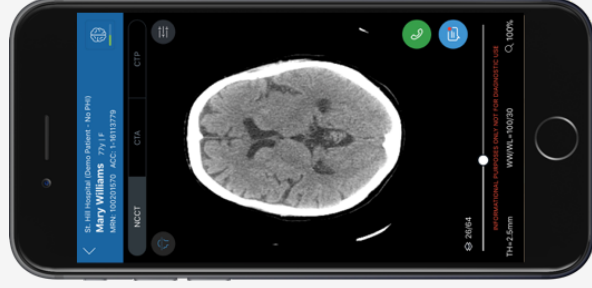
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TRANSFORMATIVE TELEMEDICINE

VALIDATE primarily leveraged Viz.ai's fast high-resolution neuroimaging platform.



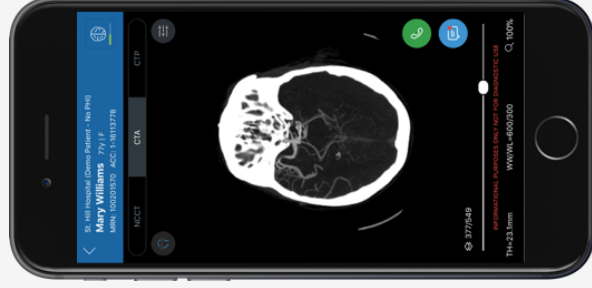
TeleSpecialists<sup>®</sup>  
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*Under different stroke care models, other Viz.ai functionalities*



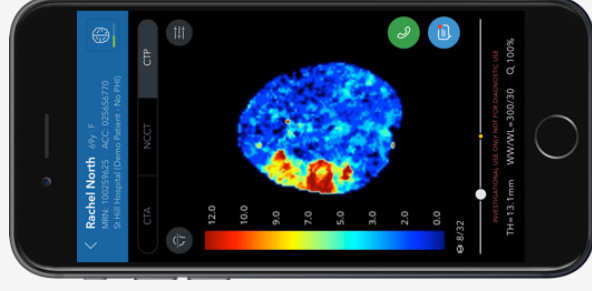
### Viz Mobile Viewer

Mobile non-diagnostic viewer for NCCT, CTA, CTP images.



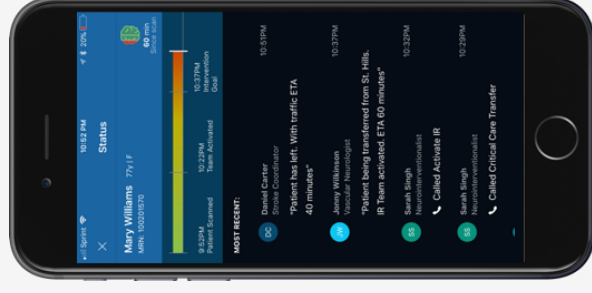
### Viz LVO

Automated detection of suspected LVOs using artificial intelligence.



### Viz CTP

Automated CT perfusion analysis and mapping.



### Viz Communication

HIPAA-compliant text messaging and telecommunication.

## CONCLUSIONS

- The results of this large multicenter investigation show that Viz.ai is a powerful tool expediting patient workflow and first contact with the NIR within a telemedicine system.

- Benefits exist regardless of whether the patient first presents to a spoke or hub hospital.

- This 17 state, 166 site study corroborates the results of previous smaller studies that concluded a benefit of Viz.ai at driving faster LVO detection and overall patient workflow.

- This large multicenter study, when combined with the results of previous reports, represent a call to action for wider adoption of this technology into the armamentarium of acute stroke care.

# Thank you

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