Controverse : Acute radiological stroke diagnosis assisted by AI improves patient outcome

PRO - position

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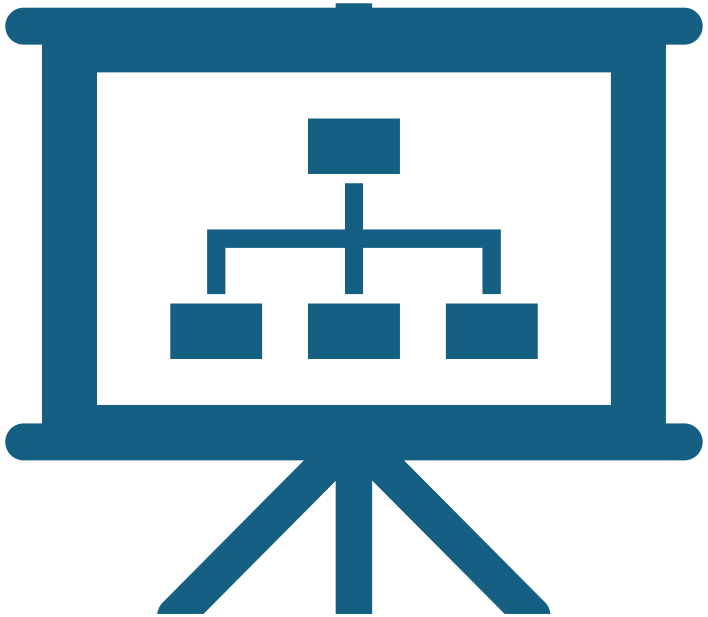
AI and Radiology



Classic AI

Generative AI

Artificial Intelligence and neuroimaging

Feature	Classic AI (Analytical / Predictive)	Generative AI
Primary Goal	Analyze, classify and predict	Create and generate
Output Type	Predictable	Unpredictable
Real-World Example in Stroke	• Identify Core and ischemic Penumbra in Stroke • ASPECTS • LVO or MeVO detection	• Create a synthetic CT perfusion Map fron Non-Contrast CT • Generating Draft Radiology Reports
FDA and CE marked Software for acute radiological stroke diagnosis assisted by AI	• 10 -12 companies • 20-30 specific modules (ASPECTS, LVO, NCCT, CTP and MRP)	None (high risk of «hallucination»)

Classic AI-powered medical imaging platforms

RAPIDAI

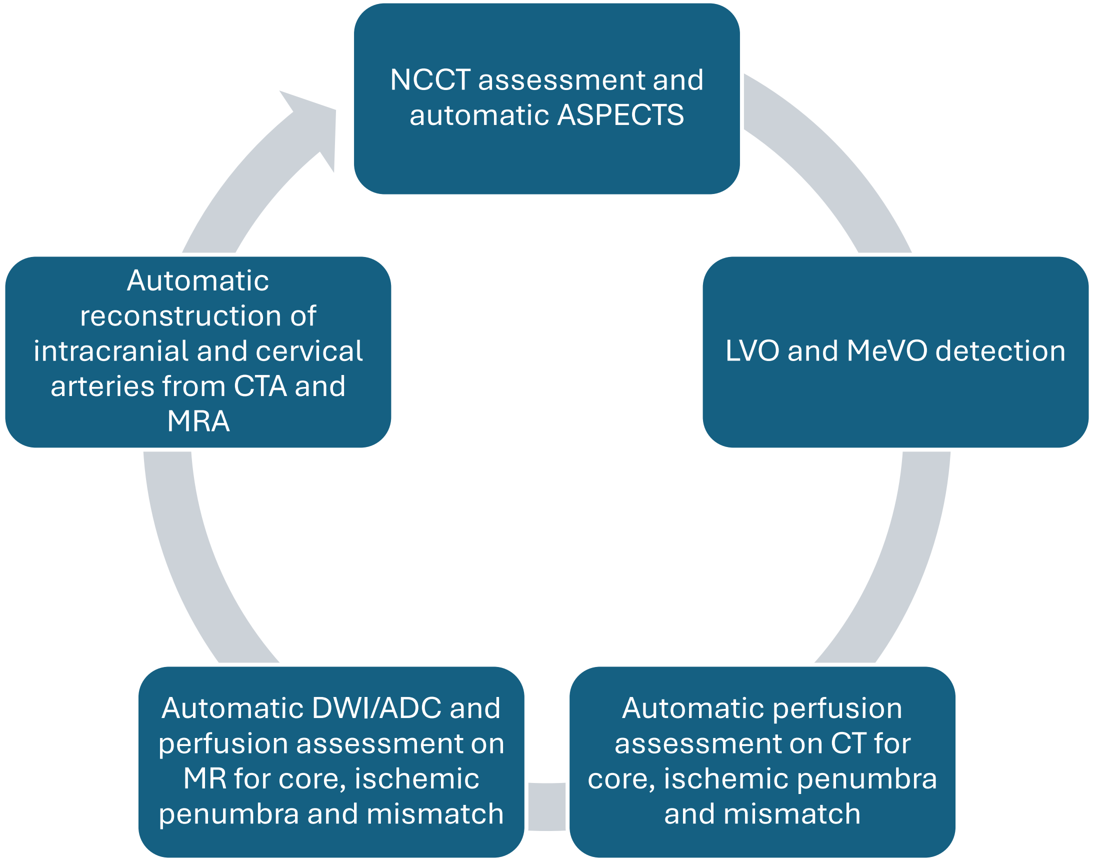
BRAINOMIX

Viz.ai

AI is designed to augment human expertise not replace it

What do these softwares do?

Automated image analysis



Improve Workflow of patients

- Instant team alerts (mobile phone applications)
- Escalation protocols
- Plateform for coordinated transfers

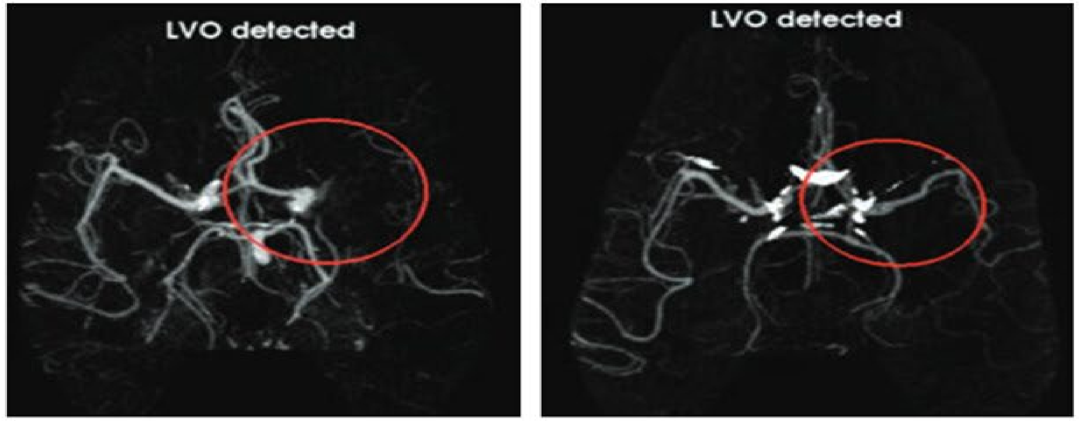
Current Evidence on Radiological AI in Acute Stroke

- Over the last decade, numerous publications have evaluated AI-based software for acute stroke imaging
- Most studies have focused on specific AI modules, such as:
  - ASPECTS assessment
  - Large-vessel occlusion (LVO) detection
  - Penumbra and Core
  - Stroke workflow optimization
- Only one cluster RCT focused on workflow
- To date, no RCT on clinical outcome

LVO detection

Internal carotid artery and M1

High-Performance Automated Anterior Circulation CT Angiographic Clot Detection in Acute Stroke: A Multireader Comparison



Left: True-positive left M1 segment LVO with independent agreement between readers 1 and 2.
Right: False-positive proximal LVO, with discordance between readers 1 (negative for LVO) and 2 (positive for LVO) and adjudication by reader 3 (negative for LVO).

- In a retrospective multi-center evaluation of 217 patients, automated AI software to detect anterior circulation large vessel occlusion (LVO) enabled rapid (mean, <3.5 minutes) detection without user intervention.
- In a mixed sample of 217 head and neck CT angiograms from multiple institutions, AI performance exceeded prespecified thresholds, with high sensitivity and specificity in the detection of LVO (sensitivity, 96%; specificity, 98%).
- High-performance detection of LVO across imaging systems and subgroups yielded an overall AUC of 99%.

Dehkharghani S et al. Published Online: January 12, 2021
https://doi.org/10.1148/radiol.20202734

Radiology

Dehkharghani S. et Al, Radiology 2021

LVO detection

Performance of Automated Algorithm in Large and Medium Vessel Occlusion Detection: A Real-World Experience

Aakanksha Sriwastwa, Yasmin N. Aziz, Kara Weiss, Robert Buse, Bin Zhang, Stacie L. Demel, Arafat Ali, Sriharsha Voleti, Lily Li-Li Wang, and Achala S. Vagal

3576 CTAs (2960 no occlusion and 616 vessel occlusion per radiologist reads)

Table 2: Accuracy metrics of an automated AI tool's performance

Occlusion Category	Occlusions Detected by AI (n/N)	Sensitivity (95% CI)	Specificity (95% CI)	Positive Predictive Value (%)	Negative Predictive Value (%)	Accuracy (%)
Anterior LVO[a]	271/301	91 (87–94)	93 (92–94)	64.1	99.1	92.8
All LVO[b]	282/390	73 (68–77)	92 (91–93)	65	96.5	90.7
Anterior LVO with M2-MCA occlusions[c]	337/465	74 (70–78)	93 (92–94)	67.3	95.9	91.9
Anterior LVO with all MeVOs[d]	346/527	65 (61–69)	93 (92–94)	68.5	93.6	90.1

AJNR 2023

ASPECTS

e-ASPECTS software improves interobserver agreement and accuracy of interpretation of aspects score

60 NCCT scans before thrombectomy

3 groups or readers:
- 6 Senior Neuroradiologists
- 6 Young Neuroradiologists
- 4 Neurologists

The dataset was evaluated twice, with a two-month interval without and with e-ASPECTS

Brinjikji et Al, IRN, 2021

Table 1. Interobserver agreement with and without e-ASPECTS assistance.

	No e-ASPECTS assistance			Yes e-ASPECTS asistance		
	% Overall agreement	Kappa (95%CI)	PABAK (95%CI)	% Overall agreement	Kappa (95%CI)	PABAK (95%CI)
M1	78%	0.60 (0.50–0.69)	0.68 (0.66–0.70)	92%	0.83 (0.76–0.90)	0.90 (0.87–0.93)
M2	69%	0.38 (0.29–0.47)	0.47 (0.44–0.50)	83%	0.67 (0.58–0.75)	0.78 (0.75–0.81)
M3	76%	0.52 (0.43–0.61)	0.61 (0.58–0.64)	86%	0.72 (0.63–0.81)	0.81 (0.77–0.85)
M4	84%	0.68 (0.60–0.75)	0.74 (0.72–0.76)	94%	0.88 (0.82–0.93)	0.94 (0.92–0.96)
M5	72%	0.44 (0.36–0.52)	0.50 (0.48–0.52)	83%	0.66 (0.58–0.74)	0.68 (0.66–0.70)
M6	87%	0.74 (0.66–0.83)	0.80 (0.78–0.82)	92%	0.83 (0.76–0.91)	0.92 (0.90–0.94)
Caudate	86%	0.71 (0.63–0.79)	0.76 (0.75–0.77)	89%	0.78 (0.70–0.87)	0.81 (0.80–0.83)
Lentiform	72%	0.44 (0.33–0.54)	0.51 (0.48–0.54)	83%	0.65 (0.56–0.75)	0.78 (0.76–0.80)
Insula	68%	0.35 (0.27–0.44)	0.46 (0.44–0.48)	79%	0.57 (0.47–0.67)	0.65 (0.63–0.67)
Internal Capsule	81%	0.62 (0.53–0.72)	0.72 (0.70–0.74)	91%	0.82 (0.76–0.89)	0.88 (0.87–0.89)

K 0.48 (moderate)

K 0.68 (good)

Brinjikji et Al, IRN, 2021

Workflow

Original research

Impact of RapidAI mobile application on treatment times in patients with large vessel occlusion

Mais Al-Kawaz,[1] Christopher Primiani,[2] Victor Urrutia,[2] Ferdinand Hui[3]

Retrospective monocentric at comprehensive stroke center

2 groups patients:

- 64 patients pre-application
- 32 patients post-application

Primary Outcome:

Door – to - groin time

Secondary Outcomes:

- Door to first pass
- Door to recanalization
- NIHSS at 24h
- NIHSS discharge
- mRS 3 months
- Primary to Comprehensive stroke center

Mais Al-Kawaz, JNIS 2022

Table 2 Mean treatment times in patients treated prior to and after RapidAI mobile application*

Outcome	Pre-app†	Post-app†	P value
Door to groin puncture (min)	104.3 (57.9)	71.1 (51.7)	0.02
Door to first pass (min)	131.9 (85.8)	97.2 (55.9)	0.02
Door to recanalization (min)	148.1 (65.1)	110.7 (56.6)	0.02

*Linear regression was used to assess the correlation between treatment times in the pre-application (pre-app) and post-application (post-app) groups.
†Mean (SD).

Mean NIHSS at 24h: 12.1 vs 8.0 (p = 0.03)
Mean NIHSS at discharge: 11.8 vs 7.8 (p = 0.04)
Mean mRS 3 months: 2.9 vs 2.9 (p = 0.80)

Mais Al-Kawaz, JNIS 2022

Thrombectomy rate and workflow

Artificial intelligence imaging decision support for acute stroke treatment in England: a prospective observational study

Kiruba Nagaratnam, Ain A Neuhaus*, Lauren Fensome, Matthew Epton, Tracey Marriott, Zoe Woodhead, Claire Fernandez, Michalis Papadakis, Stephen Gerry, Deb Lowe, David Hargroves, Dermot H Mallon, Rob Simister, Pervinder Bhogal, Oliver Spooner, Ingrid Kane, Phil Mathieson, William Mukonoweshuro, Martin James, Gary A Ford†, George Harston†*

Prospective observational study in HNS centers
Primary Outcome:
Evaluate, at national scale, whether real-world implementation of AI stroke imaging software increased access to endovascular thrombectomy across the English NHS.

Secondary Outcome:
- Door-in door-out time (first arrival and departure from the referring hospital)
- Intravenous thrombolysis rate
- mRS at discharge (surrogate for clinical outcome)

Nagaratnam et Al, Lancet Digit Health. 2025

26

Evaluation sites
(6 comprehensive +
20 primary stroke centres)

81

Non-evaluation sites
used as national
comparison group

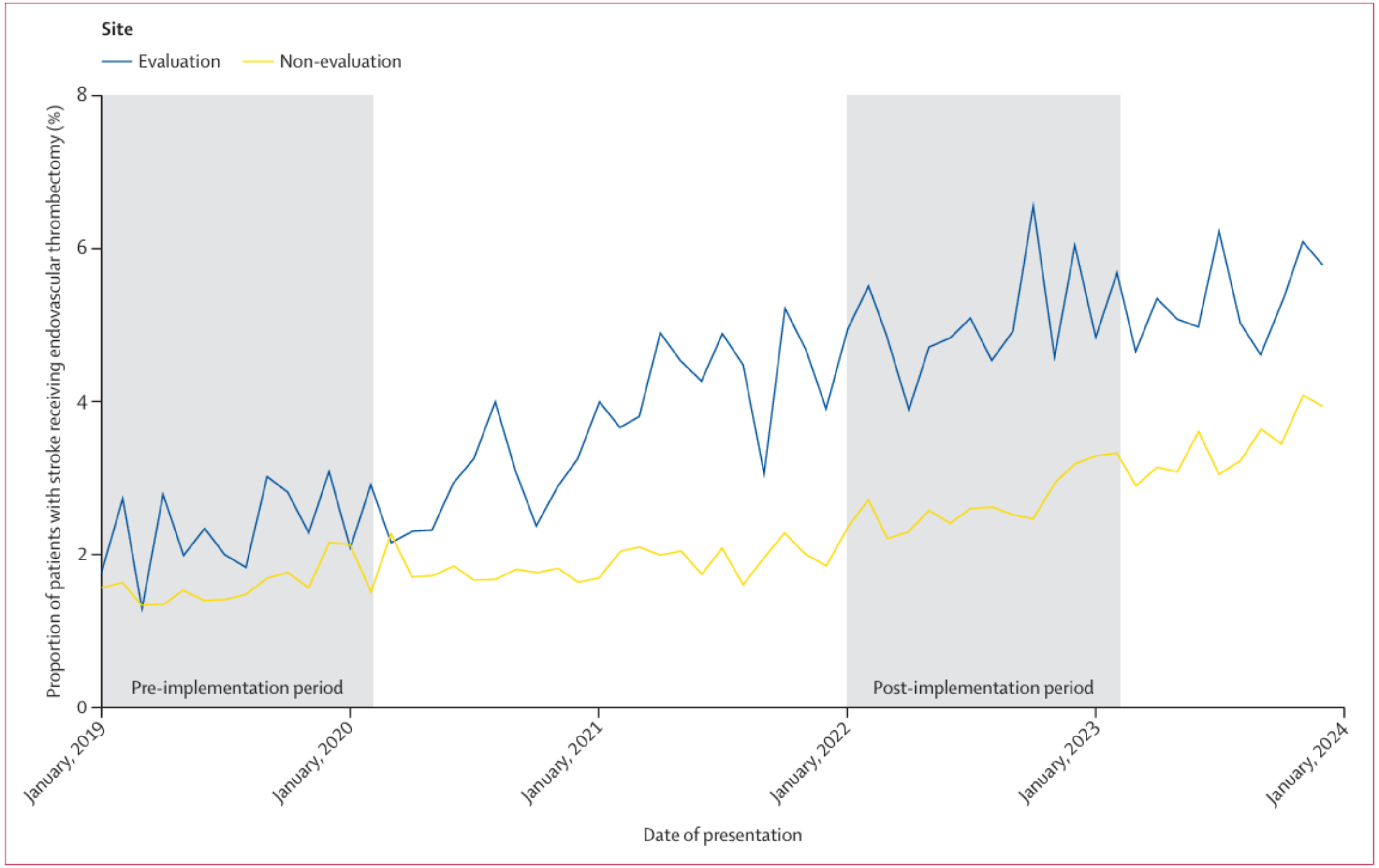
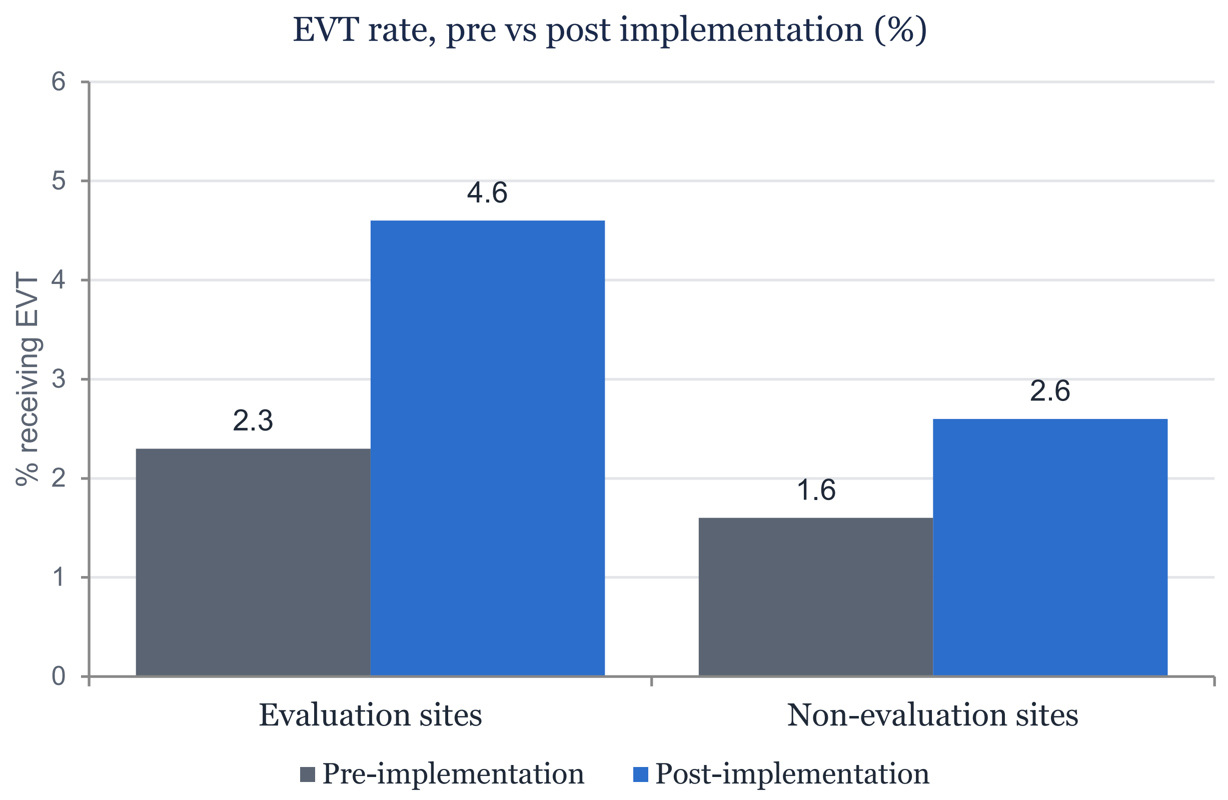


Figure 1: **Endovascular thrombectomy rates per month in the evaluation and non-evaluation sites for all patients with primary diagnosis of stroke admitted to hospitals in England**
Total patients across this time period N=452 952.

Nagaratnam et Al, Lancet Digit Health. 2025

Endovascular Thrombectomy Rates Rose — More So at Evaluation Sites



+100% relative increase in EVT at evaluation sites
(2.3% → 4.6%)

+62.5% at non-evaluation sites (1.6% → 2.6%)

Statistical significance

Site × time interaction: OR 1.24 (95% CI 1.08–1.43), p=0.0026 – larger increase in the endovascular thrombectomy rate for the evaluation sites compared with the non-evaluation sites.

Nagaratnam et Al, Lancet Digit Health. 2025

Faster Transfers, More Thrombolysis, Better Discharge Outcomes

Door-in door-out time

128 vs 192 min

with AI support vs without

64 min shorter with AI support
(p<0.0001)

IV thrombolysis

17.7% vs 9.0%

with AI support vs without

OR 1.99 (95% CI 1.79–2.22)
p<0.0001

Good outcome (mRS 0–2) at discharge

47.1% vs 45.6%

with AI support vs without

OR 1.16 (95% CI 1.07–1.25)
p=0.0002

Caveat: Lack of 3-month mRS

Nagaratnam et Al, Lancet Digit Health. 2025

Does acute radiological stroke diagnosis assisted by AI improves patient outcome ?

Randomized controlled trial evidence remains lacking

But evidence :

- **AI reduce diagnosis-to-treatment delay** — accelerating the «time is brain»

JAMA | Original Investigation

Association Between Time to Treatment With Endovascular Reperfusion Therapy and Outcomes in Patients With Acute Ischemic Stroke Treated in Clinical Practice

Reza Jahan, MD; Jeffrey L. Saver, MD; Lee H. Schwamm, MD; Gregg C. Fonarow, MD; Li Liang, PhD; Roland A. Matsouaka, PhD; Ying Xian, MD; DaJuanicia N. Holmes, MS; Eric D. Peterson, MD; Dileep Yavagal, MD; Eric E. Smith, MD, MPH

Shorter time to endovascular reperfusion therapy was significantly associated with better outcomes.

Jama, 2023

Does acute radiological stroke diagnosis assisted by AI improves patient outcome ?

Evidence:

- **AI improve detection of LVO**
- **AI reduce inter-observer variability in ASPECTS**

These tools may increse the rate of mechanical thrombectomy and may improve patient – level clinical outcome

AHA SCIENTIFIC STATEMENT

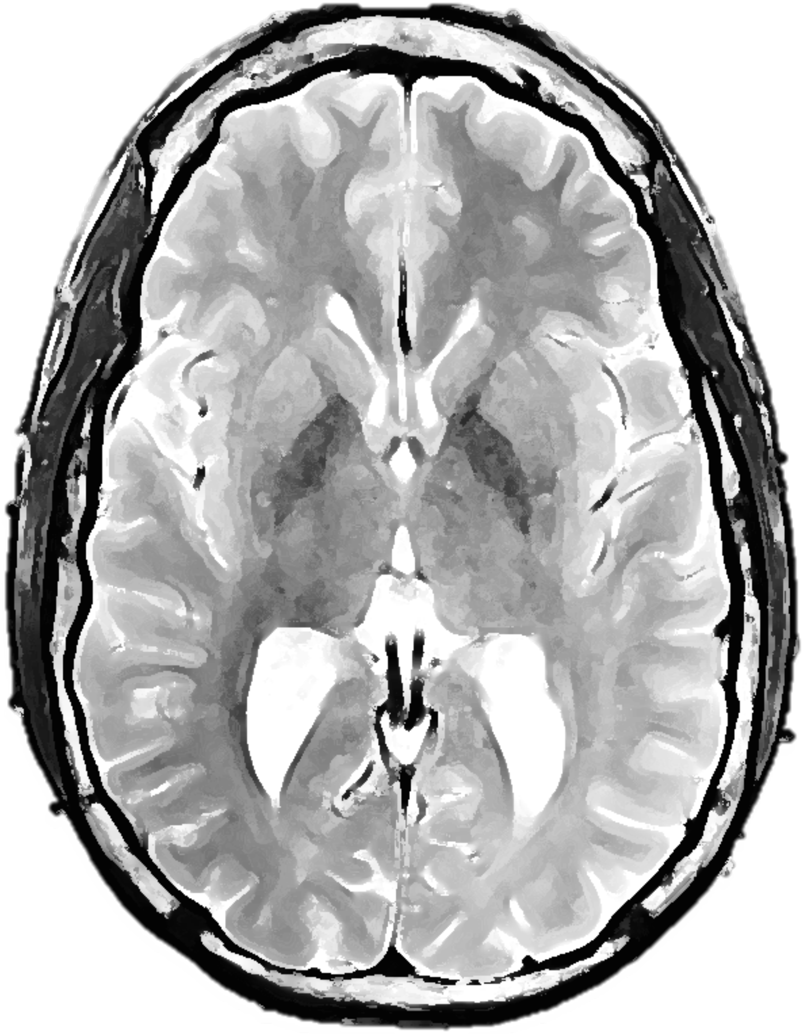
Ideal Foundational Requirements for Stroke Program Development and Growth: A Scientific Statement From the American Heart Association

Wendy Dusenbury, PhD, DNP, FAHA, Chair, Claranne Mathiesen, MSN, FAHA, Vice Chair, Michelle Whaley, MSN, Opeolu Adeoye, MD, MS, FAHA, Thabele Leslie-Mazwi, MD, Shavonne Williams, MN, Cesar Velasco, BSN, Samarth P. Shah, PharmD, Nicole R. Gonzales, MD, FAHA, and Anne W. Alexandrov, PhD on behalf of the American Heart Association Council on Cardiovascular and Stroke Nursing and the Stroke Council

« Integration of AI into neuroimaging can play an important role in rapid interpretation and stroke team response. Ideally, such software should be used at all levels of certified hospitals »

Stroke, 2023

Thanks



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