From 911 to Reperfusion: Advancing Stroke Care Through EMS Excellence



Presenters

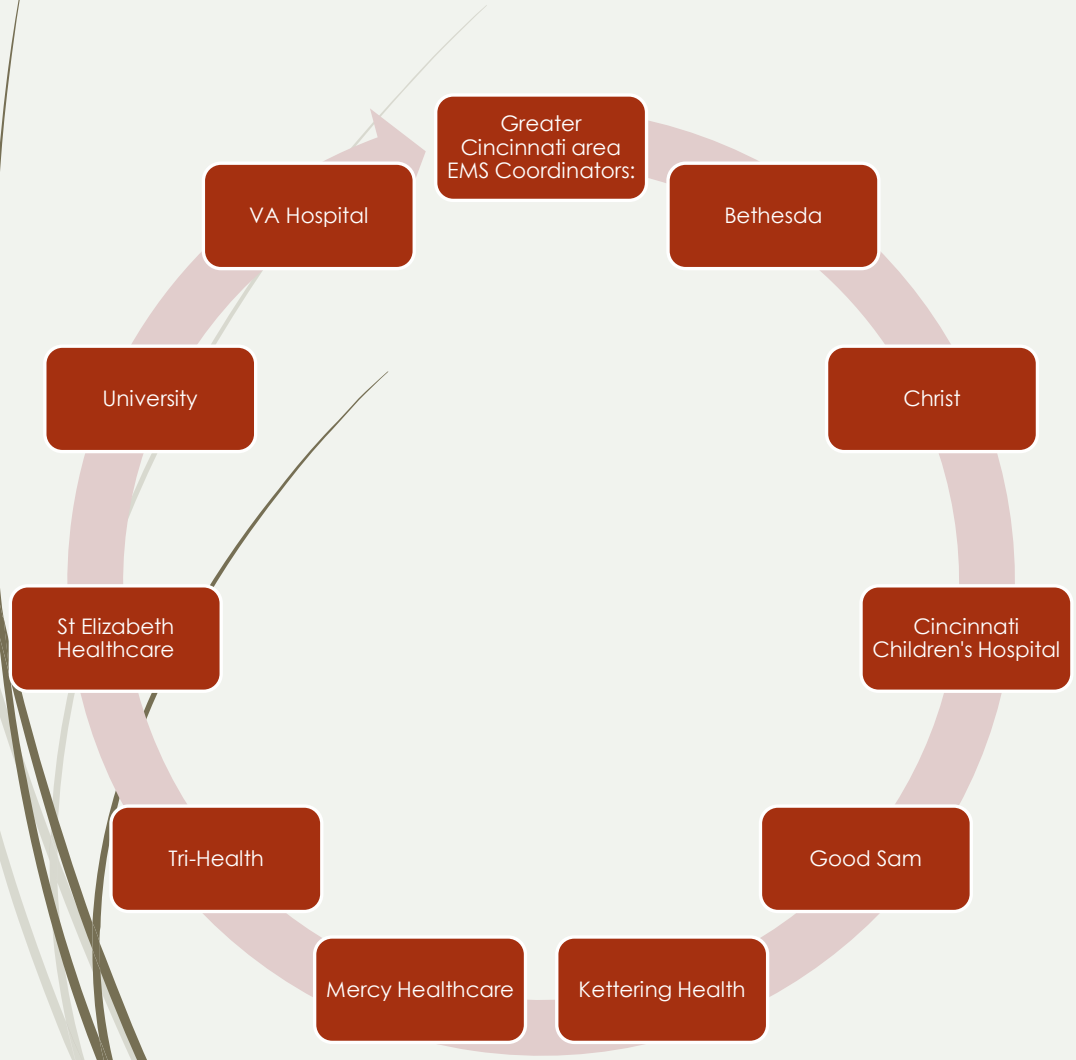
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- James.Laidlaw@UCHealth.com



- **Joshua Cox: AAS, NRP, Paramedic**
- EMS Outreach Coordinator St Elizabeth Healthcare
- Joshua.Cox@stelizabeth.com



Partnerships



- St Elizabeth works with University Hospital for Neurovascular care providers for acute stroke care, intervention for EVT

Hospital Partnerships in the Area



uc.edu webpage

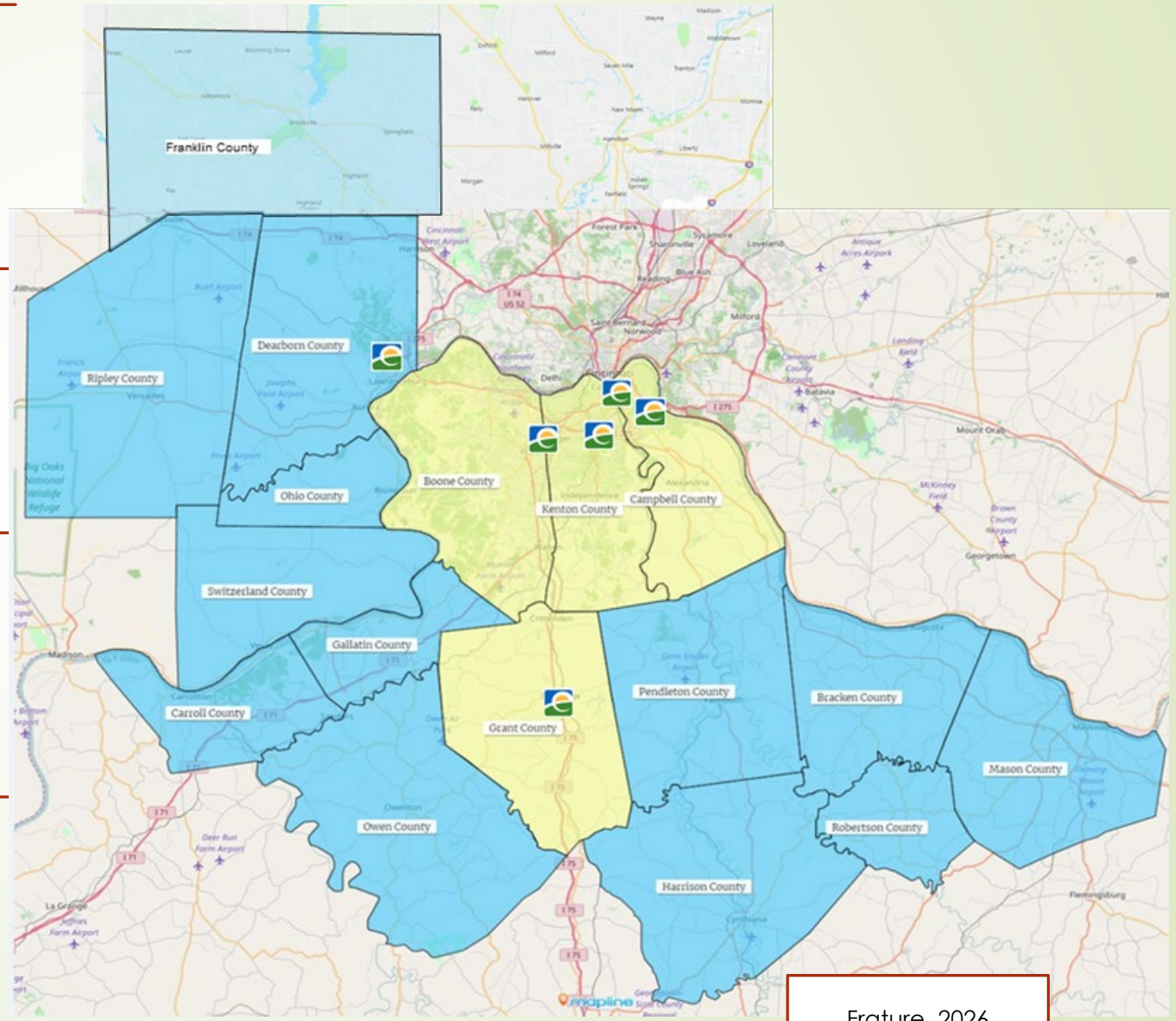
EMS Partnership

36 EMS agencies in Northern Kentucky and 13 EMS agencies in Indiana

7 Dispatch agencies

Follow Kentucky State and SWONKY EMS Protocols

Pulsara use now statewide implemented in September



Frature, 2026

Objectives

- Recognize clinical findings suggestive of acute ischemic stroke and LVO.
- Discuss the impact of early EMS recognition and prenotification on stroke system performance.
- Demonstrate understanding of coordinated stroke workflows involving EMS, emergency departments, and neurointerventional teams.
- Correlate rapid reperfusion strategies with improved neurological and functional patient outcomes.
- Leverage technology and tools to enhance patient care and treatment

SWONKY Protocols

- All Greater Cincinnati EMS agencies follow these protocols
- Majority of Northern Kentucky and Dearborn County IN follow the same protocols
- Members from EMS agencies, hospital staff, medical directors all work together in the development of these protocols
- These are reviewed and updated annually (2027 version is currently in final stages of review for approval)

Academy of Medicine of Cincinnati
2026 EMS Protocols
Clinical Practice Guidelines

PROTOCOL COMMITTEE MEMBERS

Tom Charlton, MD, Co-Chair
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Lauren Duffy, NRP, Secretary

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Katie Hernandez, PharmD
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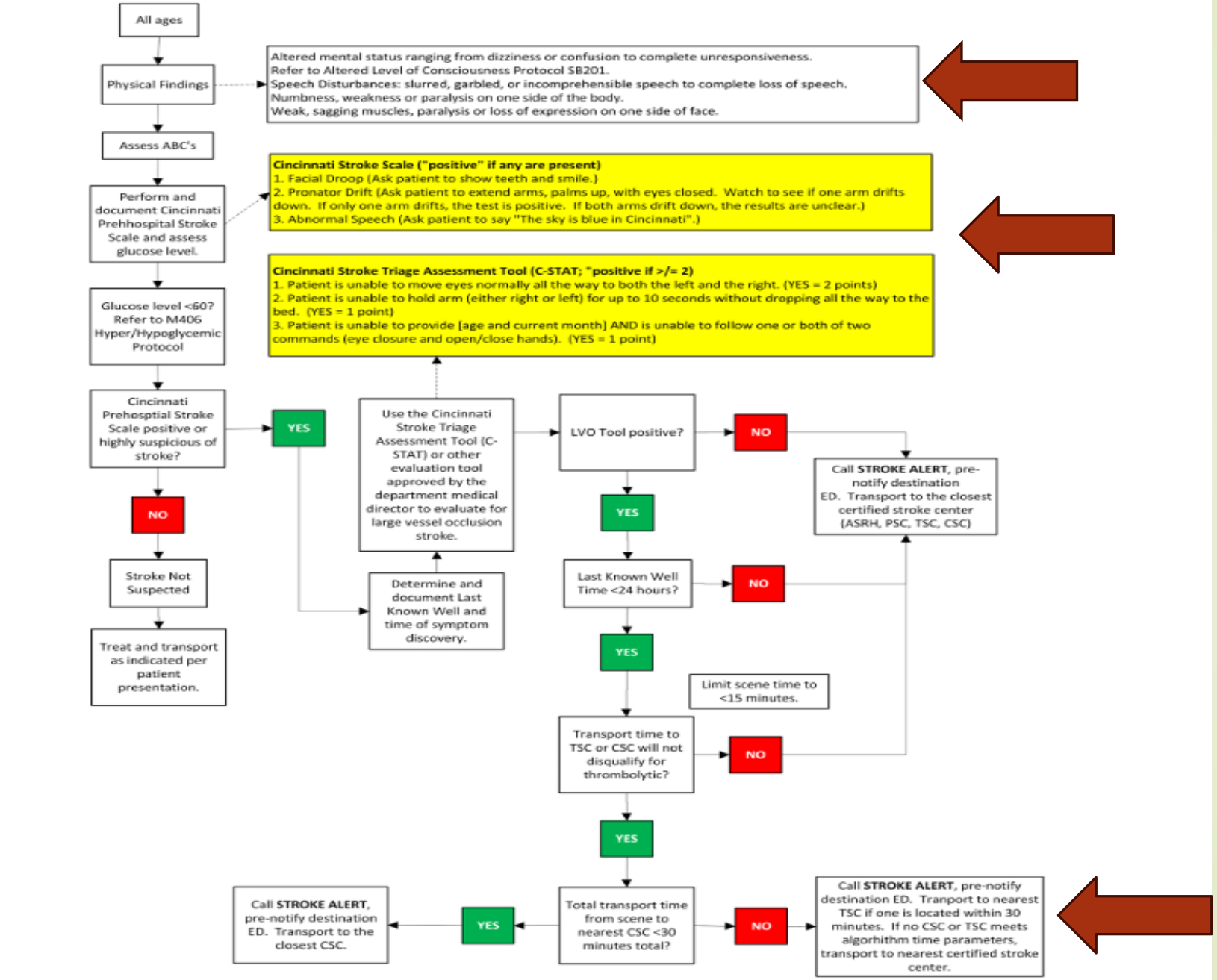
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Acknowledgments:

Thanks to Daniel Storer, MD, Mel Otten, MD, Don Locasto, MD, Hamilton Lempert, MD, and the previous authors of this operating protocol for providing the initial model.

M414	M414: Stroke	M414
Last Modified: 2025	Academy of Medicine of Cincinnati Prehospital Care Clinical Practice Guidelines	2026



- Tools are the key to success: Local tools:

  Pulsara-App based communications tool

  Green sticker Project

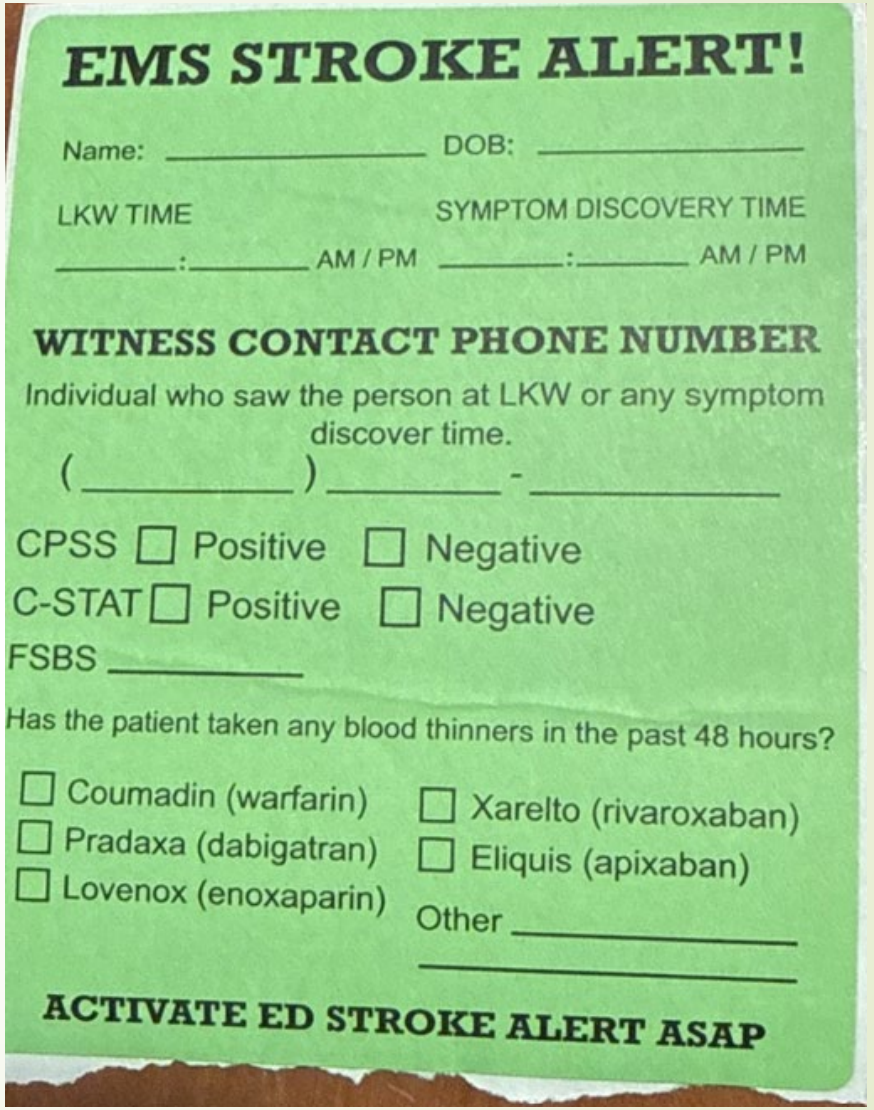
  Telephone

In the age of technology

Green Sticker Project

- Developed in Greater Cincinnati to log patient information including Last known well
- Stays on the patient throughout the EMS/ED/CT and up to admission with information staying directly with the patient
- All Greater Cincinnati area EMS agencies were educated on their use
- Still used in many agencies in the area
- Fallen out of use in Northern Kentucky with the use of Pulsara

Green Sticker



EMS STROKE ALERT!

Name: _____ DOB: _____

LKW TIME

_____:_____ AM / PM

SYMPTOM DISCOVERY TIME

_____:_____ AM / PM

WITNESS CONTACT PHONE NUMBER

Individual who saw the person at LKW or any symptom discover time.

(_____) _____ - _____

CPSS ☐ Positive ☐ Negative

C-STAT ☐ Positive ☐ Negative

FSBS _____

Has the patient taken any blood thinners in the past 48 hours?

☐ Coumadin (warfarin)
☐ Pradaxa (dabigatran)
☐ Lovenox (enoxaparin)
☐ Xarelto (rivaroxaban)
☐ Eliquis (apixaban)

Other _____

_____

ACTIVATE ED STROKE ALERT ASAP

Pulsara app

- Two- way communications tool for hospitals/EMS/EM
- Has multiple channels to add variety of providers to a case
  - ED
  - Cardiology
  - CT
  - Lab
  - Pharmacy
  - Interventionalist

Pulsara app

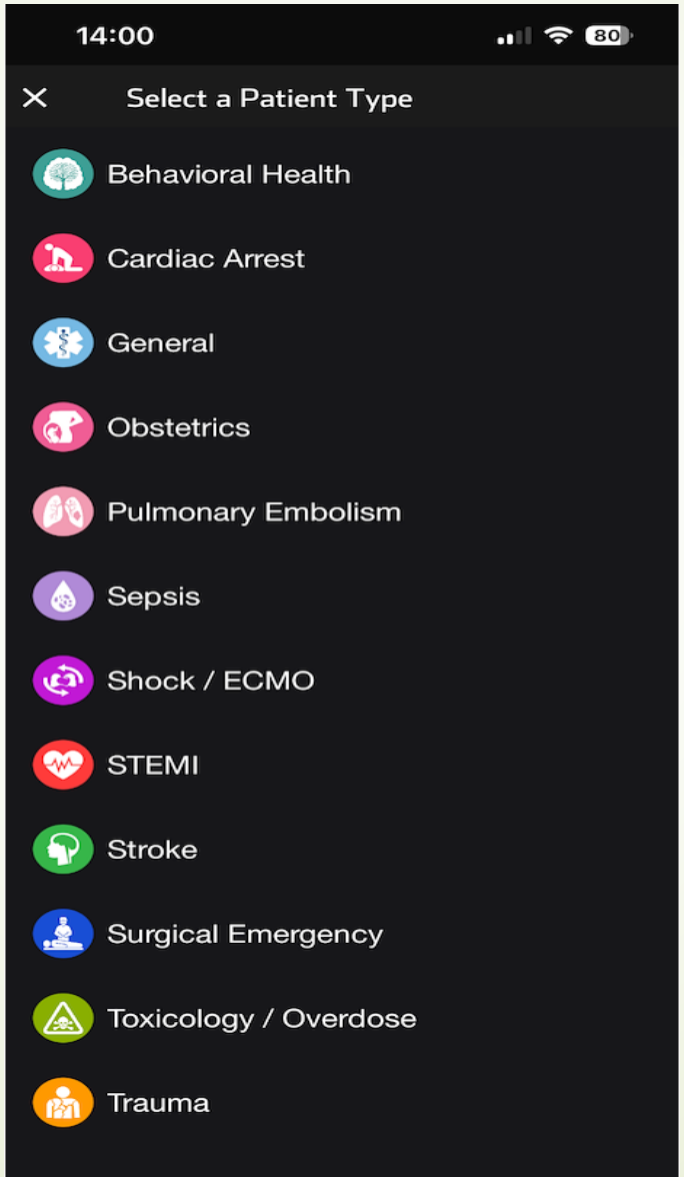
- Direct patient information
- EKG attachment
- Images and videos
- Has video chat capabilities
- Two way talk between EMS and ED
- Allows crews to bypass ED for STEMI to go direct to cath lab or direct to CT based on initial report to ED physician.

Pulsara Images

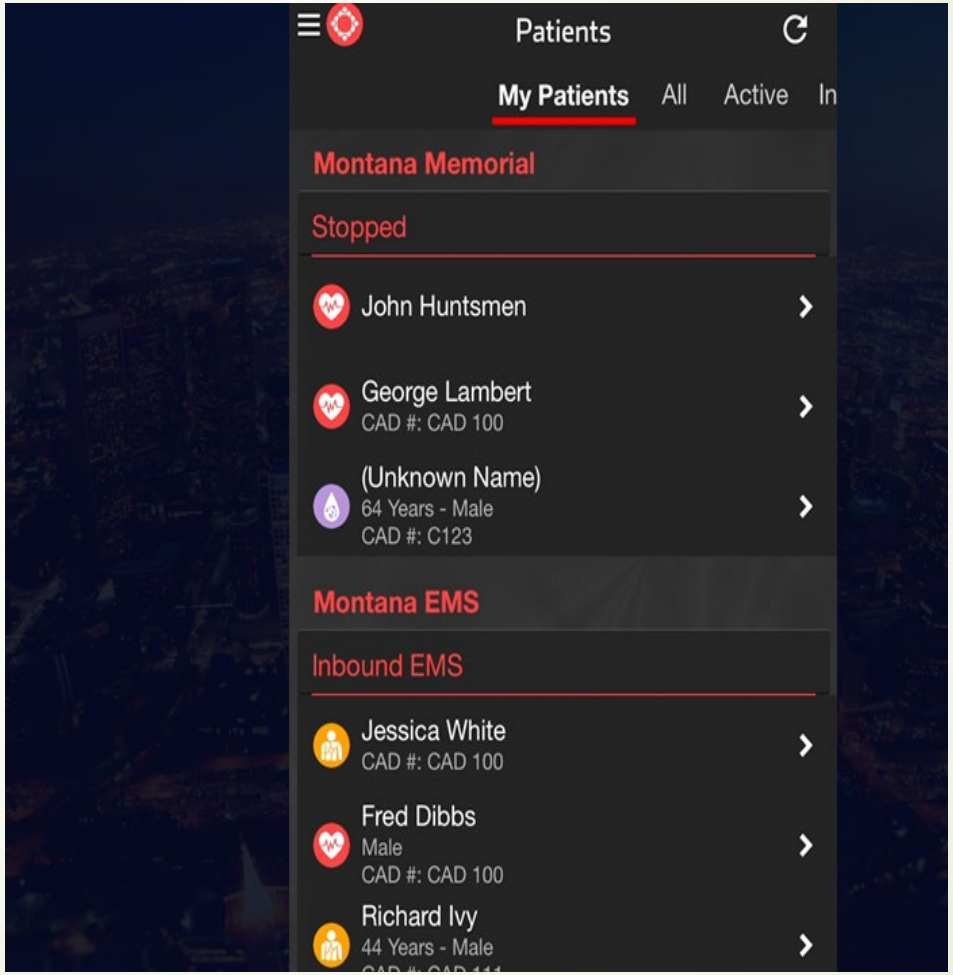


Pulsara website

Patient Type

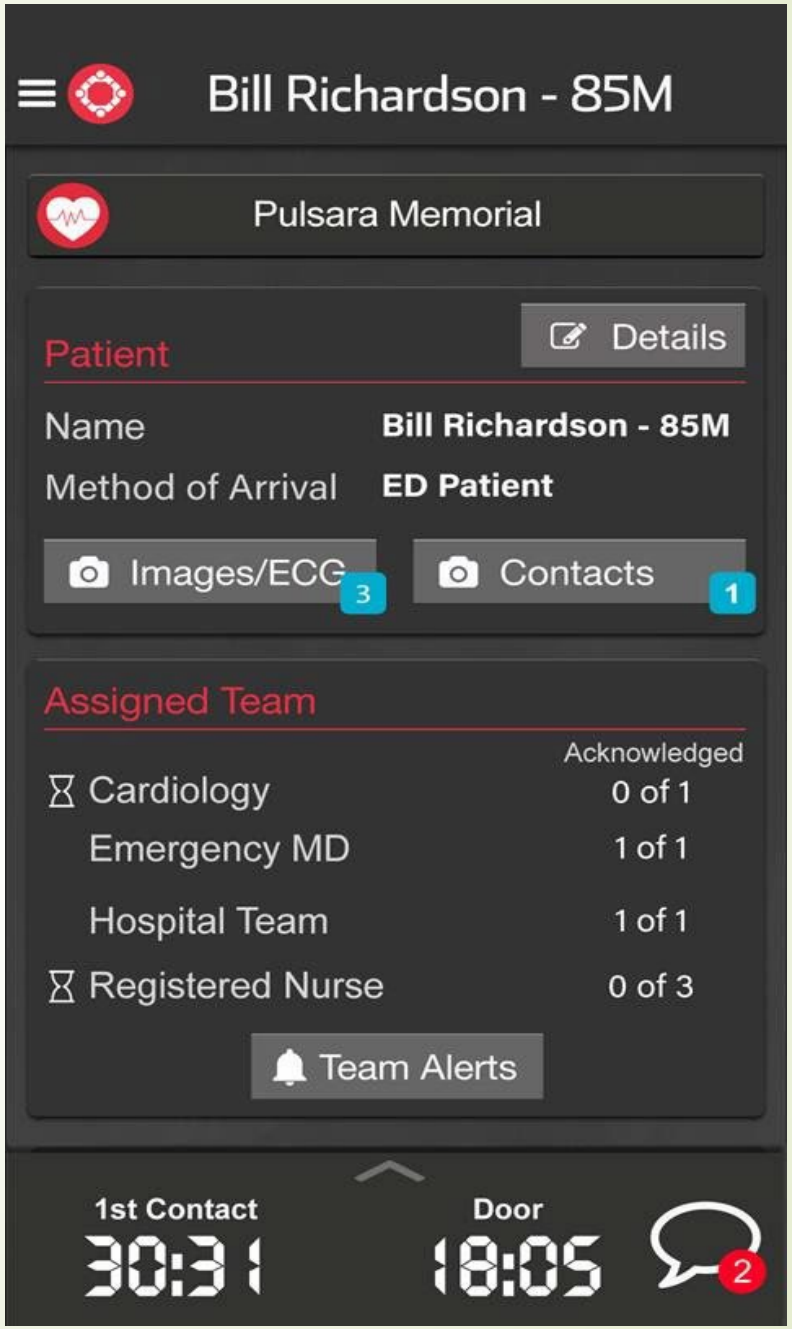


Hospital Tablet View

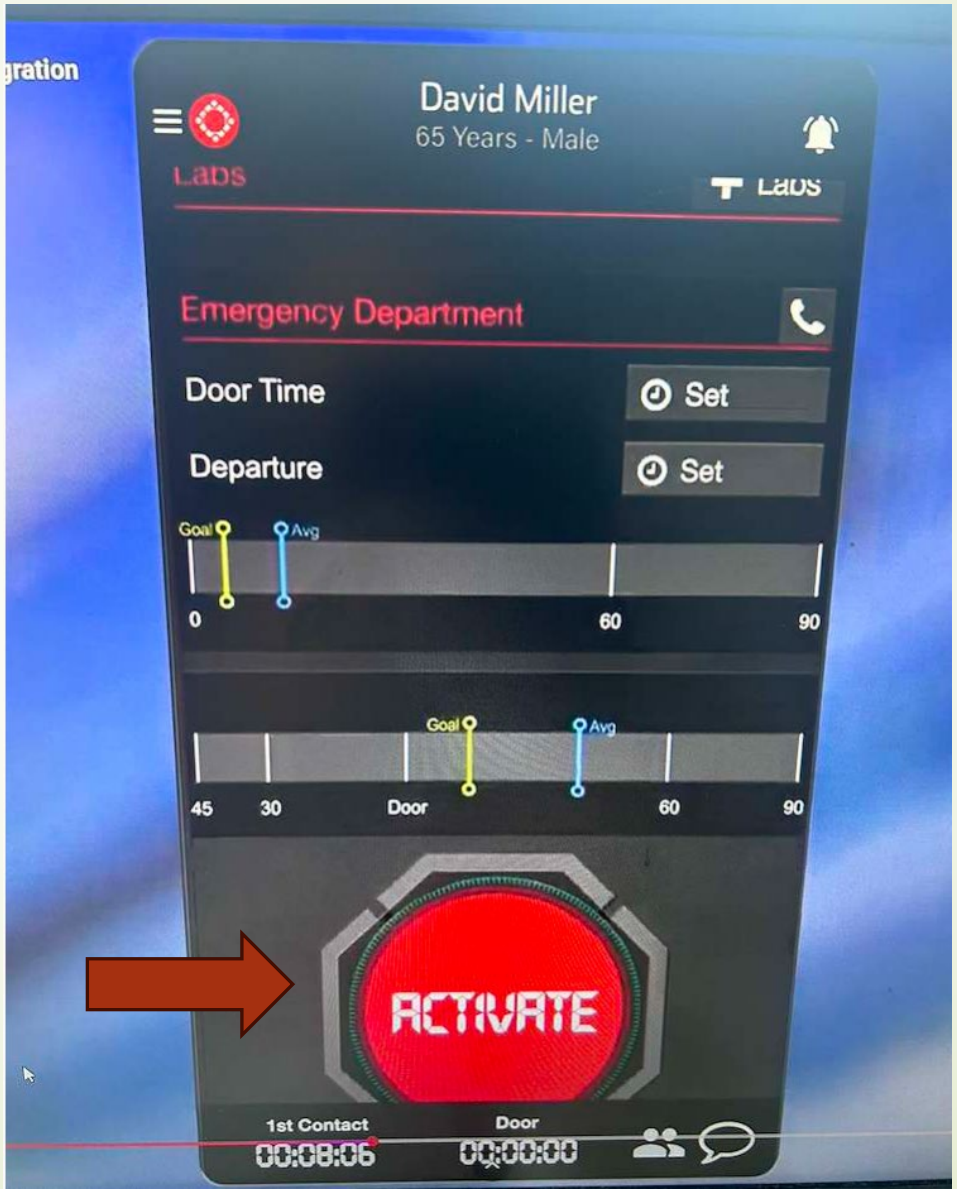


Pulsara website

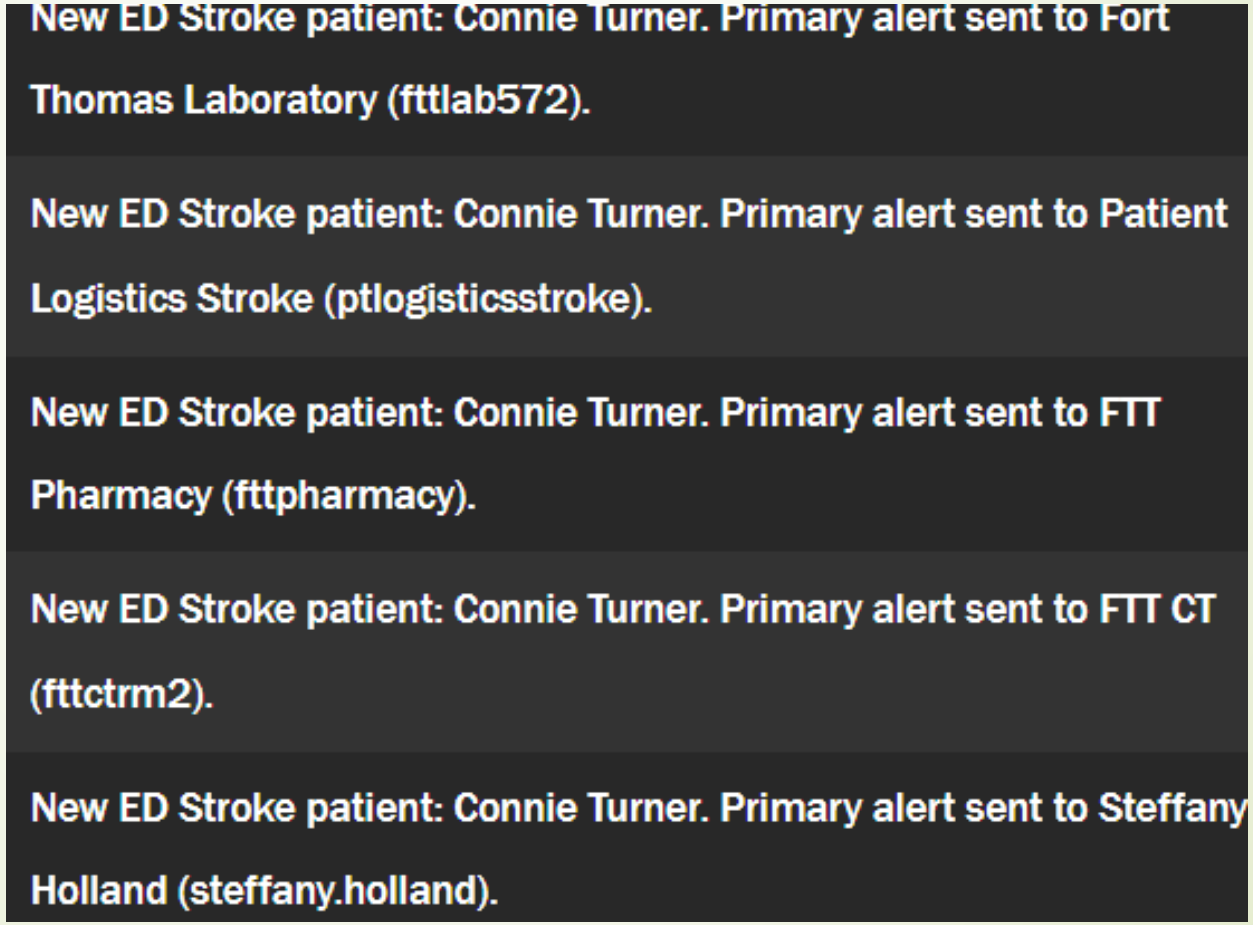
Pulsara view



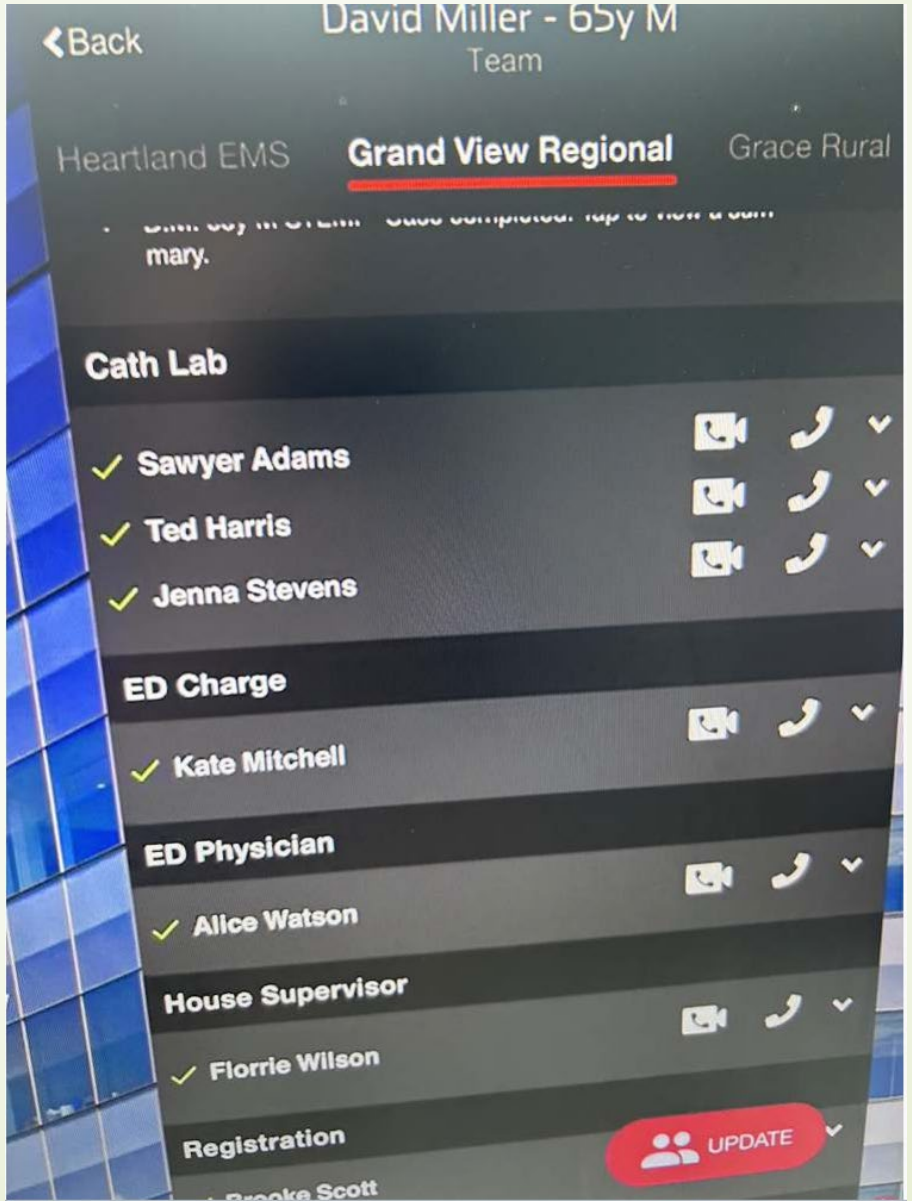
Activation


David Miller
65 Years - Male
Labs
Emergency Department
Door Time
Set
Departure
Set
Goal
Avg
0
60
90
Goal
Avg
45
30
Door
60
90
ACTIVATE
1st Contact
00:08:06
Door
00:00:00

Team members added on activation



Extended Team Info



Case study # 1 St Elizabeth Ft Thomas ED

Fire Department of Bellevue Dayton

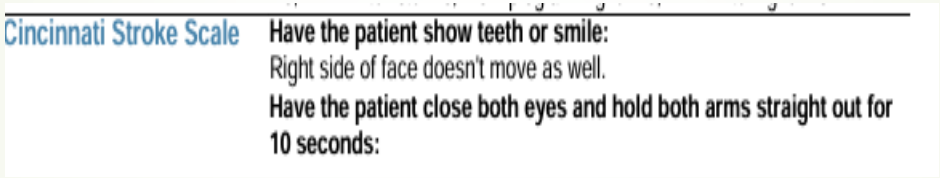
Times Pulled from EMS/Pulsara/ED/EPIC

Dispatch Call Received	19:31		
First Medical Contact (Goal < 90 Mins)	19:35		
CSS/CSTAT	19:37		2+ is Positive for Poss LVO
ED Arrival	20:04	0:27	
EMS Transport Time	19:52		
ED Notified	19:54		Phone call
NIH Scale on Arrival	35		
Time Code stroke Activated	20:19		
CT Activated Prior to ED Arrival	yes		
Patient Arrived to CT	20:08		
TNK?	20:29	0:25	
Patient Transfer for Surgery?	20:55	1:18	

Cox, 2026 Stroke review

Initial EMS Report

- Call was made to the ED with excellent report on stroke symptoms as well as good stroke assessment CSS noted in run report



Cincinnati Stroke Scale	**Have the patient show teeth or smile:** Right side of face doesn't move as well. **Have the patient close both eyes and hold both arms straight out for 10 seconds:**

- En route treatment: Assessment, 12 lead EKG, IV, BGL VS monitoring and ED notification.
- Pt immediately seen at door presentation and directed to CT
- EMS crew moved patient to CT scanner and then to ED room

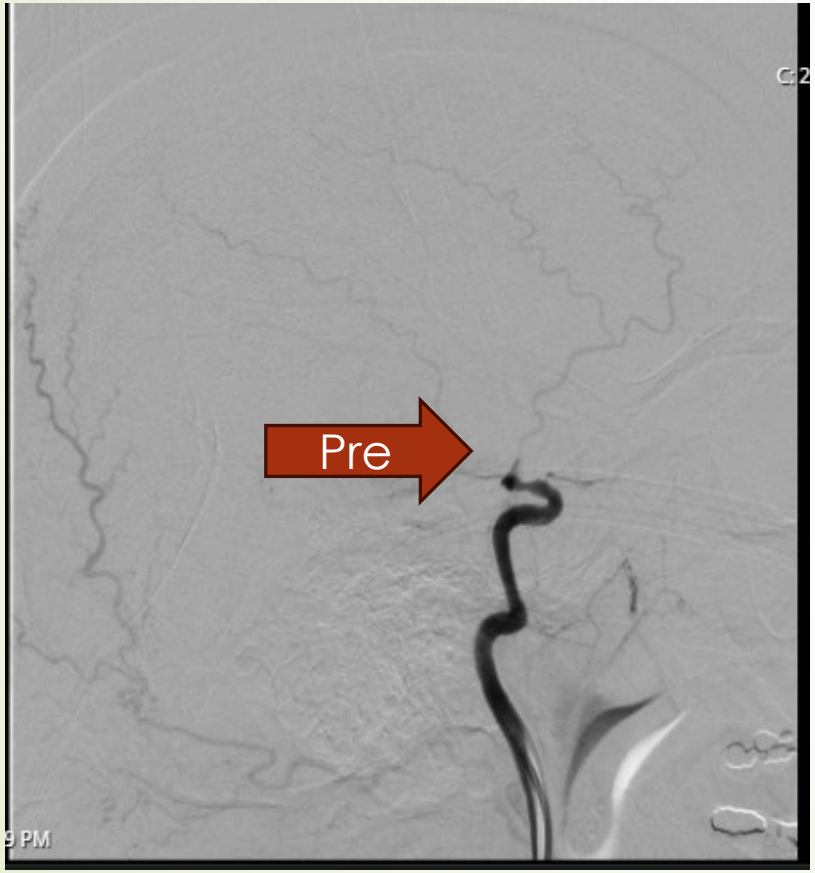
Notable times

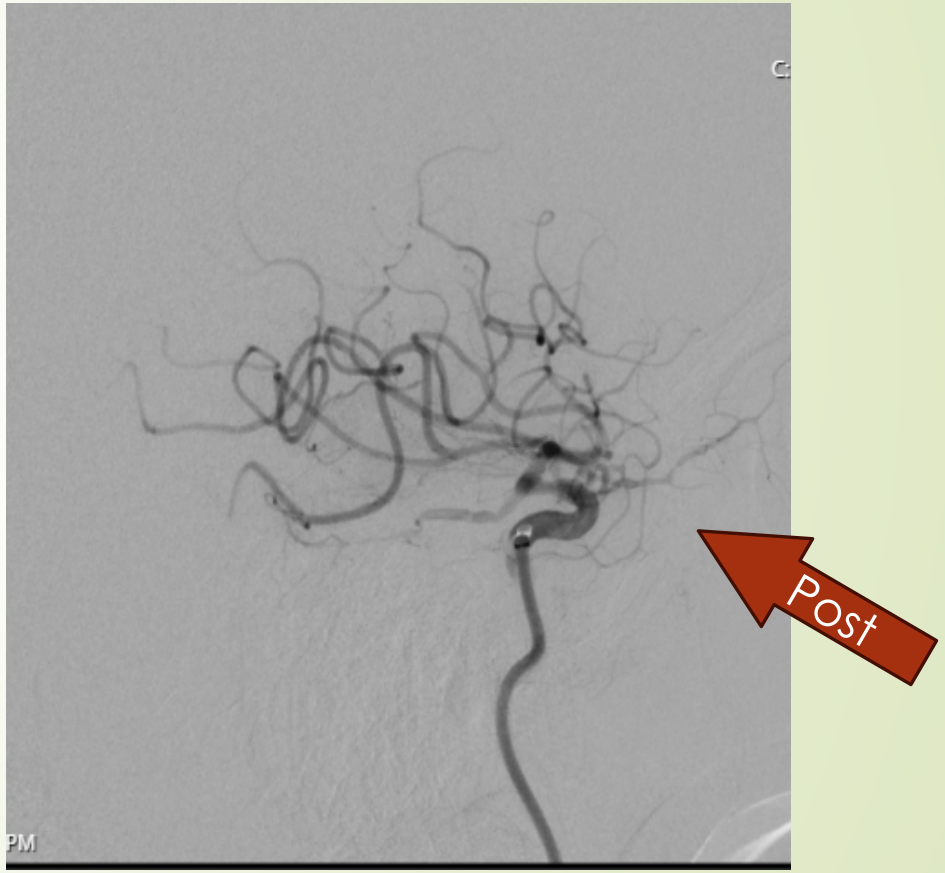
- Although EMS did not use pulsara, ED did activate to get the Lab, CT, pharmacy, IR teams all at the ready
- CT had already been activated based on phone call (4 min from door to CT)
- Door to TNK was 25 minutes
- Transfer to IR at Edgewood was 78 minutes from hitting the ED door.

CT notes

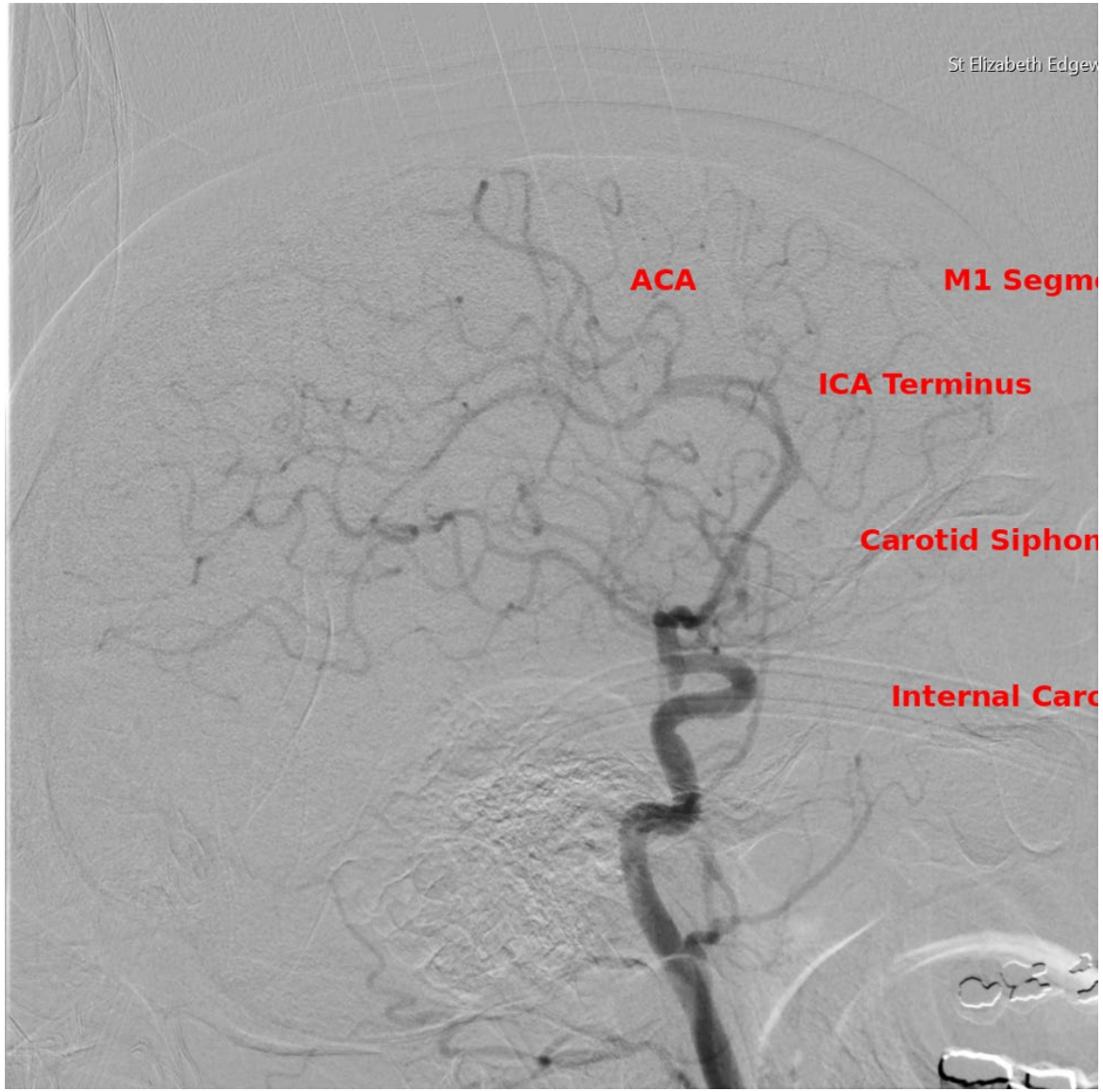
- Pt immediate to CT on arrival at ED. CTA shows occluded right internal carotid artery and right MCA on CTA. Consult with UC stroke team and recommended TNK. TNK was administered at 20:29. Pt emergently transferred to Edgewood IR for thrombectomy. Impressions from IR with thrombectomy: Occlusion of the right internal carotid at the ophthalmic artery.
- IR notes: Complete reperfusion after mechanical thrombectomy, TICI 3. Otherwise, normal 3 vessel cerebral angiogram.

Images from IR





Fraiture 2026


St Elizabeth Edgew
ACA
M1 Segm
ICA Terminus
Carotid Siphon
Internal Carc

Post Intervention

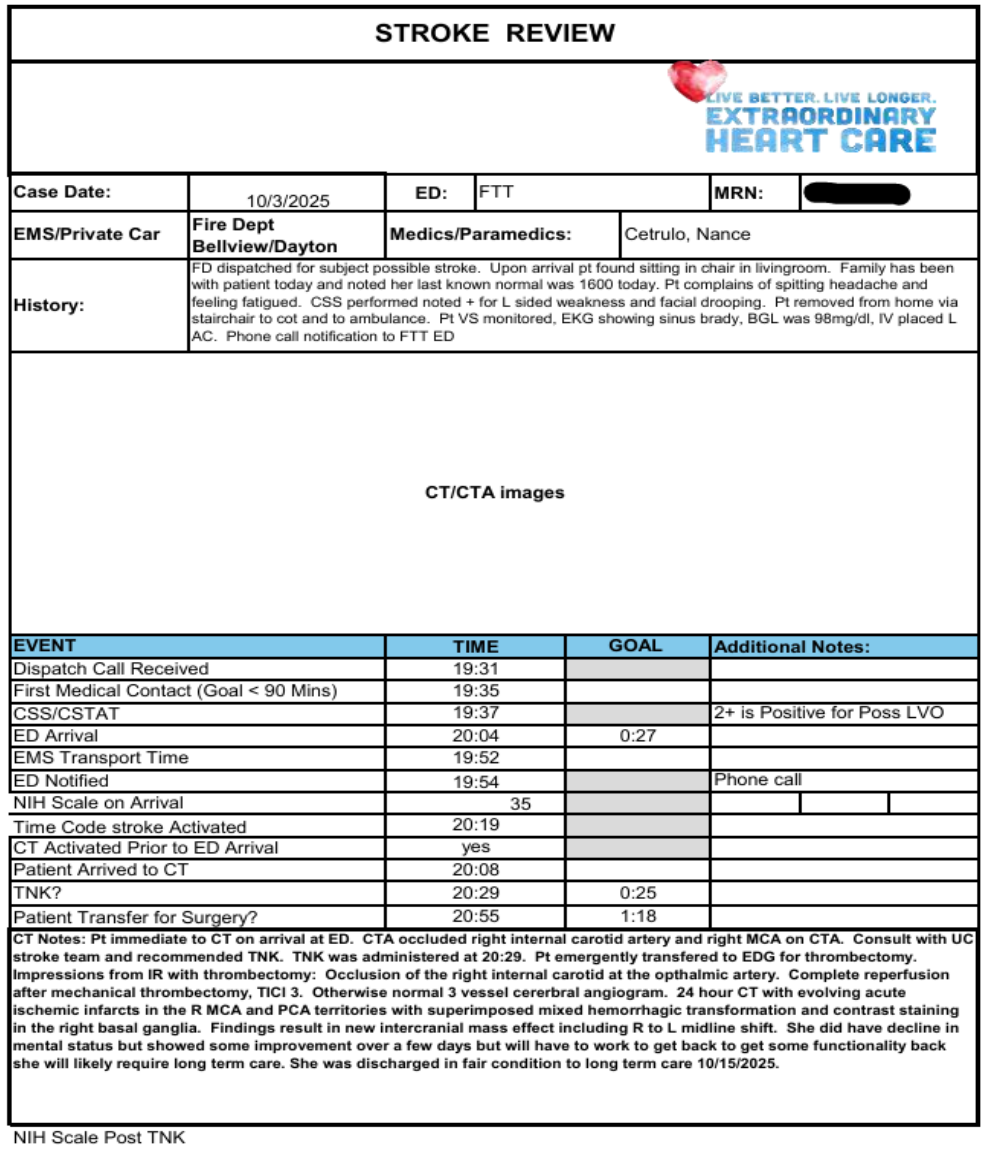
- 24 hour CT with evolving acute ischemic infarcts in the R MCA and PCA territories with superimposed mixed hemorrhagic transformation and contrast staining in the right basal ganglia. Findings result in new intercranial mass effect including R to L midline shift.
- She did have some mild improvement over the next several days
- Worked with PT/OT but still dependent with ADL
- D/C to long term care facility post treatment in fair condition

Key takaways

- EMS rapid assessment and recognition in the field is key
- Ongoing education to the public of symptom recognition for stroke works
- Early ED notification saves brain cells and functionality
- Using all the tools we have available streamlines patient care from the moment of contact. Although not used in the field on this case study, pulsara use in hospital is immediate notification to those in the care team.

Follow up report to EMS

- Brief synopsis of the EMS report
- Key Times including: First Medical Contact
- ED arrival
- Code Stroke activation
- Arrival to CT
- TNK administration
- CT/CTA notes, Post TNK findings and up to
  - Discharge; home, rehab, long term care.



STROKE REVIEW

LIVE BETTER. LIVE LONGER. EXTRAORDINARY HEART CARE

Case Date:	10/3/2025	**ED:**	FTT	**MRN:**	[redacted]
EMS/Private Car	**Fire Dept Bellview/Dayton**	**Medics/Paramedics:**	Cetrulo, Nance		
History:	FD dispatched for subject possible stroke. Upon arrival pt found sitting in chair in livingroom. Family has been with patient today and noted her last known normal was 1600 today. Pt complains of spitting headache and feeling fatigued. CSS performed noted + for L sided weakness and facial drooping. Pt removed from home via stairchair to cot and to ambulance. Pt VS monitored, EKG showing sinus brady, BGL was 98mg/dl, IV placed L AC. Phone call notification to FTT ED				

CT/CTA images

EVENT	TIME	GOAL	Additional Notes:
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First Medical Contact (Goal < 90 Mins)	19:35		
CSS/CSTAT	19:37		2+ is Positive for Poss LVO
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Patient Transfer for Surgery?	20:55	1:18	

CT Notes: Pt immediate to CT on arrival at ED. CTA occluded right internal carotid artery and right MCA on CTA. Consult with UC stroke team and recommended TNK. TNK was administered at 20:29. Pt emergently transfered to EDG for thrombectomy. Impressions from IR with thrombectomy: Occlusion of the right internal carotid at the opthalmic artery. Complete reperfusion after mechanical thrombectomy, TICI 3. Otherwise normal 3 vessel cerebral angiogram. 24 hour CT with evolving acute ischemic infarcts in the R MCA and PCA territories with superimposed mixed hemorrhagic transformation and contrast staining in the right basal ganglia. Findings result in new intercranial mass effect including R to L midline shift. She did have decline in mental status but showed some improvement over a few days but will have to work to get back to get some functionality back she will likely require long term care. She was discharged in fair condition to long term care 10/15/2025.

NIH Scale Post TNK

Case Overview and Initial Management



AI Photo

Initial Stroke Assessment

Rapid evaluation is critical, including non-contrast CT to exclude hemorrhage and CT angiography to detect large vessel occlusion.

Intravenous Thrombolysis

Tenecteplase (TNK) administered promptly based on guidelines for ease and efficacy in large vessel occlusion cases.

Endovascular Thrombectomy Escalation

Persistent occlusion after thrombolysis leads to endovascular thrombectomy, a key complementary treatment in acute stroke care.

Parallel Workflow and Early Intervention

Simultaneous thrombolysis and mobilization of interventional resources optimize patient outcomes by reducing treatment delays. Pulsara plays a large roll in this as providers can be activated and added to the cases instantaneously.

Pre-EVT Angiographic Findings



AI photo

Functional Impact of Occlusion

Pre-EVT angiography reveals abrupt contrast termination at key cerebral arteries indicating severe underperfusion.

Asymmetry and Perfusion Deficit

Clear asymmetry compared to contralateral vessels highlights large vessel occlusion and explains neurological deficits.

Procedural Planning Insights

Pre-EVT imaging identifies vessel size, tortuosity, and access challenges critical for intervention strategy.

Educational Value and Treatment Justification

Classic LVO angiographic signs justify urgent mechanical reperfusion beyond IV thrombolysis and set baseline for outcome.

Recognition of EMS Crews



Personal photo
Joshua Cox







Case study # 2 UC Health UCMC ED

Cincinnati Fire Department

Time Breakdown

CODE STROKE TNK DRILL DOWN

MR#	[redacted]		
Date/Time of arrival	11/12/2025 20:09		
Arrival Mode	Cincinnati FD	Pre-notification?	Yes- and documented the green st
Onset time - Last Known Well	11/12/2025 19:11		
Physician	Hill, Onuzuruike	Stroke Team	Richards
Triage/Primary Nurse	Schultz	Pharmacist	Pahs

CODE STROKE	DATE/TIME	GOAL from arrival	OUR TIMES	OPPORTUNITY FOR IMPROVEM - COMMENTS
Stroke Team Activation	11/12/2025 20:18	**10 min**	0:09	
Door to CT scan	11/12/2025 20:17	**20 min**	0:08	
Door CT Scan Results	11/12/2025 20:24	**35 min**	0:15	
Door to IV TNK order	11/12/2025 20:34	**35 min**	0:25	
Order to IV TNK delivery	11/12/2025 20:35	**10 min from order**	0:01	
Door to IV TNK administration		**45 min**	0:26	Awesome Job!
Onset/LKW to TNK delivery		**3 hours**	1:24	

Pre-TNK NIHSS	**12**	24 hour Post-TNK NIHSS	**2**
Pt taken straight to CT?	**Yes**		
CT ordered "Code Stroke"?	**Yes**		

Initial EMS Report

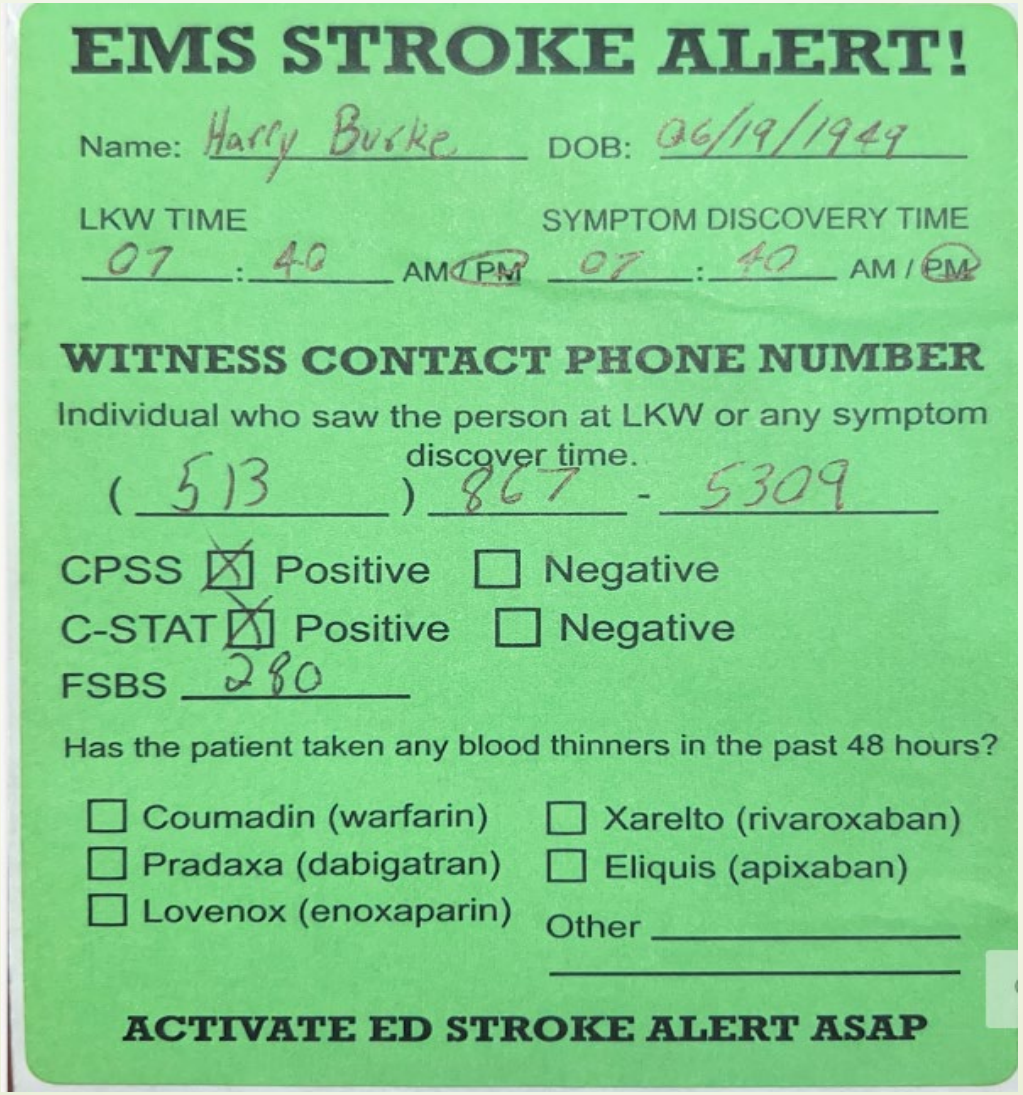
- Need to Update

Narrative
M03 dispatched with E18 for a male possible stroke. M03 arrived on scene. Male pt found sitting upright in a chair at a bar. Pt was put drinking with his wife. Pts wife reported the pt stopped responding and had odd arm movements. Pt wife then called 911. Pt had weakness on his entire R side. Pt had R sided facial droop. Pt was still unable to speak. Pt was assisted to stretcher. Stretcher to ambulance. Vitals taken. IV access gained in the R AC with an 18g catheter. 02 administered via NRB mask @10lpm. CSTAT Score of 4. Transport started to UCMC. Transport notification called to hospital doctor. Stroke alert sticker filled out. Transport complete. Once at hospital, pt had marked improvement. Pt was now able to move his R leg and R arm by himself. Pt care transferred to hospital staff in CT room. M03 available.

C-STAT Stroke Scale			
Time Performed	19:52:00 11/12/2025	**Conjugate Gaze Deviation**	Present
Total Score	4	**Age and Month**	Answers Age Incorrectly, Answers Current Month Incorrectly
Stroke Symptoms Resolved		**Eyes and Hands Commands**	Does Not Close Eyes, Does Not Open/Close Hands
		Arm Weakness	Right Arm Falls

Specialty Patient - Cincinnati Stroke Scale				
Time Performed	**Last Known Well**		**Stroke Symptoms Resolved**	
19:50 11/12/2025	19:40 11/12/2025		Yes - Resolved in EMS Presence	
Onset of Signs/Symptoms	**Screening Criteria Met**	**Facial Droop**	**Arm Drift**	**Speech**
19:40 11/12/2025	YES	Abnormal	Abnormal	Abnormal

Completed Green Sticker



EMS STROKE ALERT!

Name: Harry Burke DOB: 06/19/1949

LKW TIME 07 : 40 AM / (PM)

SYMPTOM DISCOVERY TIME 07 : 40 AM / (PM)

WITNESS CONTACT PHONE NUMBER

Individual who saw the person at LKW or any symptom discover time.

(513) 867 - 5309

CPSS [X] Positive [ ] Negative

C-STAT [X] Positive [ ] Negative

FSBS 280

Has the patient taken any blood thinners in the past 48 hours?

[ ] Coumadin (warfarin)
[ ] Pradaxa (dabigatran)
[ ] Lovenox (enoxaparin)
[ ] Xarelto (rivaroxaban)
[ ] Eliquis (apixaban)

Other _____

ACTIVATE ED STROKE ALERT ASAP

Notable times

- 2015 This is a 76-year-old male with no previous stroke history coming in for right-sided weakness dysarthria, and aphasia. He also has noticeable right-sided facial droop. Last known normal was 7:45 PM. Initial vital signs are notable for 170 systolics. Without intervention he is blood pressure has gone down to systolic 155.
- 2047 ECG for indication of stroke - Sinus rhythm with left axis deviation. Evidence for possible physically block. No previous EKG to compare.
- 2035 – TNK given
- 2051 - Radiology called back with evidence of an left M2 occlusion. Stroke team calling the neuro IR team with plans for thrombectomy.



Post Intervention

- NIHSS improved from 9 --> 2 yesterday after receiving TNK therefore not taken for EVT and admitted to Flex ICU for post-TNK monitoring.
- No complications from TNK. Improved speech - able to name, repeat, and comprehend.

Key takaways

- EMS rapid assessment and recognition in the field is key
- Ongoing education to the public of symptom recognition for stroke works
- Early ED notification saves brains
- Using all the tools we have available streamlines patient care from the moment of contact. Although not used in the field, pulsara use in hospital is immediate notification to those in the care team.

Follow up report to EMS

UC Health
UC Gardner Neuroscience Institute

Discover more at uchealth.com/stroke

EMS Follow Up
Confidential Patient Information

ARRIVAL DATE/TIME/LOCATION:

11/12/25 at 1949 UCMC

EMS AGENCY:

Cincinnati Fire

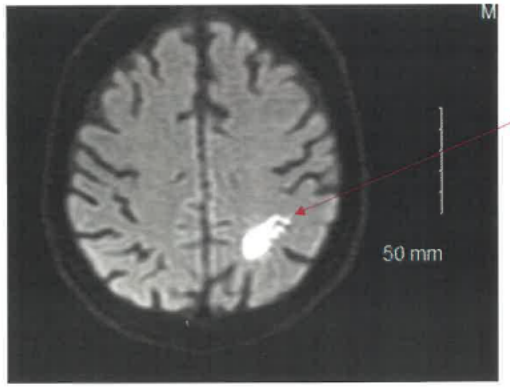
PATIENT SUMMARY:

76-year-old male out to dinner, developed aphasia, facial droop and right sided weakness. Weakness improved after CT but still aphasic. Treated with TNK. Patient was found to have a thrombus in the heart which was the cause of the stroke. Able to be discharged home with only slight dysarthria. Amazing job team!

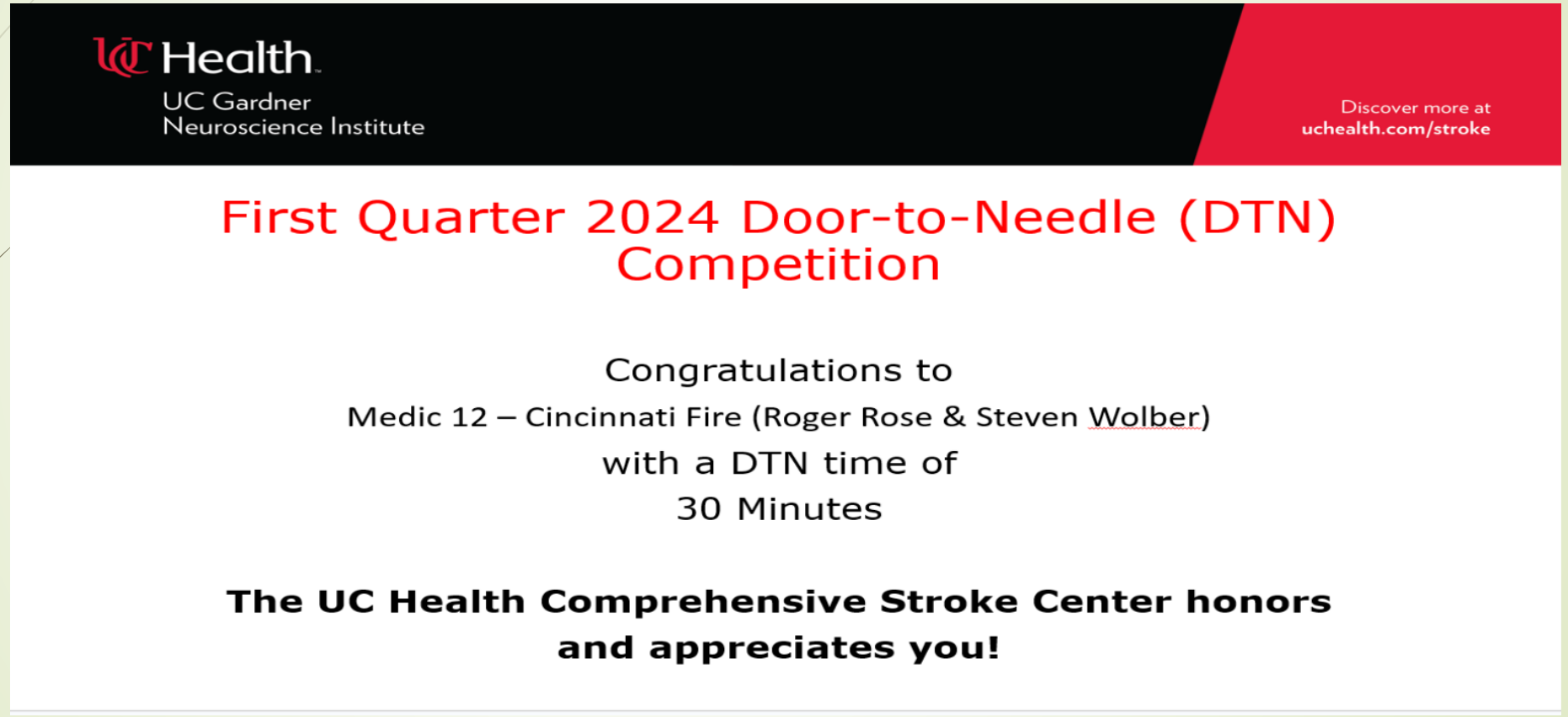
Prehospital Key Interventions	
x	Blood glucose
x	Hospital pre-notification
x	Time last known well documented
x	CPSS/C-STAT documented

Additional Notes: Stroke Alert Sticker completed

Door-to-CT Time (Goal < 20 minutes)	First Contact-to-Needle Time	Door-to-Needle Time (Goal < 45 minutes)	Discharge Disposition
8 minutes	46 minutes	26 minutes	Home



Recognition of EMS Crews



Bringing it all together

- Public education, early EMS recognition and notification are essential
- Prenotification gets all the wheels in motion to reduce DTN time
- Coordination from the field to the CT to Pharmacy to TNK and EVT if necessary are essential (workflows)
- All these come together to improve patient outcomes
- Using all the right tools is essential
- Recognition keeps all those involved in the continuum of care bought in

Questions???

- James.Laidlaw@UCHealth.com
- Joshua.Cox@stelizabeth.com

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- Pulsara. (n.d.). *Communication & logistics for better patient care*. https://www.pulsara.com/
- Case study review information 1. St Elizabeth Healthcare Joshua Cox
- Case Study review information 2. UC Health James Laidlaw