Dispatcher and EMS Stroke Recognition is Associated with Favorable Hospital Discharge

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50 YEARS OF EMERGENCY MEDICINE RESIDENCY

UC STROKE TEAM

UNIVERSITY OF CINCINNATI DIVISION OF EMS

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Disclosures

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- Travel:
  - American Stroke Association
- Project Support:
  - Prehospital Guidelines Consortium

Stroke is Important!

- About 800,000 people experience a stroke each year
  - 1 every 40 seconds!
- Important cause of death and disability
  - One of every 21 deaths in the US is related to stroke
  - One person every 3 minutes, 17 seconds dies from stroke
- $57 billion direct and indirect costs of stroke
  - 3% of the US population reports a stroke-related disability
- Disproportionate effects on:
  - Women
  - Minorities
  - Elderly
  - Certain geographies

Tsao et al. *Circulation.* 2023

Stroke Basics

- Stroke is any disruption in the blood flow to the brain...

Stroke Basics

- …leading to sudden neurologic symptoms
- Weakness
  - Arm, leg, face
- Slurred speech or inability to talk

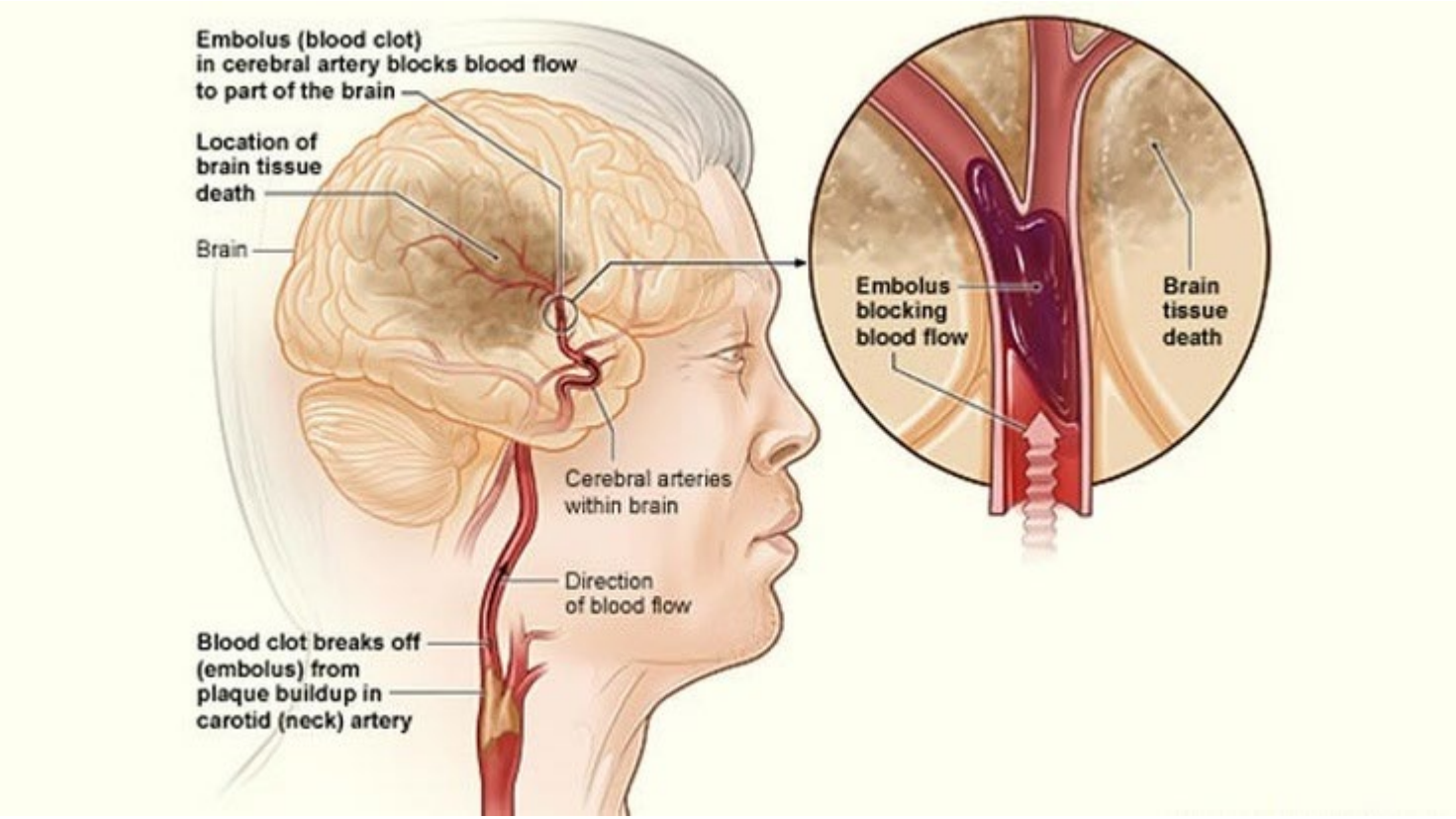
- Altered mental status or coma
- Severe headache
- Vomiting
- Dizziness

Types of Stroke

- **Ischemic** – sudden blockage in the blood flow to a part of the brain
- All the brain cells past the blockage are at risk

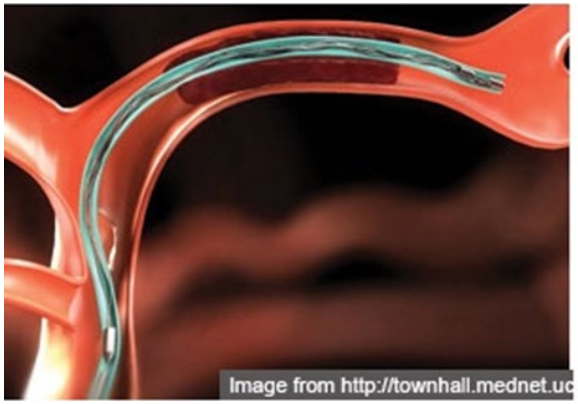
Ischemic Stroke

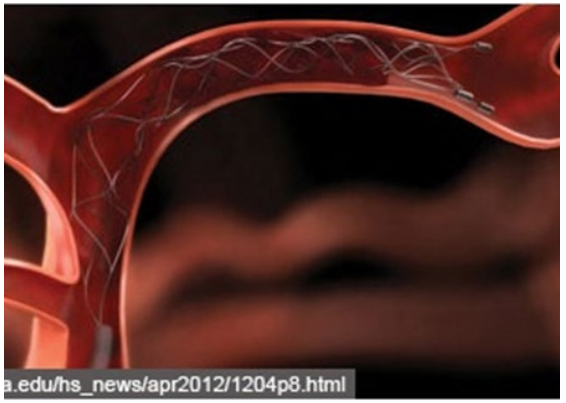
- Blockage is usually a blot clot



Stroke is Treatable!

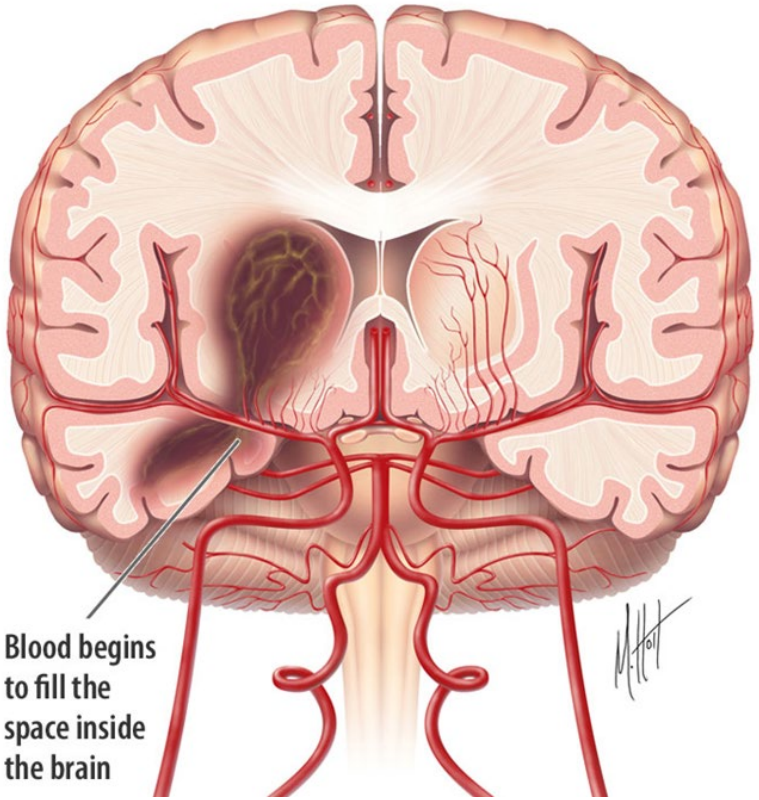
- Treatment is to open the blockage





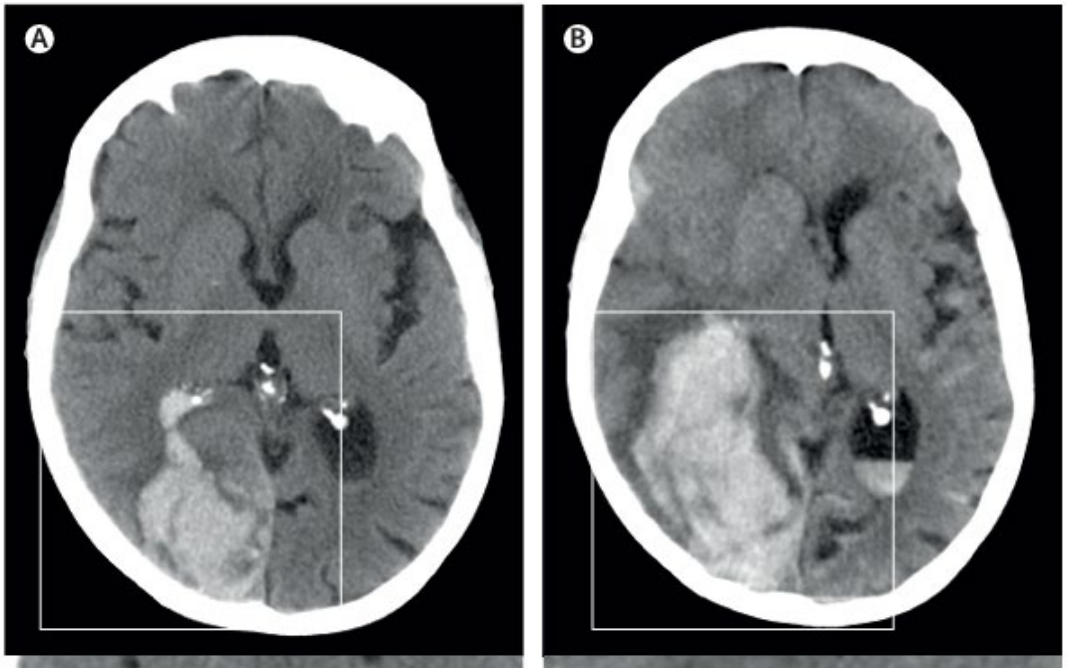
Types of Stroke

- **Hemorrhagic** – bleeding in or around part of the brain



Stroke is Treatable!

- Treatment is to limit hematoma expansion
  - Prompt blood pressure control
  - Reverse anticoagulants
  - ?Surgery



Morotti et al. *Lancet*. 2023

Acute Stroke: Time Matters

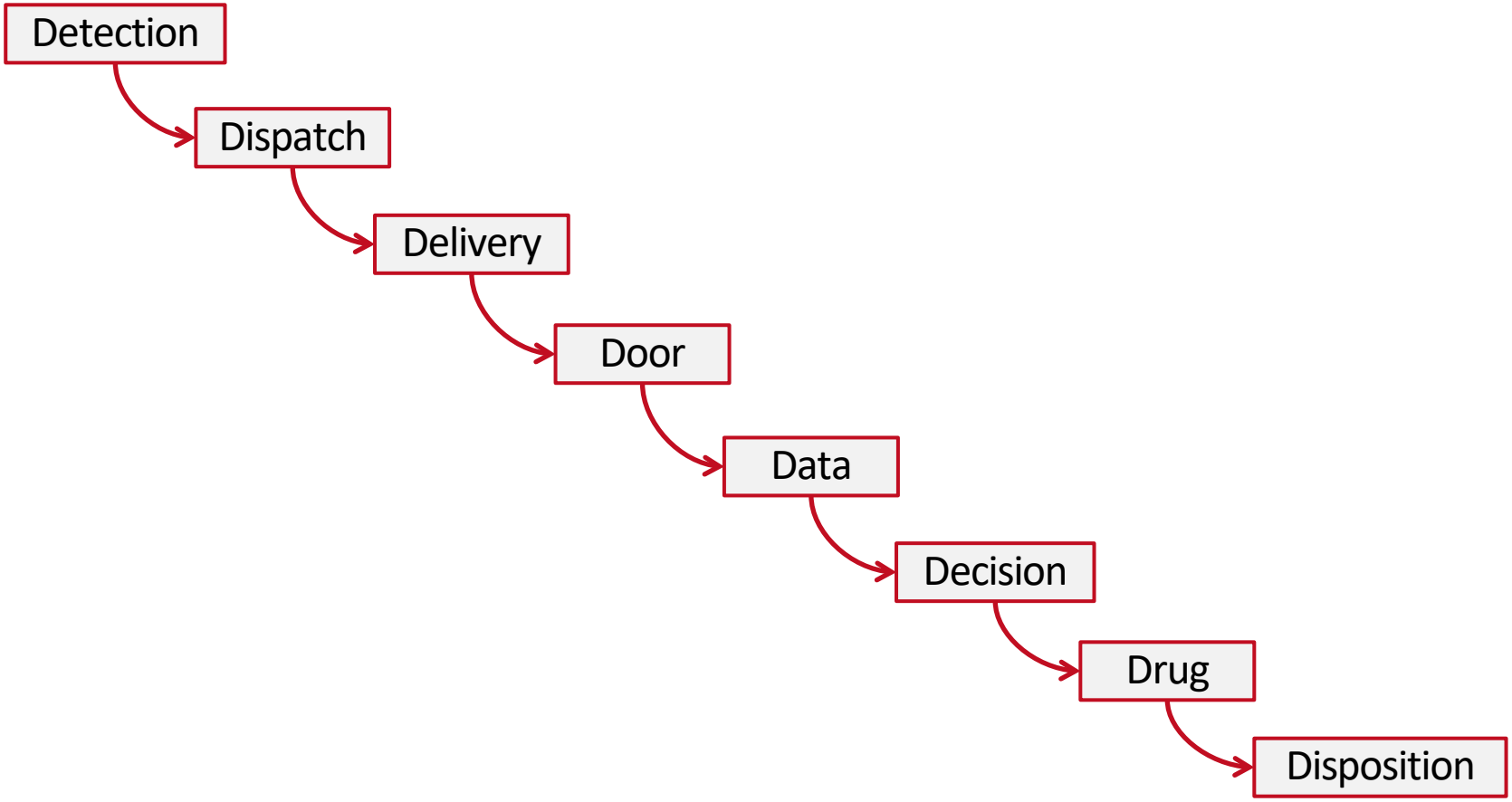
Benefit of treatment is *time dependent*!

Acute Stroke: Time Matters

- "Time is brain" adage
- 2 million brain cells per minute of stroke
- For every *15-minute* increment reduced treatment time:
  - Reduced in-hospital mortality (OR 0.96; 0.95-0.98)
  - Increased discharge home (1.03; 1.02-1.04)
  - Increased independent ambulation at discharge (1.04; 1.03-1.05)
  - Reduced symptomatic ICH (OR 0.96; 0.95-0.98)

Saver et al. *JAMA*. 2013

Stroke Chain of Survival



Jauch et al. *Stroke*. 2013
Zachrison et al. *Stroke*. 2023

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Stroke Chain of Survival

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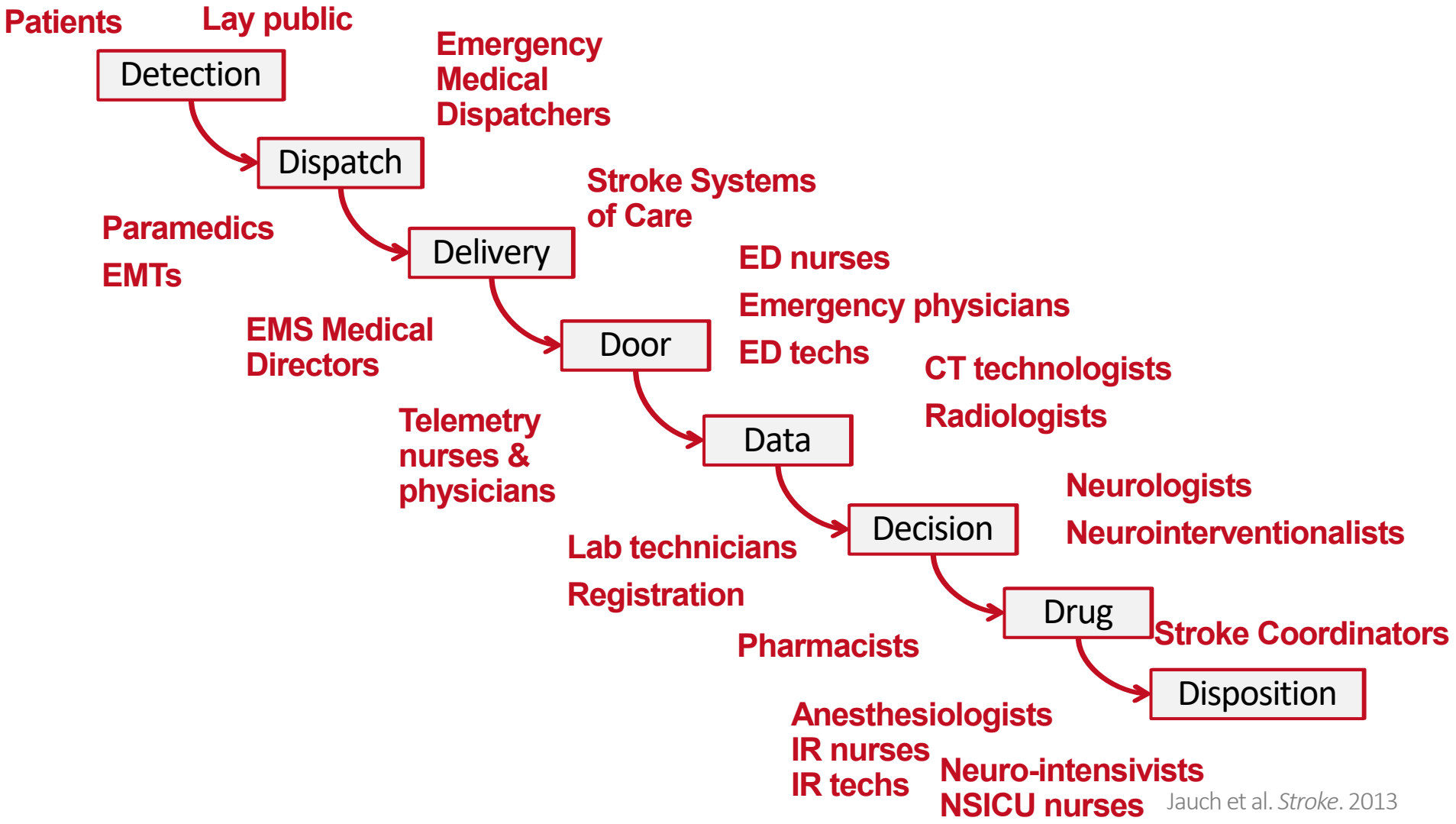

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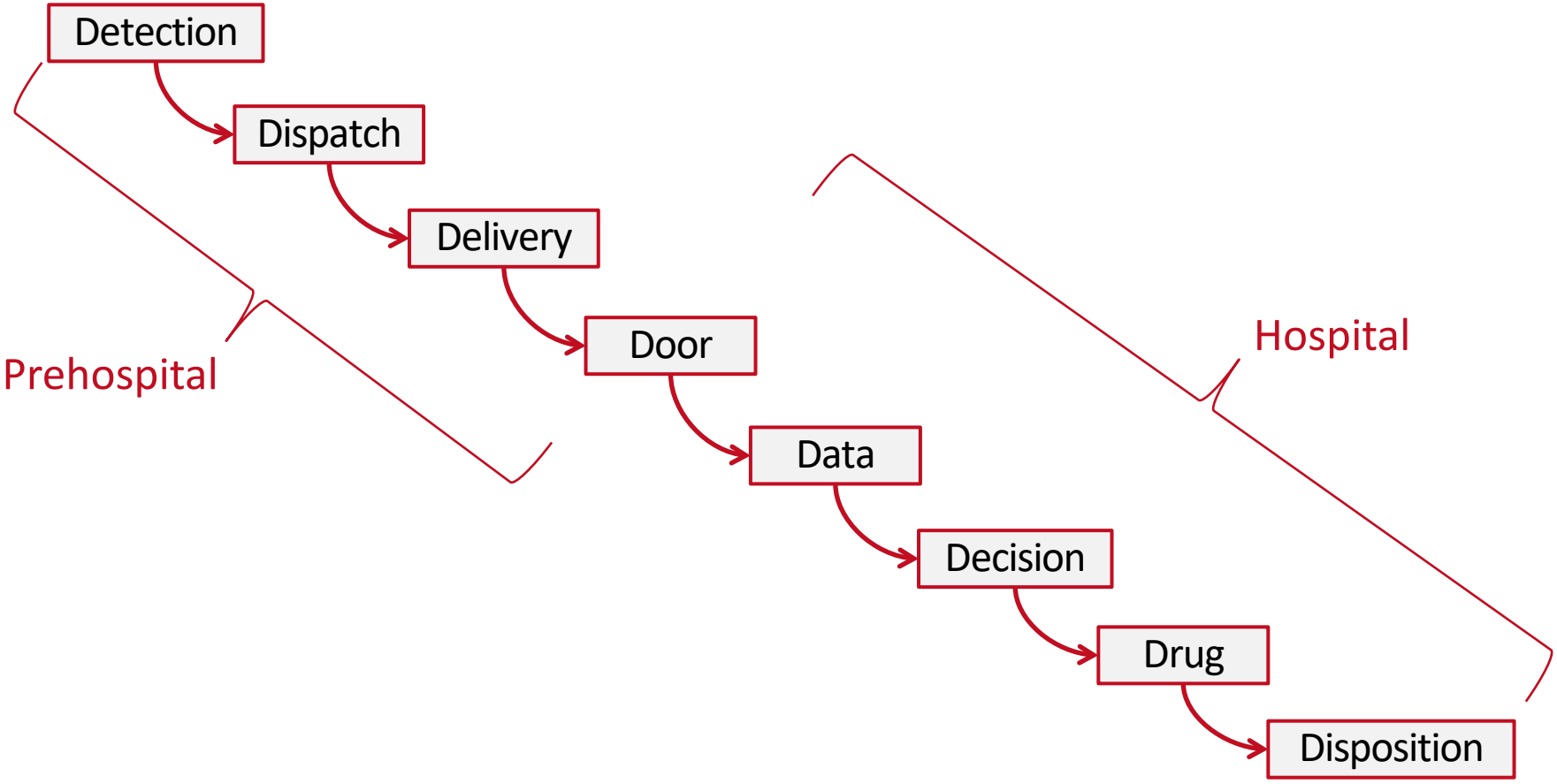

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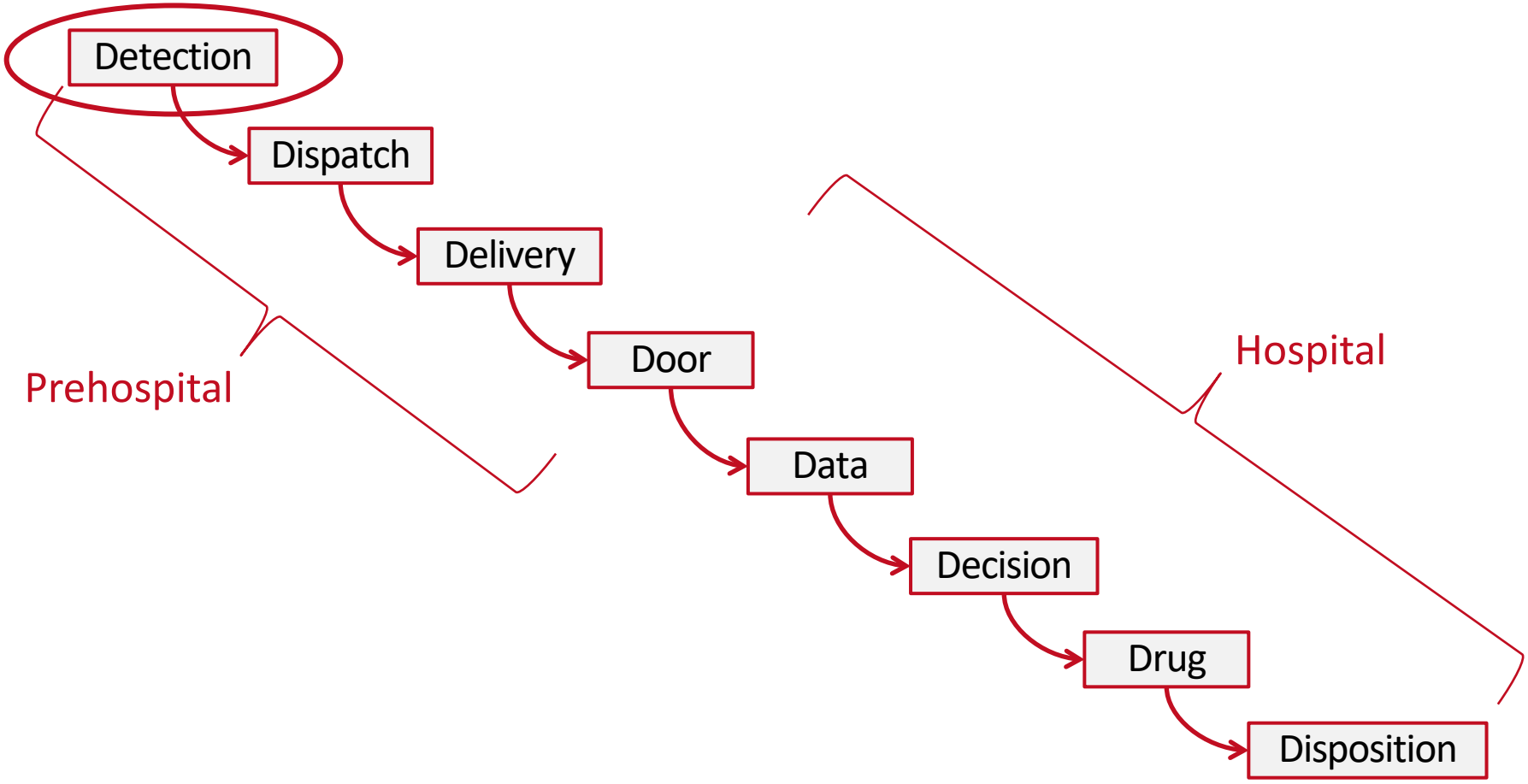

Jauch et al. *Stroke*. 2013
Zachrison et al. *Stroke*. 2023

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Layperson Outreach

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R Rostro caído.

Á Alteración del equilibrio.

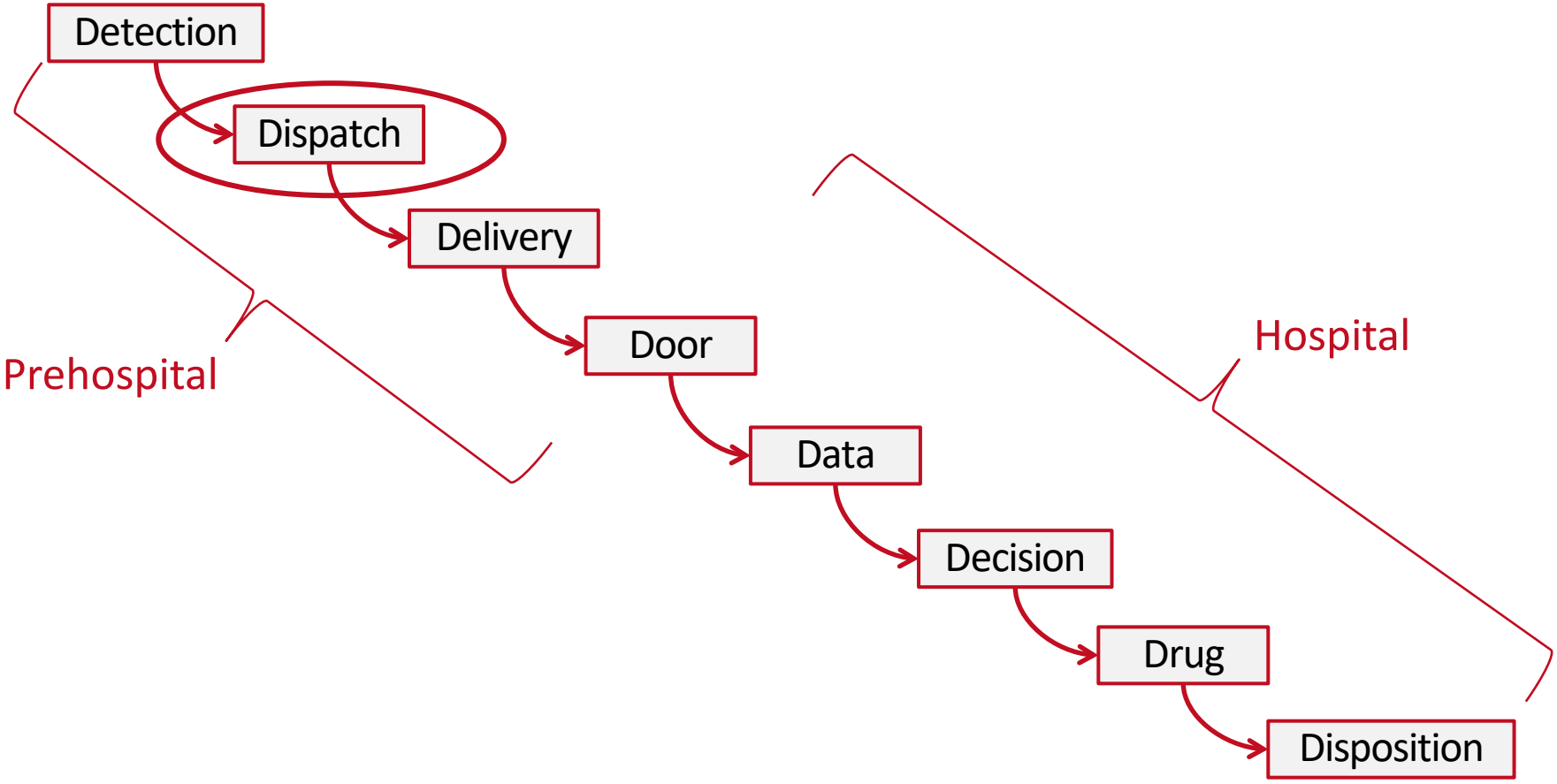
P Pérdida de fuerza en el brazo o una pierna.

I Impedimento visual repentino.

D Dificultad para hablar.

O Obten ayuda. Llama al 911.

Stroke Chain of Survival



Jauch et al. *Stroke*. 2013
Zachrison et al. *Stroke*. 2023

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Dispatch Realities

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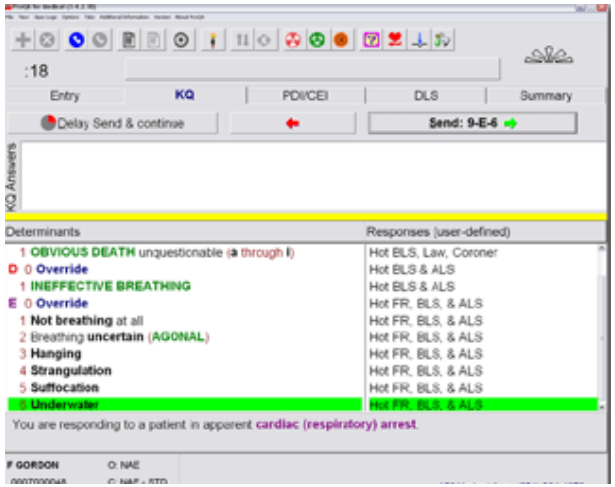
Caller Contacts 9-1-1

Emergency Telecommunicator Determines Type of Emergency

Information Gathering

Pre-arrival Instructions

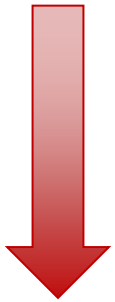


Ambulance Dispatched

"Dispatch Impression"

Dispatch Recognition

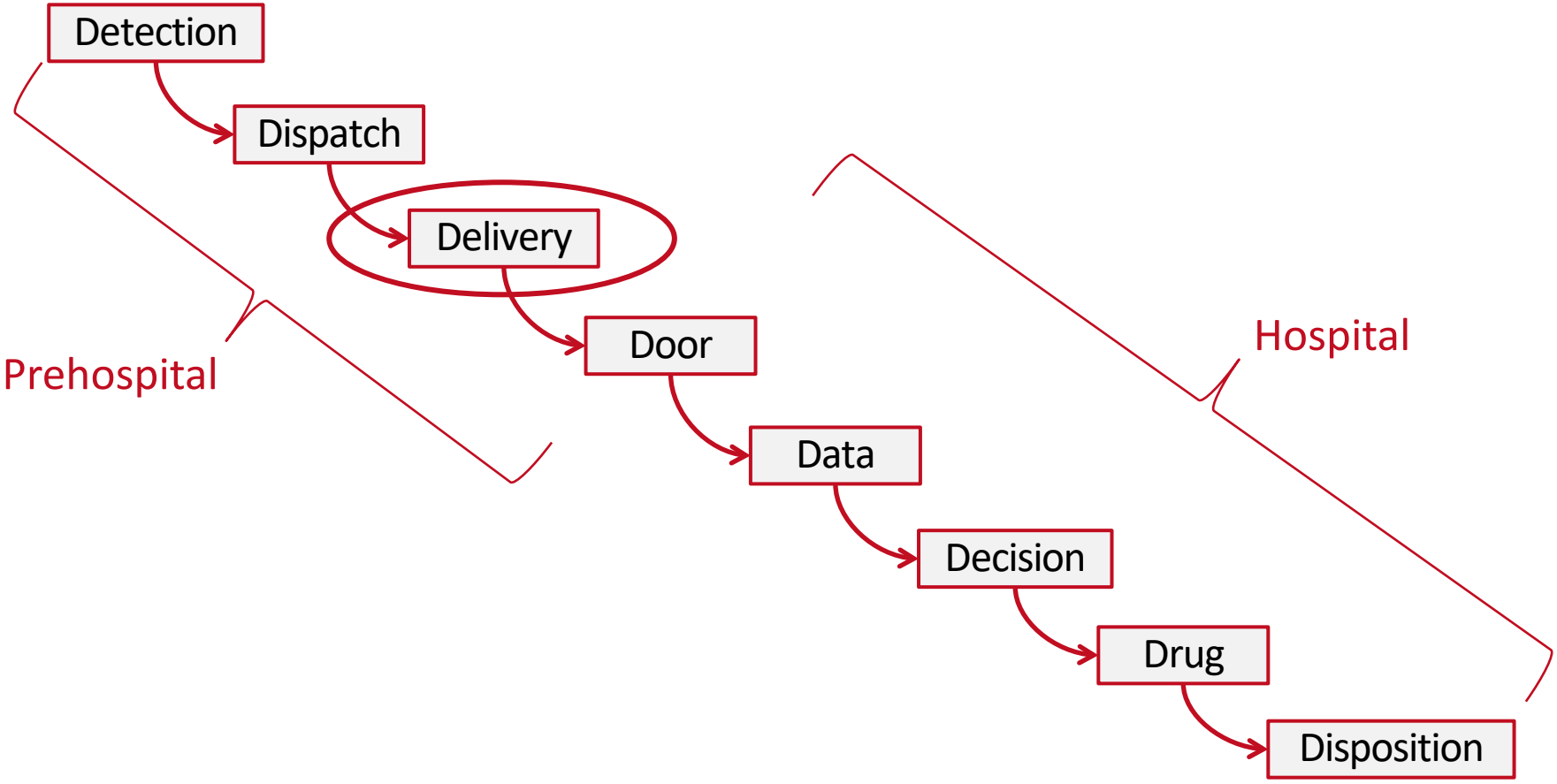
Identification of stroke during 9-1-1 call



10-minute reduction in scene-to-hospital-arrival time

Caceres et al. *JSCD*. 2013

Stroke Chain of Survival



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On-Scene Recognition

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Pre-Arrival Notification

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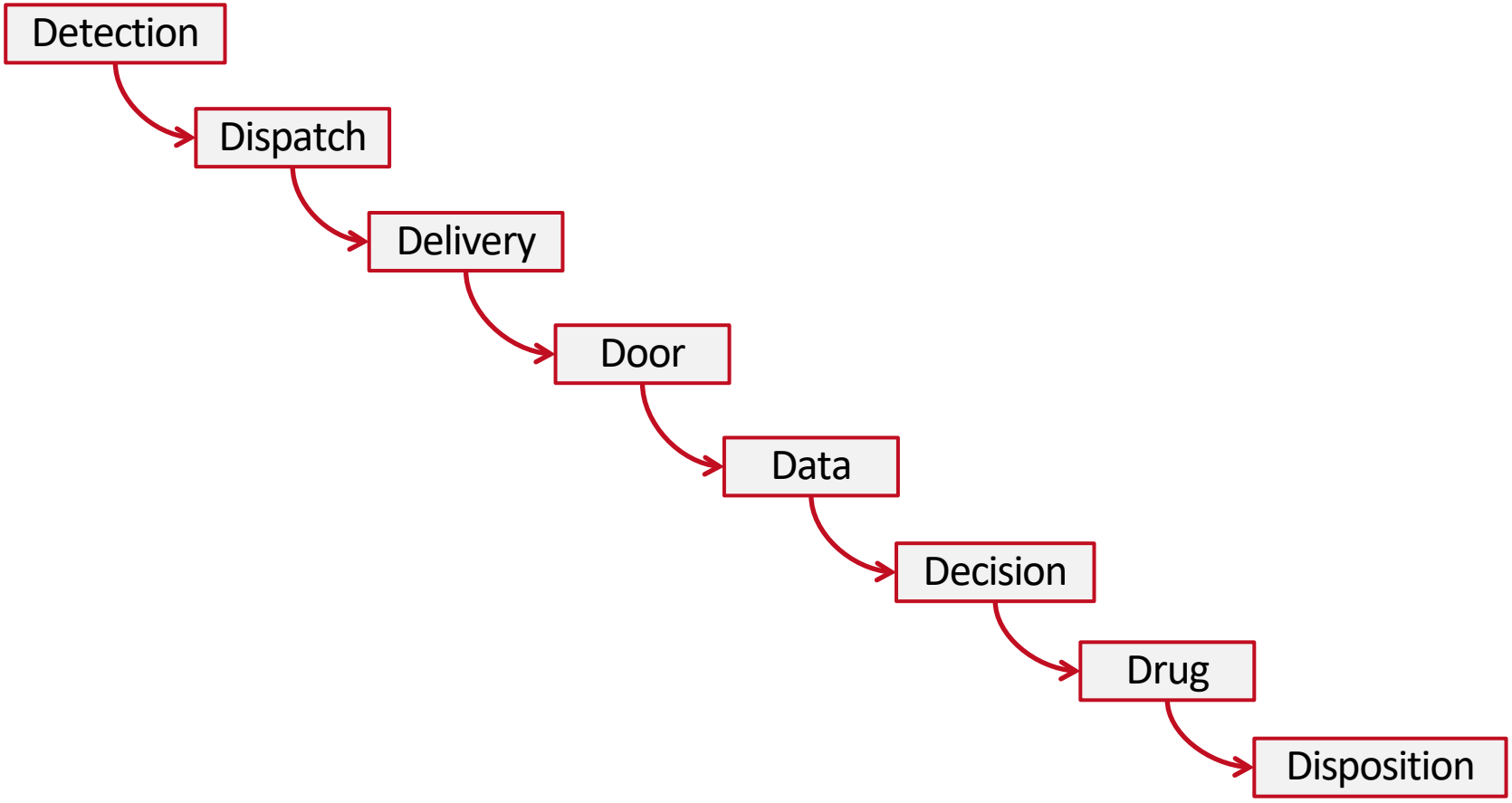

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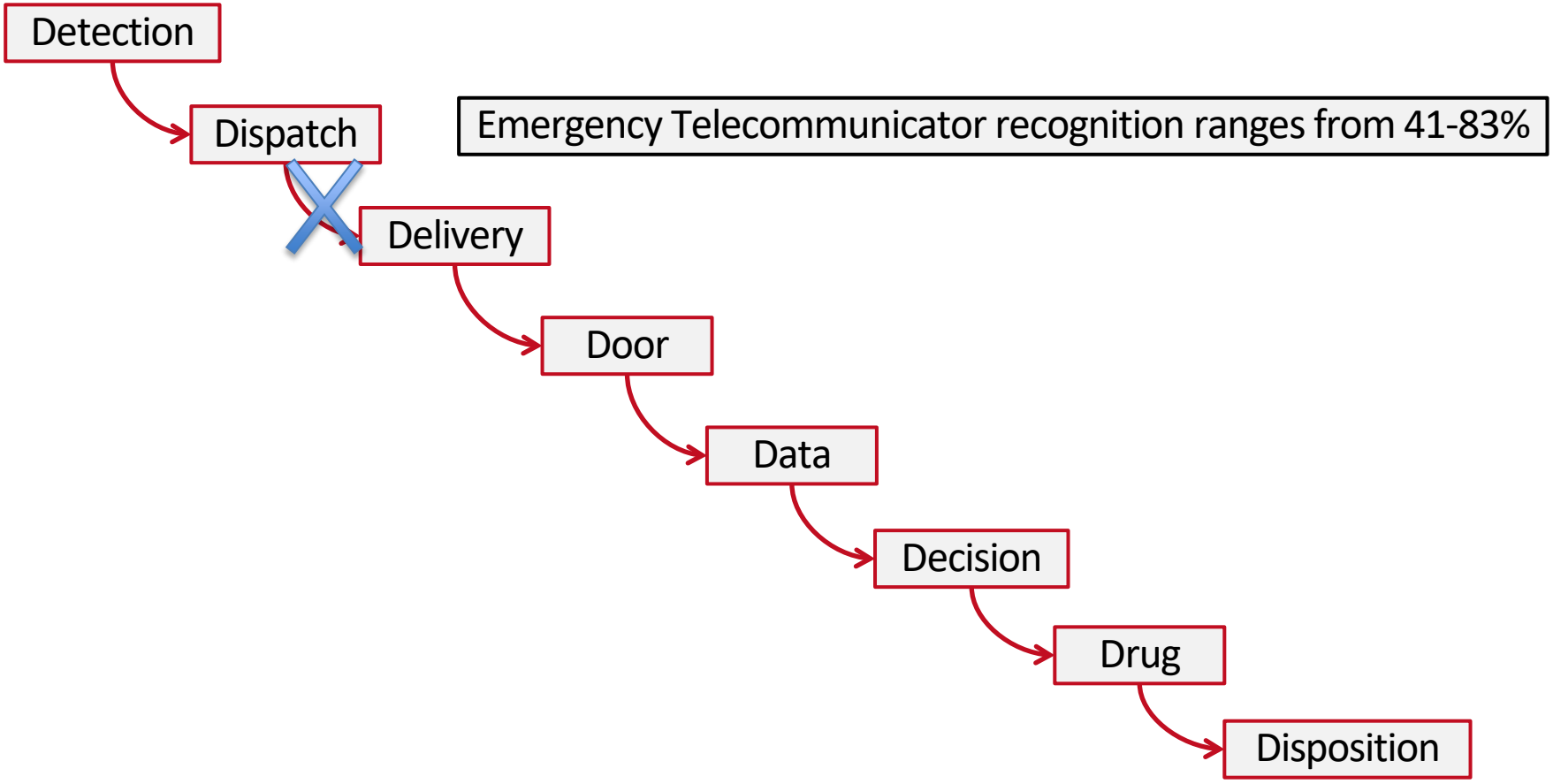

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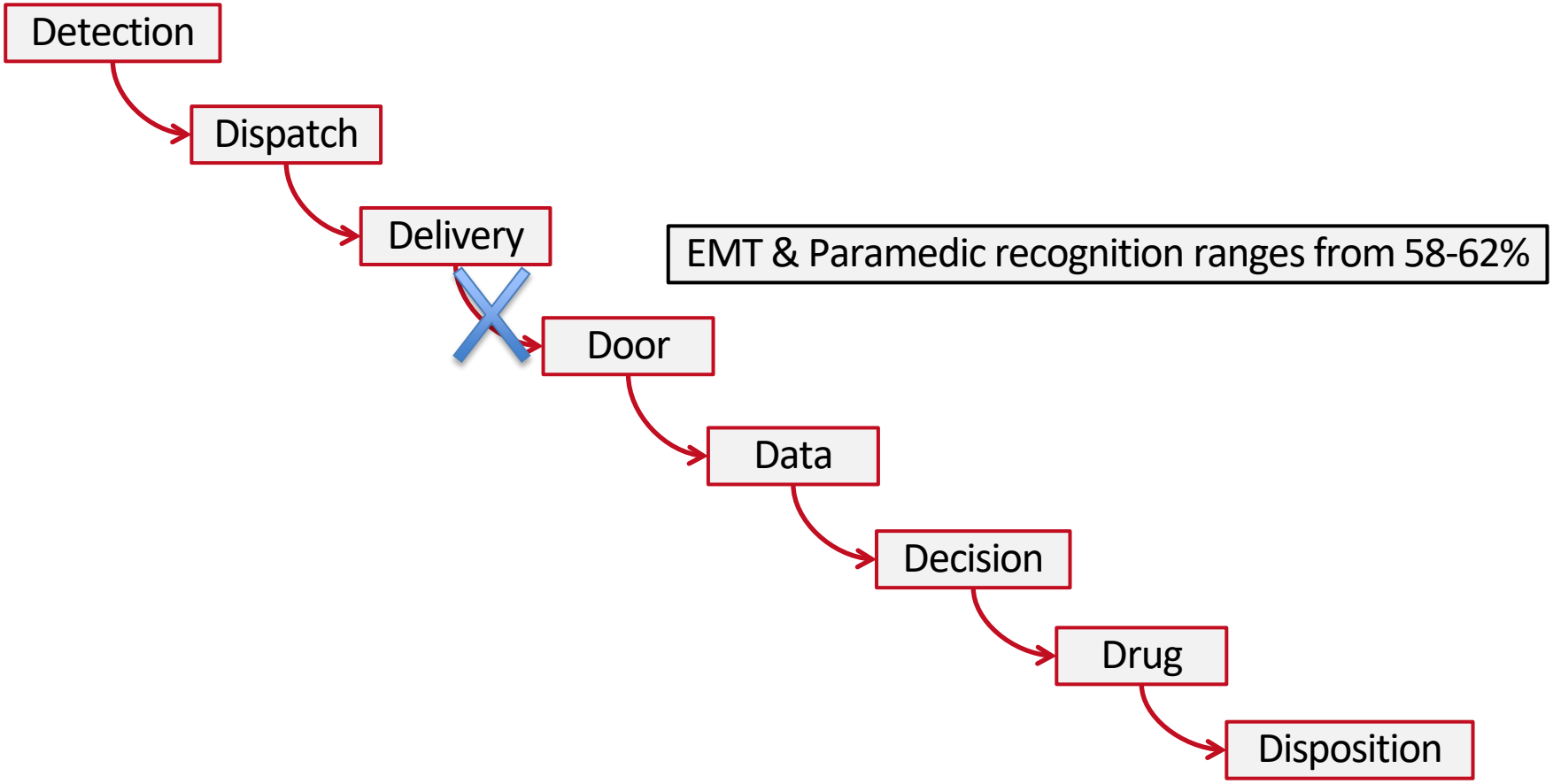

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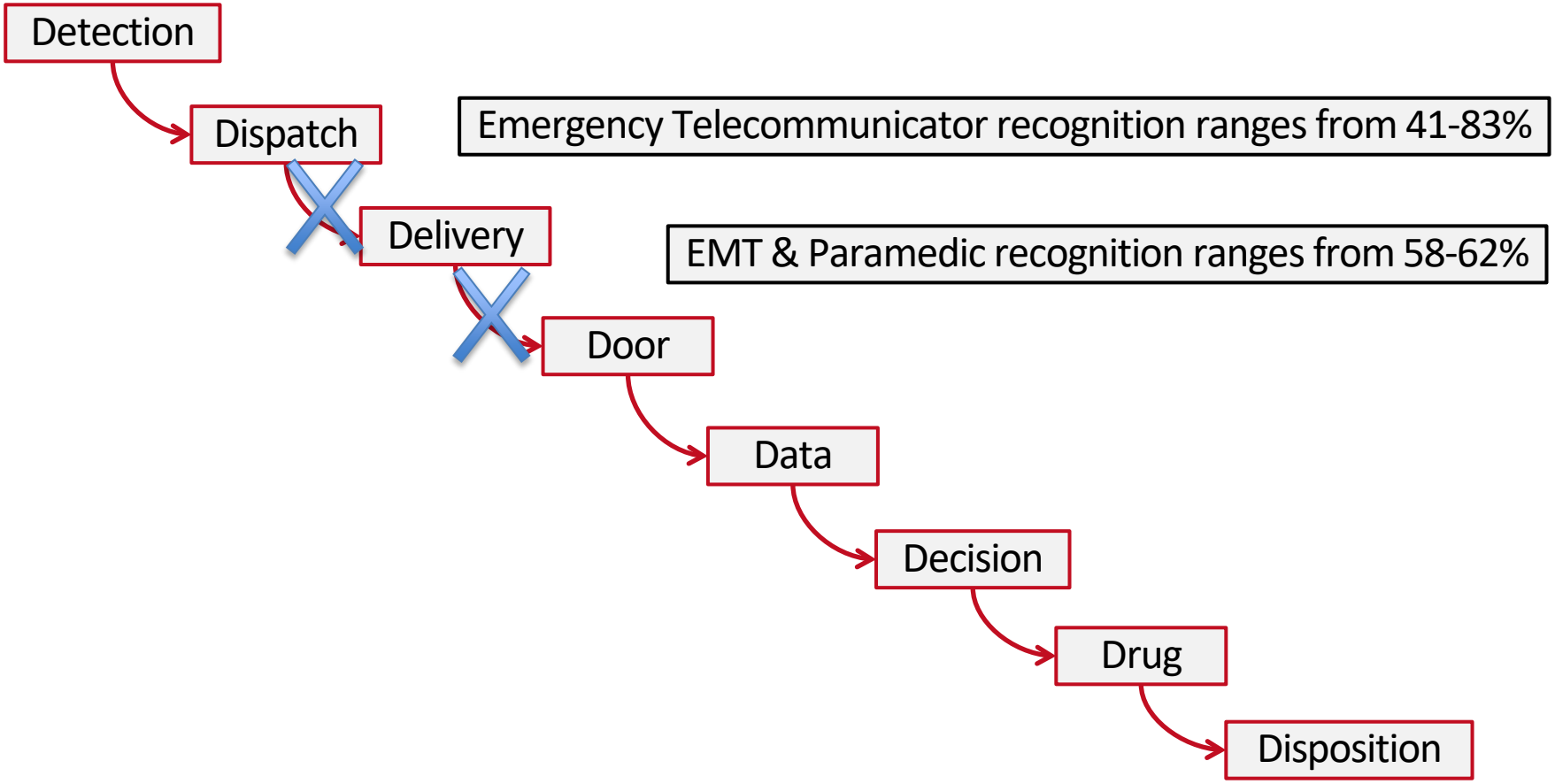

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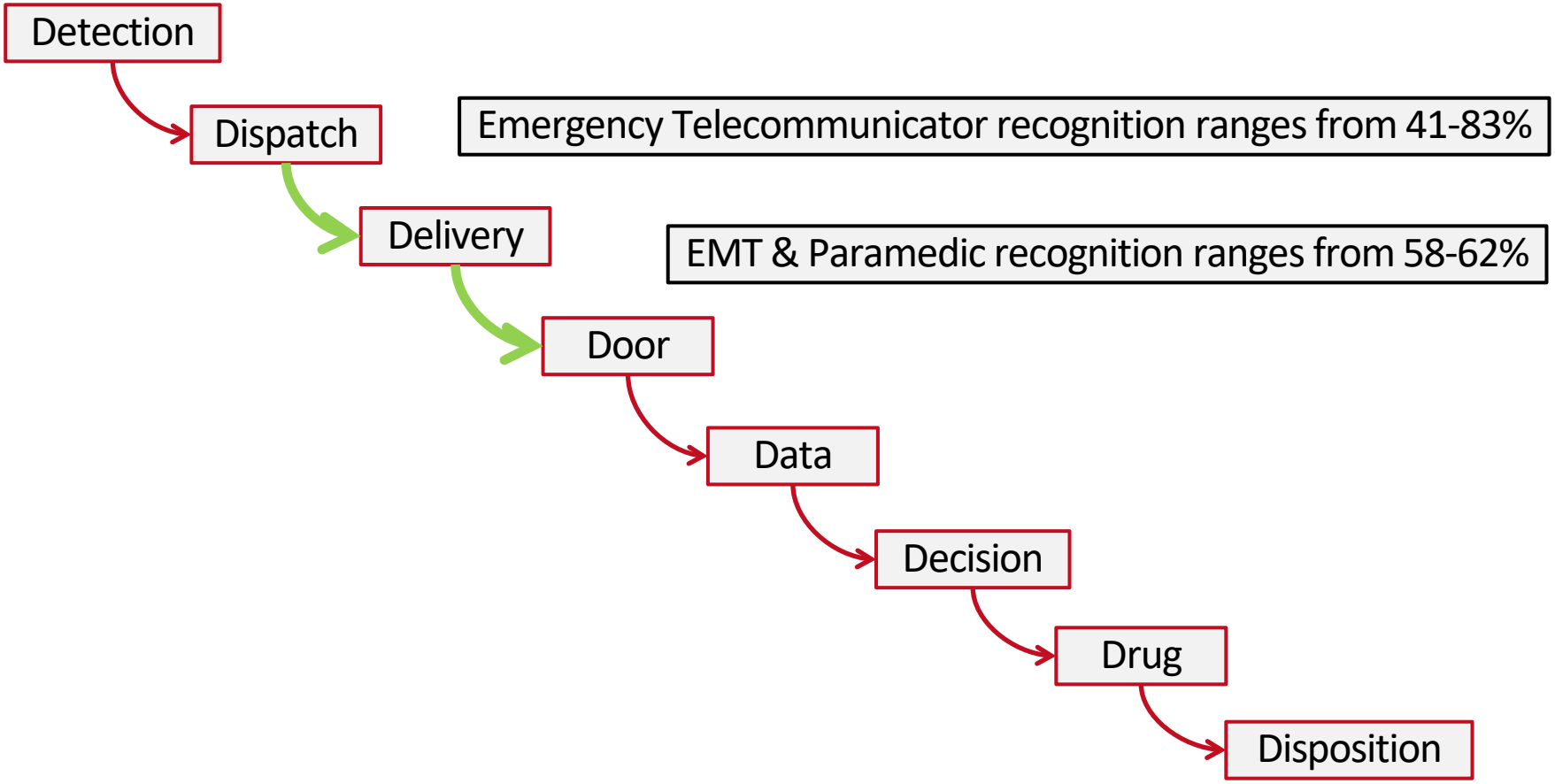

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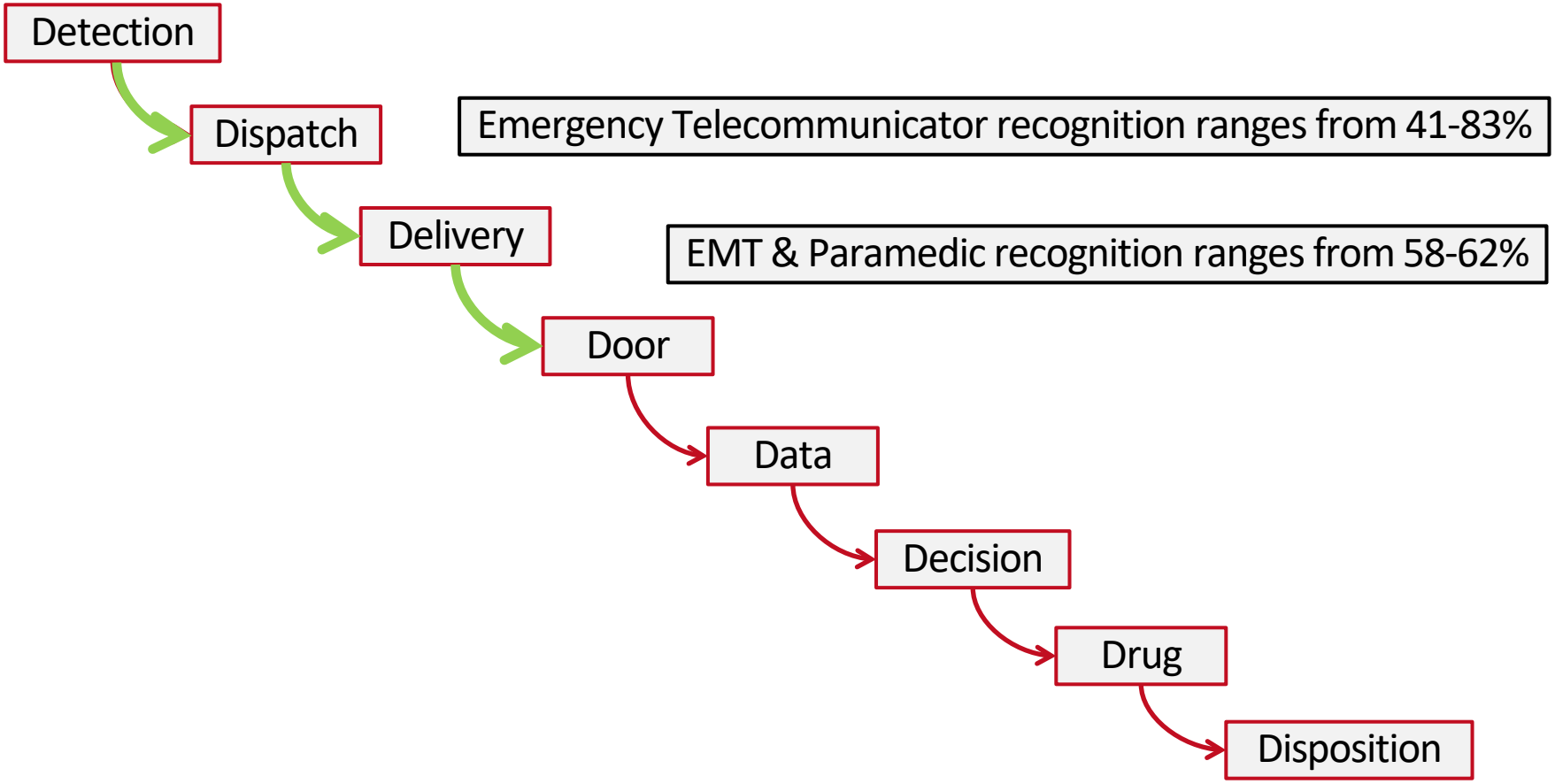

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Cueing?

Detection

Dispatch

Delivery

Door

Emergency Telecommunicator recognition ranges from 41-83%

EMT & Paramedic recognition ranges from 58-62%

Word/Phrase Used by the 9-1-1 Caller	EMD Recognized Stroke (n=53)	EMD Unrecognized Stroke (n=57)	p-value[a]
Stroke	43 (81.1%)	1 (1.8%)	<0.0005
Think	28 (52.8%)	4 (7.0%)	<0.0005
Having a stroke	21 (39.6%)	1 (1.8%)	<0.0005
Had a stroke	10 (18.9%)	0 (0%)	0.001

Disposition

Richards et al. *PEC*. 2017. Mochari-Greenberger et al. *JAHA*. 2015; Abboud et al. *PEC*. 2016; Sharma et al. *IEM*. 2015; Brandler et al. *JSCD*. 2015.

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Aim 1

- Aim 1. Describe the concordance among EMDs, EMS practitioners, and hospital discharge diagnosis of stroke.

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Aim 1

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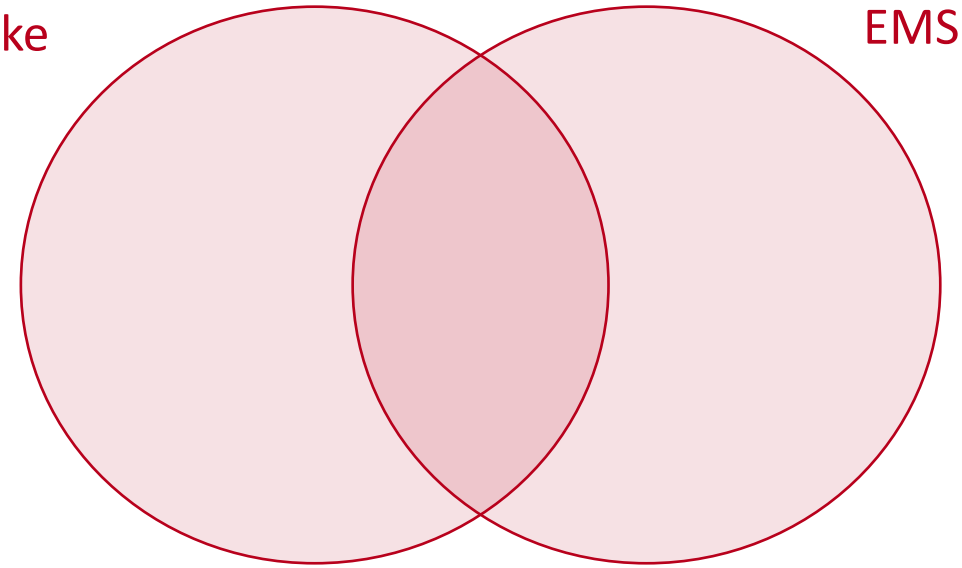
9-1-1 Suspected Stroke



EMS Suspected Stroke

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Aim 1

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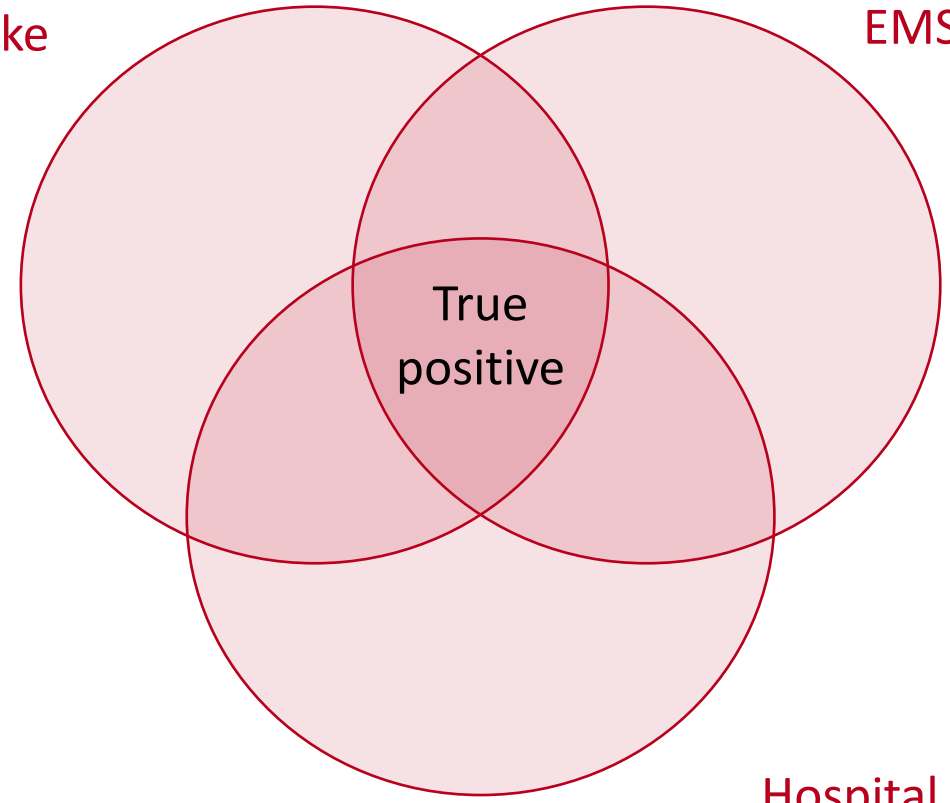

Methods

- Retrospective analysis
- ESO Data Collaborative
  - Linked EMS and ED/hospital electronic medical records from across the US
  - Dispatch, paramedic report, ED/hospital diagnosis, and disposition
- 608 EMS agencies across the US

Challenges of EMS Data

- Studies of confirmed stroke

- Limited linkage with patient outcomes

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Methods

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- Inclusion criteria
  - Emergency ground transports
  - Patients ≥ 18 years old
  - “Stroke” or “TIA” in any of:
    - Dispatch OR
    - On-scene EMS OR
    - ED/Hospital
  - Calendar Year 2021
- Exclusion criteria
  - Duplicate encounter
  - Missing any ED/Hospital ICD-10
  - Interfacility transports
- Descriptive statistics

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Aim 1

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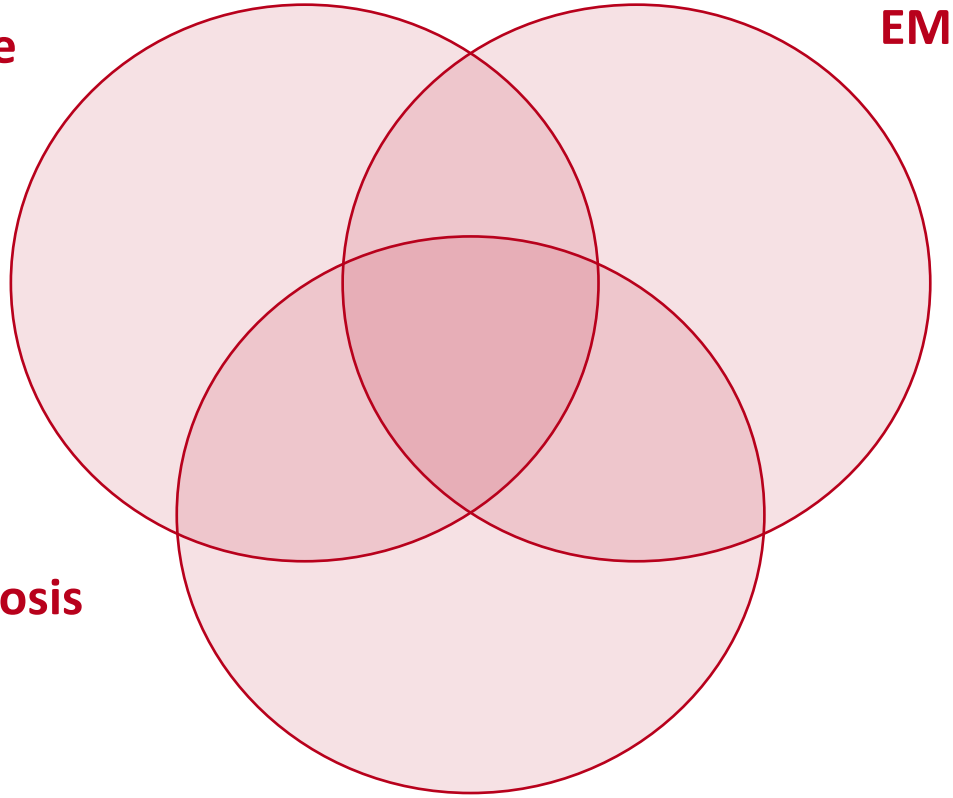
9-1-1 Suspected Stroke

- Dispatch impression
- "Stroke Card" used



EMS Suspected Stroke

- EMS impression
- Abnormal stroke screen
- Prearrival stroke alert

Hospital Stroke Diagnosis

- ED ICD-10
- Hospital primary or secondary diagnosis

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Results

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Unique patient encounters for 9-1-1 response with ground transport to an ED in 2021

	Overall n=226,090
Female	116,910 (51.7%)
Age (median, IQR)	61 (42,76)
Race/Ethnicity	
White	140,588 (62.2%)
Black	44,979 (19.9%)
Hispanic	17,860 (7.9%)
Asian	3,023 (1.3%)
Multi-racial	17,364 (7.7%)
ALS Transport	182,962 (80.9%)
Community origin	198,979 (88.0%)

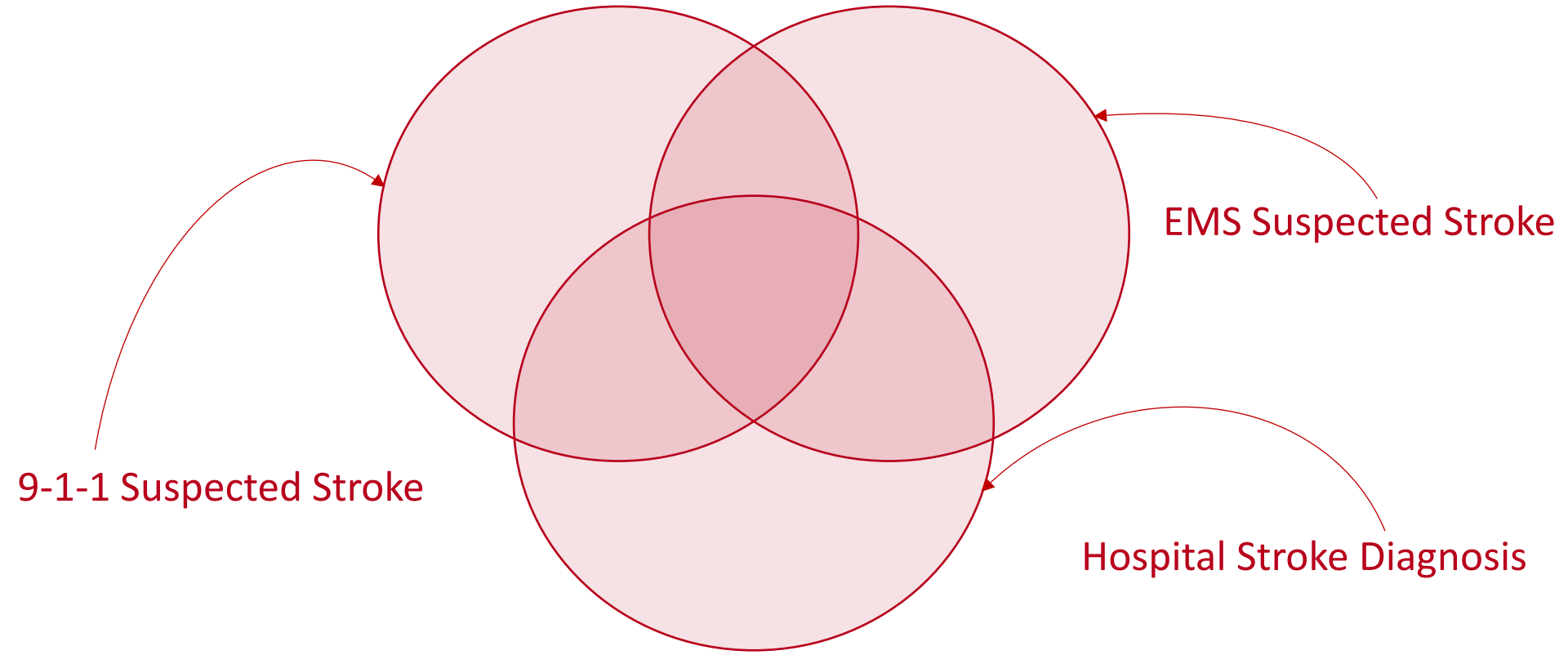
Results

	All 9-1-1 Calls	Stroke/TIA Calls
	n=226,090	**N=77,114**
Female	116,910 (51.7%)	41,201 (53.4%)
Age (median, IQR)	61 (42,76)	71 (59,81)
Race/Ethnicity		
White	140,588 (62.2%)	48,269 (62.6%)
Black	44,979 (19.9%)	13,906 (18.0%)
Hispanic	17,860 (7.9%)	5,102 (6.6%)
Asian	3,023 (1.3%)	1,201 (1.5%)
Multi-racial	17,364 (7.7%)	166 (0.2%)
ALS Transport	182,962 (80.9%)	68,915 (89.4%)
Community origin	198,979 (88.0%)	66,317 (86.0%)

Concordance

Unique patient encounters for 9-1-1 response with ground transport to an ED in 2021 for stroke/TIA

77,114



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Concordance

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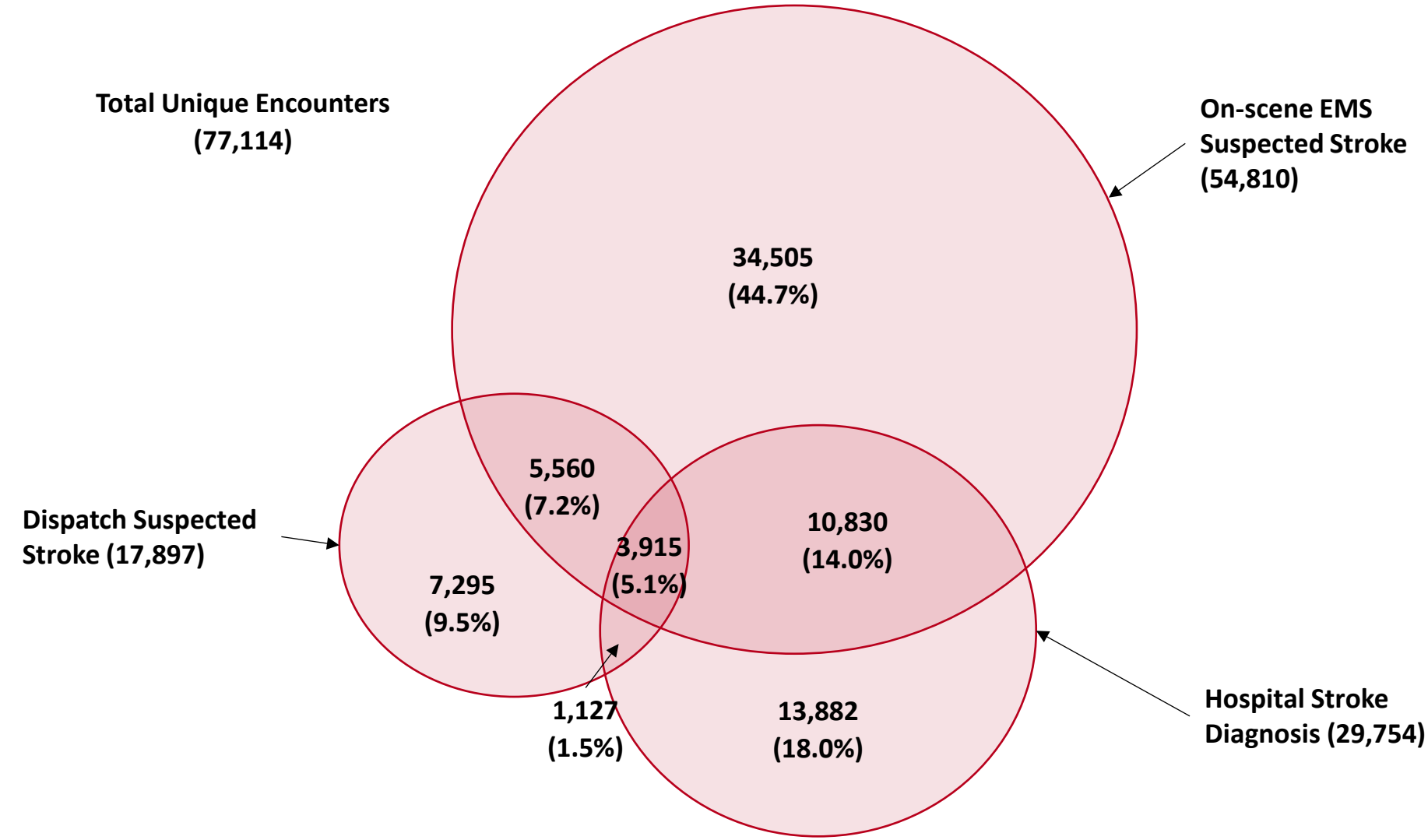
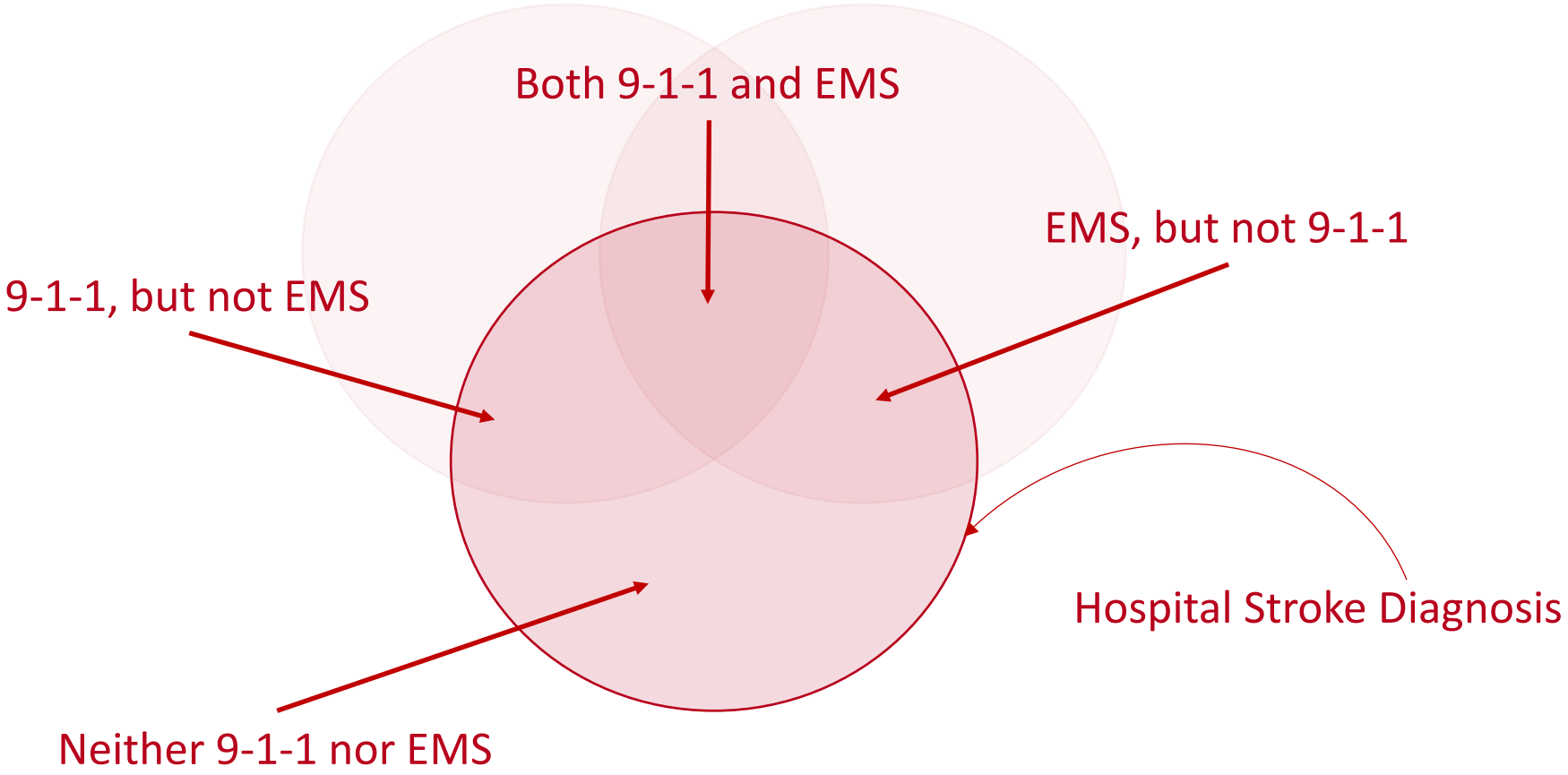


Confirmed Stroke



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Confirmed Stroke

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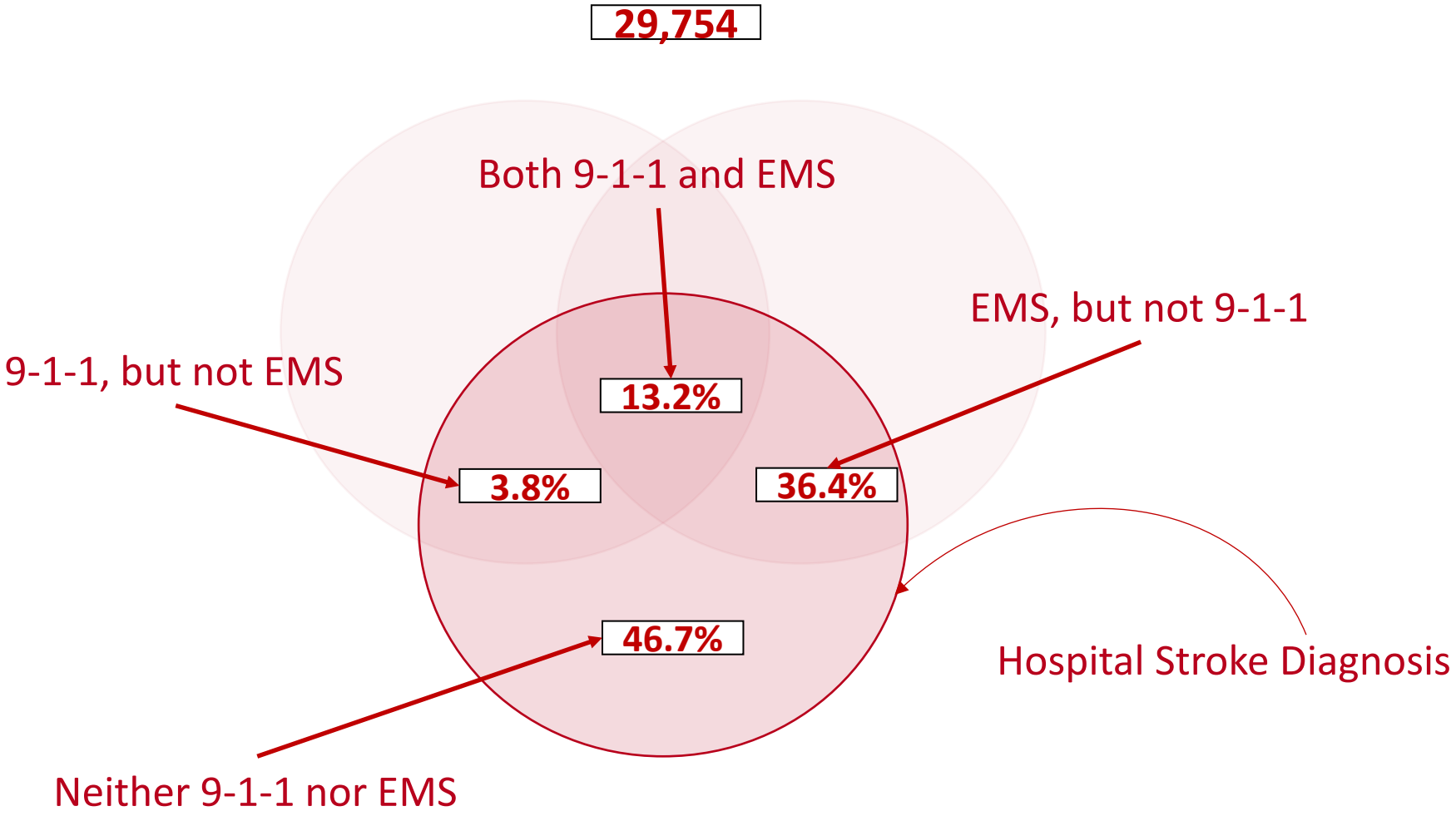

Aim 2

- Aim 2. Investigate the association between 9-1-1 stroke recognition and discharge to home during the index admission.

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Methods

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- Patients with confirmed stroke whose transport originated from a home residence or community setting

- Outcomes
  - Home or short-term acute rehabilitation were considered favorable hospital dispositions

- Statistical Analysis
  - Univariable odds ratios and 95% confidence intervals (95% CI) were used to assess the association between prehospital recognition and hospital disposition

Results

- Transported from home/community site
  - n=25,461
- Discharged to home or short-term rehabilitation
  - n=12,028 (47.2%)

Results

- Odds ratio for home/short term rehabilitation if stroke recognized by:
  - On-scene EMS: 1.43 (95%CI 1.34-1.52)
  - 9-1-1 Dispatch: 1.55 (95%CI 1.41-1.70)
  - Both: 1.80 (95%CI 1.62-2.01)

Limitations

- Retrospective dataset
- Convenience sample
- May have incomplete capture
  - E.g., “weakness” by EMS
- Patient population may not generalize

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Next Steps

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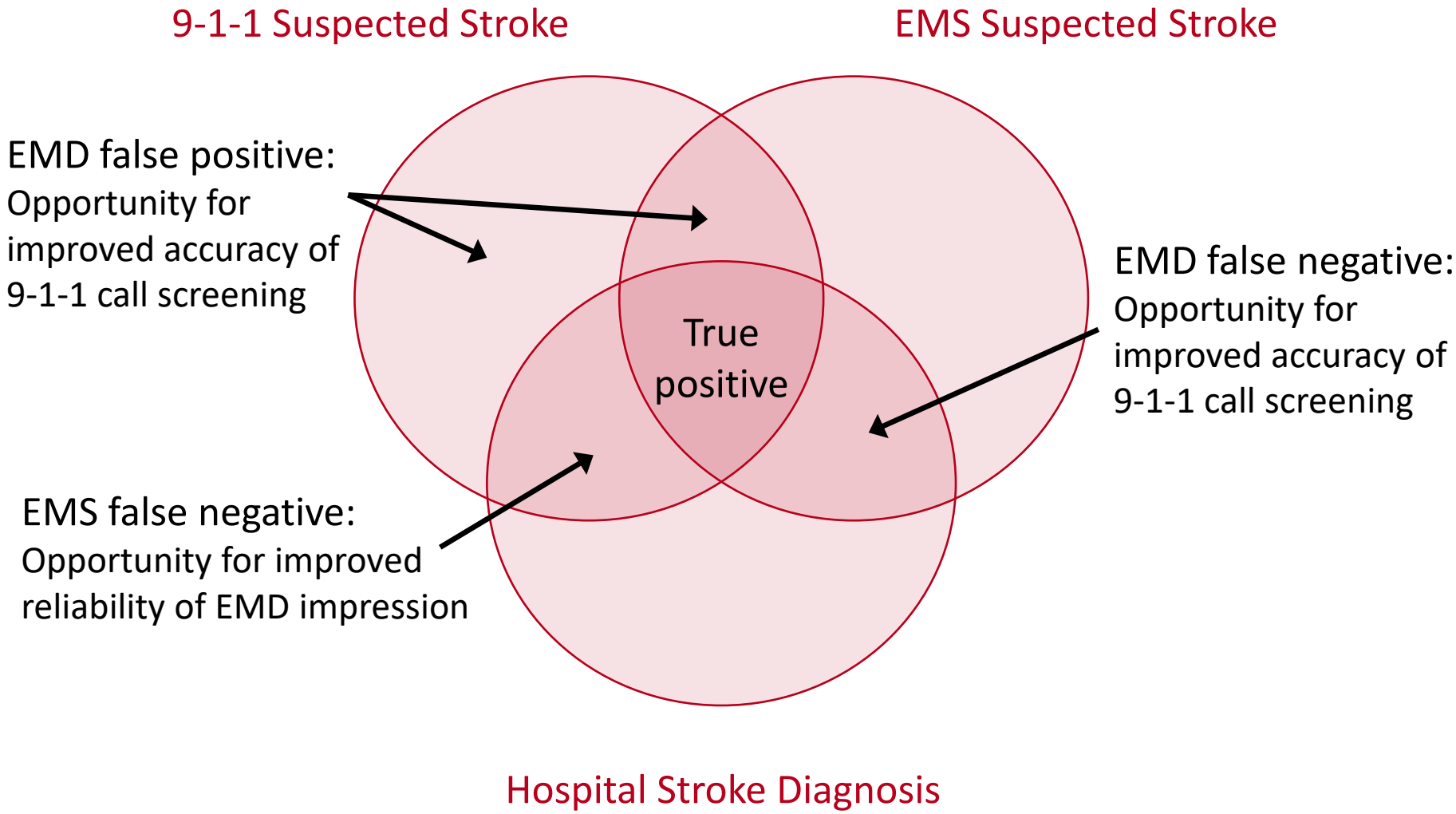
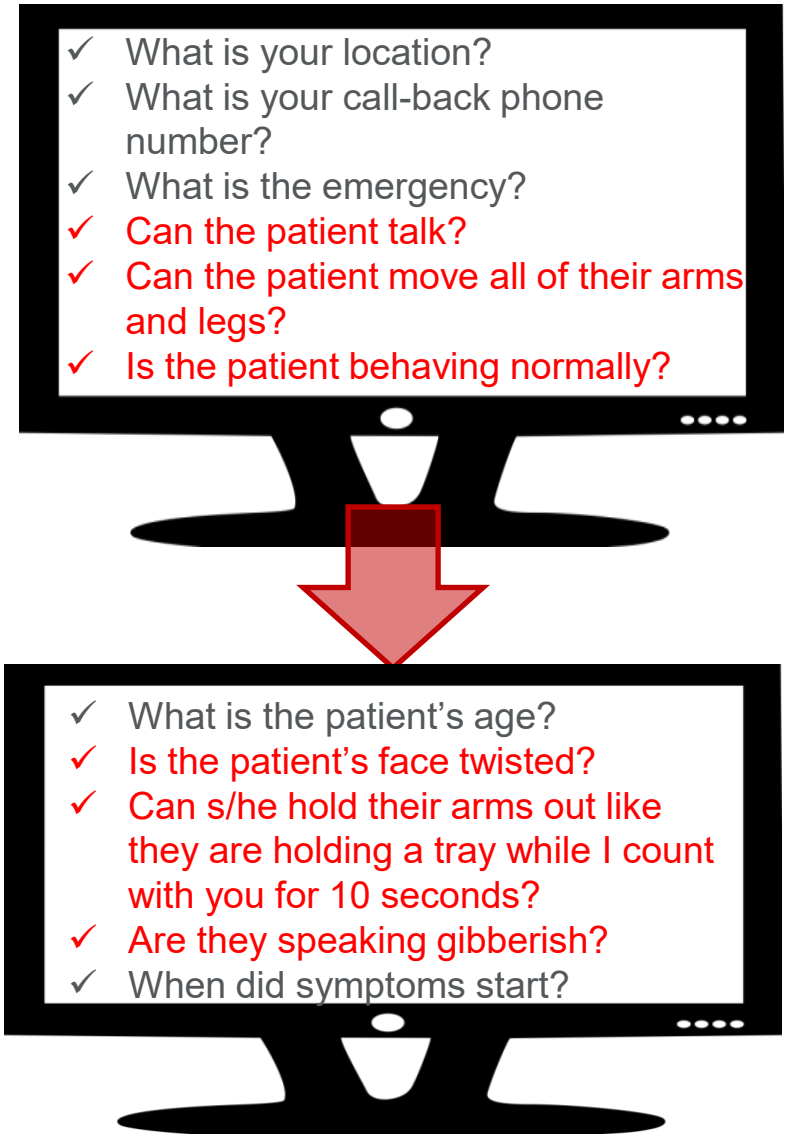


Next Steps

Emergency Medical Dispatcher is aided in using the "Recognition Protocol" for Stroke



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Next Steps

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Emergency Medical Dispatcher is aided in using the "Recognition Protocol" for Stroke

- ✓ What is your location?
- ✓ What is your call-back phone number?
- ✓ What is the emergency?
- ✓ Can the patient talk?
- ✓ Can the patient move all of their arms and legs?
- ✓ Is the patient behaving normally?

- ✓ What is the patient's age?
- ✓ Is the patient's face twisted?
- ✓ Can s/he hold their arms out like they are holding a tray while I count with you for 10 seconds?
- ✓ Are they speaking gibberish?
- ✓ When did symptoms start?

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Next Steps

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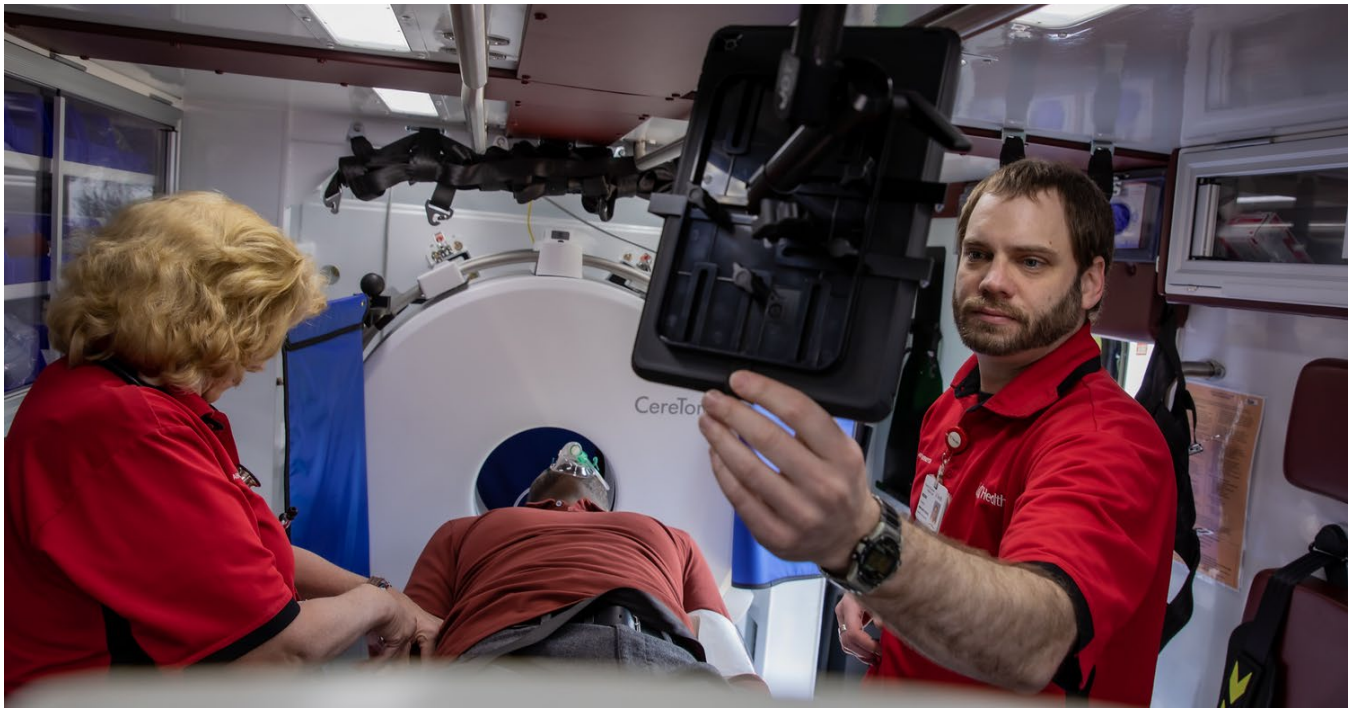

Conclusion

- Dispatch impression, EMS impression, and hospital diagnosis were infrequently all aligned in patients with stroke.

- When emergency telecommunicators and on-scene EMS practitioners both suspect stroke, patients with stroke were more likely to have favorable hospital dispositions.

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Thanks!

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- Laura Syori
- Remle Crowe
- Heidi Sucharew
- Jason McMullan

- Questions?

- Christopher.Richards@uc.edu

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Thanks!

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On-Scene Recognition

- Retrospective analysis of the Greater Cincinnati/Northern Kentucky Stroke Study

  - Geographic region of 1.3 million people

  - Representative of the U.S. in general:
    - Median age (years) 32.4 vs 32.9
    - % African American 14 vs 13
    - % below poverty 11 vs 11
    - % female 52 vs 51

Richards et al. ISC. 2021

On-Scene Recognition

	EMS Suspected Stroke (n, %) (n=595)	EMS Non-Suspected Stroke (n, %) (n=273)	Unadjusted p-value	Adjusted p-value*
Received thrombolysis	108 (18%)	21 (8%)	<0.01	<0.01
Thrombolysis among patients with LKN 0-4.5 hours	108 (39%) [n=280]	21 (20%) [n=105]	<0.01	<0.01

OR 2.67, 95% CI 1.63-4.47

"EMS Impression"

*Adjusted for NIHSS, GCS, age, sex, race, and prior stroke history.

Richards et al. ISC. 2021

50 YEARS OF EMERGENCY MEDICINE RESIDENCY

On-Scene Recognition

University of CINCINNATI

	EMS Suspected Stroke (n, %) (n=595)	EMS Non-Suspected Stroke (n, %) (n=273)	Unadjusted p-value	Adjusted p-value*
ED arrival to thrombolysis, minutes, median (IQR)	64 (49 to 95) [n=108]	83 (72 to 122) [n=21]	0.03	0.02
EMS arrival to thrombolysis, minutes, median (IQR)	91 (76 to 127) [n=105]	118 (95 to 165) [n=20]	0.03	<0.01

"EMS Impression"

*Adjusted for NIHSS, GCS, age, sex, race, and prior stroke history.

Richards et al. ISC. 2021

Confirmed Stroke

29,754

Both 9-1-1 and EMS

Table 2. Emergency Telecommunicator and On-Scene EMS Practitioner Recognition of Stroke in Patients with an ED or Hospital Diagnosis of Stroke or TIA.

n (%)	Dispatch Suspected Stroke	Dispatch Did Not Suspect Stroke	Total
EMS Suspected Stroke	3,915 (13.2%)	10,830 (36.4%)	14,745 (49.6%)
EMS Did Not Suspect Stroke	1,127 (3.8%)	13,882 (46.7%)	15,009 (50.4%)
Total	5,042 (16.9%)	24,712 (83.1%)	29,754

9-

46.7%

Hospital Stroke Diagnosis

Neither 9-1-1 nor EMS