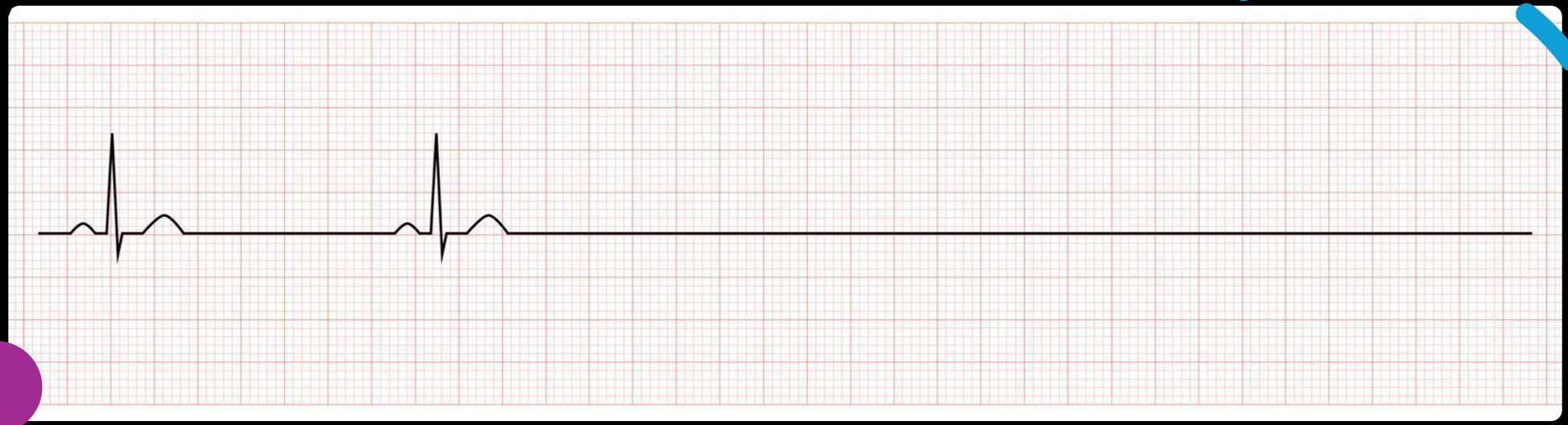

Why are we treating bradycardia with CPR?

Gail H Bradley, MD FACEP FAEMS

Medical Director

Mesa Fire and Medical Department

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What was the problem?

Missed cardiac arrest in the prehospital setting during transcutaneous pacing (TCP) is relatively common

Several recent national articles addressed this trend as well

TCP is typically performed in patients who are quite ill, with high risk to progression to cardiac arrest

Some of our previously used options for pharmacologic management of the TCP increased the risk for hypotension

How big of a problem was this?

- One agency, another agency, multiple departments
- Looked at commonalities between patients
  - All were unconscious, unresponsive, and hemodynamically unstable with heart rates in the 30s
  - What was event precipitating bradycardia?
- Confirming a pulse in the back of a moving ambulance going code 3 is challenging
  - Even in a well-lit ED we often debate as to whether or not a patient has a pulse
- Then we asked, what does TCP actually address?

Notice the VS when TCP starts

Realized patient is in cardiac arrest

So, what do you do before making a change that crews will think is crazy?

- Phone a friend!
- Reached out to EMS colleagues in Southern AZ
- They too had noticed this trend
- Asked the question, what if we just start CPR on these patients??

- Look for national data on issues related to TCP in prehospital setting

“False Electrical Capture in Prehospital Transcutaneous Pacing by Paramedics: A Case Series.”

- **Recent article published in Prehospital Emergency Care (PEC) journal**
- **Table demonstrates underlying etiologies that resulted in bradycardia along with false electrical capture**

Table A2. A complete listing of available discharge diagnoses for patients with follow-up information available.

Electrical Capture Interpretation	Discharge Diagnosis
True Electrical Capture	Acute respiratory failure with hypoxia and hypercapnia
True Electrical Capture	Syncope likely 2/2 junctional bradycardia
False Electrical Capture	Cardiac Arrest, GI Bleed
False Electrical Capture	Anoxic Brain Injury post-cardiac arrest
False Electrical Capture	Cardiac Arrest
False Electrical Capture	Large left ICH with IVH and midline shift
False Electrical Capture	Cardiac Arrest
False Electrical Capture	Cardiac arrest
False Electrical Capture	Cardiac Arrest
False Electrical Capture	Acute massive pulmonary embolism, cardiac arrest, anoxic brain injury
False Electrical Capture	Acute massive pulmonary embolism, cardiac arrest, anoxic brain injury
False Electrical Capture	Cardiac arrest
False Electrical Capture	Cardiac Arrest and Heart Block
False Electrical Capture	Cardiac Arrest
False Electrical Capture	AMS likely due to metabolic encephalopathy 2/2 UTI and bacteremia
False Electrical Capture	Acute exacerbation of CHF, Symptomatic bradycardia, Altered mental status, unspecified
False Electrical Capture	Hypothermia
False Electrical Capture	Cardiac arrest
False Electrical Capture	Hypothermia
False Electrical Capture	Cardiac Arrest

Joshua Kimbrell, Judah Kreinbrook, Dana Poke, Brittany Kalosza, Jacob Geldner, Aditya C. Shekhar, Andrew Miele, Tom Bouthillet & John Vega (15 Mar 2024): False Electrical Capture in Prehospital Transcutaneous Pacing by Paramedics: A Case Series, Prehospital Emergency Care, DOI: 10.1080/10903127.2024.2321287

Prehospital Transcutaneous Cardiac Pacing in the United States: Treatment Epidemiology, Predictors of Treatment Failure, and Associated Outcomes

"A non-bradycardic (>50 bpm) pre-pacing heart rate was associated with increased odds of pacing failure, prehospital cardiac arrest, and mortality."

Patients with initially normal or elevated heart rates that progress to bradycardia prior to pacing initiation may have underlying pathology that makes transcutaneous pacing ineffective.

Authors found that pre-pacing hypoxemia and an initial impression of respiratory distress/arrest were strongly associated with pacing failure and mortality.

"Patients with respiratory failure experienced bradycardia secondary to profound hypoxia and received pacing by prehospital clinicians instead of correction of this reversible cause of bradycardia, leading to cardiac arrest."

"Bradycardia is part of the final common pathway to death for a number of pathologies – for example, if circulatory shock or respiratory failure is allowed to proceed unchecked, bradycardia will frequently occur prior to cardiac arrest."

Training and education for prehospital clinicians should highlight the importance of considering reversible causes of bradycardia prior to pacing initiation.

Tanner Smida, Laura Voges, Remle Crowe, James Scheidler & James Bardes (04 Sep 2024): Prehospital Transcutaneous Cardiac Pacing in the United States: Treatment Epidemiology, Predictors of Treatment Failure, and Associated Outcomes, Prehospital Emergency Care, DOI: 10.1080/10903127.2024.2393768

What does TCP actually treat?

- Electrical issue!
- Bradycardia is often the “oh bleep” rhythm before a patient codes
  - ”they’re bradying down. . . “
- If bradycardia is caused by hypoxemia, hypotension, respiratory issues → TCP will not fix the patient!

So, Wh

- Updated Ja rsus going straight to
  - Hemod a = go to OHCA
  - Bradyc
  - Bradyc or Atropine
- Updated Ph Pacing (TCP)
- Removed B d neuro depression
- Added Fent deline in appendix
- Change to the guidelines in both the Central region and Southern AZ

Bradycardia Treatment updates

- **Unstable bradycardia (Symptoms of shock, impending cardiac arrest, hemodynamically unstable):**
  - **Patient is unconscious or unresponsive: refer to Cardiac Arrest (VF/VT/Asystole/PEA): Adult & Pediatric**
  - **Patient is conscious: initiate transcutaneous pacing AND Push dose Epi**
- **Stable, symptomatic bradycardia: Push dose Epi or Atropine**

Bradycardia: Adult & Pediatric

Includes: Heart rate < 60 with either symptoms (altered mental status, chest pain, congestive heart failure, seizure, syncope, shock, pallor, cyanosis, hypoxia, diaphoresis) or evidence of hemodynamic instability.

EMT

- Initiate Universal Care.
- Manage airway as indicated.
- Administer supplemental oxygen as indicated.

- For age ≤ 6 months and heart rate <60 with signs of poor perfusion despite oxygenation and ventilation, initiate chest compressions and refer to Cardiac Arrest (VF/VT/Asystole/PEA): Adult & Pediatric.

Paramedic

- Place on cardiac monitor.
- Perform 12-lead ECG.
- Unstable bradycardia (Symptoms of shock, impending cardiac arrest, hemodynamically unstable):
  - Patient is **unconscious or unresponsive**: refer to Cardiac Arrest (VF/VT/Asystole/PEA): Adult & Pediatric
  - Patient is **conscious**: initiate transcutaneous pacing **AND** Push dose Epi
- Stable, symptomatic bradycardia: Push dose Epi or Atropine

- Epinephrine (push dose): 1 mcg/kg bolus, max 20mcg per dose, IV/IO every 2 minutes.
  - Titrate to MAP > 65 or SBP > 90
- Atropine Sulfate: 1 mg IV/IO every 3-5 min, max total dose 3 mg.

Epinephrine (push dose) preparation: mix 1 mL of 0.1mg/mL (CARDIAC) epinephrine with 9 mL of NS. This results in 10 mcg/mL concentration.

- Epinephrine 0.1 mg/mL: 0.01 mg/kg (0.1 mL/kg) IV/IO every 3-5 minutes.
- Atropine Sulfate: 0.02 mg/kg IV/IO (min dose 0.1 mg), max initial dose 0.5 mg, max total dose 3 mg.

- **If bradycardia and symptoms of hemodynamic instability continue, consider transcutaneous pacing.**
- **When pacing, consider Pharmacologic Management with Fentanyl: 1 mcg/kg/dose IN/IV/IO, max initial dose 100 mcg, max total dose 200 mcg.**
  - **If age > 60 consider reducing dose by half**
  - **Reassess pain every 5 minutes, observe for adverse effects, and re-dose as indicated.**
- **Initiate $EtCO_2$ for all patients receiving pharmacologic management for pain control.**

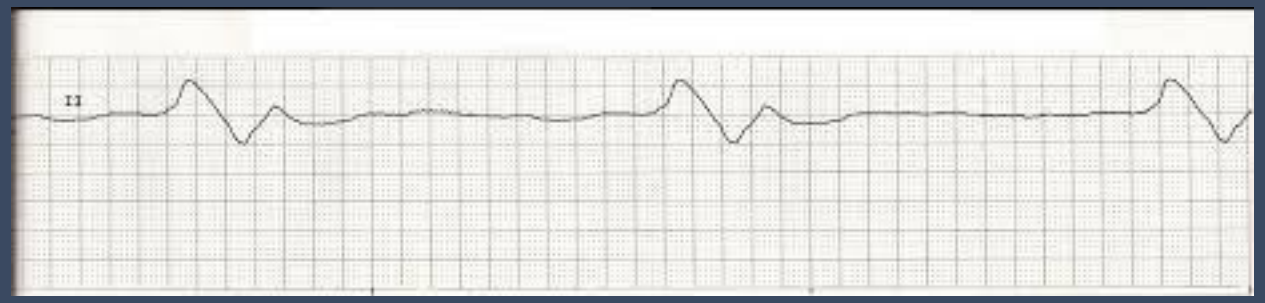
What happened after the change was made?

EDUCATION

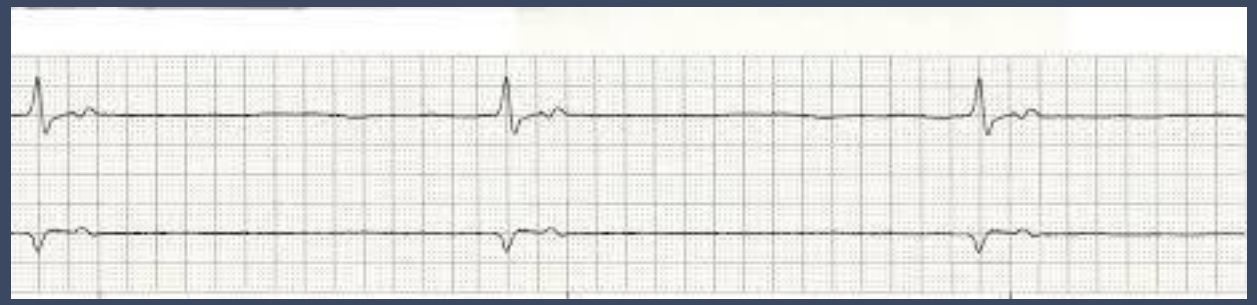
MORE EDUCATION

SALES PITCH MODE!

To pace or not to pace?

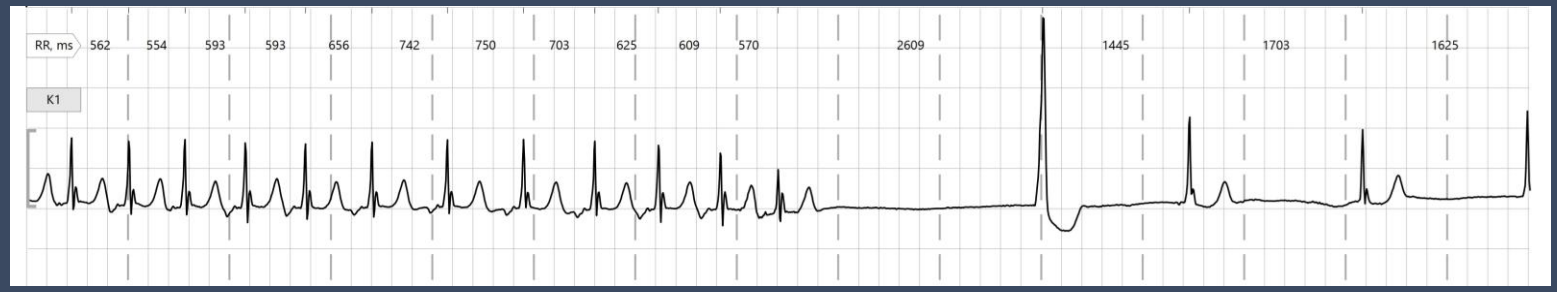


- Transcutaneous pacing in the prehospital setting is a low frequency, high risk intervention
- Maintaining (and tracking) mechanical capture during transport to the hospital can be difficult
- If a patient is becoming increasingly bradycardia, especially in the setting of respiratory distress/failure, think of bradycardia as impending cardiac arrest
- Pacing will only work on electrical issues, any other underlying cause of bradycardia will not be fixed by pacing



4 Key Points

- Bottomline, if we miss cardiac arrest while pacing a patient, the patient has no chance of survival
- Have a very low threshold for initiating CPR
- Pacing will only fix electrical (eg. Conduction) issues
- For all other causes, the underlying cause of bradycardia needs to be addressed



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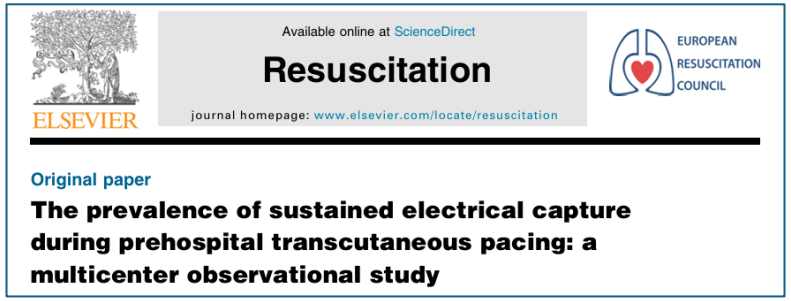
False Electrical Capture in Prehospital Transcutaneous Pacing by Paramedics: A Case Series

Joshua Kimbrell, Judah Kreinbrook, Dana Poke, Brittany Kalosza, Jacob Geldner, Aditya C. Shekhar, Andrew Miele, Tom Bouthillet & John Vega

	True Capture	False Capture
Number of patients	4 (17%)	19 (83%)
Change in SBP	40mmHG	-1mmHG
Median Current	95mA	70mA
Survival to admission	2 (50%)	10 (52%)
Neuro intact at discharge	1 (25%)	0

Pacing Is Difficult and Mortality Is High



Available online at ScienceDirect

Resuscitation

journal homepage: www.elsevier.com/locate/resuscitation

EUROPEAN RESUSCITATION COUNCIL

Original paper

The prevalence of sustained electrical capture during prehospital transcutaneous pacing: a multicenter observational study

Retrospective Study 2017-2024

- 299 Pacing cases
- 4 EMS agencies between 2017-2024

<10% had electrical capture

- 33% of cases were post-ROSC

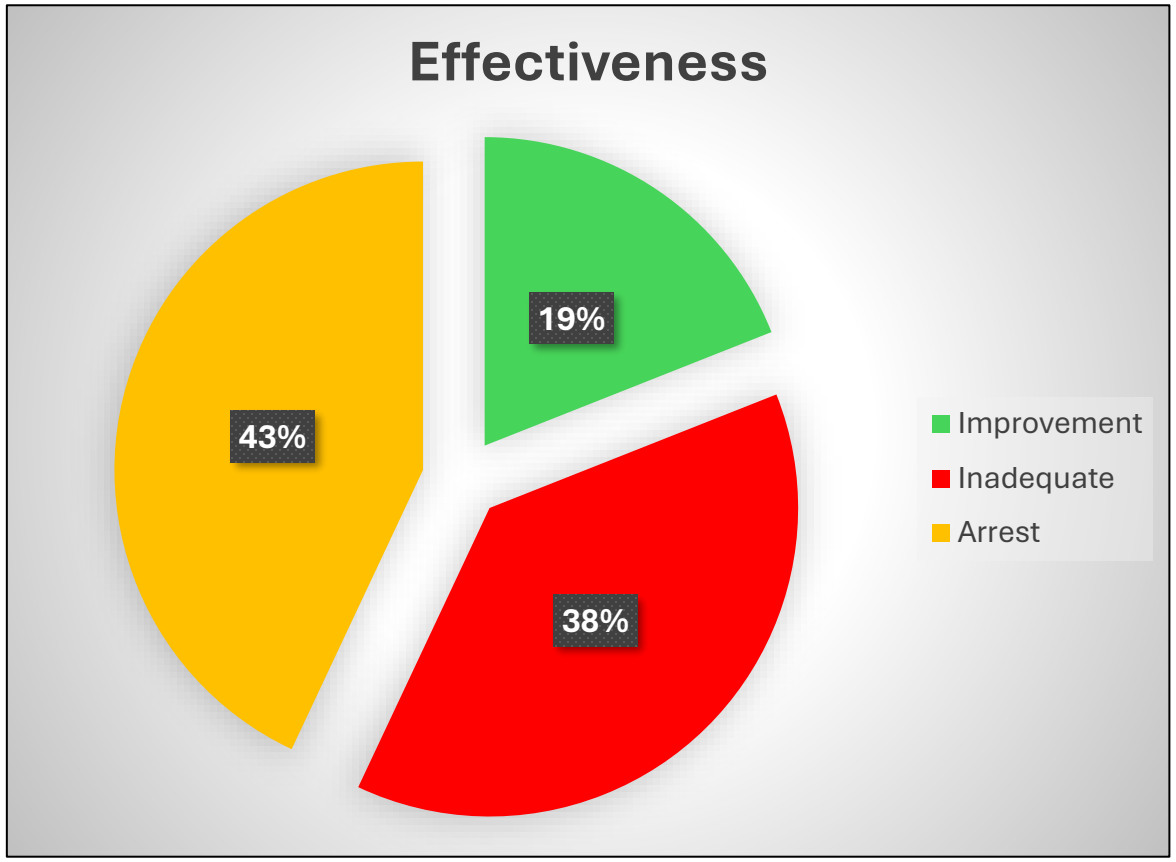
Successful TCP variables

- Higher pacing current
- Higher heart rate prior to TCP

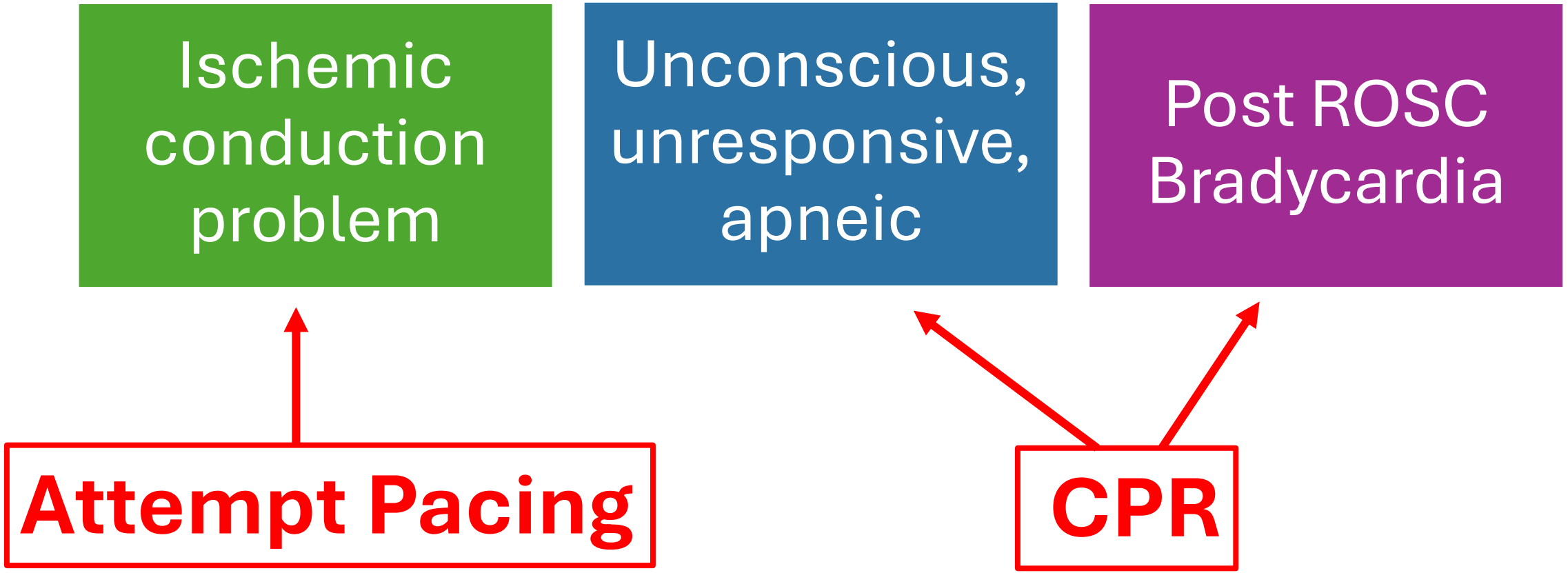
AFR Pacing: July 2023- Present

- 102 total pacing cases
  - Detailed code-stat review of 58 cases
  - 51 transported to ED
  - 7 dead on scene

- Most Common Pacing Indications:
  - Bradycardia: 41/58 (71%)
  - Post Arrest ROSC: 15/58 (26%)



Three Buckets Of Unstable Bradycardia



Primary Conduction Issue

Epi mini-bolus then pace

Electrical Capture

- Anterior/posterior pad placement
- Wide QRS
- Tall Broad T wave

Mechanical Capture - Don’t rely on pulse check

- Increased BP
- Increased Capno
- Increased mentation

Start epi drip if no improvement

True Electrical Capture:

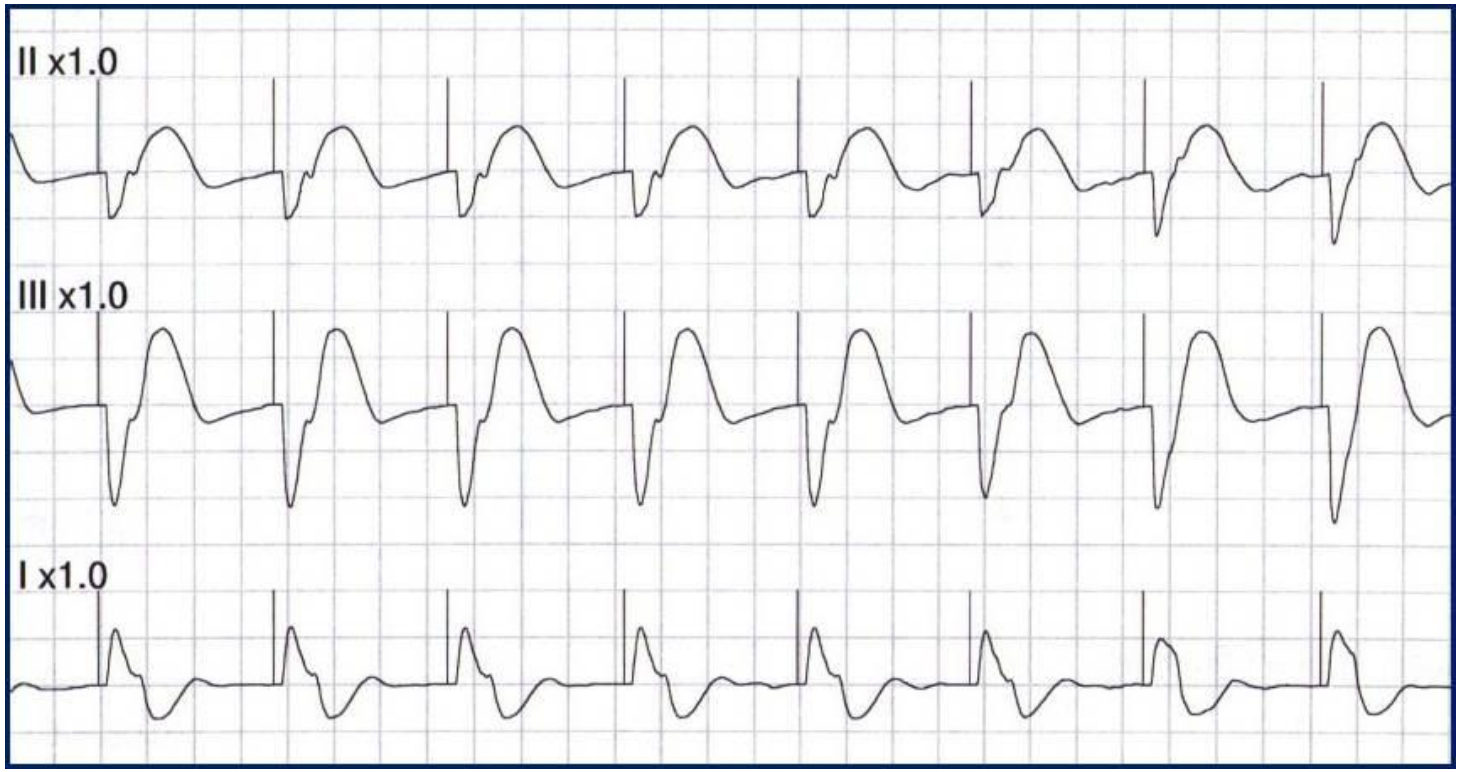
1. **Pacer spike**
2. **Tall, broad QRS complex**
3. **Followed by a broad, tall T-wave.**
4. **Matches O2 pleth**

False Capture (Artifact):

- "QRS" appears narrow, sharp, or jagged,
- Flat T-wave
- May have phantom complexes

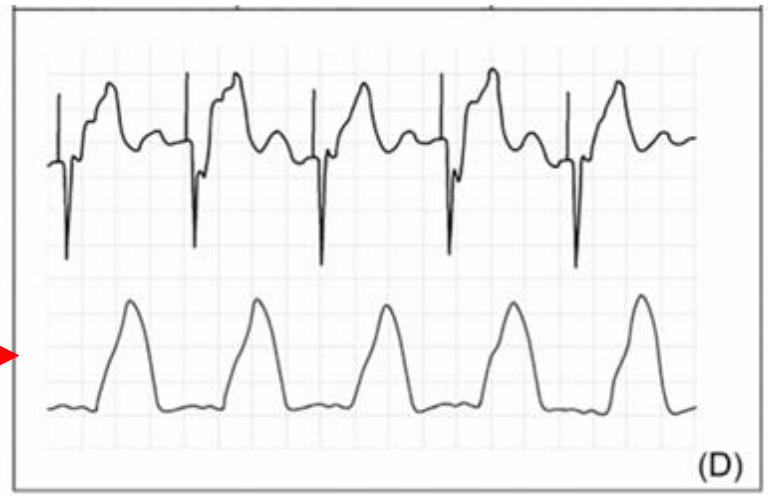
True Capture

1. Pacer spike
2. Tall, broad QRS complex
3. Followed by a broad, tall T-wave.
4. Matches O2 pleth



ems12lead.com

O2 Pleth should match pacing rate if electrically captured

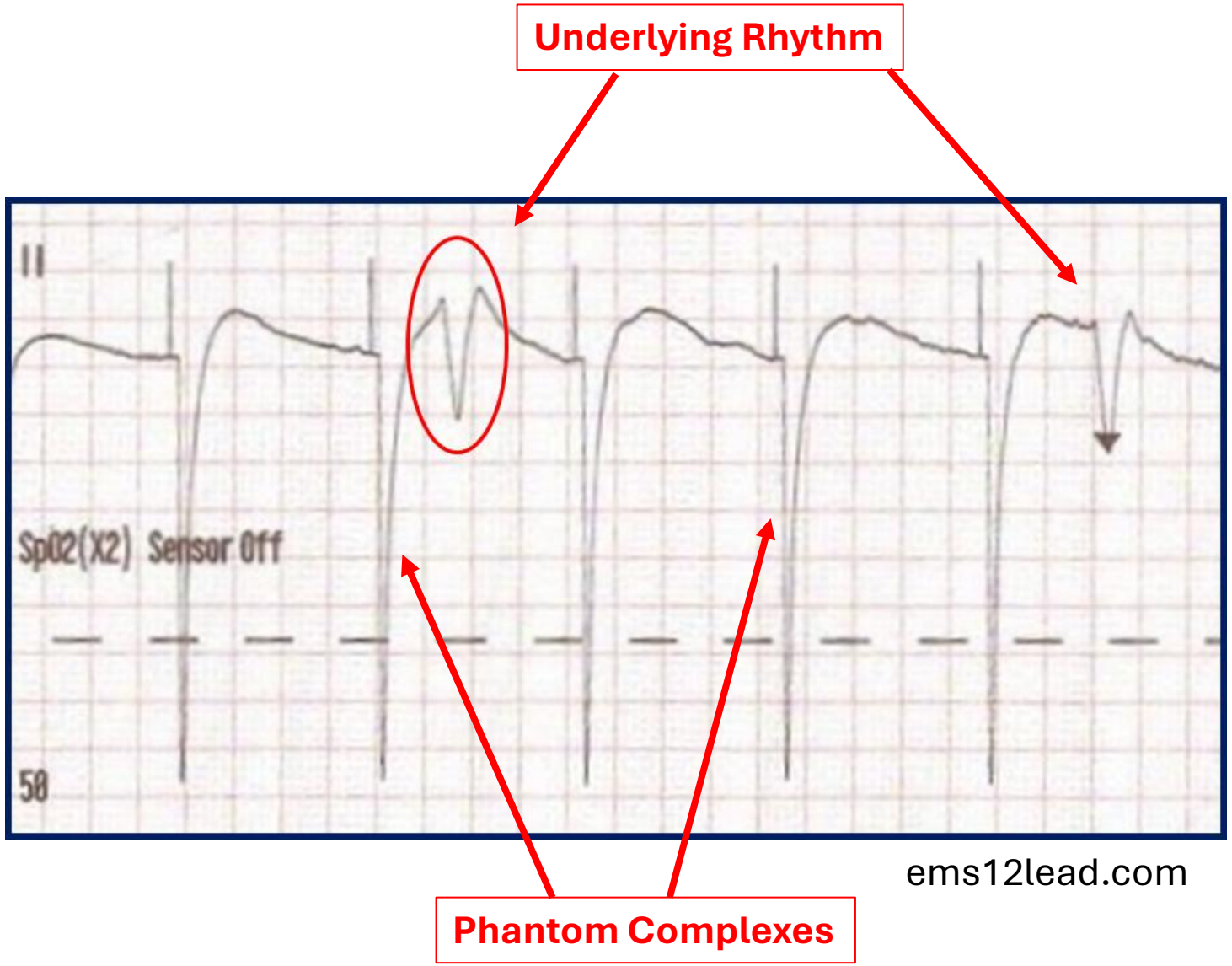


False Capture

- Near-vertical down-stroke is a “phantom” QRS complex
  - Electrical current passing between pads

- Unimpressive T-waves.

- Visible underlying rhythm is not scientifically possible!



ems12lead.com

Unconscious, Unresponsive or Post- ROSC

1. Cardiac dose epi
2. Start CPR
3. Follow PEA arrest algorithm
4. Start chemical pacing with epi drip

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Additional DISCLOSURE in this case

for Continuing Medical Education Purposes …

It should be noted that Dr. Youngquist does have a consulting relationship with CPR Therapeutics

However, this CME activity has been designed and reviewed by an independent committee with no relevant financial ties to ensure that the content is free of commercial bias and evidence-based. Accordingly, all of the relevant financial relationships listed for Dr. Youngquist have been mitigated.

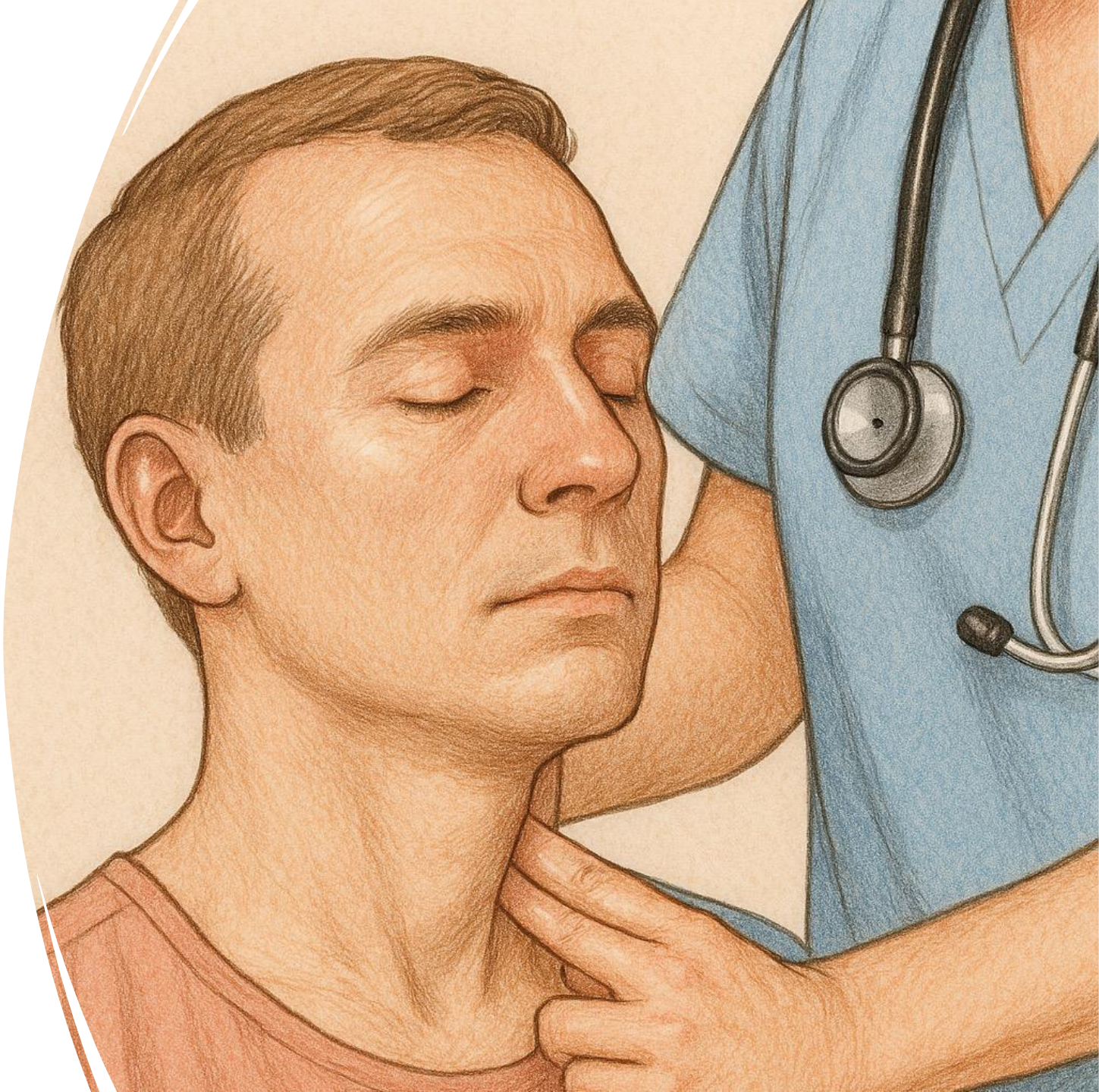
A New Direction in Pulse Detection: Multi-Modal Approaches to Confirm ROSC

Scott T Youngquist, MD, MS
Salt Lake City Fire Department

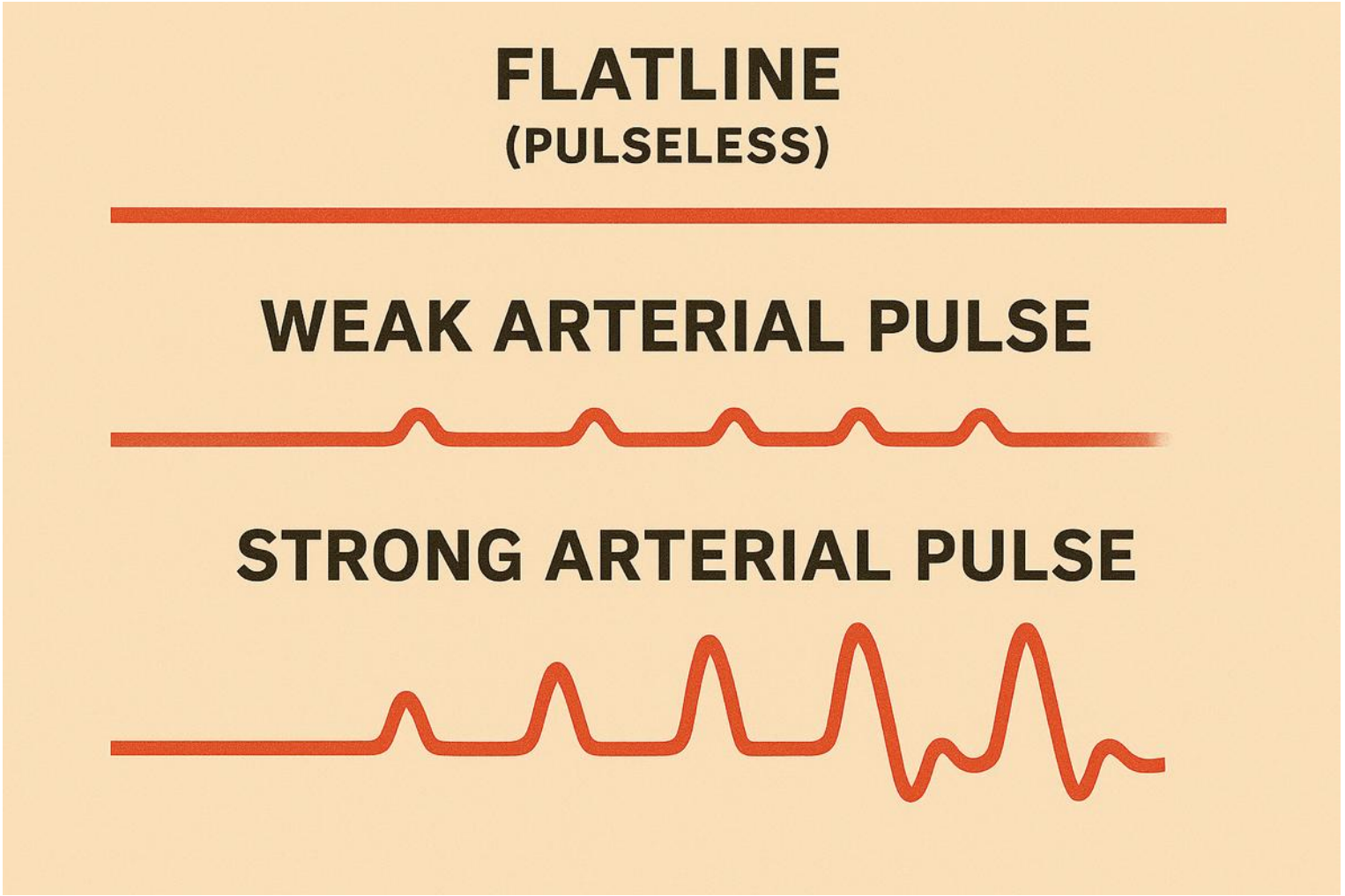

HIPPOCRATES.
ÆTAT. SUÆ 60.
TINCT.
DIGIT.
J. B. Greuze inv.
L. de St. Aubin lith.
LE MÉDECIN.
Il prend le Pouls.

One of the Most Pressing Problems in Resuscitation

Errors in determining pulse status lead to mortality through both poor sensitivity and poor specificity



A Spectrum of Pulselessness



Accuracy by Trained Providers ~55%

Laypersons ~3%

Eberle B. Resuscitation 1996;33(2):107-16

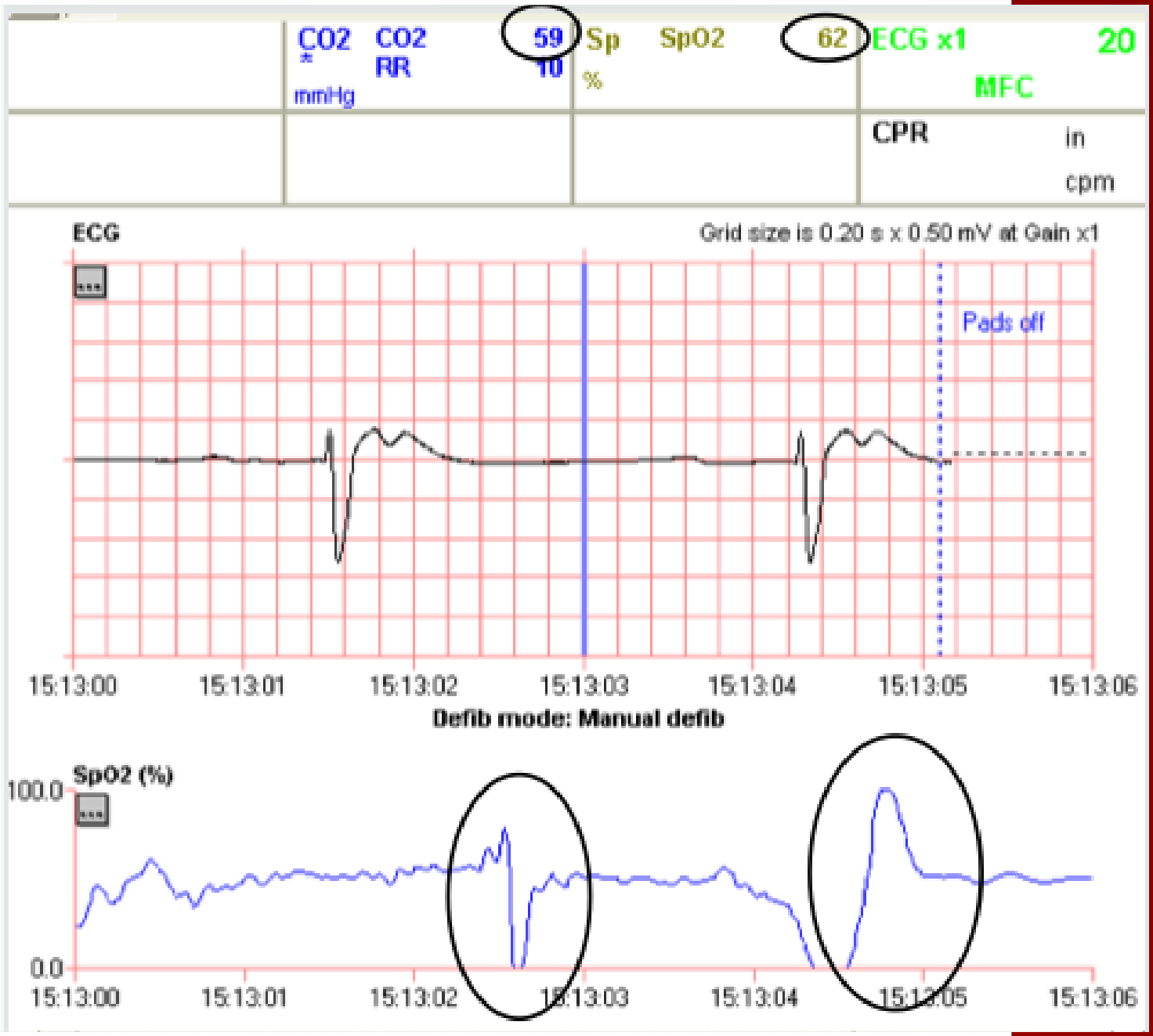
Tibbals J, Weeranatna C. Resuscitation 2010;81:671-5

Call for Termination of Resuscitation

45-year-old male, bystander CPR, shocked into PEA at a Walmart. After 40 minutes of attempts and 9 doses of epinephrine, requesting permission to terminate attempt

THE UNIVERSITY of UTAH

25-year-old with seizure disorder and arrest. Initial rhythm VF. No ROSC after 30 minutes of efforts. End of defibrillator file before patches removed.



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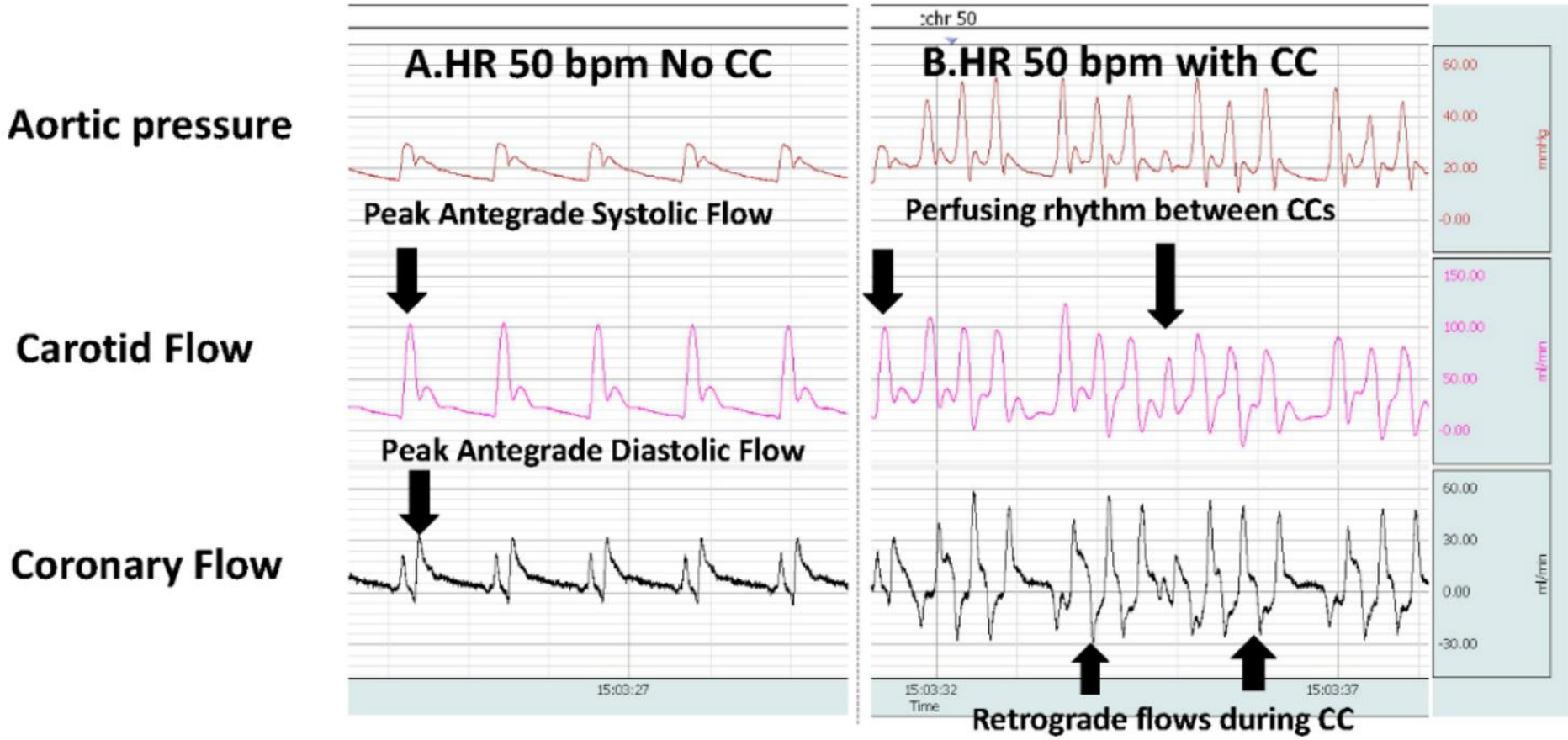
At Least There's No Problem with Just Doing More CPR in a Patient with a Pulse, no?

THE UNIVERSITY of UTAH

CPR on a Beating Heart



Agrawal V, Lakshminrusimha S, Chandrasekharan P. Chest Compressions for Bradycardia during Neonatal Resuscitation-Do We Have Evidence? Children (Basel). 2019 Oct 29;6(11):119.

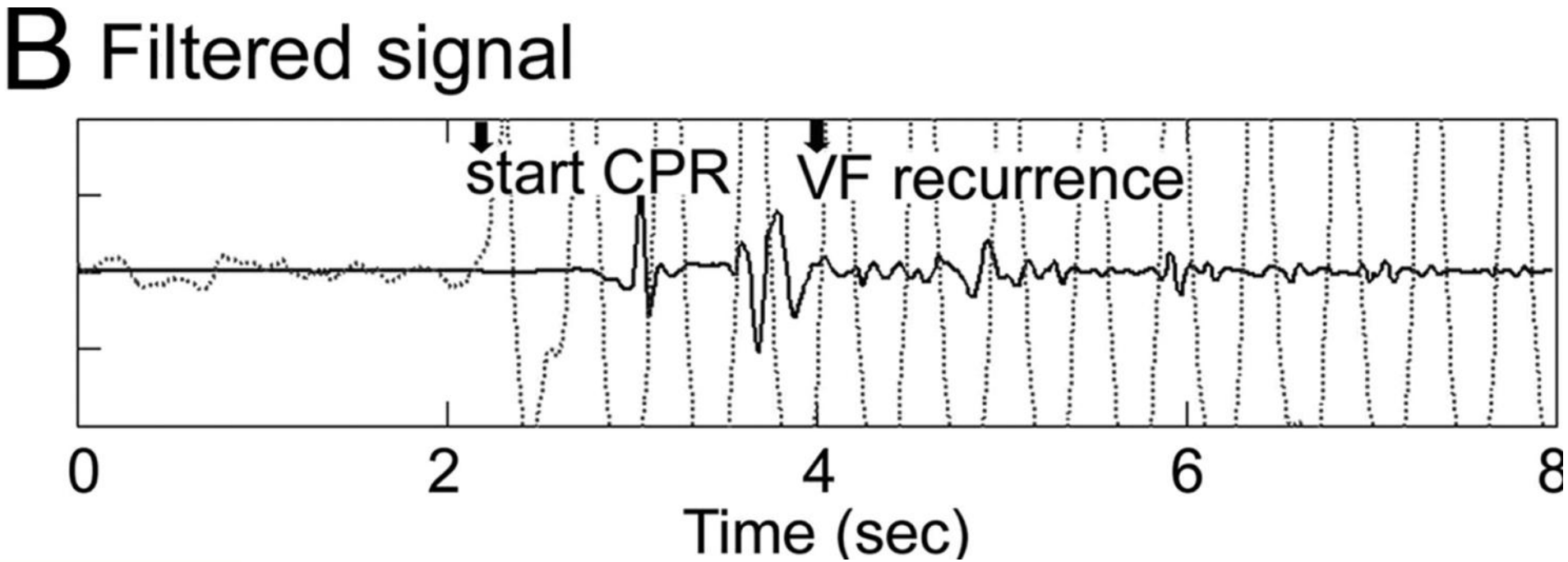
RESEARCH ARTICLE | Originally Published 30 December 2009 |

Check for updates

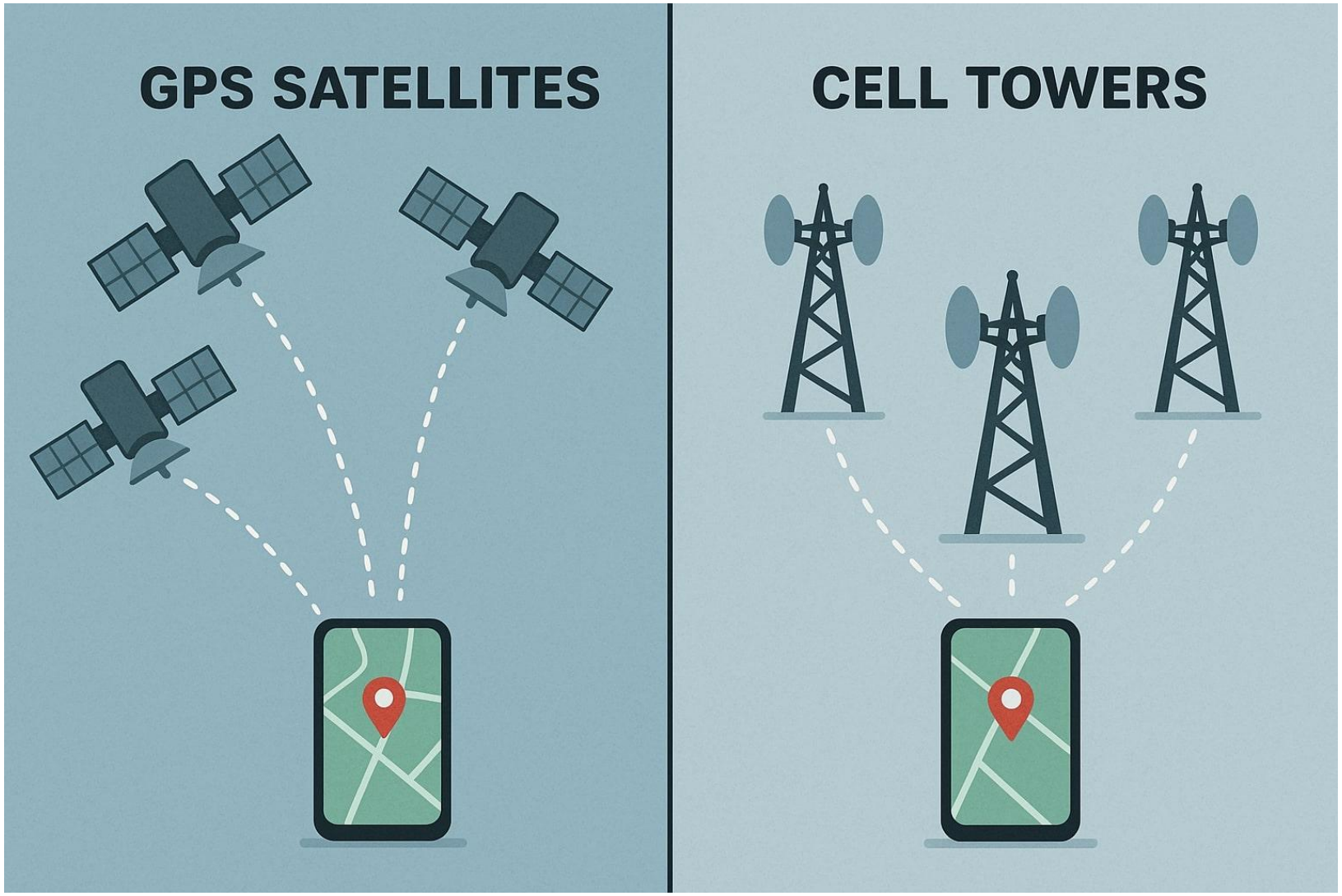
Chest Compressions Cause Recurrence of Ventricular Fibrillation After the First Successful Conversion by Defibrillation in Out-of-Hospital Cardiac Arrest

Jocelyn Berdowski, MSc, MSE, Jan G.P. Tijssen, PhD, and Rudolph W. Koster, MD, PhD | AUTHOR INFO & AFFILIATIONS

Circulation: Arrhythmia and Electrophysiology • Volume 3, Number 1 • https://doi.org/10.1161/CIRCEP.109.902114

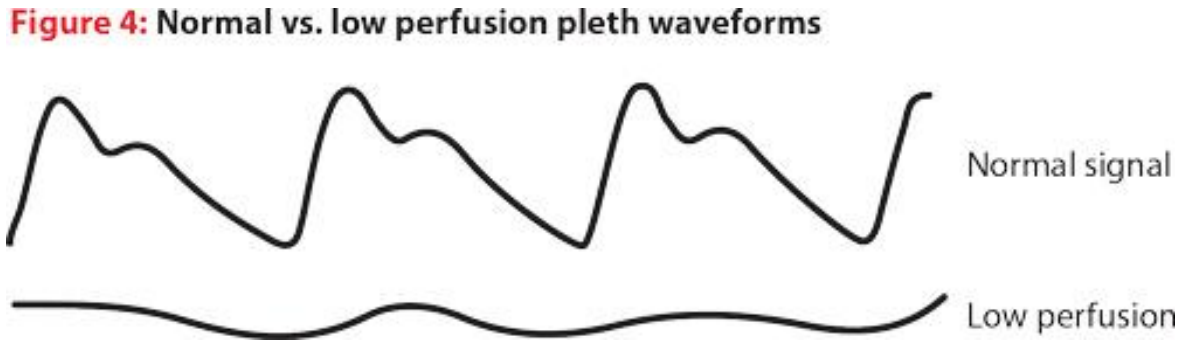


Triangulating the ROSC signal



SpO2

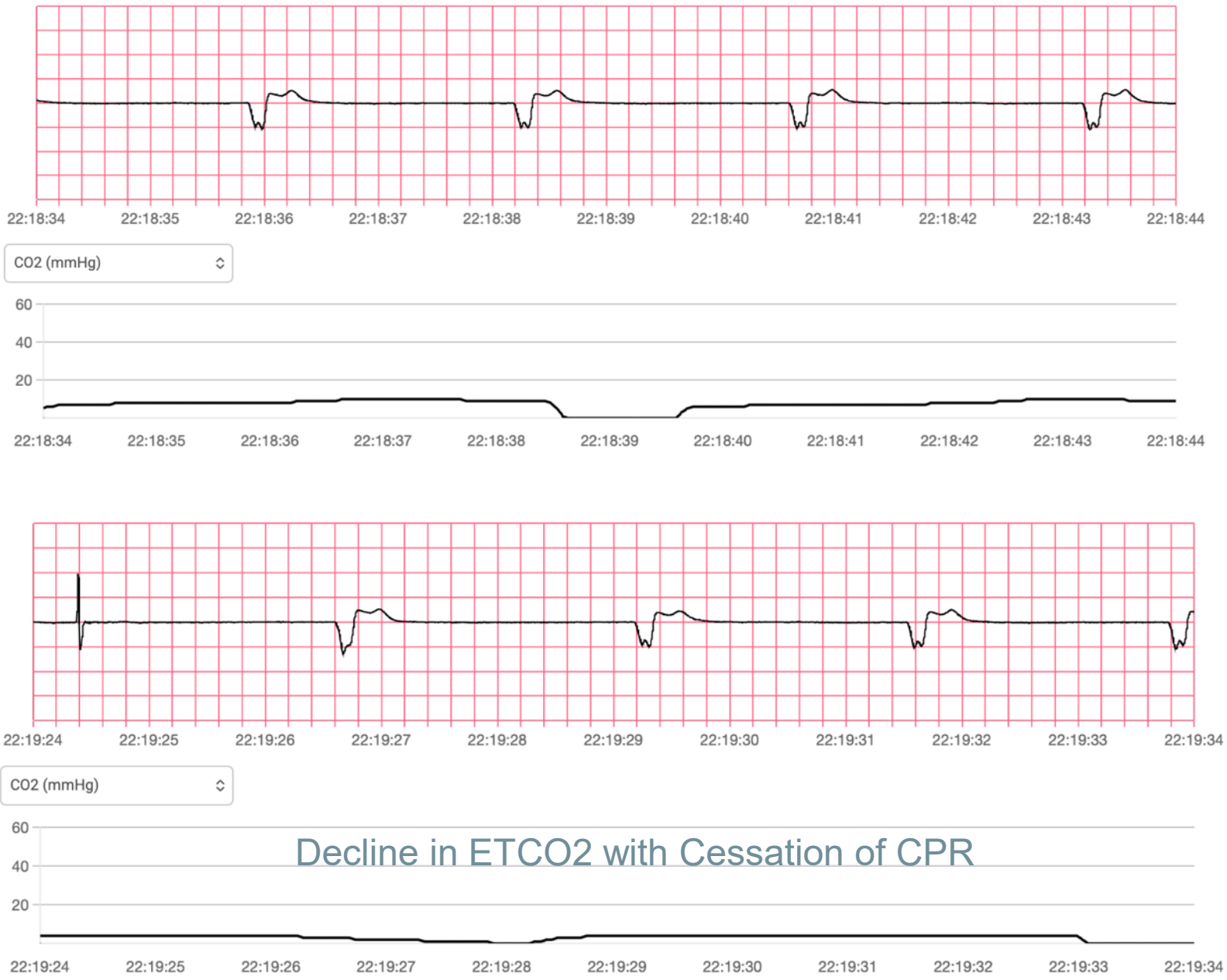
- No published sensitivity/specificity estimates
- Likely low sensitivity but high specificity
  - Often not placed during cardiac arrest
  - If it shows a pulsatile waveform, do not ignore it!



https://www.jems.com/patient-care/airway-respiratory/the-how-what-and-why-of-ems-pulse-oximetry/

End-Tidal CO2

- We all look for the rise
- What about the fall?
  - In PEA when CPR is stopped but you continue ventilating
    - ETCO2 should drop if no significant circulation from ROSC


22:18:34
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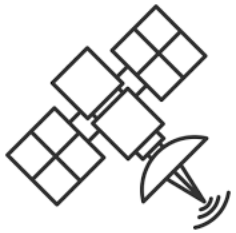
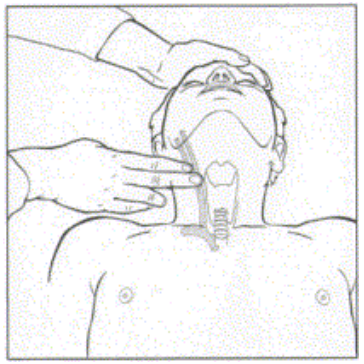
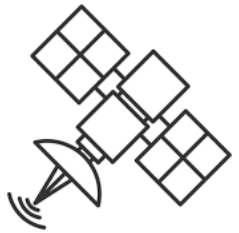
22:18:42
22:18:43
22:18:44
CO2 (mmHg)
60
40
20
22:19:24
22:19:25
22:19:26
22:19:27
22:19:28
22:19:29
22:19:30
22:19:31
22:19:32
22:19:33
22:19:34
CO2 (mmHg)
60
40
20
Decline in ETCO2 with Cessation of CPR

Triangulated Pulse Check in PEA



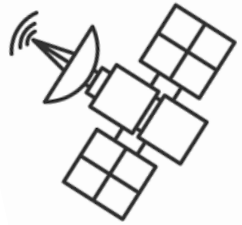
Pulse Check





ETCO2

Does ETCO2 drop off?

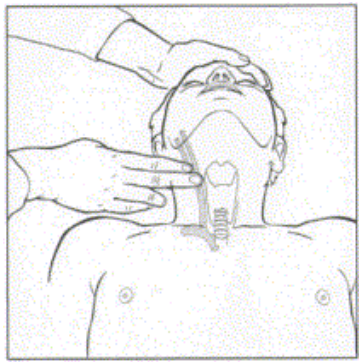


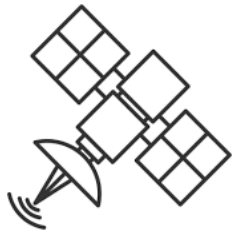
SpO2

Is a corresponding waveform seen?

Triangulated Pulse Check at End of Resuscitation in PEA

Pulse Check



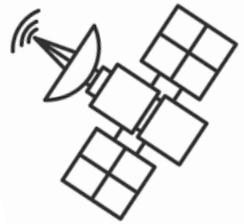


ETCO2

Does ETCO2 drop off?

NIBP

Is a BP Measurable?



SpO2

Is a corresponding waveform seen?

Femoral Artery Doppler

- Very high accuracy for any arterial flow and for SBP ≥ 60 using Peak Systolic Velocity (PSV) ≥ 20 cm/s;
  - diagnostic accuracy for ROSC with SBP ≥ 60 around 89–91%.

RESUSCITATION 173 (2022) 157–165

Available online at ScienceDirect

Resuscitation

journal homepage: www.elsevier.com/locate/resuscitation

EUROPEAN RESUSCITATION COUNCIL

ELSEVIER

Clinical paper

Femoral artery Doppler ultrasound is more accurate than manual palpation for pulse detection in cardiac arrest

Allison L. Cohen[a,b], Timmy Li[a,b], Lance B. Becker[a,b,c], Casey Owens[b,c], Neha Singh[c], Allen Gold[d], Mathew J. Nelson[a,b], Daniel Jafari[a,b], Ghania Haddad[b], Alexander V. Nello[a,b], Daniel M. Rolston[a,b,], Northwell Health Biostatistics Unit[1]*

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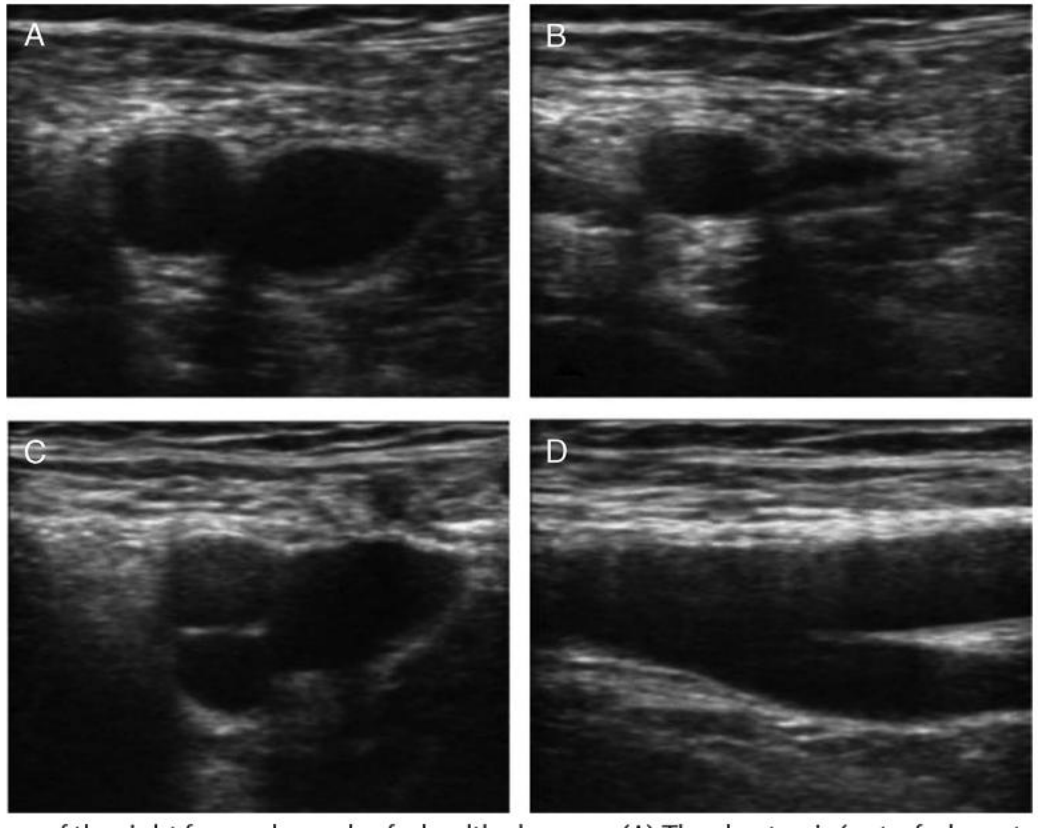
Arterial line

- Gold Standard
  - Gives you instant pulse check
  - Gives you CPR feedback
- Hard to achieve with active CPR (manual harder than LUCAS)



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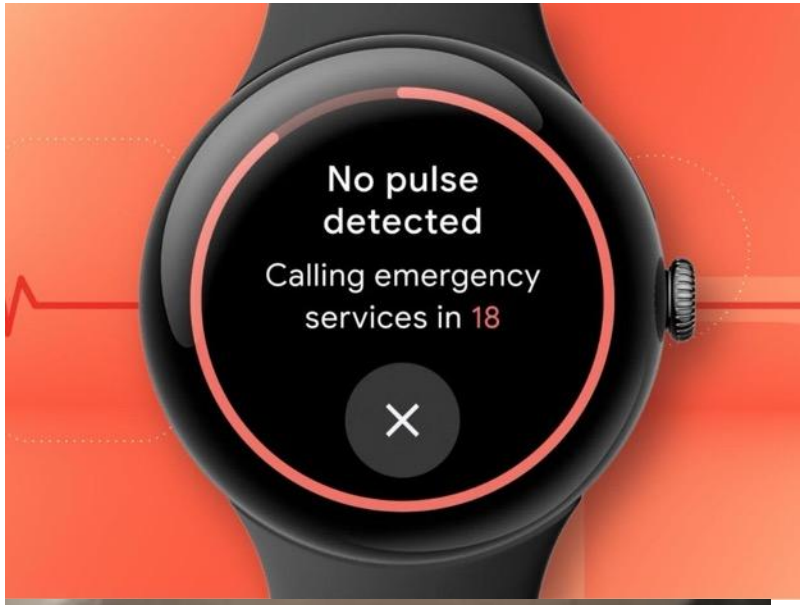
Future Solutions

- Smart watches
- BP interpolation of SpO2 plethysmograph
- Carotid doppler patches



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Take Homes

- Terminating resuscitation in PEA is a dangerous proposition
- In the field must triangulate the probability of a pulse in some cases: $ETCO_2$, SpO_2, BP
- In the Field use ultrasound – if available -- to check pulse and arterial line if enough hands

STAYIN' ALIVE, STAYIN ALIVE

What Are Suggested Approaches to Post-ROSC Management?

UTSTEIN Survival
Agencies > 200 Arrests/year

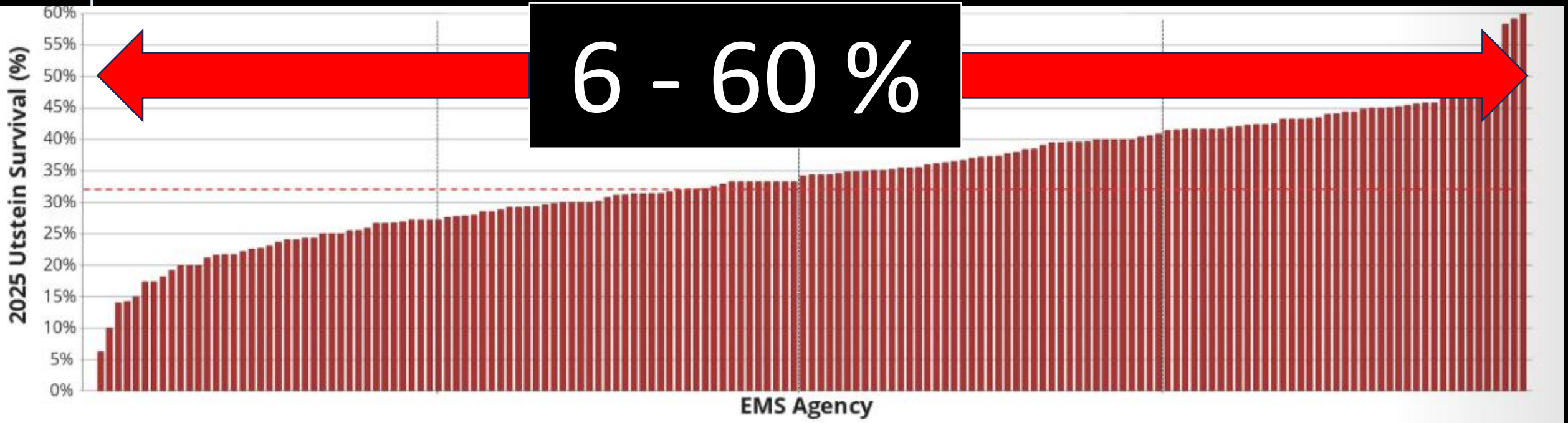


Figure 23. Variability in Utstein survival rates, among EMS agencies with ≥200 CARES cases in 2025.

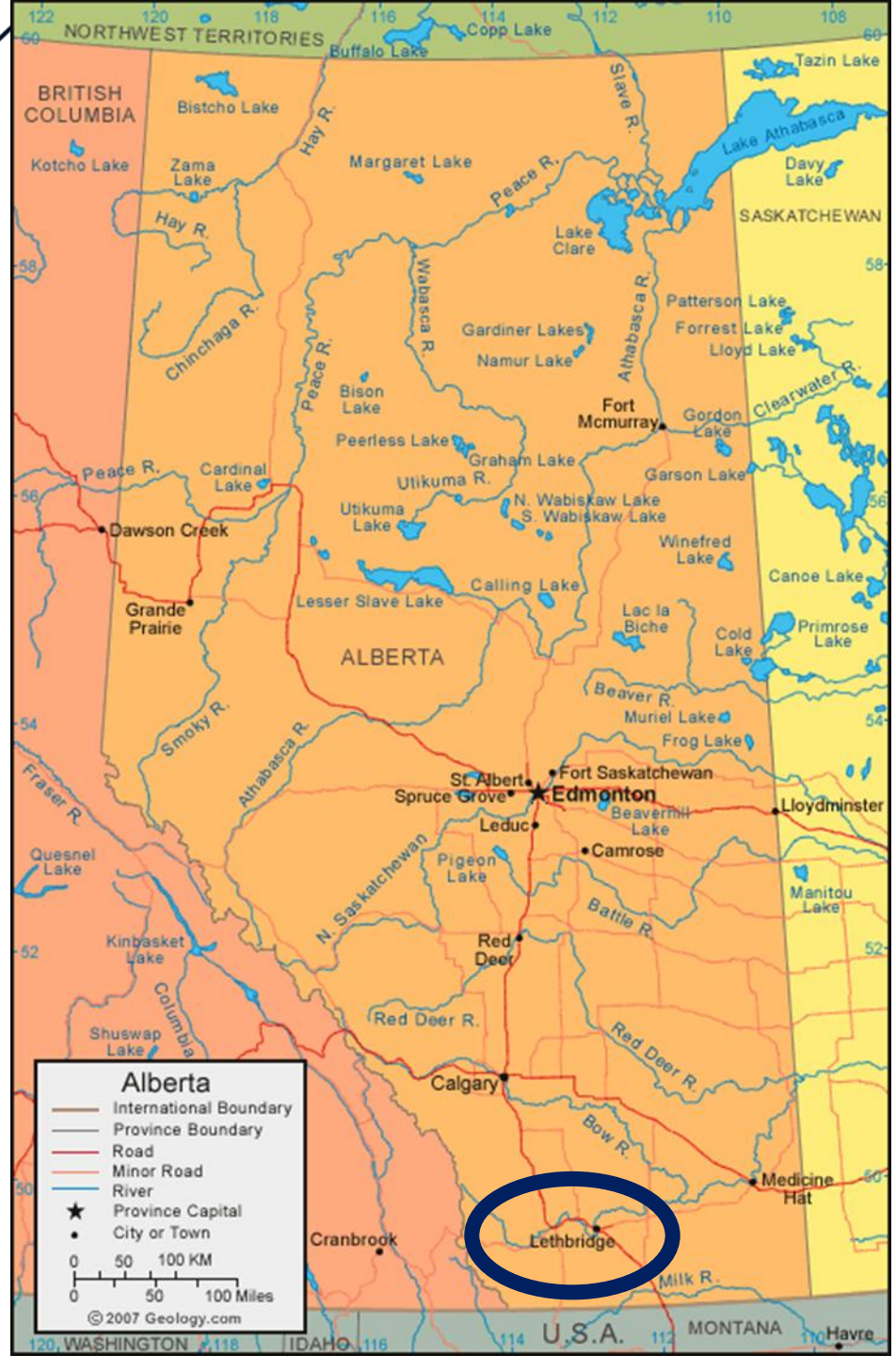
What is Going On?

Lethbridge Fire & EMS

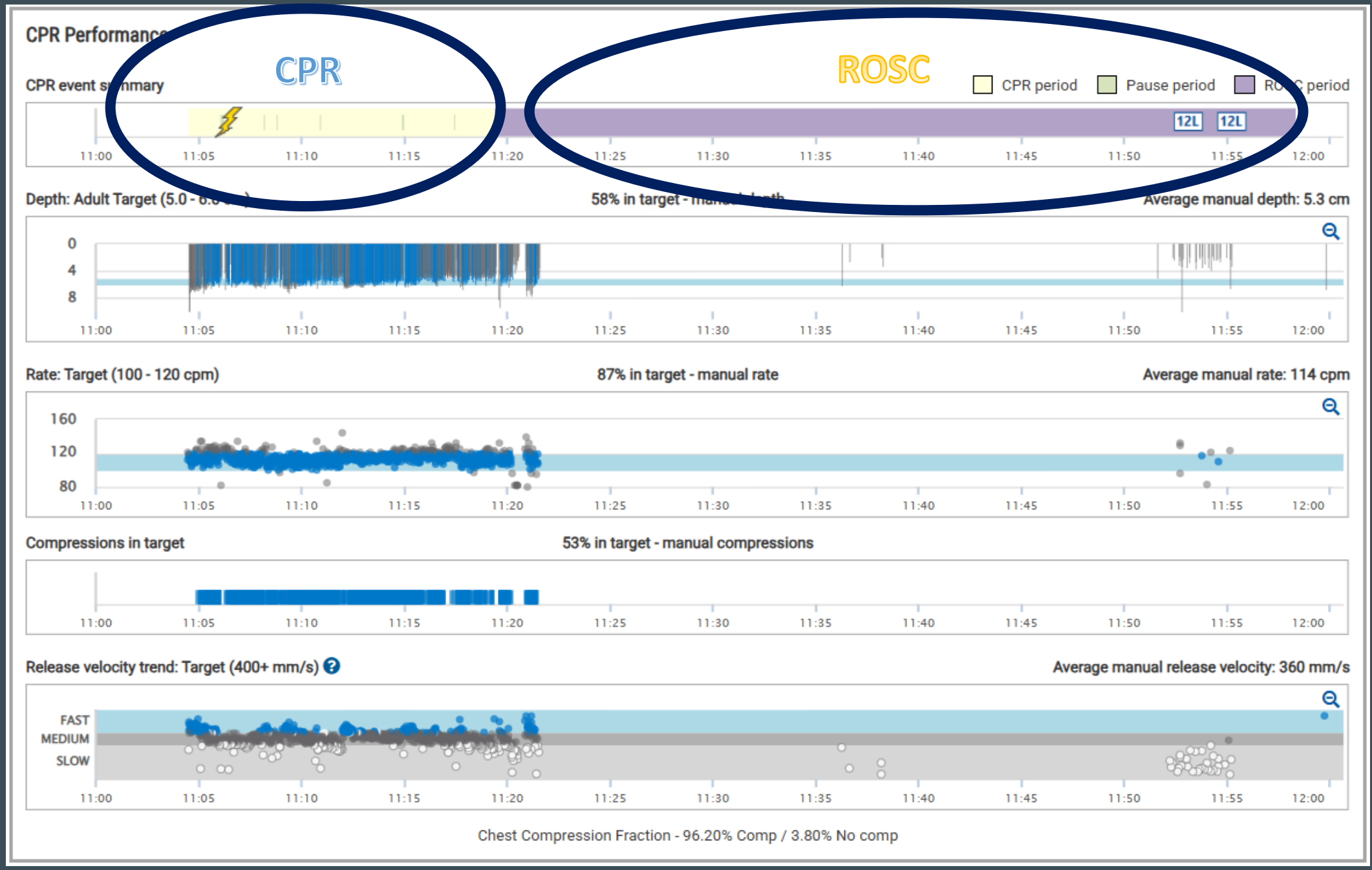
Pop. 140,000 | 190 Front-line Members | 21,974 EMS Calls

Mike Humphrey

Adam Perrett



Lethbridge is the 3rd Largest City in Alberta, Canada


CPR Performance
CPR
ROSC
CPR event summary
CPR period
Pause period
ROSC period
12L
12L
11:00
11:05
11:10
11:15
11:20
11:25
11:30
11:35
11:40
11:45
11:50
11:55
12:00
Depth: Adult Target (5.0 - 6.0
58% in target - manual depth
Average manual depth: 5.3 cm
0
4
8
Rate: Target (100 - 120 cpm)
87% in target - manual rate
Average manual rate: 114 cpm
160
120
80
Compressions in target
53% in target - manual compressions
Release velocity trend: Target (400+ mm/s)
Average manual release velocity: 360 mm/s
FAST
MEDIUM
SLOW
Chest Compression Fraction - 96.20% Comp / 3.80% No comp

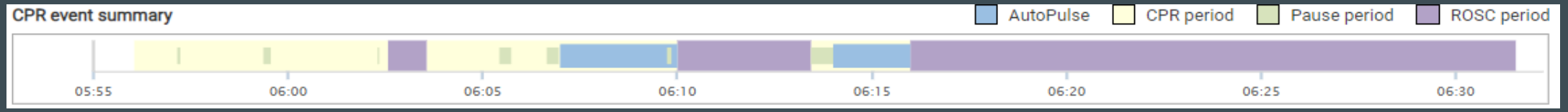
THE ALBERTA CANROC COLLABORATIVE

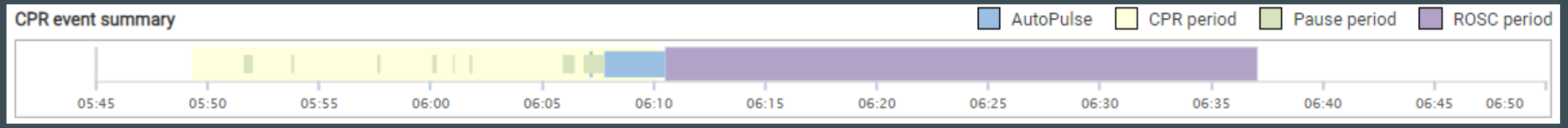
EMERGENCY MEDICATIONS

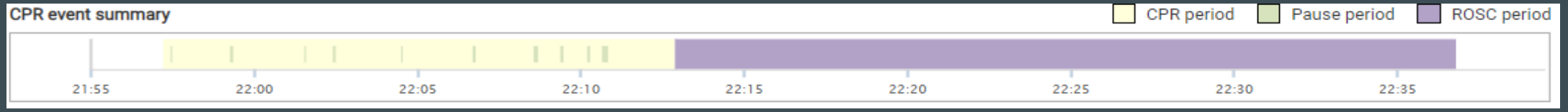
PUSH-DOSE EPINEPHRINE

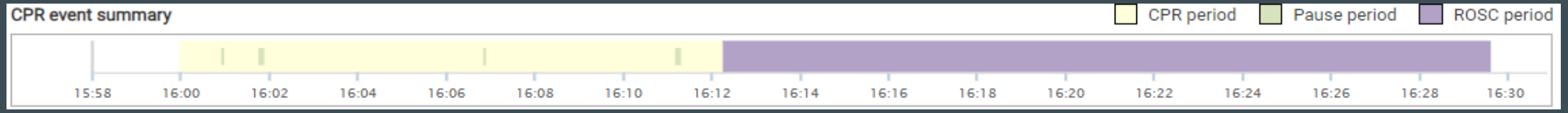
20 mcg Q2min

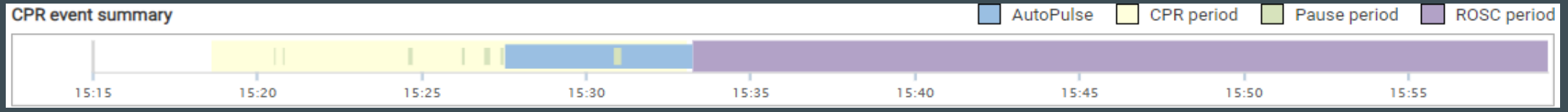
THE ALBERTA CANROC COLLABORATIVE

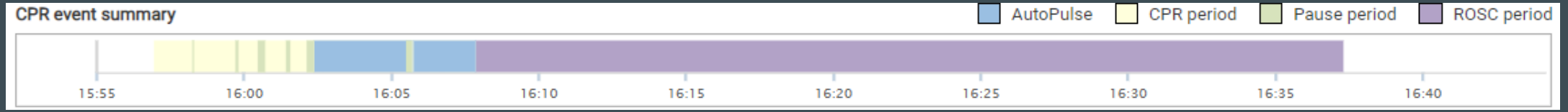




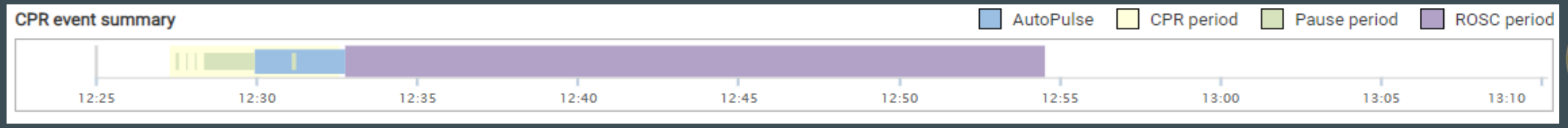


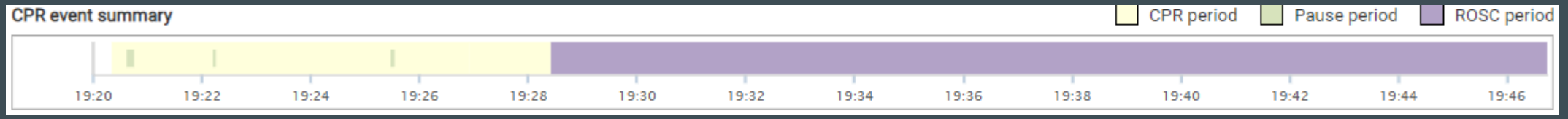


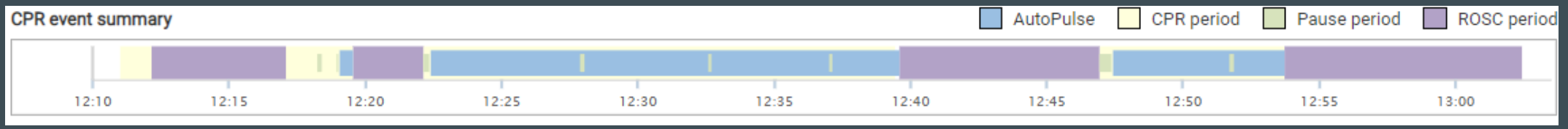


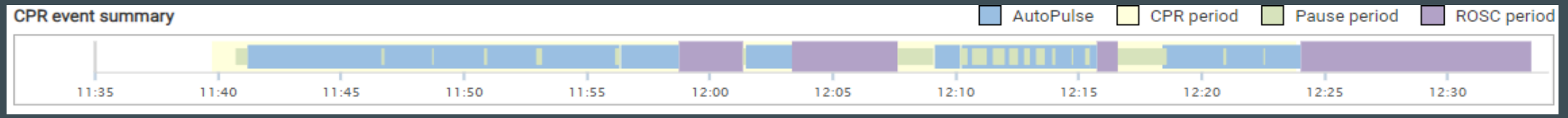


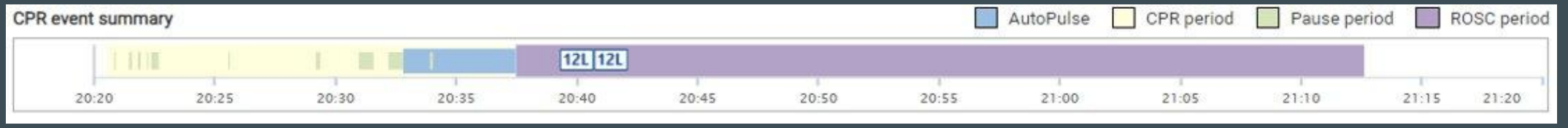
THE ALBERTA CANROC COLLABORATIVE

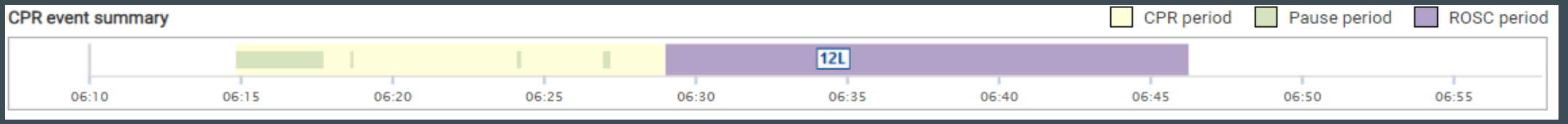


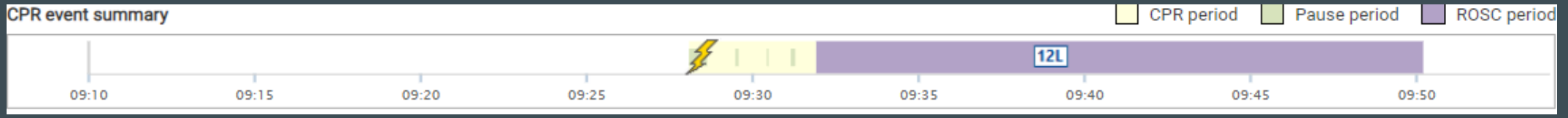


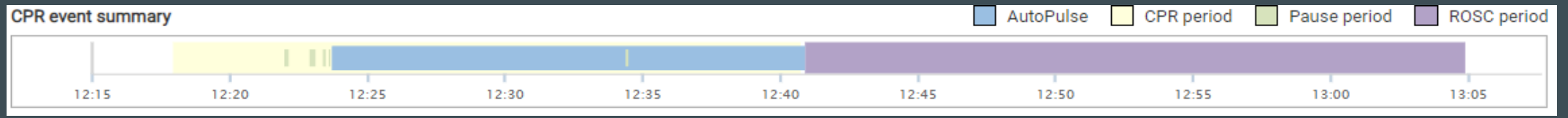












- **Pre- /Post-Protocol analysis**
- **April 2022 as the implementation date**

	PRE	POST
Rearrest	48%	32%
ED with ROSC	61%	81%

THE ALBERTA CANROC COLLABORATIVE

DATA DRIVES CHANGES

29 February 2024 | Revised: 30 July 2024 | Accepted: 5 August 2024

10.1002/emp2.13321

JACEP OPEN

WILEY

CLINICAL CONCEPTS

Emergency Medical Services

Rationale and development of a prehospital goal-directed bundle of care to prevent rearrest after return of spontaneous circulation

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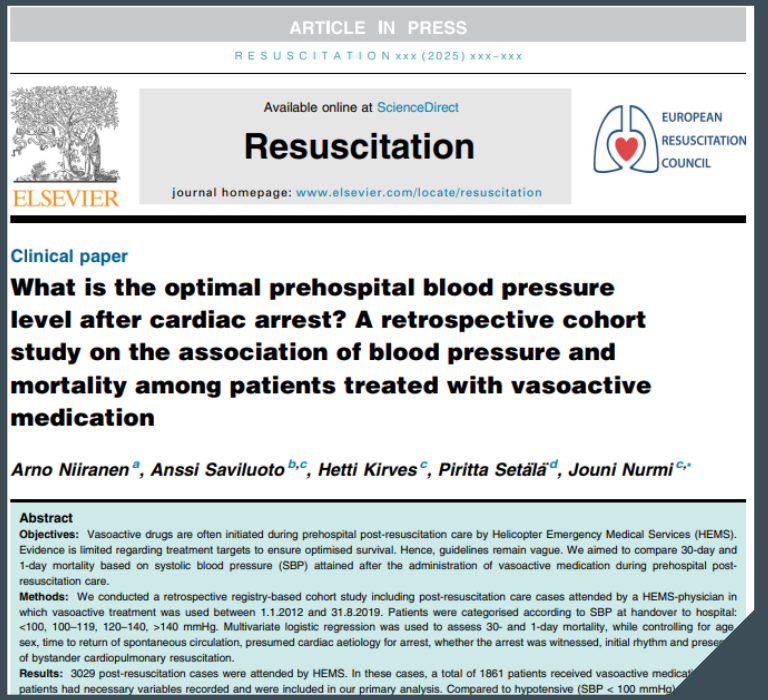

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RESUSCITATION xxx (2025) xxx–xxx

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Resuscitation

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EUROPEAN RESUSCITATION COUNCIL

Clinical paper

What is the optimal prehospital blood pressure level after cardiac arrest? A retrospective cohort study on the association of blood pressure and mortality among patients treated with vasoactive medication

Arno Niiranen[a], Anssi Saviluoto[b,c], Hetti Kirves[c], Piritta Setälä[d], Jouni Nurmi[c,]*

Abstract

Objectives: Vasoactive drugs are often initiated during prehospital post-resuscitation care by Helicopter Emergency Medical Services (HEMS). Evidence is limited regarding treatment targets to ensure optimised survival. Hence, guidelines remain vague. We aimed to compare 30-day and 1-day mortality based on systolic blood pressure (SBP) attained after the administration of vasoactive medication during prehospital post-resuscitation care.

Methods: We conducted a retrospective registry-based cohort study including post-resuscitation care cases attended by a HEMS-physician in which vasoactive treatment was used between 1.1.2012 and 31.8.2019. Patients were categorised according to SBP at handover to hospital: <100, 100–119, 120–140, >140 mmHg. Multivariate logistic regression was used to assess 30- and 1-day mortality, while controlling for age, sex, time to return of spontaneous circulation, presumed cardiac aetiology for arrest, whether the arrest was witnessed, initial rhythm and presence of bystander cardiopulmonary resuscitation.

Results: 3029 post-resuscitation cases were attended by HEMS. In these cases, a total of 1861 patients received vasoactive medication. patients had necessary variables recorded and were included in our primary analysis. Compared to hypotensive (SBP < 100 mmHg)

THE ALBERTA CANROC COLLABORATIVE

CAL-ROC SOS BUNDLE

CIRCULATION

HEMODYNAMIC OPTIMIZATION

GOAL = AVOID HYPOTENSION

Actions	Trigger
Assess BP q3min	All
Administer NS Bolus 500mL	All
Prepare push-dose epinephrine	All
Administer push-dose epinephrine	SBP<120mmHg
Repeat NS Bolus 500mL	Persistent SBP<120mmHg
Repeat push-dose epinephrine	Persistent SBP<120mmHg

STEMI IDENTIFICATION

GOAL = IDENTIFY STEMI & DYSRHYTHMIAS

Actions	Trigger
Continuous cardiac rhythm monitoring	Focused assessment q3mins or if clinical deterioration
Obtain and transmit 12-lead ECG	All

AIRWAY

AIRWAY MANAGEMENT

GOAL = SECURE AIRWAY

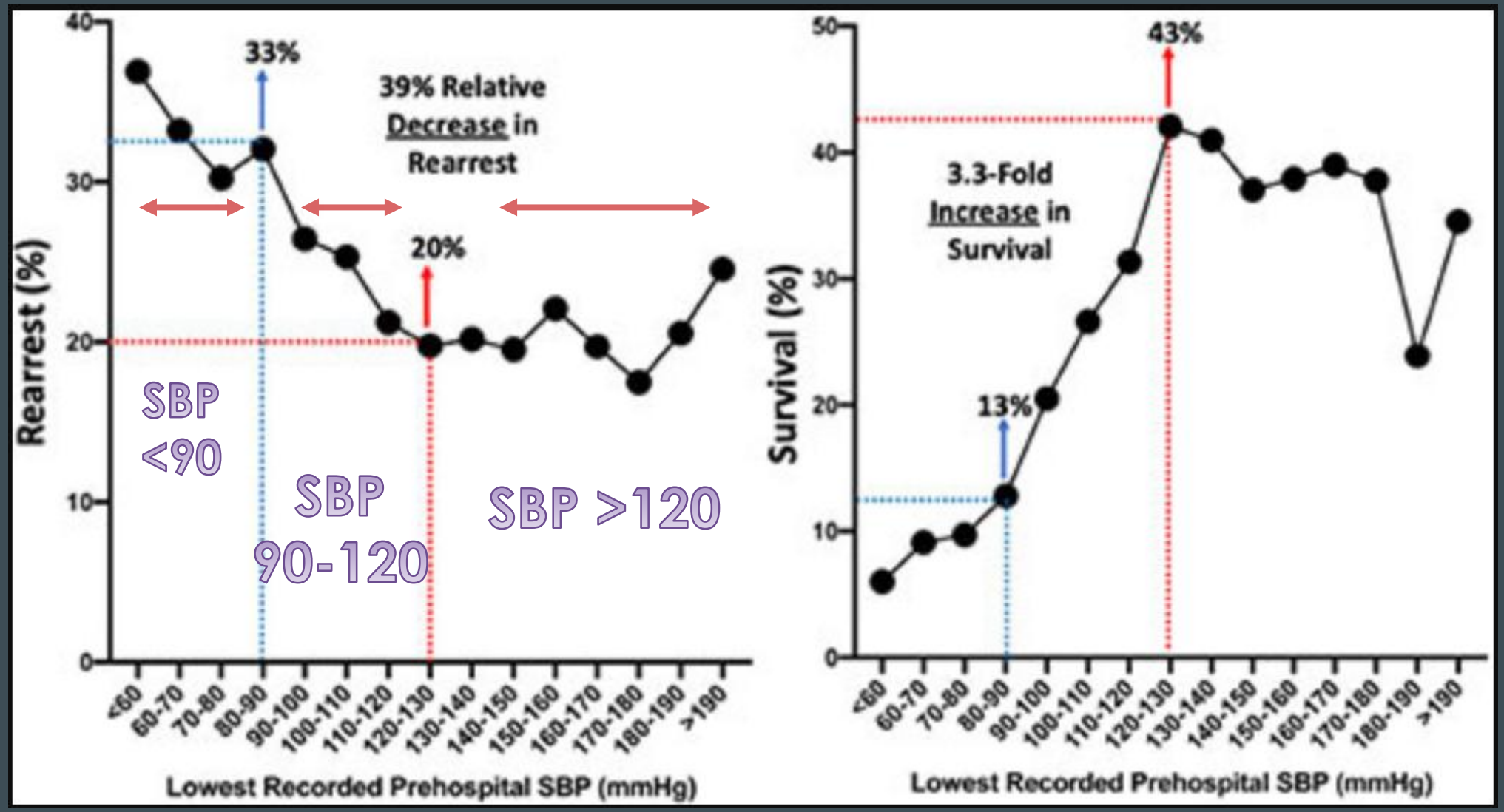
Actions	Trigger
Place Advanced Airway*	If BVM ineffective or after HD optimized and prior to transport
Confirm airway with $EtCO_2$	All

BREATHING

VENTILATION AND OXYGENATION

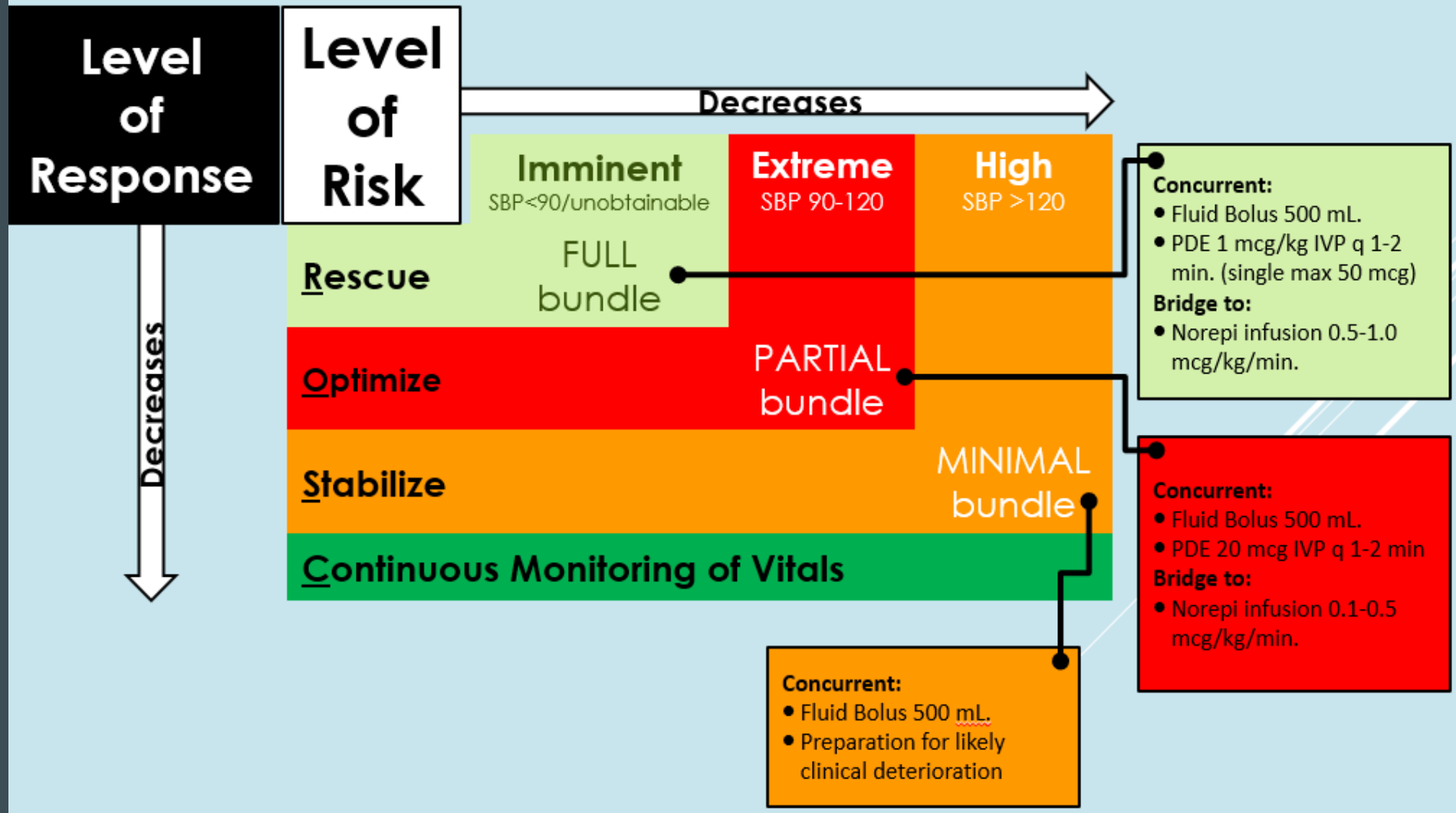
GOAL = AVOID HYPER/HYPOVENTILATION

Actions	Trigger
Initiate ventilations at 10 BPM	All
Continuous EtCO2 and SpO2 monitoring	Focused assessment q3mins or if clinical deterioration
Target $EtCO_2$ 35-45mmHg	All
Target SpO_2 94-98%	All


Rearrest (%)
40
30
20
10
0
33%
39% Relative
Decrease in
Rearrest
20%
SBP
<90
SBP
90-120
SBP >120
<60
60-70
70-80
80-90
90-100
100-110
110-120
120-130
130-140
140-150
150-160
160-170
170-180
180-190
>190
Lowest Recorded Prehospital SBP (mmHg)
Survival (%)
50
40
30
20
10
0
43%
3.3-Fold
Increase in
Survival
13%
<60
60-70
70-80
80-90
90-100
100-110
110-120
120-130
130-140
140-150
150-160
160-170
170-180
180-190
>190
Lowest Recorded Prehospital SBP (mmHg)

THE ALBERTA CANROC COLLABORATIVE

TARGETED INTERVENTION WITH R-O-S-C GOAL SBP >120



Summary

- QA / QI is key in cardiac arrest
- SBP < 90 mmHg → Fluid bolus, Push Pressor Epinephrine 50 mcg Q2 min, bridge to NE Drip
- SBP 90 – 120 mmHg → Fluid bolus, Push Pressor Epinephrine 20 mcg Q2 min, bridge to NE Drip

STAYIN' ALIVE, STAYIN ALIVE

What Are Suggested Approaches to Post-ROSC Management?

FORT WORTH®

Office of the
Medical Director

Stayin' Alive, Stayin' Alive: What Are Suggested Approaches to Post-ROSC Management? (Continued)

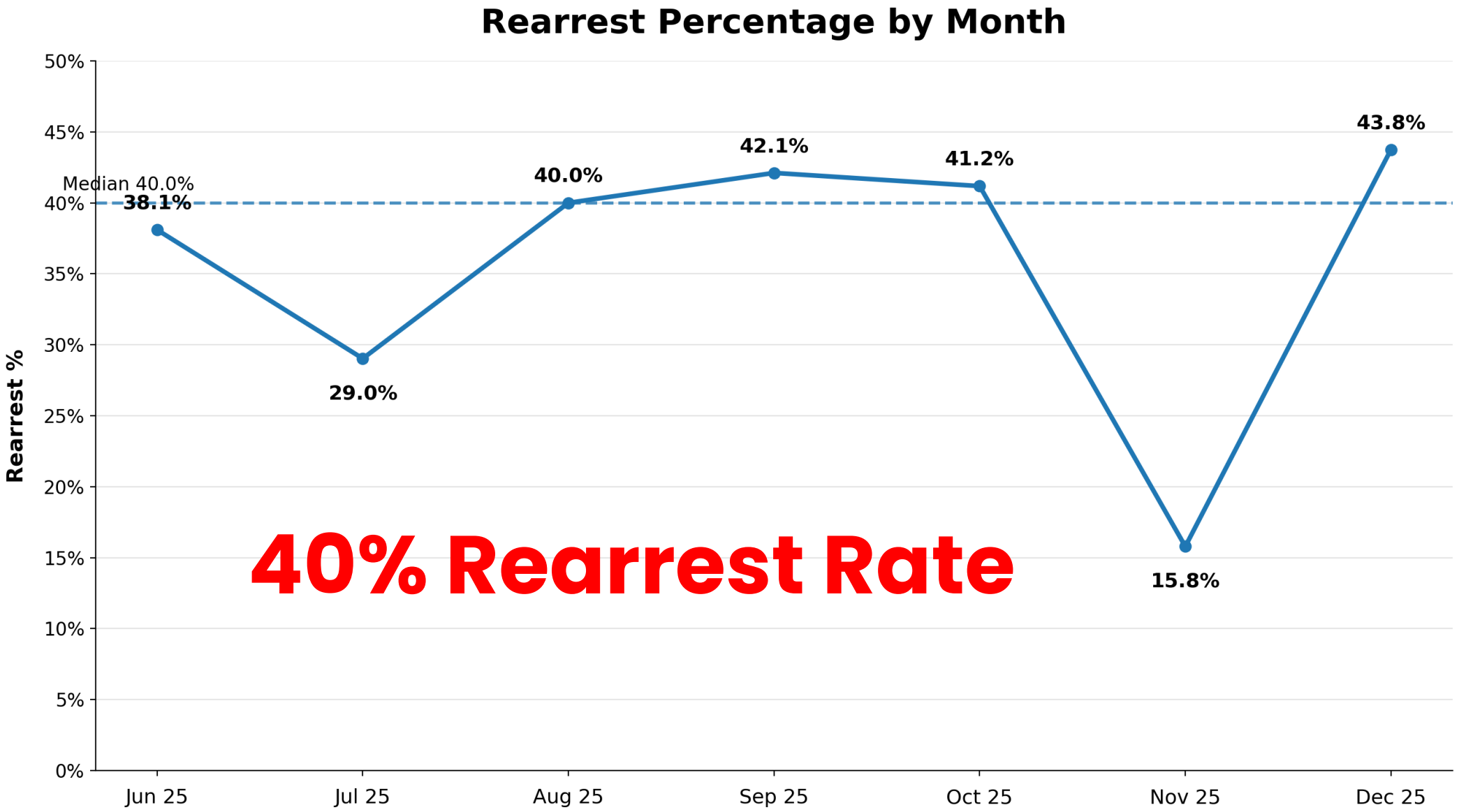
Brian Miller, MD, FACEP, FAEMS
Associate System Medical Director
Fort Worth Office of the Medical Director

Chain of Survival Committee

Purpose: Improve OHCA Utstein survival in our system through a multidisciplinary chain of survival QI program

Improvement Workgroups:

- **Pre-Arrival**
- **Resuscitation**
- **Post-ROSC**


Rearrest Percentage by Month
Rearrest %
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
Median 40.0%
38.1%
29.0%
40.0%
42.1%
41.2%
15.8%
43.8%
Jun 25
Jul 25
Aug 25
Sep 25
Oct 25
Nov 25
Dec 25
40% Rearrest Rate

Cardiac

Post ROSC

If ROSC occurs in-place,

Basic

- **Remain in-place for a minimum of 10 minutes**, accomplishing the following:
  - Assess ventilation effectiveness and vital signs
  - BP q 2 minutes
  - Obtain 12-lead ECG ASAP following ROSC
  - Assess blood glucose
  - Notify receiving PCI center, activate STEMI alert as appropriate
  - Place MCD in ready mode for transport
  - Secure patient

Paramedic

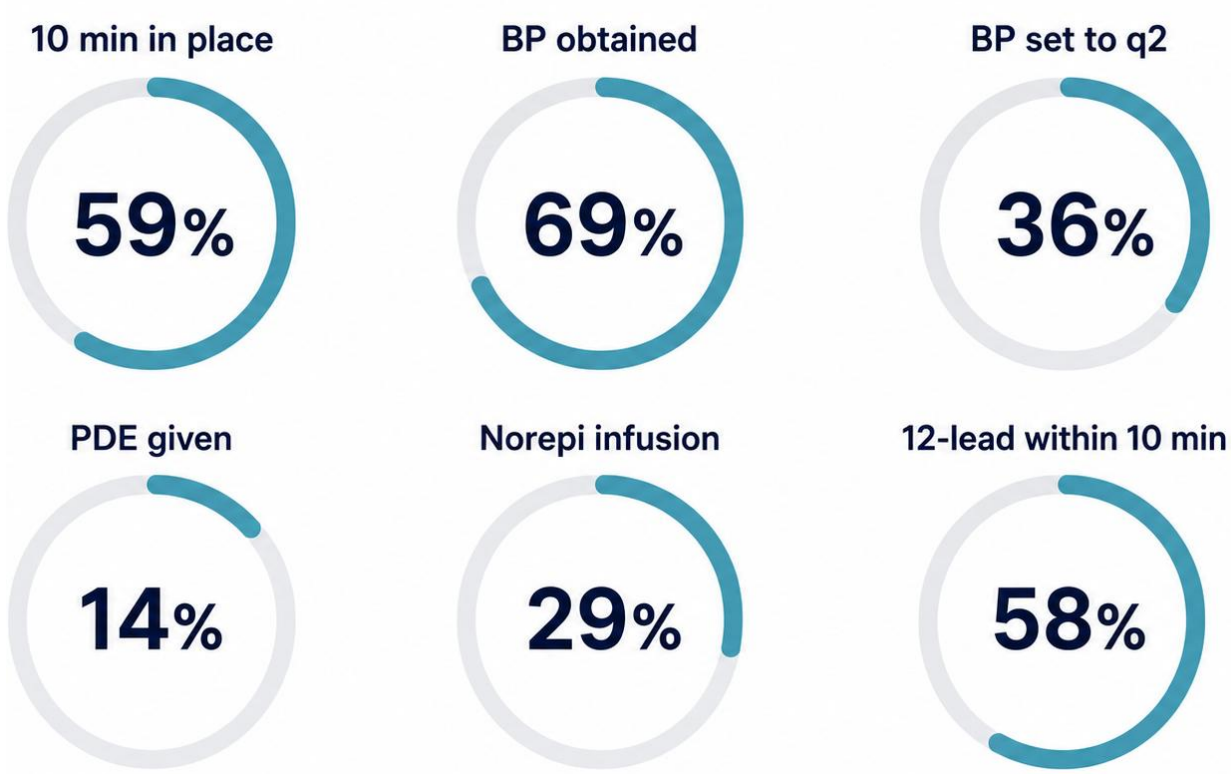
- Reassess rhythm
- Assure ≥ 2 routes of IV/IO access
- Maintain MAP ≥ 65 or age appropriate goals

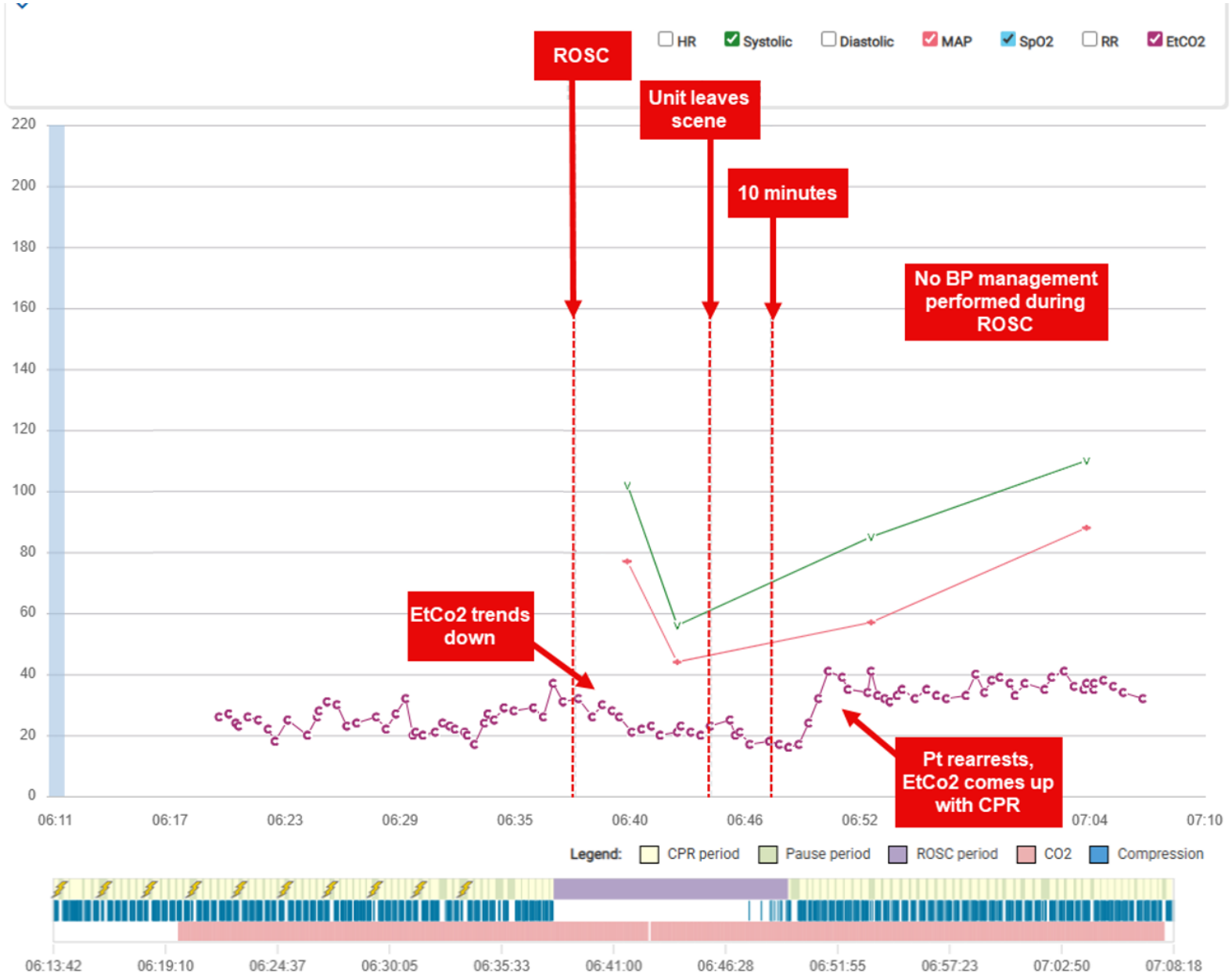
If hypotensive,

- Norepinephrine
  Adult - 5 mcg/min, titrate to MAP ≥ 65
  Pedi - 0.1 mcg/kg/min, titrate to age appropriate goals

Post-ROSC Process Metrics

- Significant variation
- Delay and difficulty in obtaining BPs
- 64% - no regular or q2 BPs
- Conservative pressors
- Focus on less critical treatment priorities



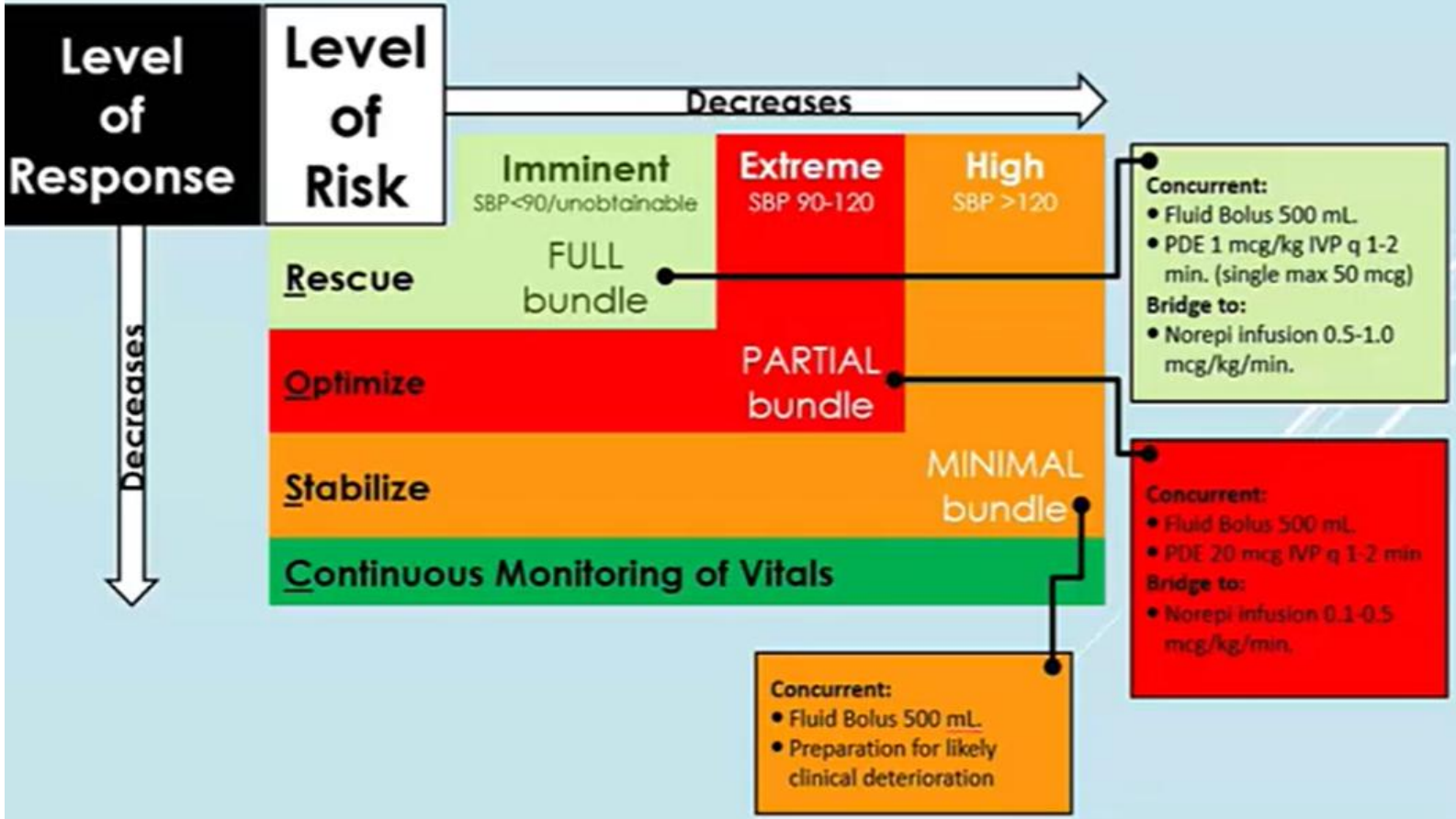

HR
Systolic
Diastolic
MAP
SpO2
RR
EtCO2
ROSC
Unit leaves scene
10 minutes
No BP management performed during ROSC
EtCo2 trends down
Pt rearrests, EtCo2 comes up with CPR
220
200
180
160
140
120
100
80
60
40
20
0
06:11
06:17
06:23
06:29
06:35
06:40
06:46
06:52
07:04
07:10
Legend:
CPR period
Pause period
ROSC period
CO2
Compression
06:13:42
06:19:10
06:24:37
06:30:05
06:35:33
06:41:00
06:46:28
06:51:55
06:57:23
07:02:50
07:08:18

AIM:

Decrease our OHCA post ROSC rearrest rate from 42% to 20% within one year through a Post ROSC Improvement Process.


NAEMSP
FLORIDA
FLORIDA EMS WEEKLY WEBINAR SERIES
ROSC BUNDLE OF CARE
Leading Experts • Live Q&A • Real-World EMS Insights
Friday, November 21st, 2025 at 11AM EST
Speaker Panel
Adam Perrett
Medical Training Officer
Peter Antevy, MD
EMS Medical Director
Mike Humphrey
EMS Operations Officer

TARGETED INTERVENTION WITH R-O-S-C GOAL SBP >120



FWOMD Post-ROSC Checklist Goals

- **Early & aggressive hemodynamic support**
- Simplicity
- Fit on a badge buddy card
- Address identified post-ROSC “misses”
- Lead to norepi infusion (if needed)

The Post-ROSC Checklist

Post-ROSC Checklist

☐ Announce ROSC ☐ GABP ☐ Set BP Q2

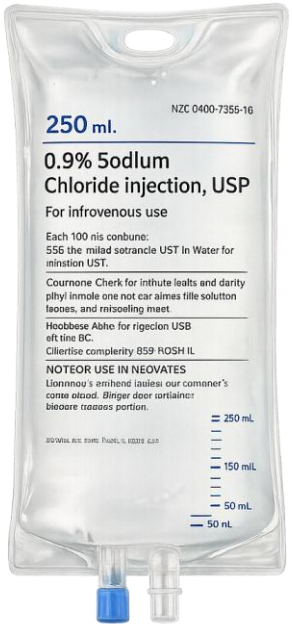
Paramedic

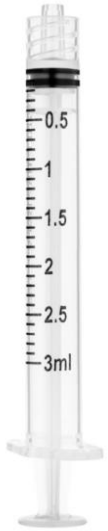
NorEpi	SBP	Push Dose	Infusion
Rescue	<90 or UTO	3 mL q 2 min	50 mcg/min
Press	90 - 120	2 mL q 2 min	30 mcg/min
Mix	>120	Prep PDL & Infusion	

☐ Assign monitor watcher ☐ Obtain 12 Lead
☐ Confirm Airway/EtCO2 ☐ MCD Backplate

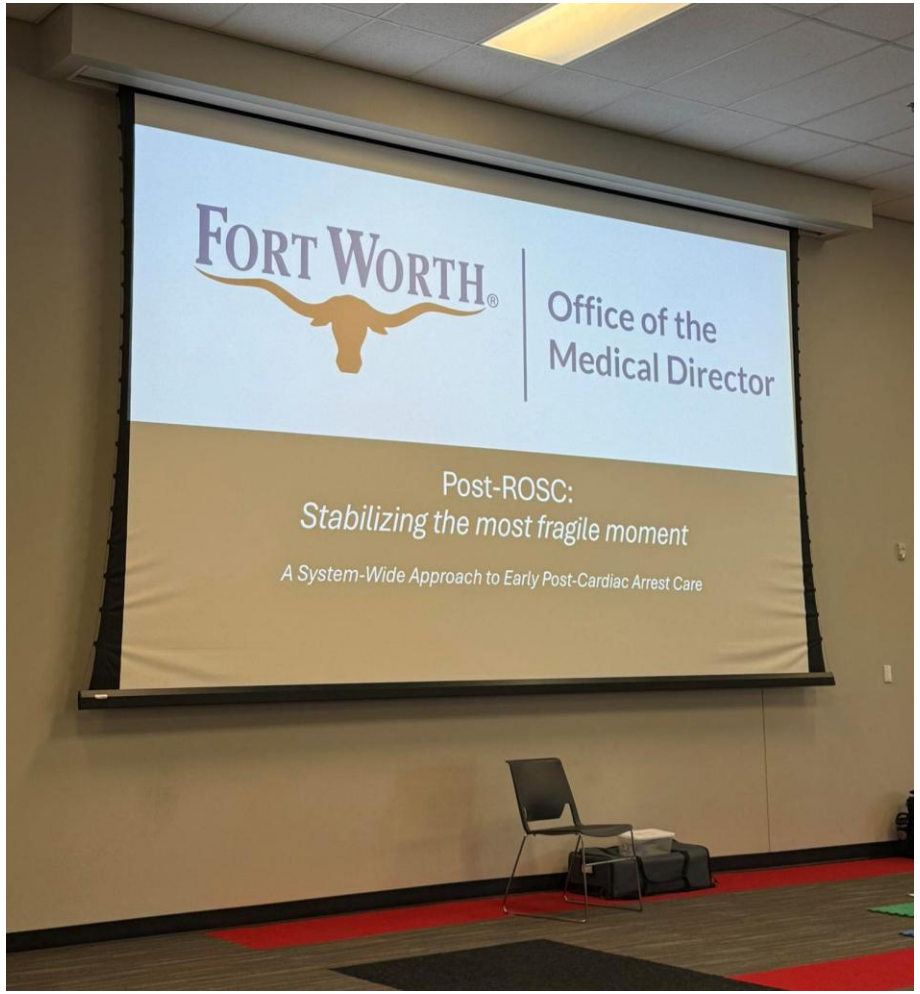
The Post-ROSC Checklist

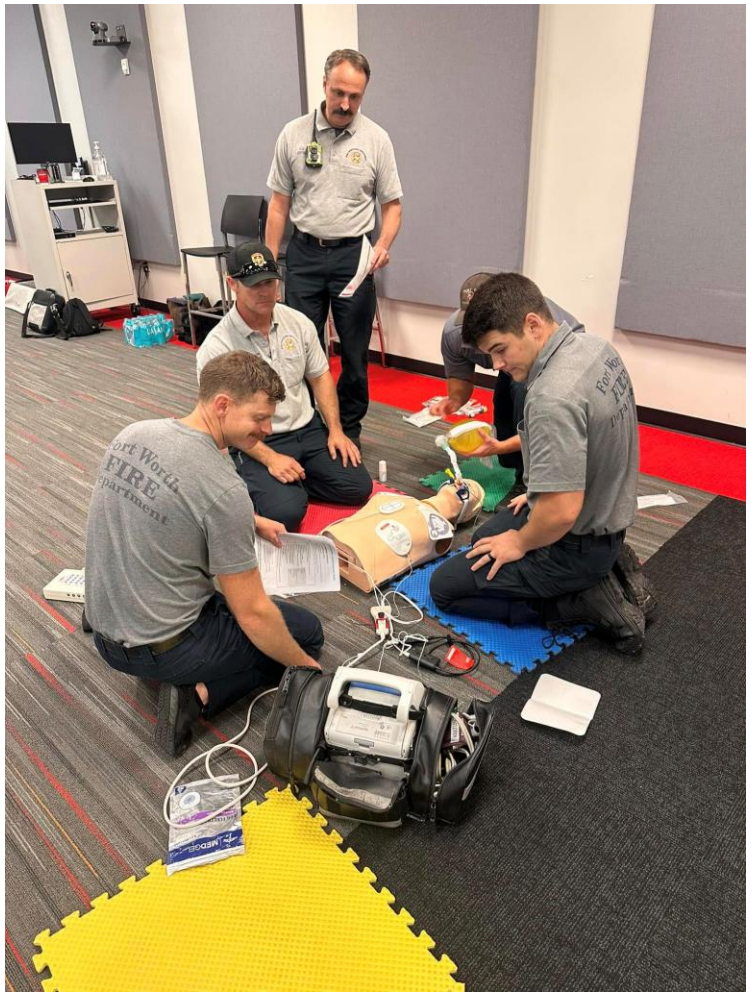
NorEpi	SBP	Push Dose	Infusion
Rescue	<90 or UTO	3 mL q 2 min	50 mcg/min
Press	90 - 120	2 mL q 2 min	30 mcg/min
Mix	>120	Prep PDL & Infusion	

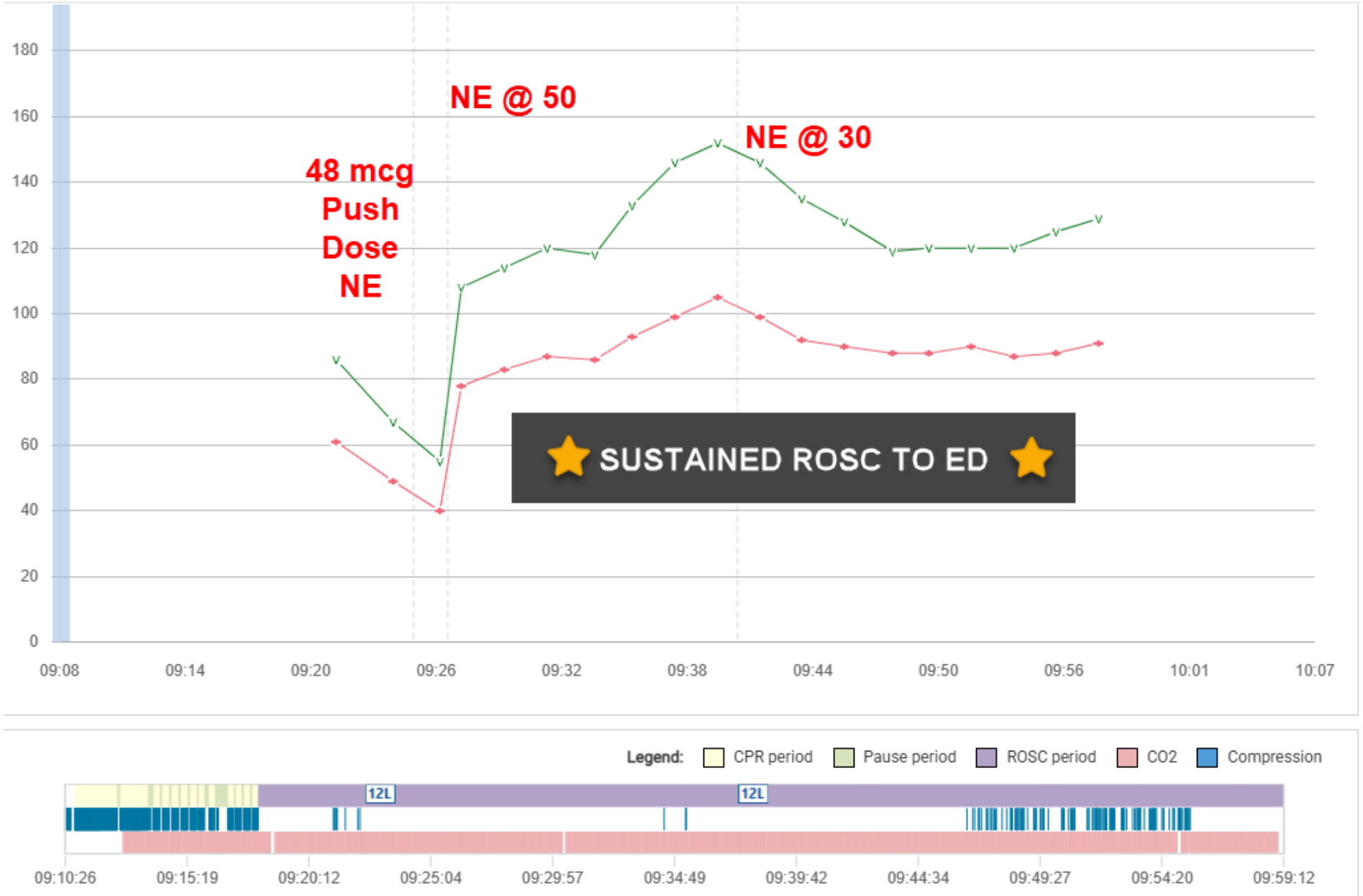




Systemwide CE May 2026






180
160
140
120
100
80
60
40
20
0
NE @ 50
NE @ 30
48 mcg
Push
Dose
NE
SUSTAINED ROSC TO ED
09:08
09:14
09:20
09:26
09:32
09:38
09:44
09:50
09:56
10:01
10:07
Legend:
CPR period
Pause period
ROSC period
CO2
Compression
12L
12L
09:10:26
09:15:19
09:20:12
09:25:04
09:29:57
09:34:49
09:39:42
09:44:34
09:49:27
09:54:20
09:59:12

Category	Count	%
Rescue	22	63%
Press	10	29%
Mix/Monitor	3	8%

Performance	Pre-Testing	With Bundle
BP	69%	94%
BPQ2	36%	80%
Re-Arrest	42%	27%

Conclusion

- Don’t be fooled by early normal/high BPs
- Depth and duration of hypotension matters
- SBP <90 might not be optimal early ROSC target
- Early aggressive hemodynamic support key
- Consider bundle of post-ROSC & pressor care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UT Southwestern
Medical Center
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@BrianMillerMD
2018 Joseph Haubert

A Shot of Adrenaline Will Do Ya : IM Epi

Dr P. R. Banerjee
Medical Director Polk County Fire Rescue
Assistant Professor in Emergency Medicine
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Epinephrine

Cardiac arrest is a leading cause of death worldwide

US survival to discharge after (OHCA) < 10% for over 60 years

Improves ROSC and survival NOT neurological recovery

Higher neurologically survival if given < 10 min of arrest

Epi…Many Routes Along the Way

Intracardiac IC (1960s-1970s)

- Poss lacerated coronaries, tamponade, fell out of favor

Endotracheal ET 1980s-1990s (ACLS 90s)

- IV access difficult or first dose until IV
- 2-2.5x dose, dilute
- Fell out of favor, delayed and lower peak concentrations vs. IV, may worsen VQ mismatch, no demonstrated benefit (removed in 2010)

Intraosseus IO

- 1922 pioneered for resuscitation, diff access
- 1940s-1990s, transitioned to mostly pediatrics
- ADVENT OF THE DRILL: Early 2000s, speed, reliability
- 2004 EZ IO FDA approved, transition back to adults
- 2005 AHA Guidelines IO equivalent to IV

Intramuscular IM

- Most recent research exploring this
- Showed improved survival 11% vs. 7%
- Potential new direction

Many Epi Doses Along the Way…

Staple of ACLS based on animal models

High-dose improved ROSC worsened neurological recovery and long-term survival

1960's

1980s

1990s

2026

AHA recommended escalating doses for cardiac arrest

Lower doses administered at specific intervals

IM Epi…Something Novel…Will it Work?

IM

Fast, Safe, Easy

Self administered for Allergic Rxns.

RESUSCITATION

Search for...

CLINICAL PAPER · Volume 201, 110266, August 2024

Download Full Issue

Early intramuscular adrenaline administration is associated with improved survival from out-of-hospital cardiac arrest

Helen N. Palatinus [a] · M. Austin Johnson [a] · Henry E. Wang [b] · Guillaume L. Hoareau [a,d] · Scott T. Youngquist [a,c]

Affiliations & Notes · Article Info · Linked Articles (4)

Abstract

Background

Early administration of adrenaline is associated with improved survival after out-of-hospital cardiac arrest (OHCA). Delays in vascular access may impact the timely delivery of adrenaline. Novel methods for administering adrenaline before vascular access may enhance survival. The objective of this study was to determine whether an initial intramuscular (IM) adrenaline dose followed by standard IV/IO adrenaline is associated with improved survival after OHCA.

Methods Study Design

We conducted a before-and-after study of the implementation of an early, first-dose IM adrenaline EMS protocol for adult OHCAs. The pre-intervention period took place between January 2010 and October 2019. The post-intervention period was between November 2019 and May 2024.

Setting

Single-center urban, two-tiered EMS agency.

Participants

Adult, nontraumatic OHCA meeting criteria for adrenaline use.

Intervention

Single dose (5 mg) IM adrenaline. All other care, including subsequent IV or IO adrenaline, followed international

IM Epi

1405 adults w OHCA, IM Epi

Adult Non traumatic Cardiac arrest Jan 2010 – May 2024

Improved survival (11 vs 7%)

Neurologically survival (9.8 % vs 6.2 %;) vs. IV/IO

Salt Lake City FD, 2019,

5 mg IM with IV/IO attempts

R & D

Polk County IM Epi
December – March 2025-2026
350 patients so far…

VF ROSC
increased 22%
36% to 58%

VF Survival
increased 20%
35% to 55%

PEA / Asystole
ROSC
increased 1%
27% to 28%

PEA / Asystole
survival
dropped 2%
22% to 20%

PaulBanerjee@Polkfl.gov

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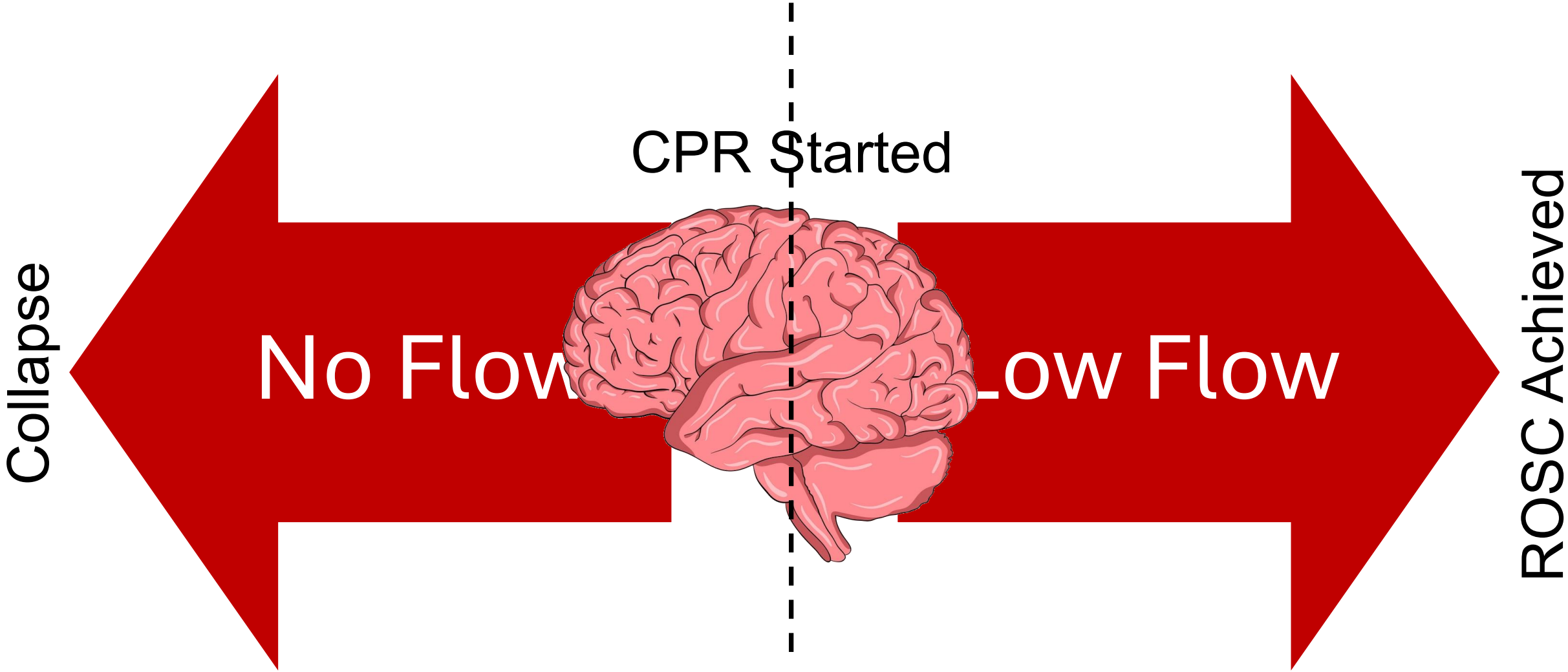
A Shot of Adrenaline Will Do Ya: *Why Are We Administering Intramuscular Epinephrine ?*

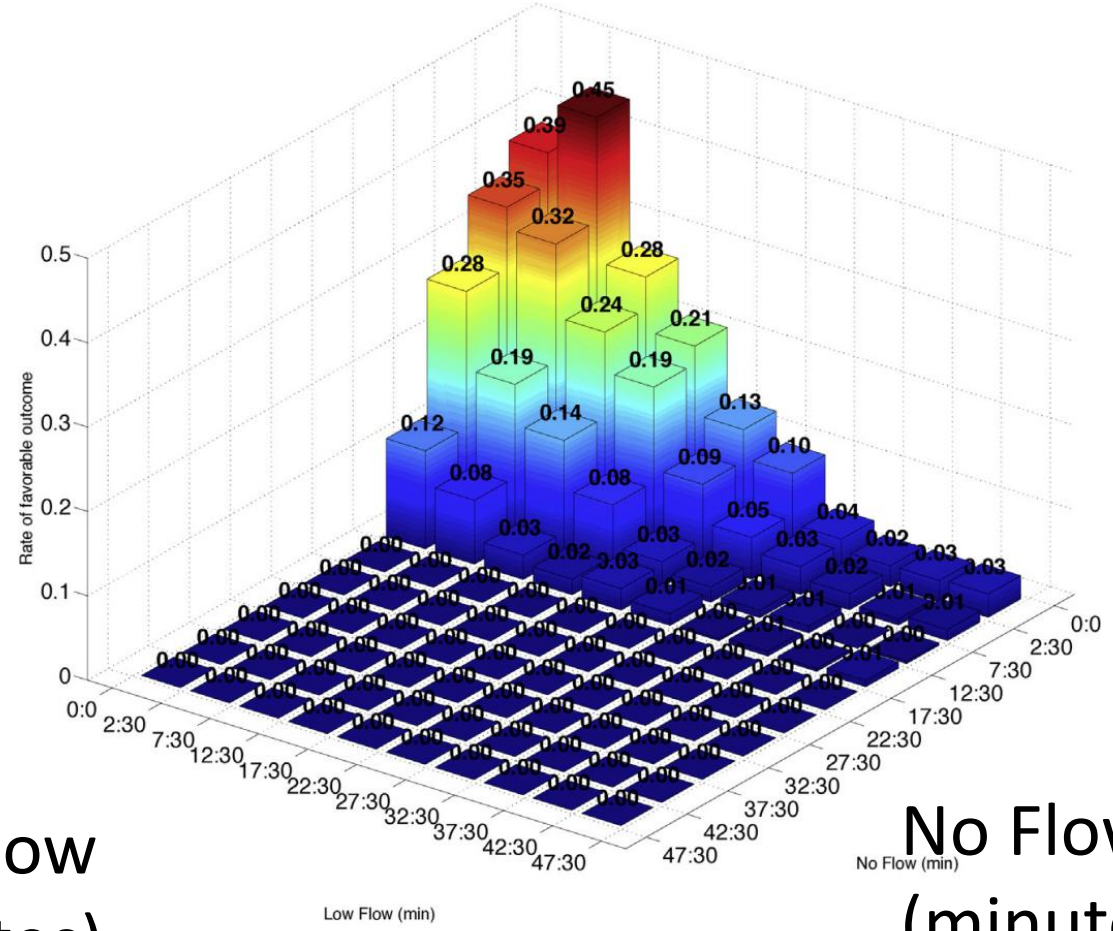
Scott T. youngquist, md, ms

Professor, department of emergency medicine, university of utah

Chief Medical officer, salt lake city fire department, salt lake city, Utah

Two periods of ischemia





Low Flow (minutes)

No Flow (minutes)

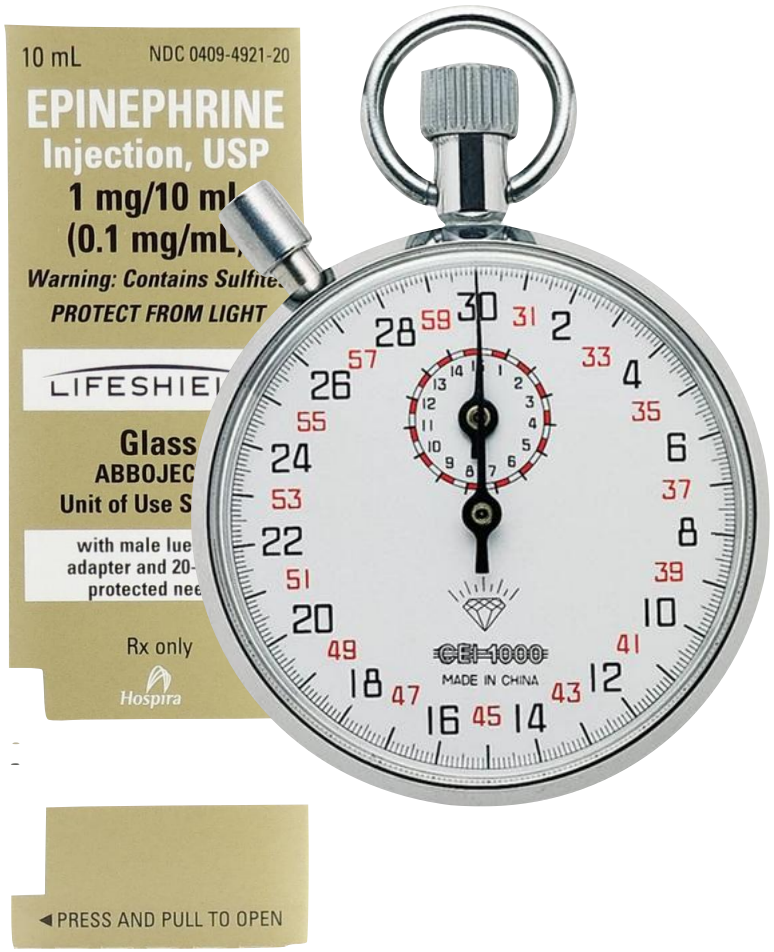
No Flow and Low Flow Time

Early CPR and Early ROSC = Highest Survival

Adnet F, et al. Resuscitation 111 (2017) 74-81


CEI 1000
MADE IN CHINA


SALT LAKE CITY
E5


10 mL
NDC 0409-4921-20
EPINEPHRINE
Injection, USP
1 mg/10 mL
(0.1 mg/mL)
Warning: Contains Sulfites
PROTECT FROM LIGHT
LIFESHIELD
Glass
ABBOJECT
Unit of Use S
with male lue
adapter and 20-
protected nee
Rx only
Hospira
◄PRESS AND PULL TO OPEN
CEI-1000
MADE IN CHINA

EARLIER IS BETTER

Time-to-epi is a lever in survival

SURVIVAL TO HOSPITAL DISCHARGE

62% higher

(95% CI 1.45–1.83)

FUNCTIONAL SURVIVAL

2X Higher

(95% CI 1.73–2.52)

Patients who got epi ≤10 minutes from scene arrival had ~2× the chance of neurologically intact survival.

Ran L et al. J Am Heart Assoc 2020;9:e014330.

The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 AUGUST 23, 2018 VOL. 379 NO. 8

A Randomized Trial of Epinephrine in Out-of-Hospital Cardiac Arrest

G.D. Perkins, C. Ji, C.D. Deakin, T. Quinn, J.P. Nolan, C. Scomparin, S. Regan, J. Long, A. Slowther, H. Pocock, J.J.M. Black, F. Moore, R.T. Fothergill, N. Rees, L. O'Shea, M. Docherty, I. Gunson, K. Han, K. Charlton, J. Finn, S. Petrou, N. Stallard, S. Gates, and R. Lall, for the PARAMEDIC2 Collaborators*

PARAMEDIC-2

999 Call

Scene Arrival

Vascular Access Obtained

Epi Given

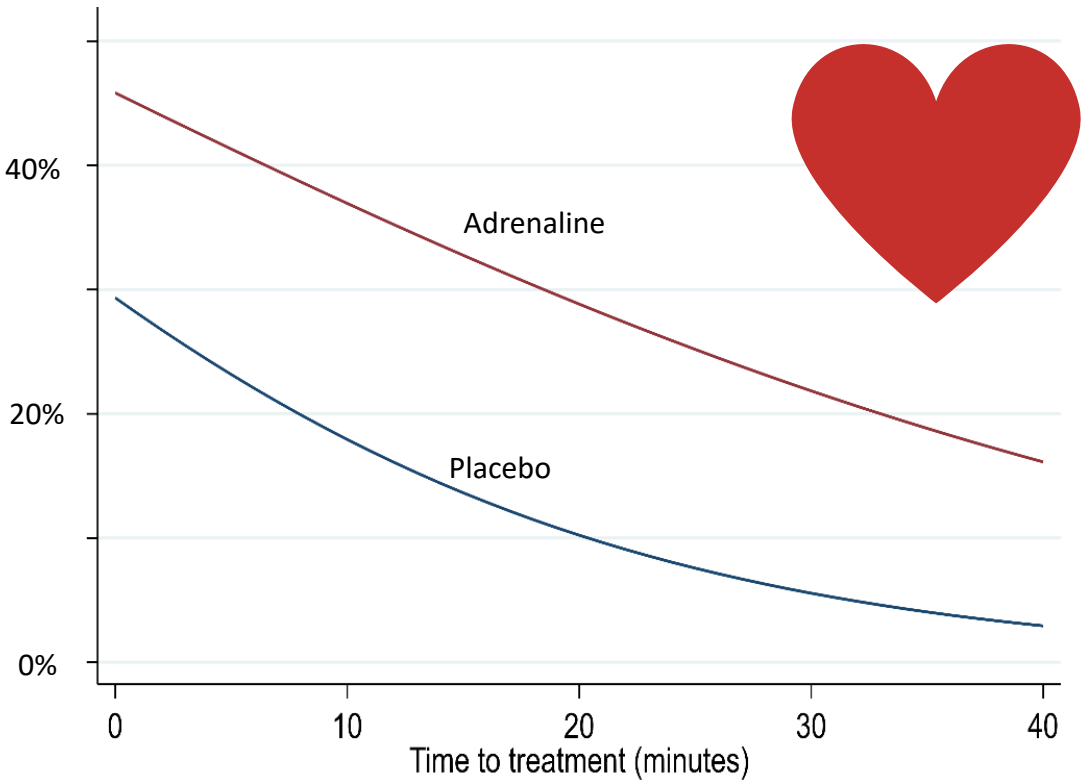
Median 21.5 min
PARAMEDIC-2 Trial

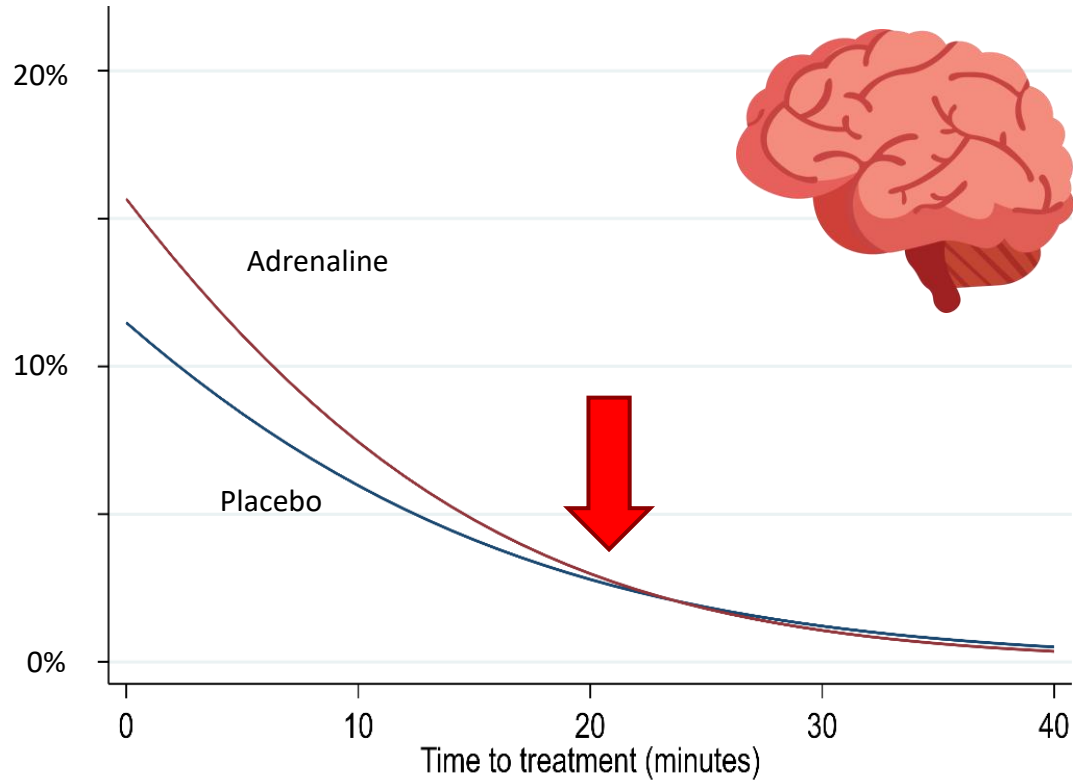
33% IO
66% IV

PARAMEDIC2

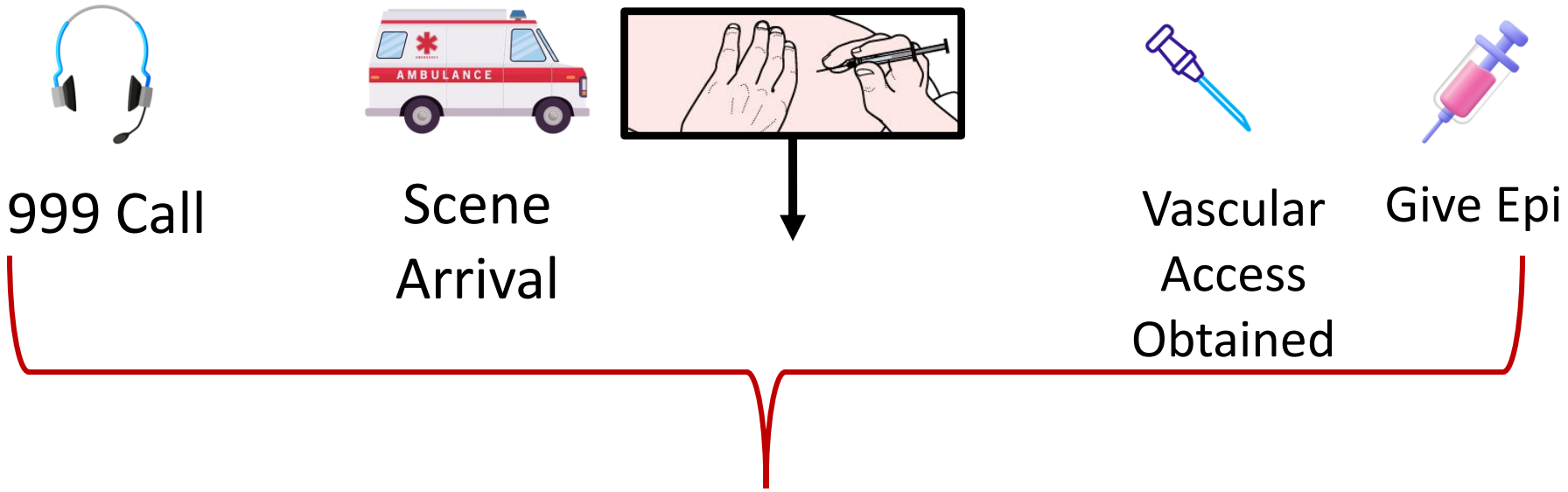
The Adrenaline Trial

Perkins ICM 2020





PARAMEDIC-2



Median 21.5 min

PARAMEDIC-2 Trial

Animal models

- Generally favor higher IM doses producing similar rise in serum epinephrine levels
- Similar rates of ROSC to IV

Available online at ScienceDirect

Resuscitation

journal homepage: www.elsevier.com/locate/resuscitation

Clinical paper

Early intramuscular adrenaline administration is associated with improved survival from out-of-hospital cardiac arrest ☆

Helen N. Palatinus[a,*], *M. Austin Johnson*[a], *Henry E. Wang*[b], *Guillaume L. Hoareau*[a,d], *Scott T. Youngquist*[a,c]

Abstract

Background: Early administration of adrenaline is associated with improved survival after out-of-hospital cardiac arrest (OHCA). Delays in vascular

Study design

Before-and-after study

Single-center EMS agency

Single dose (5 mg) IM epinephrine lateral thigh

Eligibility criteria

Inclusion Criteria	Exclusion
Age > 18 years old Meets indications for epinephrine	Age <18 years old Traumatic etiology Drowning Strangulation DNR Epinephrine given prior to EMS arrival Epinephrine given by ETT Missing outcome/epi data

Outcomes

Primary outcome

- Survival to hospital discharge

Secondary outcomes

- EMS arrival to first epinephrine
- Survival to hospital admission
- Favorable neurologic outcome

study population

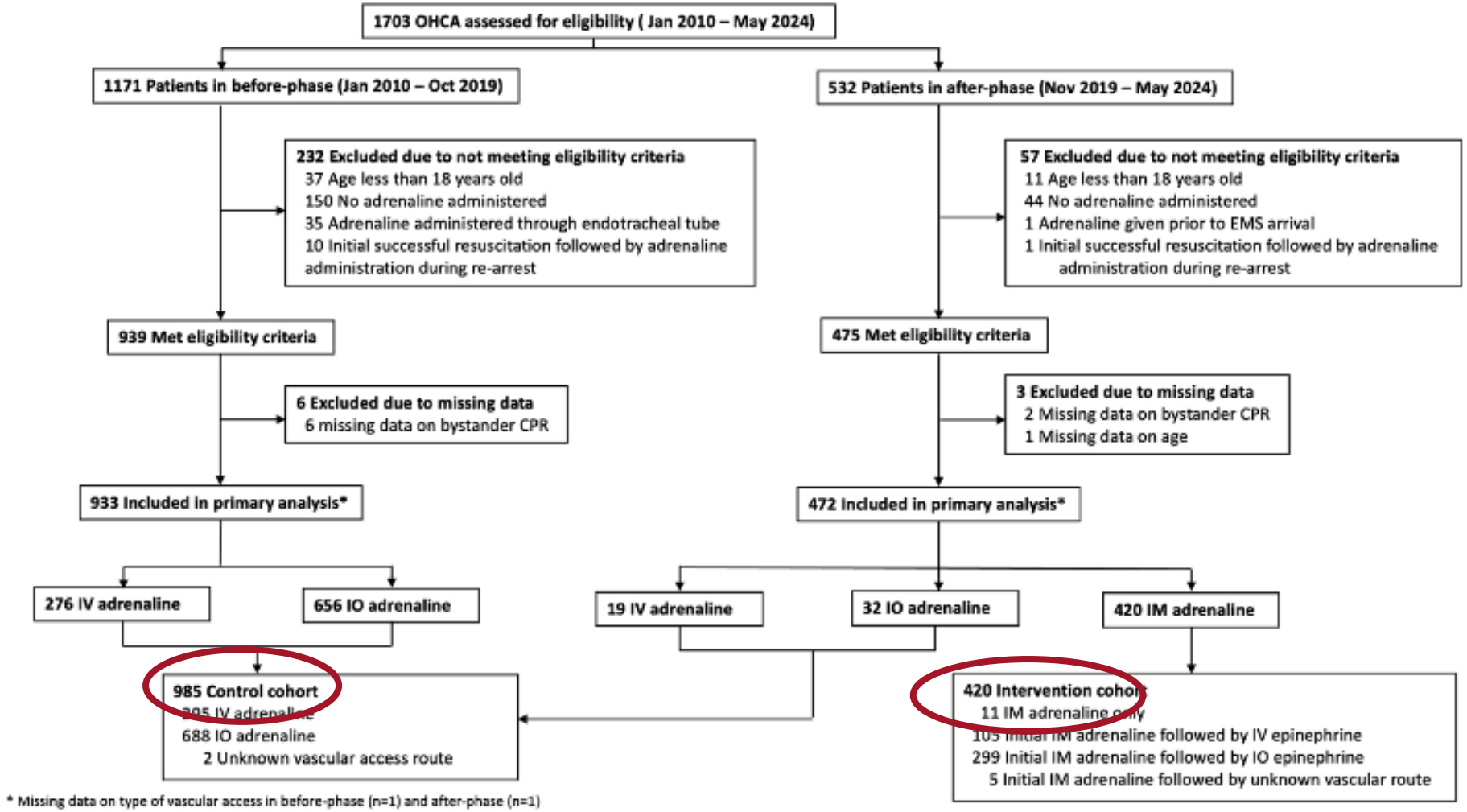


Fig. 1 – Selection of Study Population.

RESULT #1

Time-to-first-dose dropped by 3.4 minutes from scene arrival

IV / IO ROUTE

7.8 min

IQR 5.9–10.4

IM ROUTE

4.4 min

IQR 3.0–6.0

3.4 minutes earlier — measured from EMS arrival to the first dose of epinephrine.

Association of im epinephrine with outcomes

Table 2 – Outcomes of Patients Treated with an Initial Adrenaline Dose Administered through the IV/IO Route Compared to the IM Route.

Outcome	IV/IO Cohort No. (%) (n = 985)	IM Cohort No. (%) (n = 420)	Absolute Difference (%)	Odds Ratio (95% CI) * Unadjusted	Adjusted
Survival to Hospital Admission	311 (31.6)	156 (37.1)	5.6	1.28 (1.01–1.63)	1.37 (1.06–1.77)
Survival to Hospital Discharge	69 (7.0)	46 (11.0)	4.0	1.63 (1.10–2.42)	1.73 (1.10–2.71)
Favorable Neurologic Outcome	61 (6.2)	41 (9.8)	3.6	1.64 (1.08–2.48)	1.72 (1.07–2.76)

* Multivariate logistic regression model adjusted for age, sex, witnessed arrest, bystander CPR, public location of arrest, initial cardiac rhythm, EMS response time.

discussion

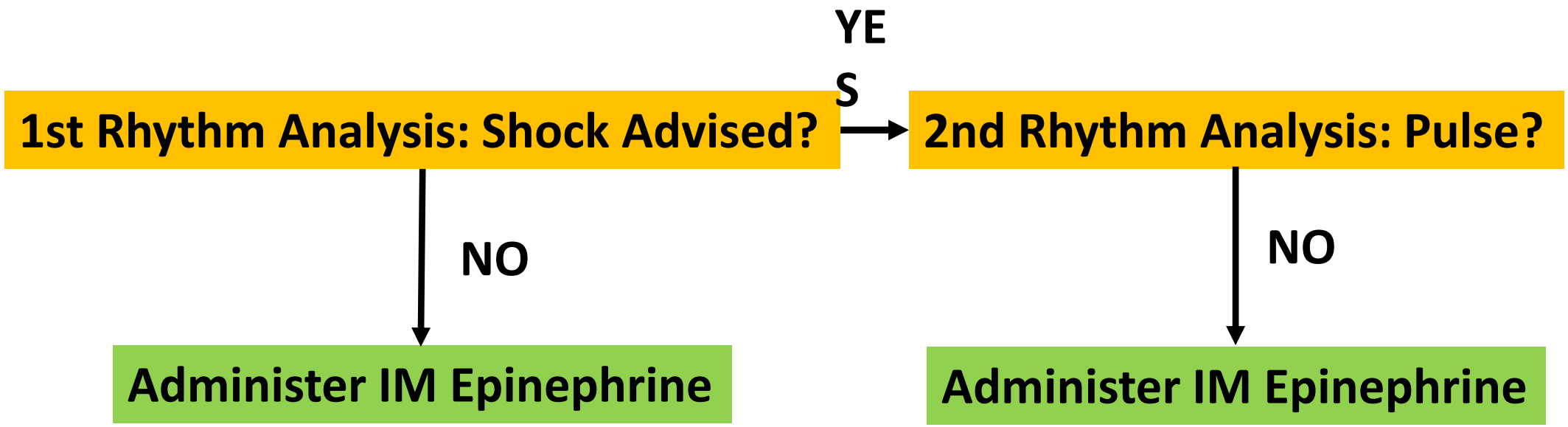
- First clinical study of IM epinephrine in OHCA
- Align with prior reports of early epinephrine and improved outcomes
- Potential implications for ALS/BLS care, pediatric resuscitation

conclusion

An initial IM dose of epinephrine as an adjunct to standard ACLS was associated with improved survival to hospital discharge and favorable neurologic status at discharge.

Randomized, controlled trials are needed to fully assess the potential benefit of IM epinephrine delivery in OHCA.

Algorithm for BLS IM epinephrine



Are We Through with CPC2?

5 Year Review of Neuroprotective CPR & & Improved Survival from Out-Of-Hospital Hospital Cardiac Arrest

Kerry Bachista, MD, NRP, FACEP, FAEMS · Jeffrey M. Goodloe, MD, NRP, FACEP, FAEMS · Joseph E. Holley, MD, FACEP, FAEMS

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Critical Care Medicine

Original Investigation

Crit Care Med February 2024; 52: 170-181

LATE BREAKER ARTICLES

Survival for Nonshockable Cardiac Arrests Treated With Noninvasive Circulatory Adjuncts and Head/Thorax Elevation*

OBJECTIVES: Cardiac arrests remain a leading cause of death worldwide. Most patients have nonshockable electrocardiographic presentations (asystole/pulseless electrical activity). Despite well-performed basic and advanced cardiopulmonary resuscitation (CPR) interventions, patients with these presentations have always faced unlikely chances of survival. The primary objective was to determine if, in addition to conventional CPR (C-CPR), expeditious application of noninvasive circulation-enhancing adjuncts, and then gradual elevation of head and

Kerry M. Bachista, MD, FACEP, FAEMS[1,2]

Johanna C. Moore, MD, MSc, FACEP[3]

José Labarère, MD, PhD[4]

Remle P. Crowe, PhD[5]

Lauren D. Emanuelson, RN, BS,

But...

We Were Also Seeing a New Clinical Signal ...

>30min
CPR.

Edmond, Oklahoma Survivors 11/9/22

72 Minutes Continuous CPR!

More on that in a minute...

5-year experience with Head Up CPR

Comparison of 5-Year Neurologically Intact Survival Between an Automated Head Up Cardiopulmonary Resuscitation Registry and a National Cardiac Arrest Registry

Johanna C. Moore[1], Kerry Bachista[2], Bayert Salverda[3], Jeff Wittmer[4], Shaun White[5], Joe E. Holley[6], Jerome Cole[7], Lauren Emanuelson[8], Brian Davis[9], Jeffrey Goodloe MD[10], Matthew Cox[11], James Reynolds[12], Darrin Gomes[12], Lewis Siegel[13], Chris Williamson[14], Christopher T. Holloway[14], William Crawford[15], Tony Sposeto[16], Mark Carter[17], Nathaniel R. Hunt[18], Sue Duval[19], Pouria Poorzand[20], Robb DeVries[21], Guillaume Debaty[22]

1. Hennepin County Medical Center, Minneapolis, MN 2. Mayo Clinic, Jacksonville, FL 3. Hennepin Healthcare Research Institute, Minneapolis, MN 4. St. Johns County Fire Rescue, Saint Augustine, FL 5. Edina Fire Department, Edina, MN 6. University of Tennessee, Memphis, TN 7. Germantown Fire Department, Germantown, TN 8. Advanced Medical Transport of Central Illinois, Peoria, IL 9. Edmond Fire Department, Edmond, OK 10. University of Oklahoma School of Community Medicine, Tulsa, OK 11. Emergency Medical Services Authority, Tulsa, OK 12. Chesapeake Fire Department, Chesapeake, VA 13. Chesapeake Regional Healthcare, Chesapeake, VA
oines, IA 17. Collierville Fire and Rescue, Collierville, TN 18. University of Michigan, Ann Arbor, MI 19. University of Minnesota, Minneapolis, MN 20. Lehigh Valley Health Network, ton
MI 22. Centre Hospitalier Universitaire de Grenoble, Grenoble, France

Background

Pre-clinical animal studies have demonstrated improved cerebral blood flow and neurological survival with Automated Head Up Position (AHUP) cardiopulmonary resuscitation (CPR) as compared to flat conventional (C) CPR. AHUP CPR consists of 1) Gradual automated head and thorax elevation 2) active compression decompression CPR and 3) an impedance threshold device. Subsequently, observational propensity-matched studies of out-of-hospital cardiac arrest (OHCA) patients demonstrated a time-dependent association between survival with intact neurological function (SNF) and AHUP CPR implementation. However, comparison of AHUP CPR outcomes with

Hypothesis

Use of AHUP CPR for OHCA by first responder agencies will demonstrate a higher incidence of SNF compared to C-CPR outcomes from a national registry in the United States.

Methods

- Data from 5 years (2020-2024) from an AHUP-CPR Registry comprised of OHCA patients routinely treated by first responders with AHUP CPR were compared with data from the Cardiac Arrest Registry to Enhance Survival (CARES).
- Patient demographics, arrest characteristics, ROSC, SHD, and SNF were recorded. SNF was defined as a Cerebral Performance Category 1 or 2 at

Results

- Nine AHUP registry sites (MN, FL, TN, IL, OK, VA, AL, IA, MI) were included.
- Summary 5-year demographics (Table 1) and clinical outcomes (Table 2) are shown.
- For the AHUP sites, the average time (mm:ss, SD) from 9-1-1 call to start of CPR was 9:09 (4:37) and time to start of AHUP CPR was 12:46 (5:57). The AHUP registry had a higher 5-yr incidence of SNF versus the CARES registry (difference 2.7%, 95% CI 1.8-3.7, $p < 0.0001$). This difference was consistent over years (Figure 1)
- Secondary outcomes of return of spontaneous circulation and survival to

	AHUP REGISTRY		CARES	
Date Range	2020-2024		2020-2024	
# of Cases	3700		679494	
Avg. Age (STD)	67.0	16.8	62.3	
Male % (#)	61.5%	2275	64.5%	438282
VF % (#)	20.0%	739	17.3%	117766
All Non-Shockable % (#)	75.9%	2810	82.7%	561616
Witnessed % (#)	47.6%	1760	49.7%	337916
Bystander Witnessed % (#)	35.9%	1330	37.5%	254594
EMS Witnessed % (#)	11.6%	430	12.3%	83322
Bystander CPR % (#)	42.1%	1557	38.8%	263364

Table 1 (above): Patient demographic and arrest characteristics

	AHUP REGISTRY		CARES		Difference (95% CI)	p value
Date Range	2020-2024		2020-2024			
# of Cases	3700		679494			
Sustained ROSC% (#)	29.2%	1081	26.8%	181777	2.4% (1.0-3.9)	P = 0.0007
Survival to D/C% (#)	12.9%	478	9.6%	65095	3.3% (2.3-4.4)	P < 0.0001
Survival with Good Outcome% (#)	10.3%	382	7.6%	51519	2.7% (1.8-3.7)	P < 0.0001

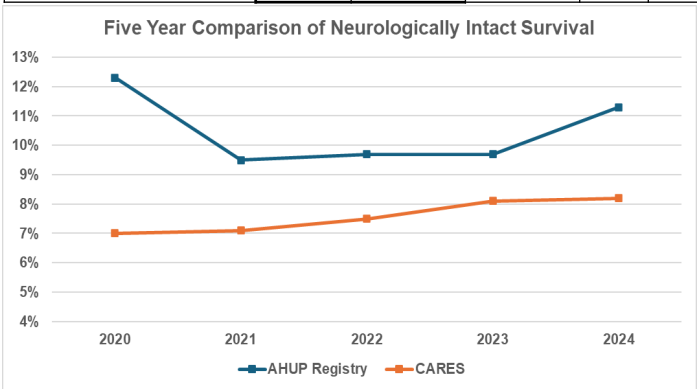


Table 2 (above): Patient clinical outcomes and comparisons

Figure 1 (left): Year by year comparison of survival with intact neurological survival between two OHCA registries

Limitations

- Data comparisons are in aggregate and unadjusted
- Data from both registries are observational and non-randomized

Conclusions

Over a 5-year period, an unadjusted analysis of aggregate data from two OHCA patient registries demonstrated that the incidence of survival with intact neurological function was higher in patients treated with AHUP CPR as part of first responder care versus patients treated with conventional CPR methods.

References

1. Moore JC et al. Resuscitation. 2017 Dec;121:195-200. PMID: 28827197.
2. Moore JC et al. Resuscitation. 2021 Jan;158:220-227. PMID: 33027619;
3. Moore JC et al. Resuscitation. 2022 Oct;179:9-17. PMID: 35933057.
4. Bachista KM et al. Crit Care Med. 2024 Feb 1;52(2):170-181. PMID: 38240504.

5-YEAR REGISTRY (Yet to be Published) RESULTS

- Jan 1, 2020 (COVID Era) and December 31, 2024:
- >3700 Pts from 10 EMS agencies across 9 states
  (MN, FL, TN, IL, OK, VA, AL, IA, MI)
- Avg age 64 yrs, 64% Men, 911 Call to CPR=9.99 min
- 391 (10.5%) Survived with CPC 1-2 (91% = CPC 1)
- Avg age of Intact Survivors was 56 yrs
- For Non-Shockables: 12% (PEA) & 2% (Asystole) survived CPC 1-2.

How were these places doing before?

Overall Neurologically-Favorable Survival

Before AHUP CPR

8.5%

246 / 2,884

p = 0.01

Statistically significant improvement in pooled results across all sites

Compared to other metrics?

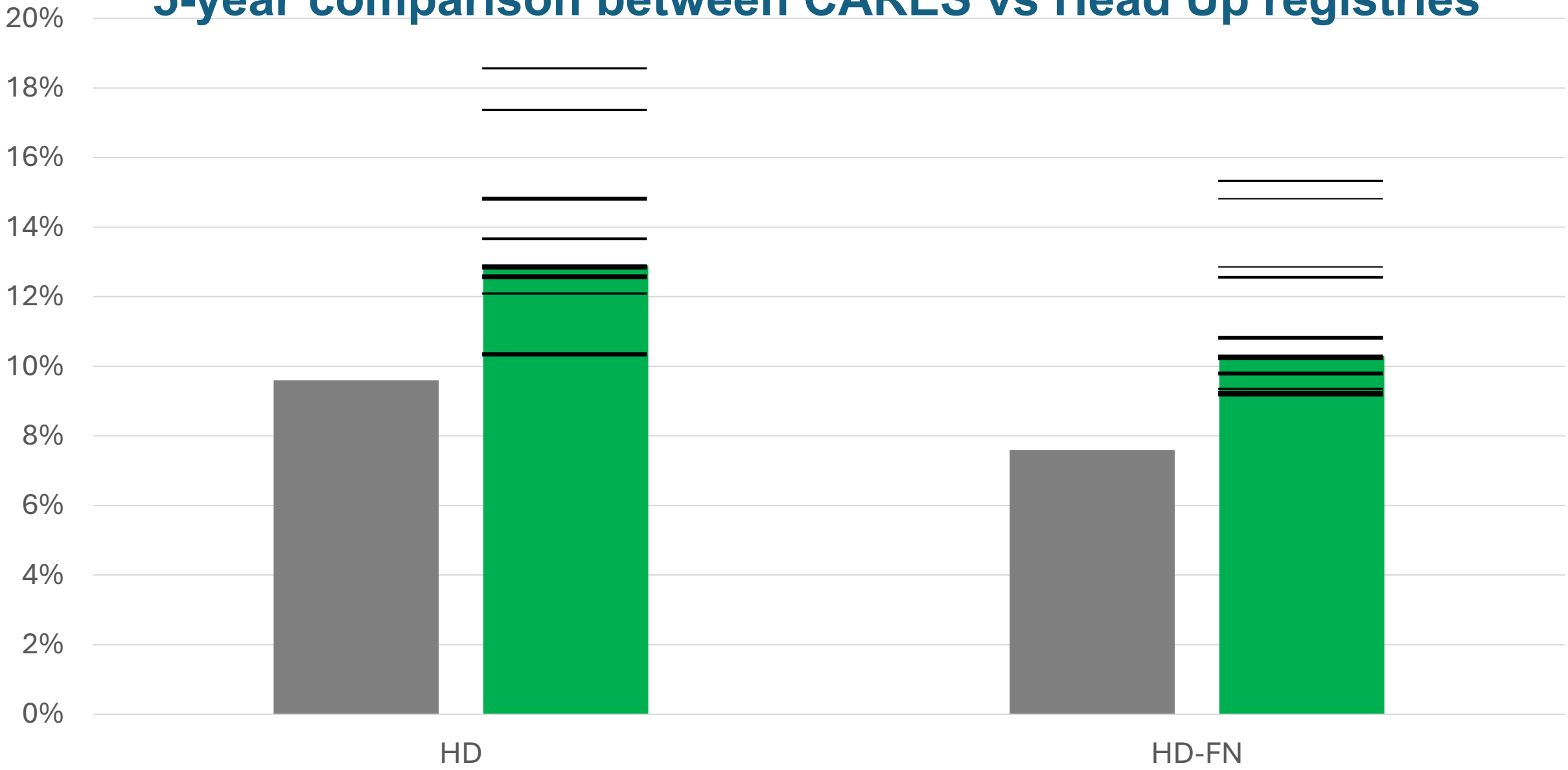
5-Year AHUP Registry vs CARES

	2020-2024		
	AHUP Registry	**CARES**	**p-value**
% Sustained ROSC	**29.3% (1091/3721)**	**26.8% (181,777/679,474)**	**0.0004**
% Hospital D/C	**13.0% (483/3721)**	**9.6% (65,095/679,474)**	**<0.00001**
% Neuro Intact Survival	**10.5% (379/3721)**	**7.6% (51,519/679,474)**	**<0.00001**

Participating Sites: Edina, MN, St Johns County, FL, Germantown, TN, Edmond, OK, Tuscaloosa, AL, Peoria, IL, Chesapeake, VA, Des Moines, IA, Canton, MI

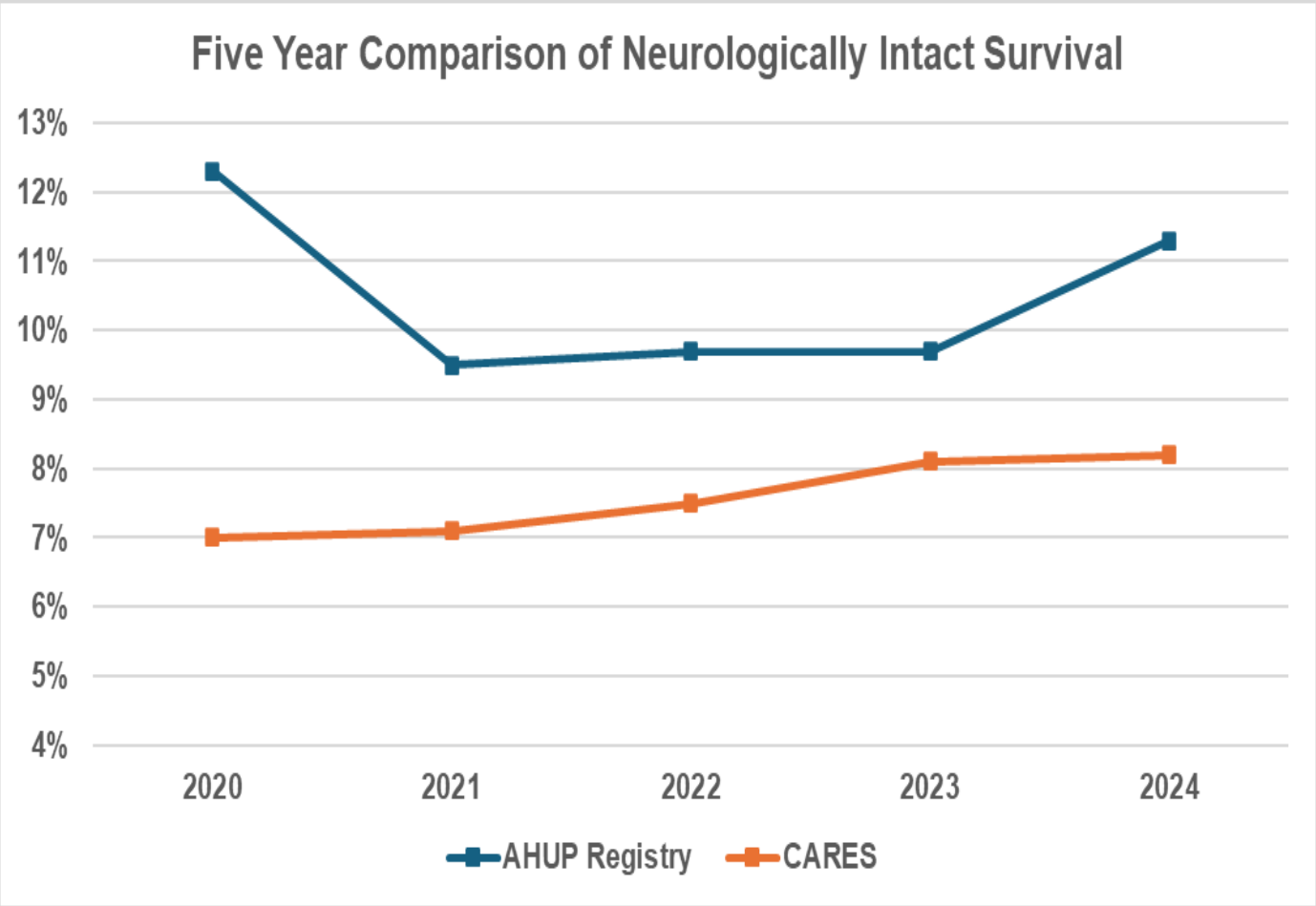
Presented at the AHA Nov 2025

5-year comparison between CARES vs Head Up registries



HD=hospital discharge
FN=favorable neurological survival

Trends?


Five Year Comparison of Neurologically Intact Survival
13%
12%
11%
10%
9%
8%
7%
6%
5%
4%
2020
2021
2022
2023
2024
AHUP Registry
CARES

Are We Through with CPC2? Neuroprotective CPR & Improved Survival from Out-Of-Hospital Cardiac Arrest

Jeffrey M. Goodloe, MD, NRP, FACEP, FAEMS

Chief Medical Officer

EMS System for Metropolitan Oklahoma City and Tulsa

Professor & EMS Section Chief

University of Oklahoma School of Community Medicine

Medical Director - Oklahoma Highway Patrol

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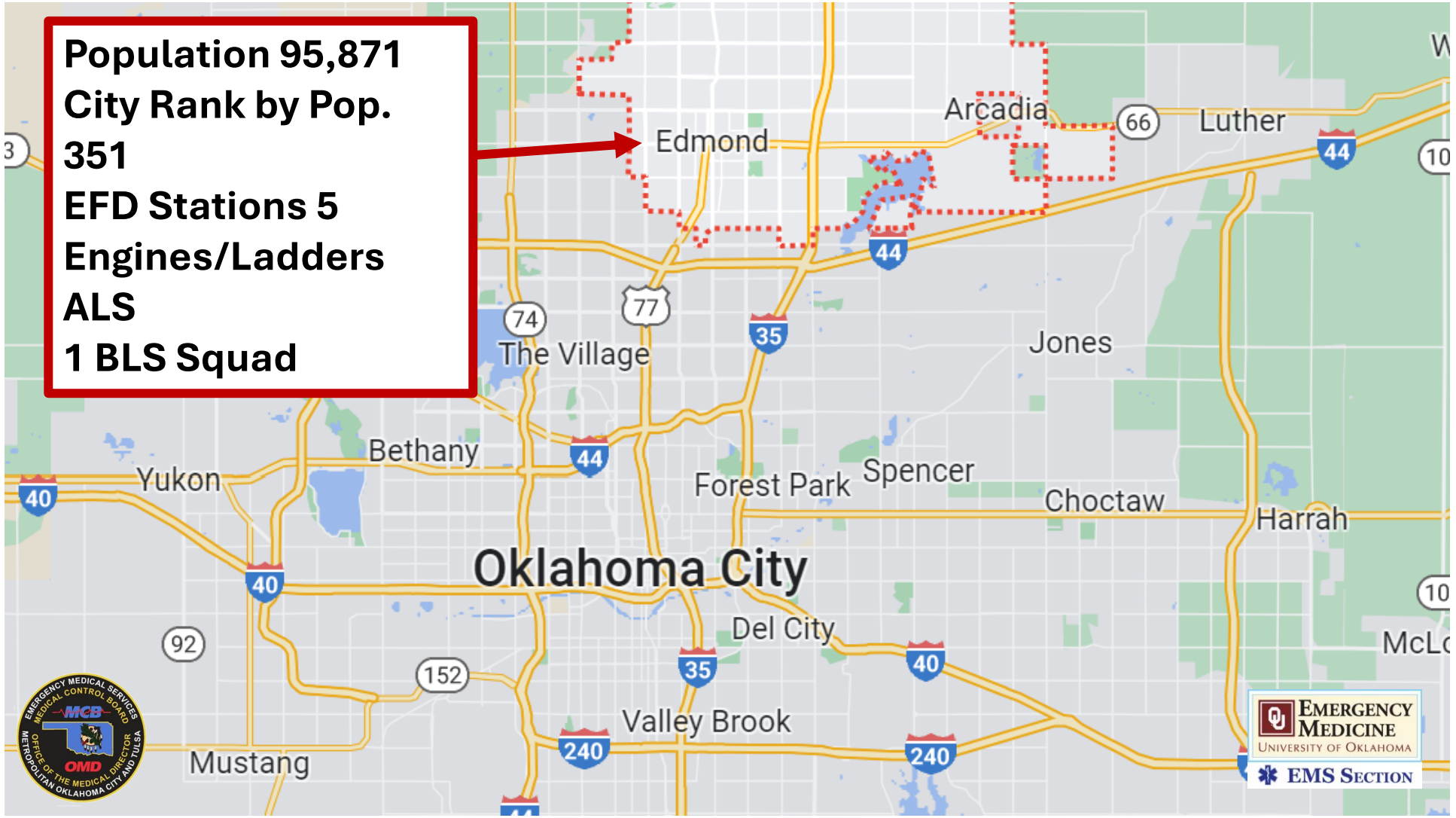
Population 95,871
City Rank by Pop.
351
EFD Stations 5
Engines/Ladders
ALS
1 BLS Squad
Edmond
Arcadia
Luther
The Village
Jones
Bethany
Yukon
Forest Park
Spencer
Choctaw
Harrah
Oklahoma City
Del City
Valley Brook
Mustang
McL
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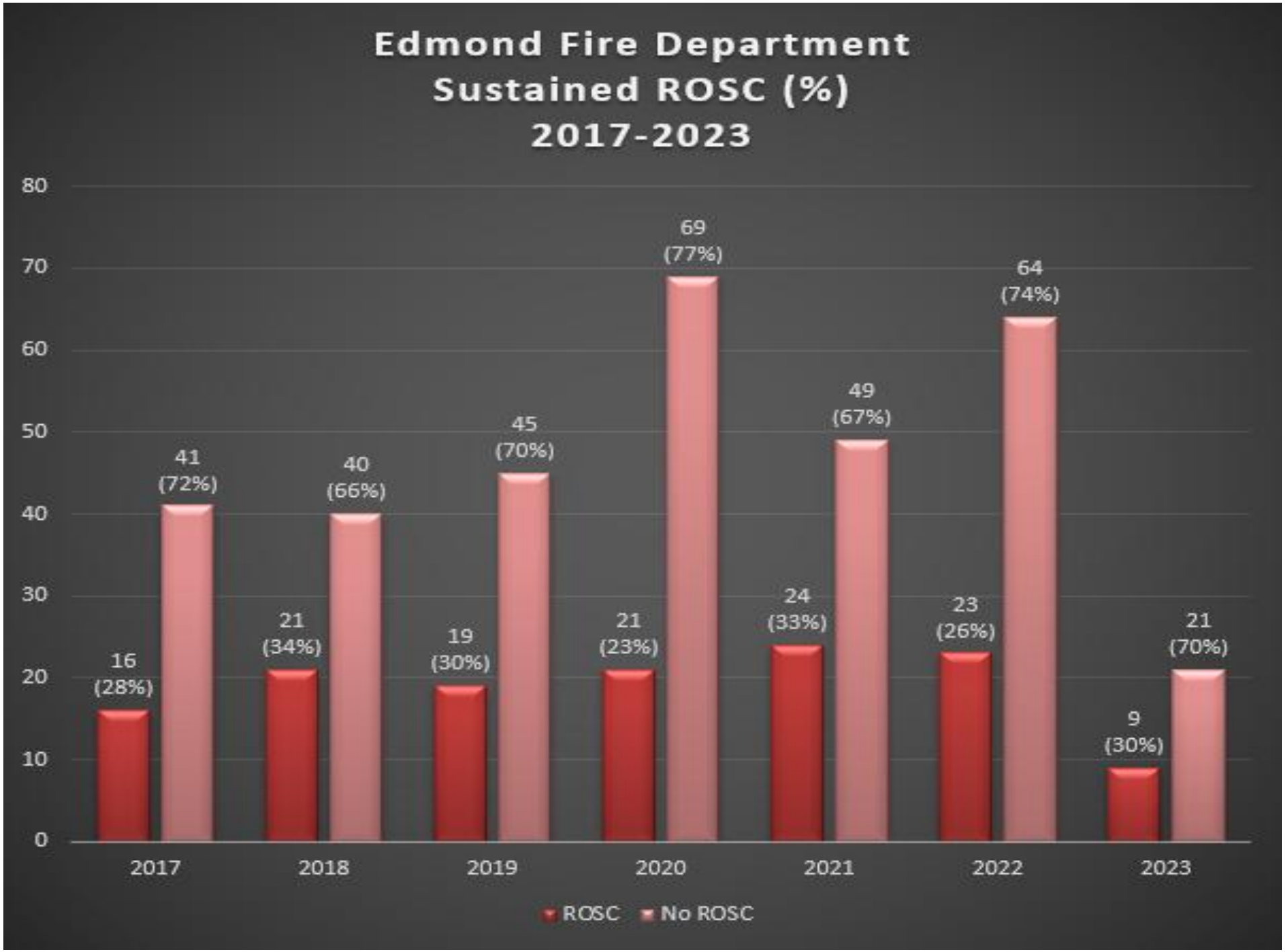
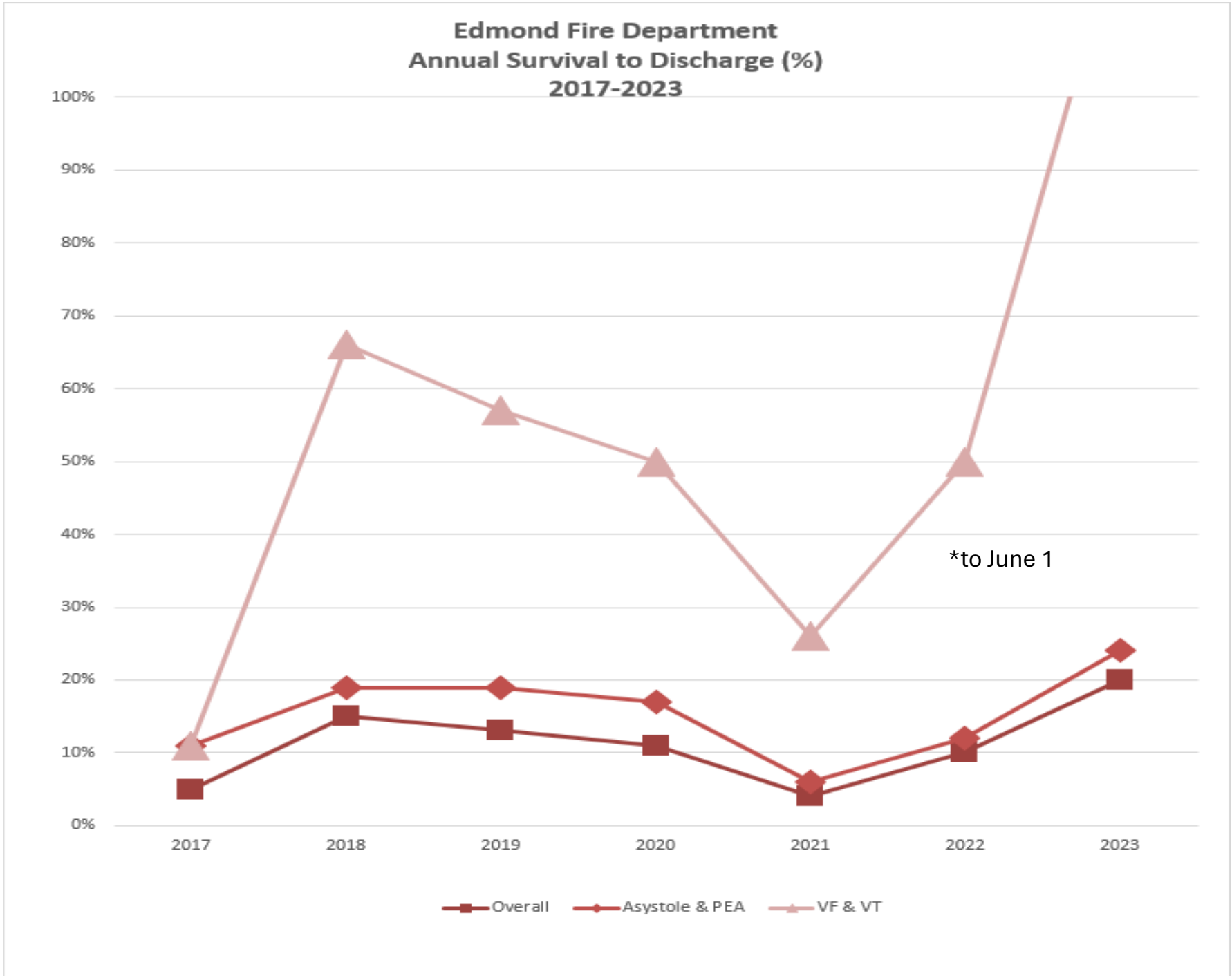
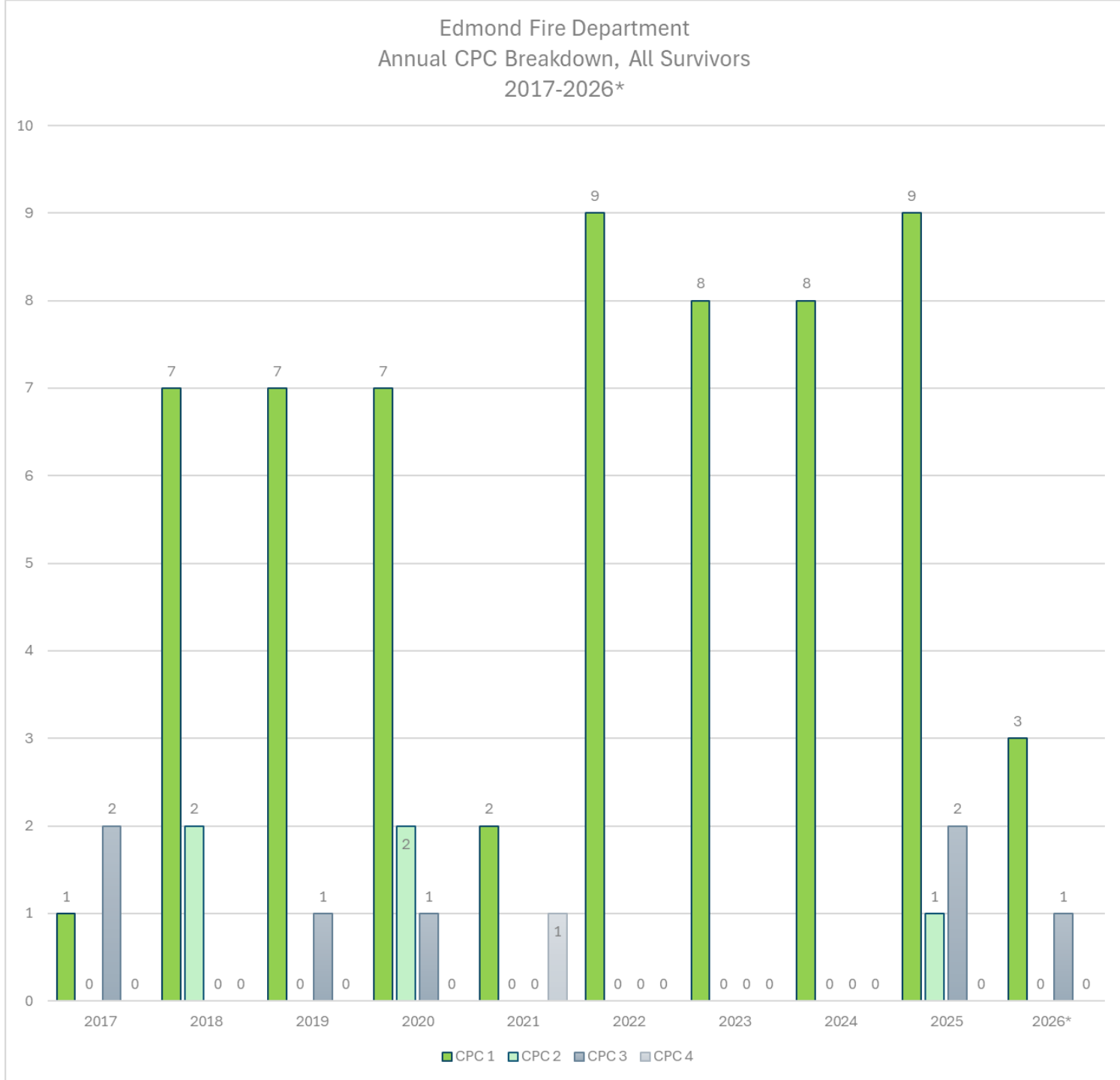

Edmond Fire Department
Sustained ROSC (%)
2017-2023
80
70
60
50
40
30
20
10
0
16 (28%)
41 (72%)
21 (34%)
40 (66%)
19 (30%)
45 (70%)
21 (23%)
69 (77%)
24 (33%)
49 (67%)
23 (26%)
64 (74%)
9 (30%)
21 (70%)
2017
2018
2019
2020
2021
2022
2023
ROSC
No ROSC


Edmond Fire Department
Annual Survival to Discharge (%)
2017-2023
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
2017
2018
2019
2020
2021
2022
2023
*to June 1
Overall
Asystole & PEA
VF & VT


Edmond Fire Department
Annual CPC Breakdown, All Survivors
2017-2026*
10
9
8
7
6
5
4
3
2
1
0
2017: 1, 0, 2, 0
2018: 7, 2, 0, 0
2019: 7, 0, 1, 0
2020: 7, 2, 1, 0
2021: 2, 0, 0, 1
2022: 9, 0, 0, 0
2023: 8, 0, 0, 0
2024: 8, 0, 0, 0
2025: 9, 1, 2, 0
2026*: 3, 0, 1, 0
CPC 1
CPC 2
CPC 3
CPC 4

CY2025 Metro OKC & Tulsa

Witnessed, bystander CPR, VF on arrival = “Utstein”

42%

N=21

CPC1 = 100%

What about all the others?

- 1559 OOHCA resuscitations in 2025
- Survival from all variables:

N=102

CPC1 or CPC2 = 88%

EMERGENCY MEDICAL SERVICES MEDICAL CONTROL BOARD
MCB
OMD
OFFICE OF THE MEDICAL DIRECTOR METROPOLITAN OKLAHOMA CITY AND TULSA

TULSA FIRE DEPARTMENT
PROTECTING LIFE, HEALTH, PROPERTY & ENVIRONMENT
EST. 1900

FIRE RESCUE EMS
OKC
EST 1889

EMERGENCY MEDICINE
UNIVERSITY OF OKLAHOMA
EMS SECTION

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