Connecting EMS, Hospitals, and Community

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Presenter Disclosure Information

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Community, Hospital, EMS in Cardiac Arrest

FINANCIAL DISCLOSURE:
No relevant financial relationship exists

Effective Cardiac Arrest Care…

…is a SYSTEM of treatment

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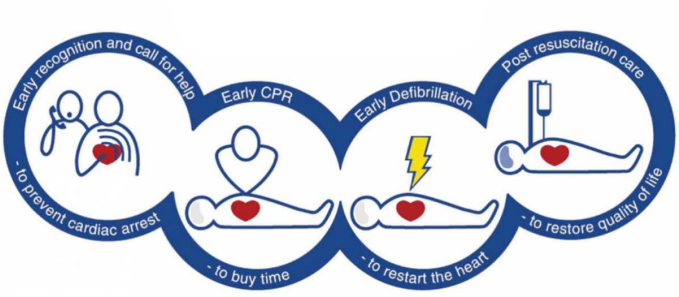
…is a SYSTEM of treatment



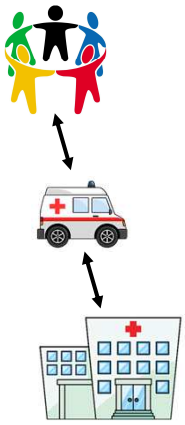
Goal

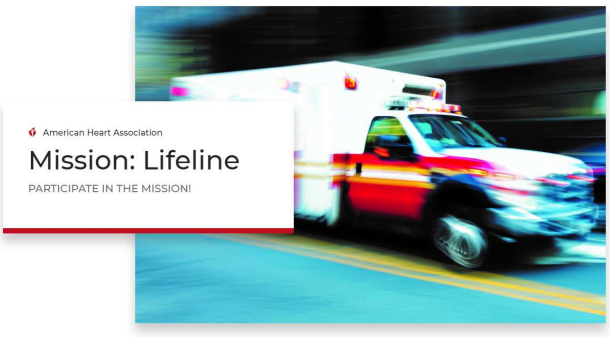
Interconnect:

Community

EMS

Hospital





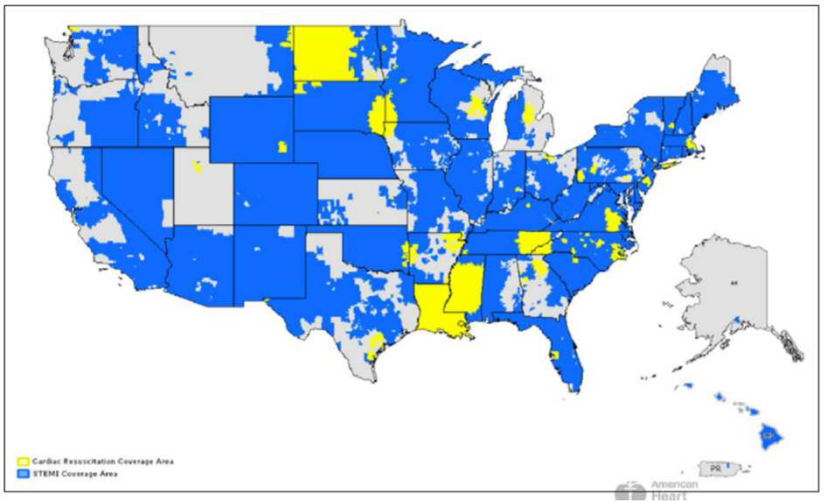
"Cardiac Resuscitation Center?"

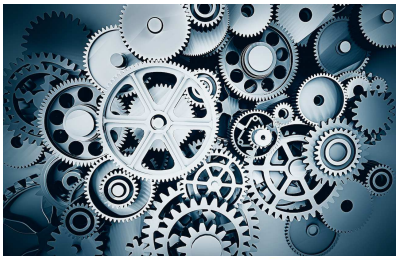
Insufficient resources for acute cardiac care

No true way to define a "center"

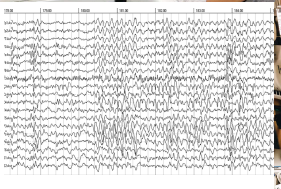
Experts aligned OHCA care with STEMI care

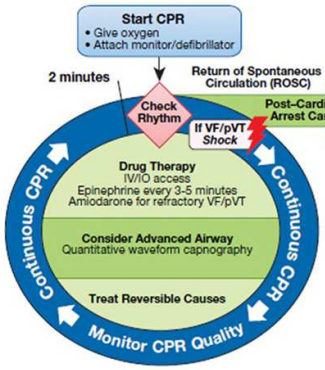
OHCA → transport to 25/7 PCI Facility


Cardiac Resuscitation Coverage Area
STEMI Coverage Area
American Heart




ConFig
80
119/79
29/14
97
40
97/73 (79)




Start CPR
• Give oxygen
• Attach monitor/defibrillator
2 minutes
Return of Spontaneous Circulation (ROSC)
Check Rhythm
If VF/pVT
Shock
Post–Cardiac Arrest Care
Drug Therapy
IV/IO access
Epinephrine every 3-5 minutes
Amiodarone for refractory VF/pVT
Consider Advanced Airway
Quantitative waveform capnography
Treat Reversible Causes
Continuous CPR
Continuous CPR
Monitor CPR Quality

So, what to do after ROSC?

Think about:

- Transport to Resuscitation Center
- Components of Specialized Care

Resuscitation Centers

LEVEL 1 (RECEIVING)

Ideal STEMI receiving center (24/7 PCI)
Work with EMS/Referral centers to develop plan
Initiate hypothermia asap when indicated
Universal 24 h/d, 7d/w acceptance w/o diversion
Cardiology + OTHERS involvement asap
Defer neuro prognostication for 72 hrs
Assess ICD need, placement, follow-up
Treat simultaneous patients
Treat re-arrest

LEVEL 2 (REFERRING)

Ideal STEMI referring center (no 24/7 PPCI)
Maintain plans with EMS to ensure priority transfer
Initiate hypothermia asap when indicated
Transfer ROSC within 120 minutes door-to-device
Treat re-arrest

Local Implementation

LA County

- Already had Regionalized STEMI System
- → transport OHCA with shockable rhythm to STEMI Center
- → therapeutic hypothermia

- This in addition to bystander CPR, early defibrillation access, prolonged field resus efforts

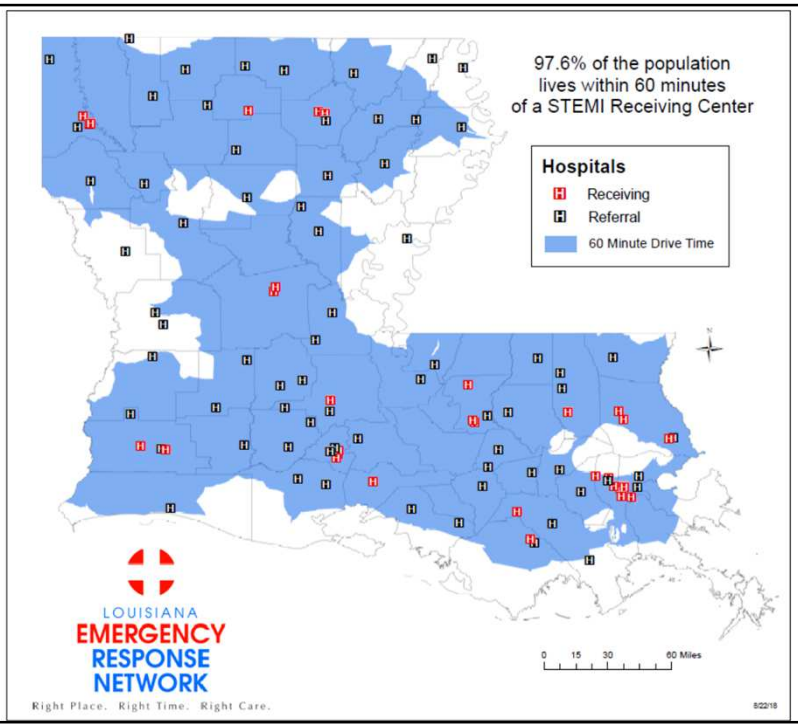
- Improved CPC 1 or 2 from 6% to 40%

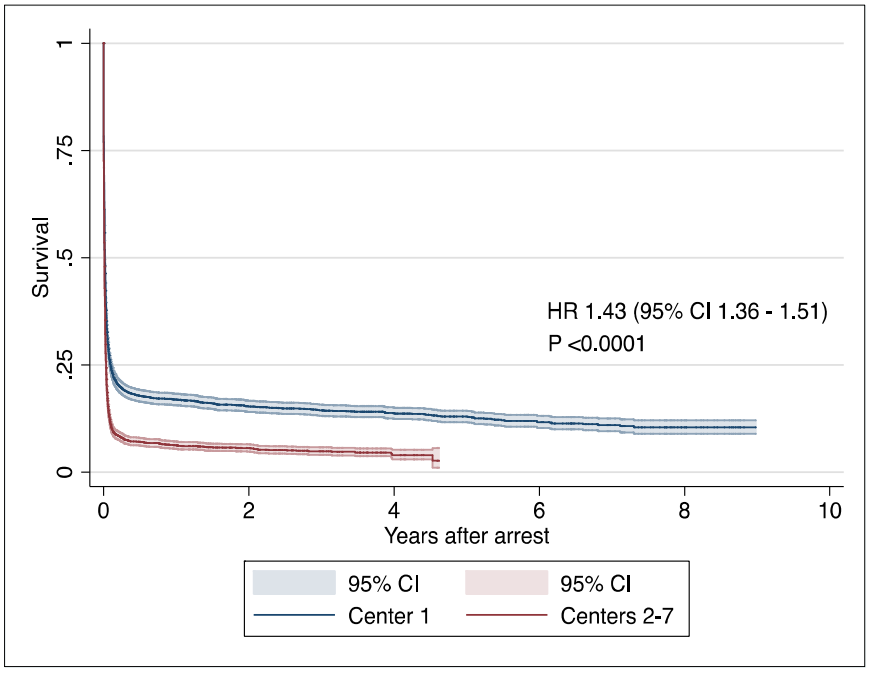
Statewide Implementation

Arizona, 2007

- State Recognized Cardiac Arrest Receiving Centers
- Focus on therapeutic hypothermia, emergency PCI, delayed prognostication of neuro status
- EMS bypass protocol for OHCA + ROSC → nearest center

Overall Survival= 21.4% → 39.2%
CPC 1 or 2= 19.4% → 29.8%





Elmer JP, et al Resuscitation 2016 (in press)

Components of Specialized Care

Targeted Temperature Management

- Goal has been between 32 ˚C and 36 ˚C
- No superiority between 33 ˚C and 36 ˚C
- < 32 ˚C is bad
- Hyperthermia is bad

- Now:

36 ˚C for 24 hours in uncomplicated/moderate coma (with some motor response), no malignant EEG patterns, cerebral edema on CT scan

32 ˚C for 24 hours with deep coma (no motor or brainstem response), malignant EEG patterns, CT suggestive of edema

Components of Specialized Care

Access to PCI

- 70% OHCA patients have CAD
- Up to 50% have coronary occlusion
  - Even though many without ST-elevations on EKG

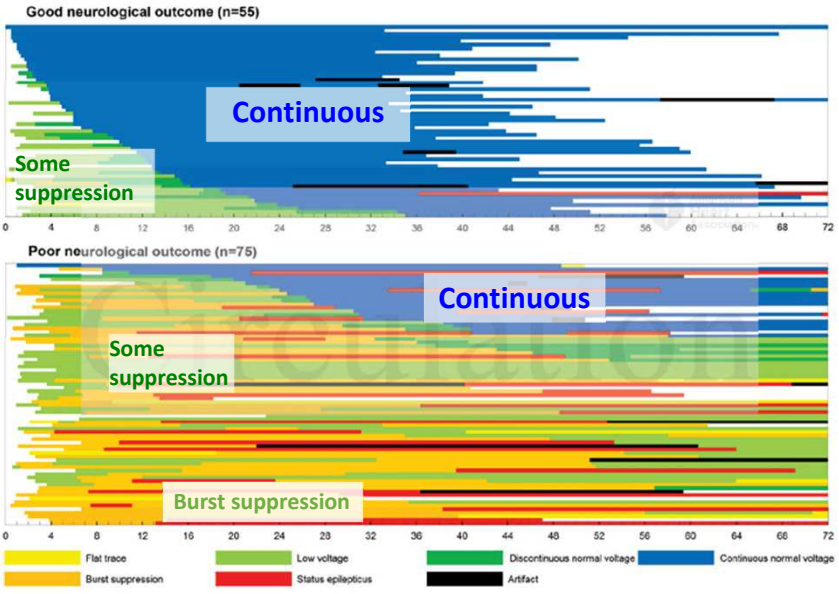
- Challenge:
  - STEMI metrics, doctors, hospitals want good outcomes
  - OHCA-ROSC patient is already a challenge and may need PCI, but less guarantee for good outcome

Need to secure recommendations for appropriate use and outcomes reporting of PCI in the OHCA-ROSC patient

Components of Specialized Care

Prognostication and Neuro Critical Care

- Wait
  - 72 hours after return to normothermia if TTM
  - 72 hours after ROSC if no TTM
  - Avoid premature conclusions or withdrawal of care
- Continuous EEG monitoring
  - Prognosis
  - Treat seizures
  - Monitor and help the Brain
- Sedation
  - Propofol + Fentanyl
  - Midazolam
  - Dexmedetomindine



Oh, et al. *Circ*. (2015)

In the Field

Target End-tidal CO2 around 35-45

- Avoid hyperventilation
- Decreases CO2 → cerebral vasoconstriction → damage

Ensure adequate oxygenation

- SpO2 greater than 94%
  - Hypoxia → damage
- Avoid 100% or hyperoxia → damage

In the Field

Hypotension or Hypoperfusion = BAD → damage

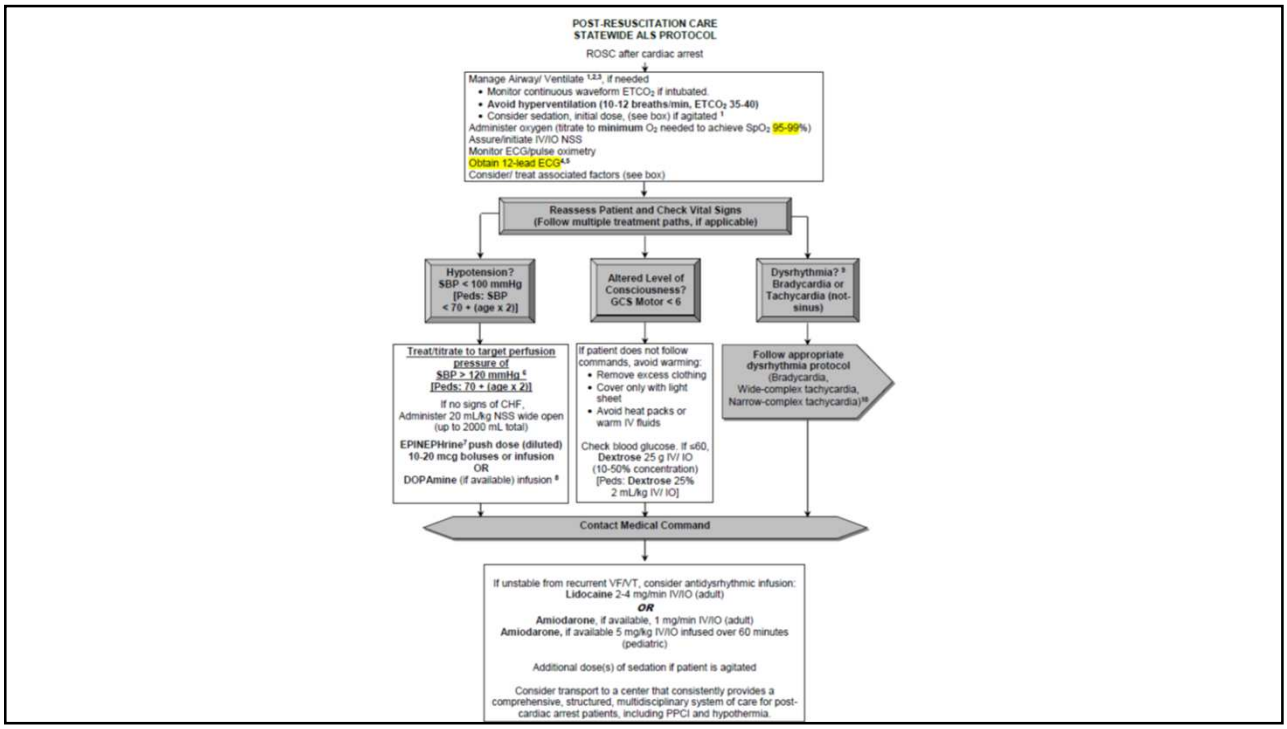
Goal Mean Aterial Pressure (MAP) above 65 mmHg

Prefer 80-100 mmHg to maximize cerebral perfusion

IV Fluids as needed

Vasopressors as needed (Norepinephrine and Epinephrine)

- Dopamine



Key Post Arrest Interventions:

Intervention	Performed	Comment
Airway Secured	N/A	No advanced airway – pt combative
2 EtCO2 readings documented	N/A	
2 Blood Pressures documented	YES	90 & 90/SYS
Fluid Bolus	NO	
Epinephrine Drip	NO	
12 Lead EKG	YES	STEMI
Glucose	NO	

Future Concepts…

…SYSTEMS AND TECHNOLOGY

The future of EMS and Acute Care…

…It will entail more **integrated or regionalized** systems of care in a variety of ways

The future of EMS and Acute Care…

… **integrated** **or** **regionalized** systems of care

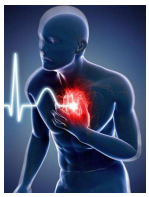
American Heart Association
American Stroke Association
CERTIFIED
Meets standards for
Primary Stroke Center

The future of EMS and Acute Care…

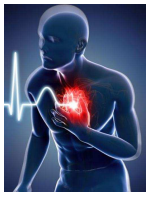
… **integrated** **or** **regionalized** systems of care

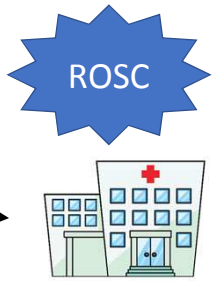
American Heart Association
American Stroke Association
CERTIFICATION
Meets standards for
Comprehensive Stroke Center

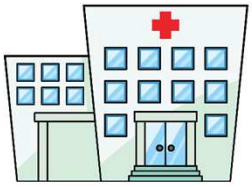
Regionalized Systems of Care



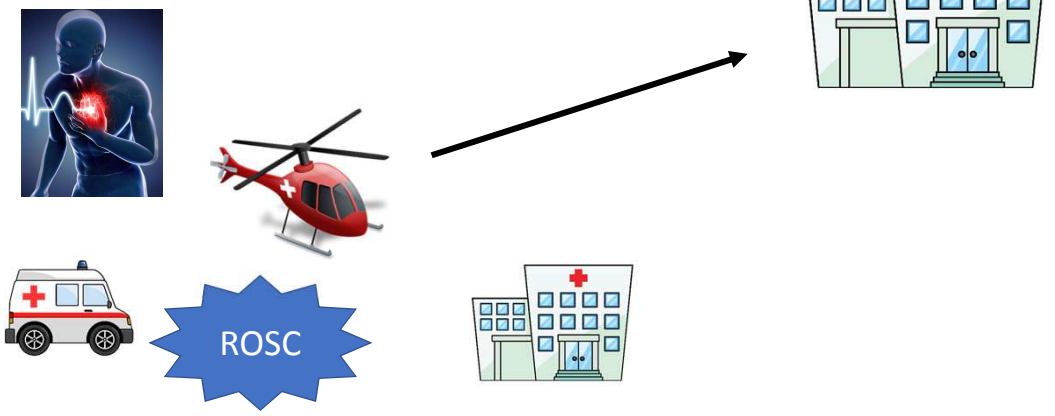
Regionalized Systems of Care



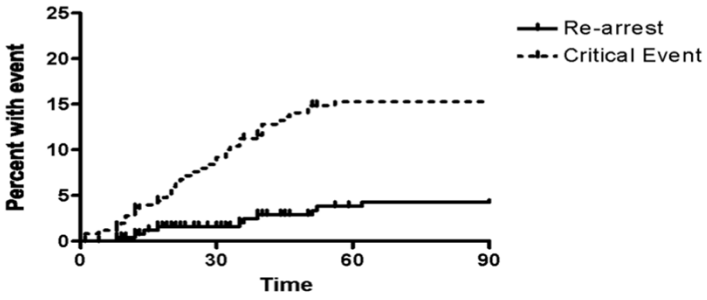




Regionalized Systems of Care



Safe to transport?



Included (n=248)
- Cardiac (n-231)
- Overdose (n=15)
- Airway Obstruction (n=2)

Re-Arrest Enroute (n=15) (6%)	Critical Event (N=58) (24%)	No Event Enroute (n=175) (71%)

Hartke 2010; Resuscitation 81(8):938-42

ECPR for Out of Hospital Cardiac Arrest

Emergency Cardio-Pulmonary Bypass (ECPB)

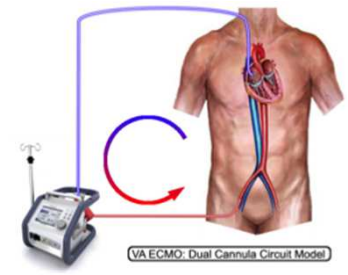
- Extra-Corporeal Life Support (ECLS)
  - Veno-Arterial Extracorporeal Membrane Oxygenation (VA-ECMO)
- **Extra-Corporeal CPR (ECPR or eCPR) = CPR + ECLS until ROSC or circuit on**

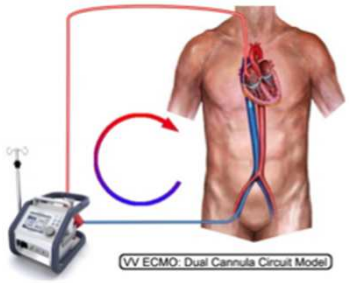
NOT:

- Veno-Venous Extra-Corporeal Membrane Oxygenation (VV-ECMO)

Basic Concept

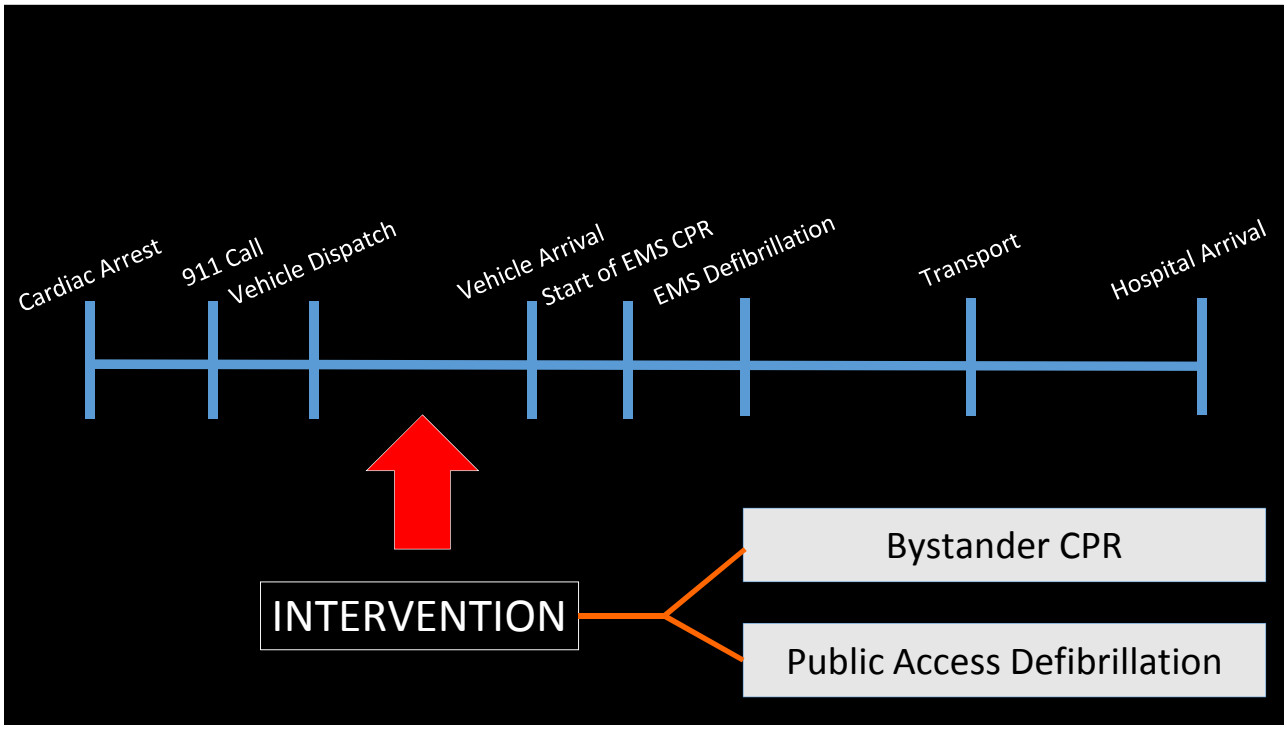
- **Veno-Arterial (VA)**
  - blood drawn from venous system
  - returned to arterial system
  - CARDIAC & PULMONARY support
  - central or peripheral cannulation
- **Veno-Venous (VV)**
  - blood drawn from venous system
  - returned to venous system
  - PULMONARY support only





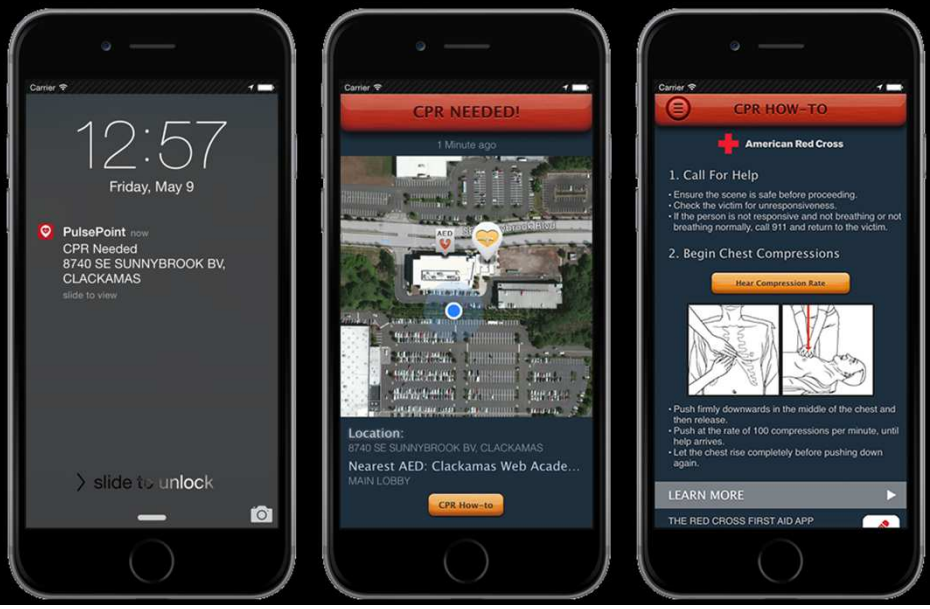
University of Pittsburgh & Pittsburgh EMS Prehospital ECPR Checklist:

[ ] Witnessed arrest
[ ] Bystander CPR
[ ] Age ≥ 18 and ≤60
[ ] Initial shockable rhythm or PEA rate > 20 bpm
[ ] Good functional status prior to arrest (patient living independently and not from a skilled nursing facility/ LTAC and no prior neurocognitive dysfunction)
[ ] No signs of irreversible organ dysfunction (such as COPD on home O2, stigmata of liver cirrhosis or ESRD such as AV fistula or terminal cancer)
[ ] No morbid obesity (Morbid obesity defined as inability to fit into LUCAS device and/or abdominal pannus overhanging inguinal crease)
[ ] End tidal CO2 >10 mmHg with CPR
[ ] Expected time from collapse to ED arrival <= 30 mins

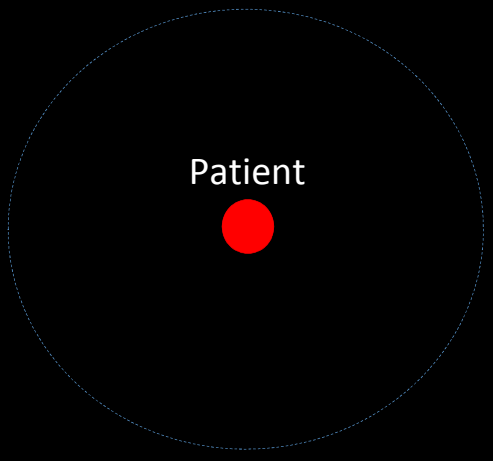

Cardiac Arrest
911 Call
Vehicle Dispatch
Vehicle Arrival
Start of EMS CPR
EMS Defibrillation
Transport
Hospital Arrival
INTERVENTION
Bystander CPR
Public Access Defibrillation


?
01:00
02:30
07:30
09:15
PSAP
Dispatch
Turnout
Travel
01:00
01:30
05:00
01:45

PulsePoint

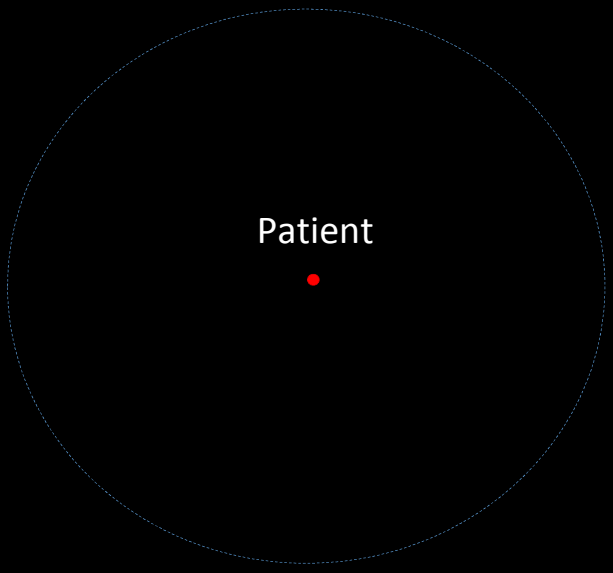


Standard Bystander CPR

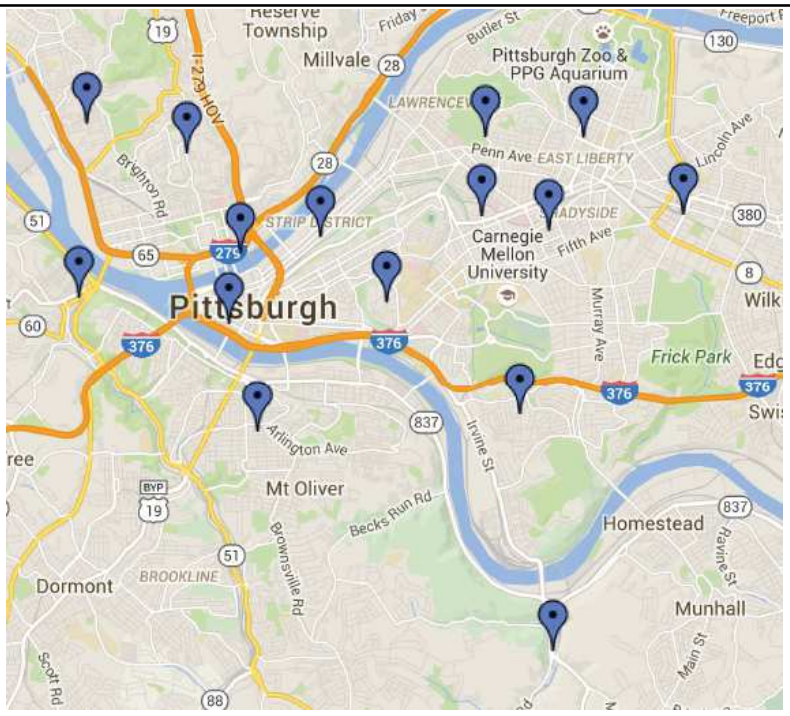


Effective Radius:
Shouting Distance

Dispatch-Connected Bystander CPR



Effective Radius:
Walking Distance




Township
Fox Chapel
Reserve Township
Kees Rocks
Pittsburgh
Wilkinsburg
Green Tree
Homestead
Munhall
Dorm
279
65
28
8
130
51
837
121
19


Map
Satellite
Responder6190
Google

Let's Connect

EMS, Hospitals, Community

Layperson CPR + AED → legislation → CPR in Schools →
911 instructions → real-time location data →
EMS response → high-quality care →
destination protocols → network of appropriate
referral and receiving hospitals →
specialization, QI, data and outcomes measurement

= SYSTEM