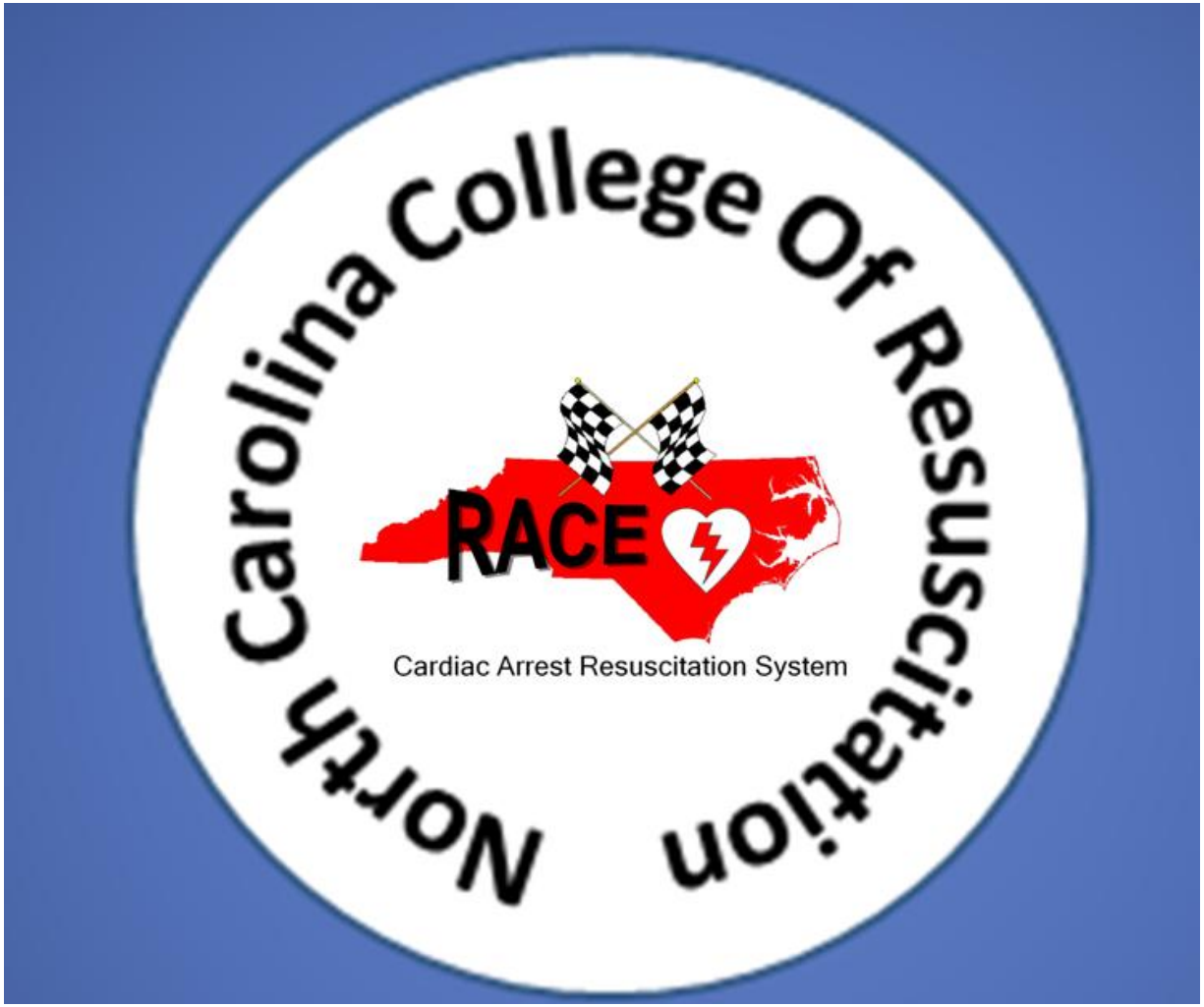
MODULE 7


North Carolina College Of Resuscitation
RACE
Cardiac Arrest Resuscitation System

On-Scene Resuscitation

Brent Myers, MD MPH

Director | Medical Director

Wake County EMS, Raleigh, NC

Plan For Discussion:

- Rationale for EMS Providers
- On-Scene Resuscitation
- Choreography
- Check lists
- Conclusions

“The Most Powerful Predictor by far of survival to hospital discharge is return of spontaneous circulation in the field”

Kellerman A. Annals Emerg Med 2010;56:358-61

Transport for Continued Resuscitation?

- Evidence suggests survival is 10 to 35 times more likely if ROSC is achieved in the field
- Unless patients are going to be taken to the cardiac cath lab intra-arrest or placed on ECMO, it is unclear what (if any) treatment advantage is conferred by in-hospital vs. pre-hospital treatment of medical arrest

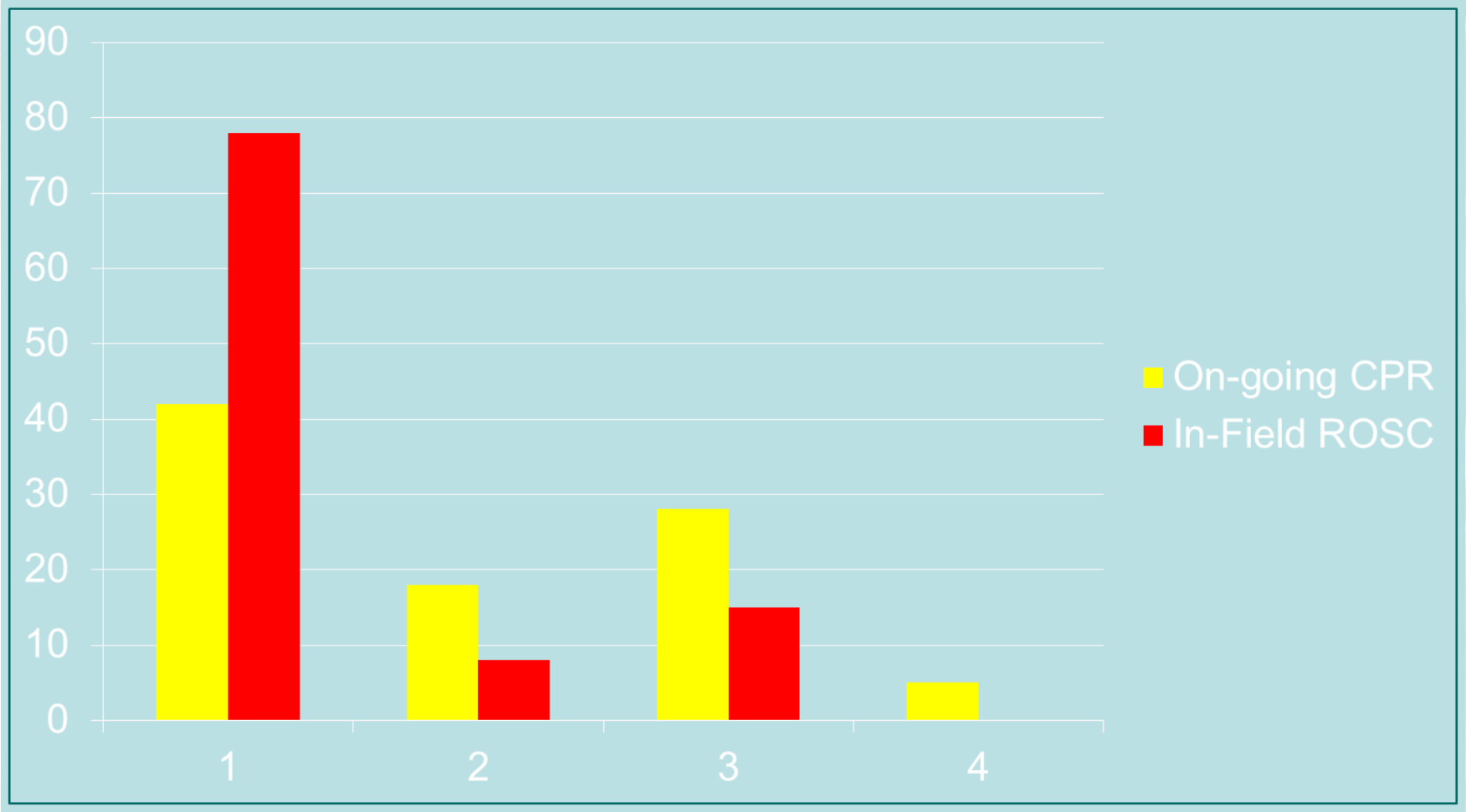
Transport for Continued Resuscitation?

- Dismal survival rates for patients with on-going CPR on arrival to emergency department
  - Lewis L et al demonstrated a zero percent neurologic-intact survival rate except for patients who suffered arrest during transport.
    - American J of Emerg Med 1990;8(2):118-120

Transport for Continued Resuscitation?

- Dismal survival rates for patients with on-going CPR on arrival to emergency department
  - Herlitz J et al. demonstrated a 6% admission rate, a 1.2% survival to discharge rate, with 43% of survivors suffering significant neurologic impairment for such patients
    - Resuscitation 1997;33(3):223-231

CPC Scores for Survivors:



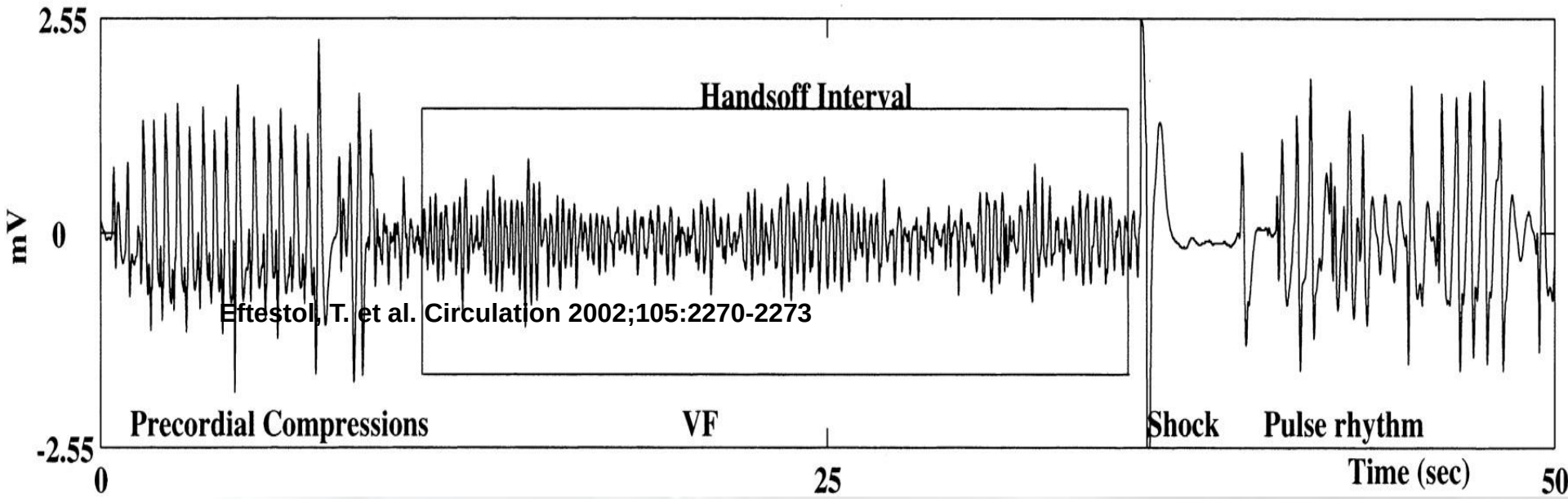
Transport for Continued Resuscitation?

- Evidence suggests survival is 10 to 35 times more likely if ROSC is achieved in the field
- Unless patients are going to be taken to the cardiac cath lab intra-arrest, it is unclear what (if any) treatment advantage is conferred by in-hospital vs. pre-hospital treatment of medical arrest

Because of the difficulty in providing effective chest compressions while moving the patient during CPR, the resuscitation should generally be conducted where the patient is found (Class IIa, LOE C). This may not be possible if the environment is dangerous.

Berg et al Circulation 2010;122:s685-705

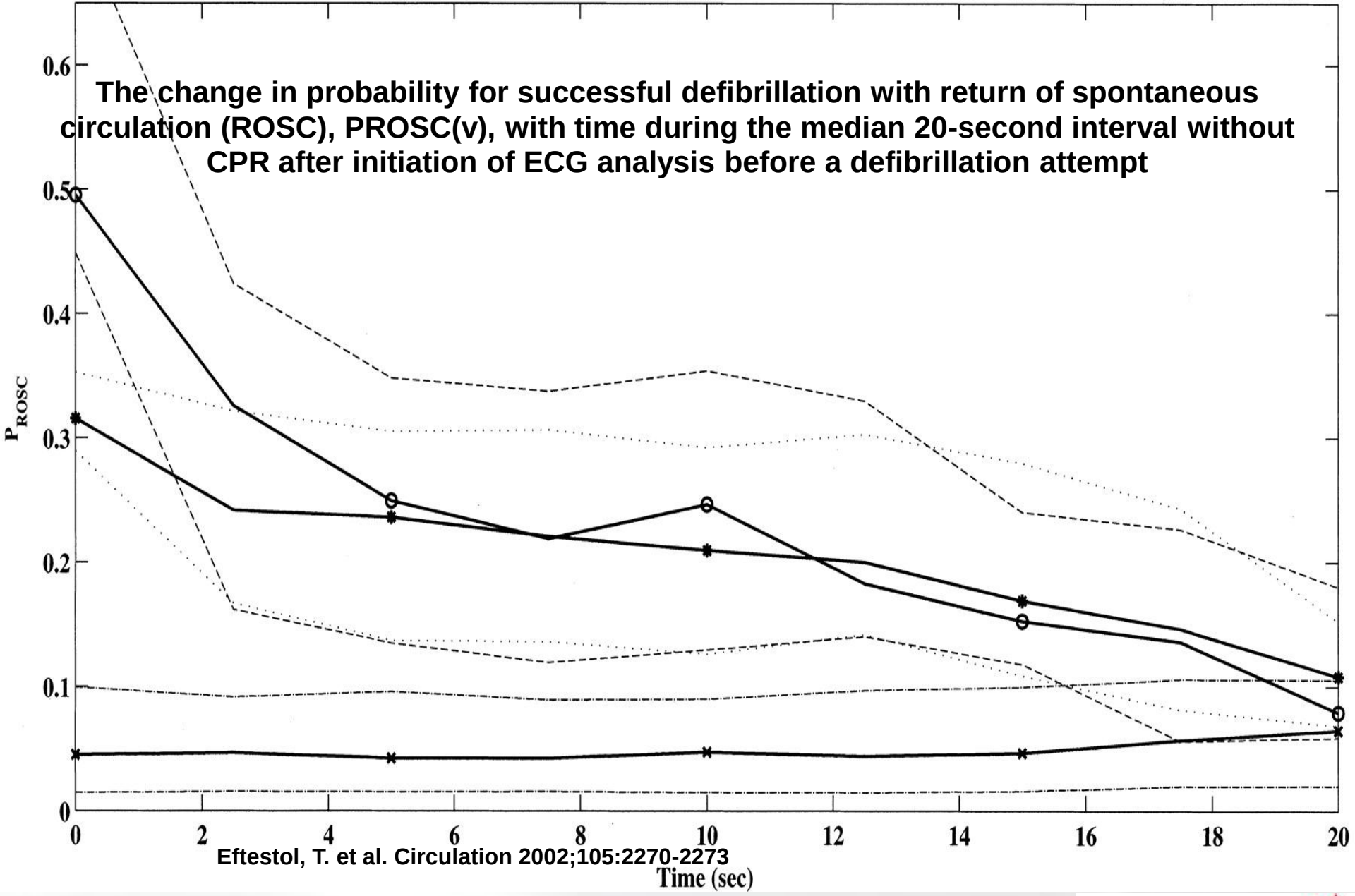
A 50-second ECG tracing illustrating VF with artifacts from precordial chest compressions, followed by a hands-off interval, a countershock, and return of spontaneous circulation (ROSC)



Eftestol, T. et al. Circulation 2002;105:2270-2273

Circulation

The change in probability for successful defibrillation with return of spontaneous circulation (ROSC), PROSC(v), with time during the median 20-second interval without CPR after initiation of ECG analysis before a defibrillation attempt



Eftestol, T. et al. Circulation 2002;105:2270-2273

Circulation

Resuscitation Outcomes Consortium (ROC):

Regional Variation in Out-of-Hospital Cardiac Arrest Incidence and Outcome

Graham Nichol, MD, MPH
Elizabeth Thomas, MSc
Clifton W. Callaway, MD, PhD
Jerris Hedges, MD, MS
Judy L. Powell, BSN
Tom P. Aufderheide, MD
Tom Rea, MD
Robert Lowe, MD, MPH
Todd Brown, MD
John Dreyer, MD
Dan Davis, MD
Ahamed Idris, MD
Ian Stiell, MD, MSc

Context The health and policy implications of regional variation in incidence and outcome of out-of-hospital cardiac arrest remain to be determined.

Objective To evaluate whether cardiac arrest incidence and outcome differ across geographic regions.

Design, Setting, and Patients Prospective observational study (the Resuscitation Outcomes Consortium) of all out-of-hospital cardiac arrests in 10 North American sites (8 US and 2 Canadian) from May 1, 2006, to April 30, 2007, followed up to hospital discharge, and including data available as of June 28, 2008. Cases (aged 0-108 years) were assessed by organized emergency medical services (EMS) personnel, did not have traumatic injury, and received attempts at external defibrillation or chest compressions or resuscitation was not attempted. Census data were used to determine rates adjusted for age and sex.

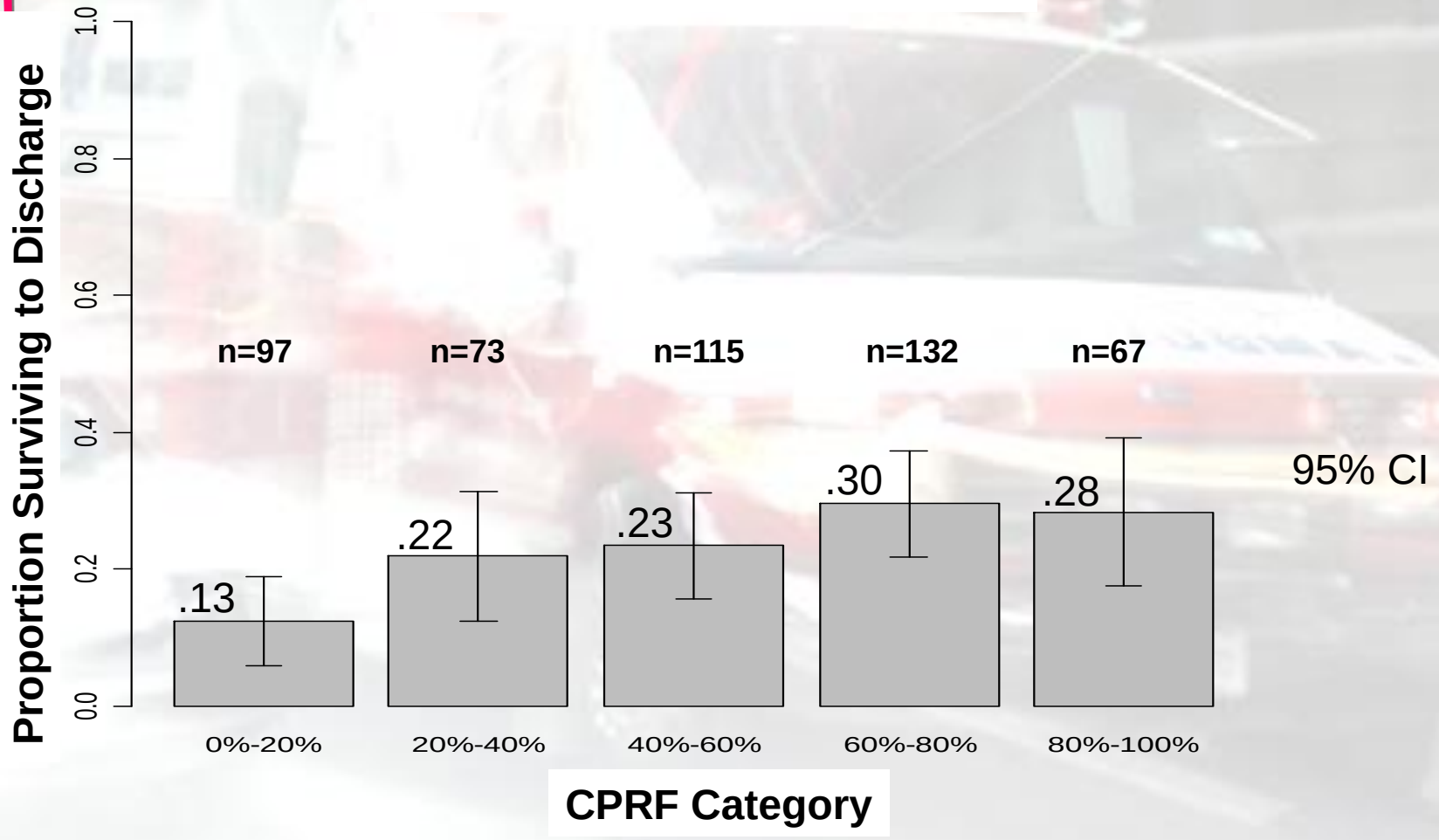
Main Outcome Measures Incidence rate, mortality rate, case-fatality rate, and survival to discharge for patients assessed or treated by EMS personnel or with an initial rhythm of ventricular fibrillation.

Results Among the 10 sites, the total catchment population was 21.4 million, and there

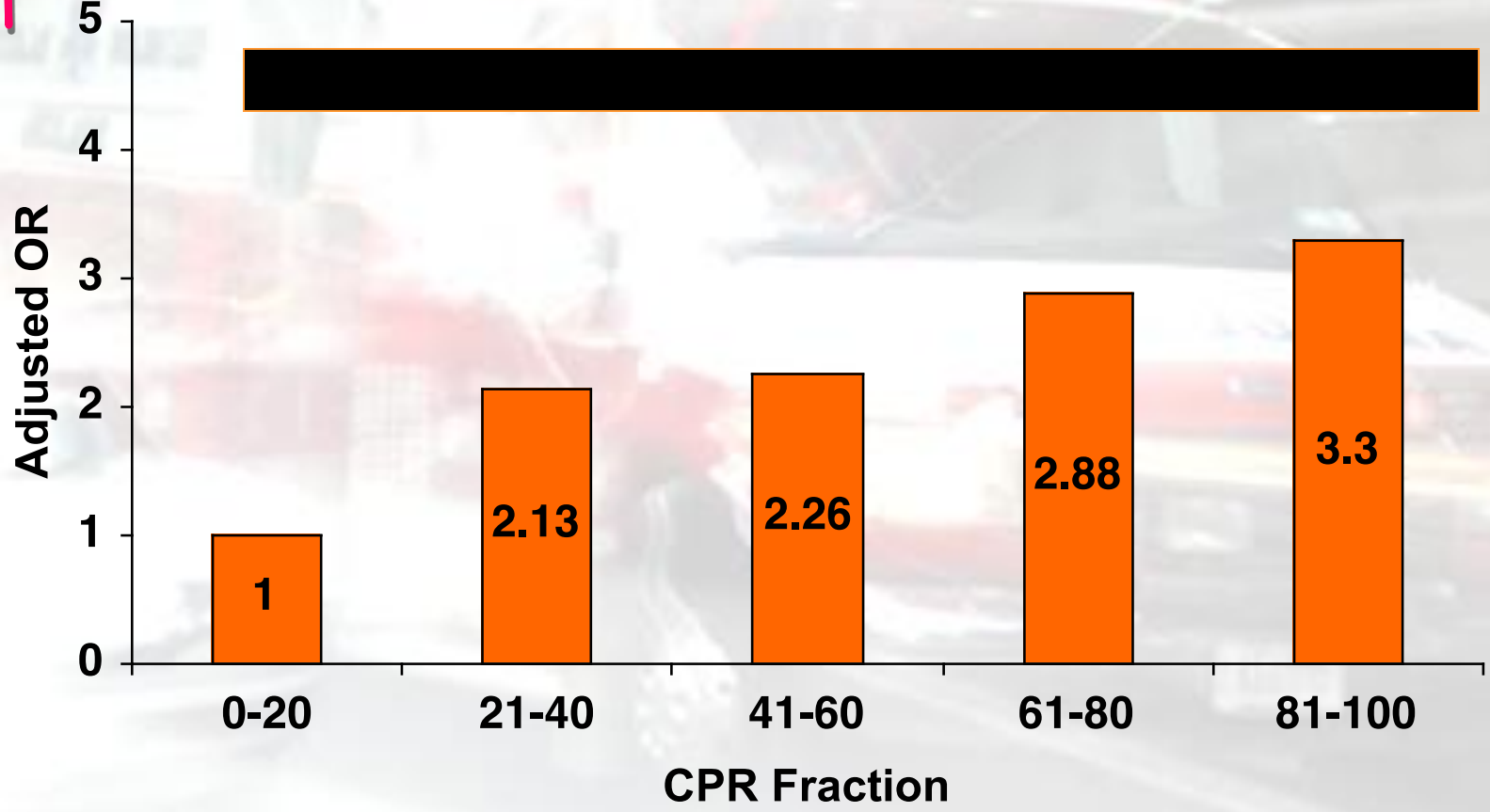
Median Survival 8.4% (3.0% - 16.3%)

VF Median Survival 22% (7.7% - 39.9%)

Resuscitation Outcomes Consortium (ROC) Results: Survival by CPRF Category



ROC: Adjusted Odds Ratio of Survival:



Adjusted for: bystander CPR, age, gender,
time from 911 call to arrive at scene, chest compression rate, public location

11. A Comparison of Chest Compression Quality Delivered During On-Scene and Transport Cardiopulmonary Resuscitation

Christopher S. Russi, Logan J. Kolb, Lucas A. Myers, Erik P. Hess, Roger D. White, *Mayo Clinic*

Prehospital Emergency Care 2011;15(1):106

Results (Pre-Feedback)

N = 108 % (25th, 75th)

Scene Correct Rate%

Median: 44.8 (9.54, 59.6)

Mean: 38.49 CI (33.2, 43.78)

Transport Correct Rate%

Median: 11.16 (5.83, 39.32)

Mean: 23.16 CI (18.35, 27.97)

Scene Correct Depth%

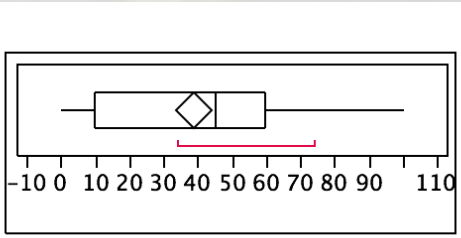
Median: 40.94 (15.96, 73.29)

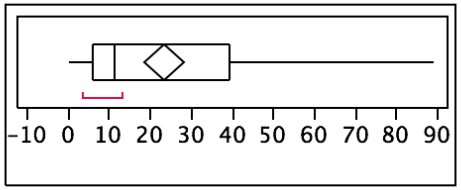
Mean: 45.06 CI (38.76, 51.37)

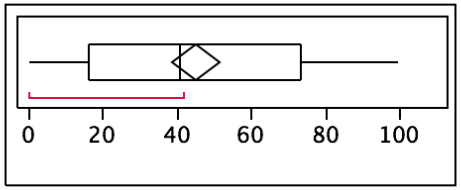
Transport Correct Depth%

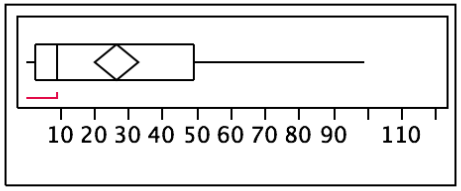
Median: 8.88 (2.62, 49.01)

Mean: 26.37 CI (20.12, 32.63)



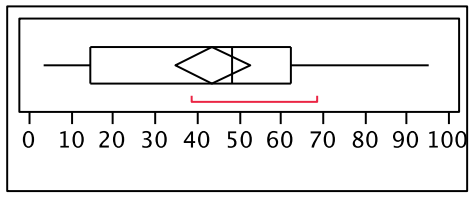






Results (Post-Feedback)

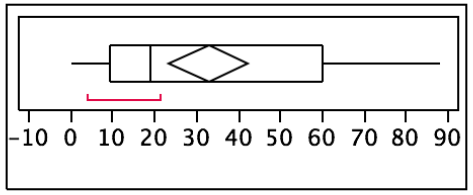
N = 35 % (25th, 75th)



Scene Correct Rate%

Median: 48.16 (14.68, 62.36)

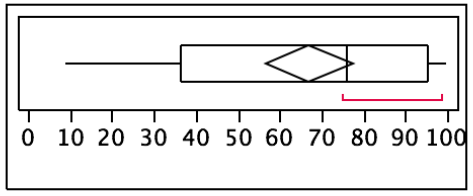
Mean: 43.6 CI (34.61, 52.59)



Transport Correct Rate%

Median: 19.0 (9.52, 60.22)

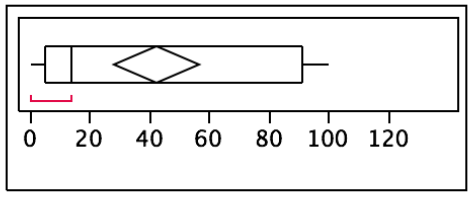
Mean: 32.78 CI (23.21, 42.33)



Scene Correct Depth%

Median: 75.73 (36.23, 95.07)

Mean: 66.86 CI (56.57, 77.16)



Transport Correct Depth%

Median: 14.0 (4.78, 90.78)

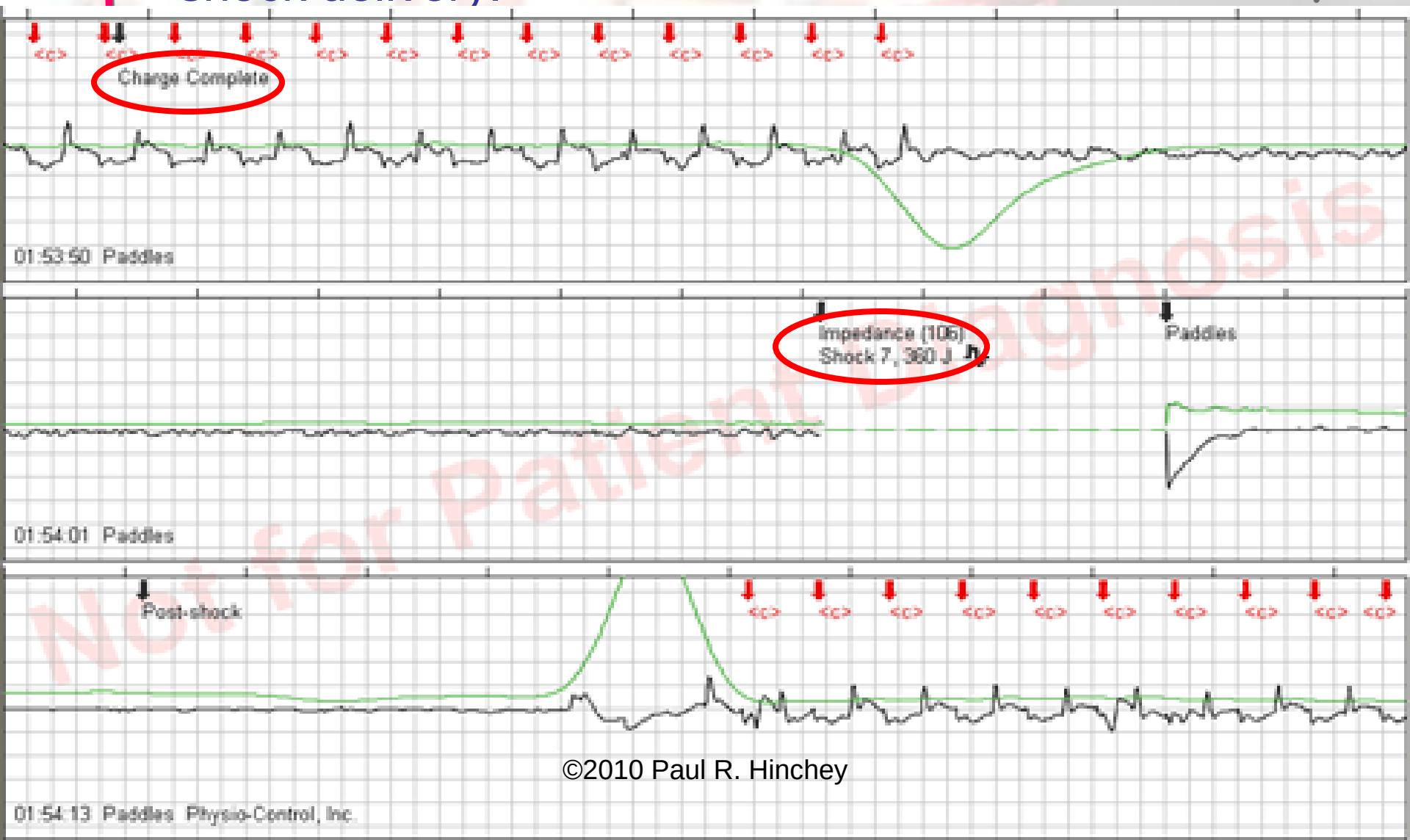
Mean: 42.04 CI (27.98, 56.11)

Task Interruptions:

- Airway interventions and IVs
- Ventilations
- Pulse checks
- Rhythm analysis
- Defibrillation
- Changing compressors
- Patient movement

We have limited awareness of task time in complex processes….so these interruptions should be engineered and choreographed to minimize their impact…..

>20 second pause for defibrillation. Appears that a ventilation was given before the compressions resumed. Compressions resume 10 seconds after shock delivery.



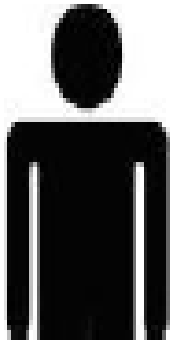
Pit Crew Model:

- Same name…many versions
- CPR
  - Maximize compression fraction
  - Effective compression(rate/depth)
  - Provider fatigue
- Controlled ventilations
- Defib
  - Pre-charge @1:45
  - Emphasis on Shock/Don’t’ shock

So we went to the simulation lab and now it’s ALL choreographed….

Person in Position 4 (P4) always just outside the "Triangle" of CPR

1. Team Leader Duties
2. May assist with BIAD preparation and securing If needed

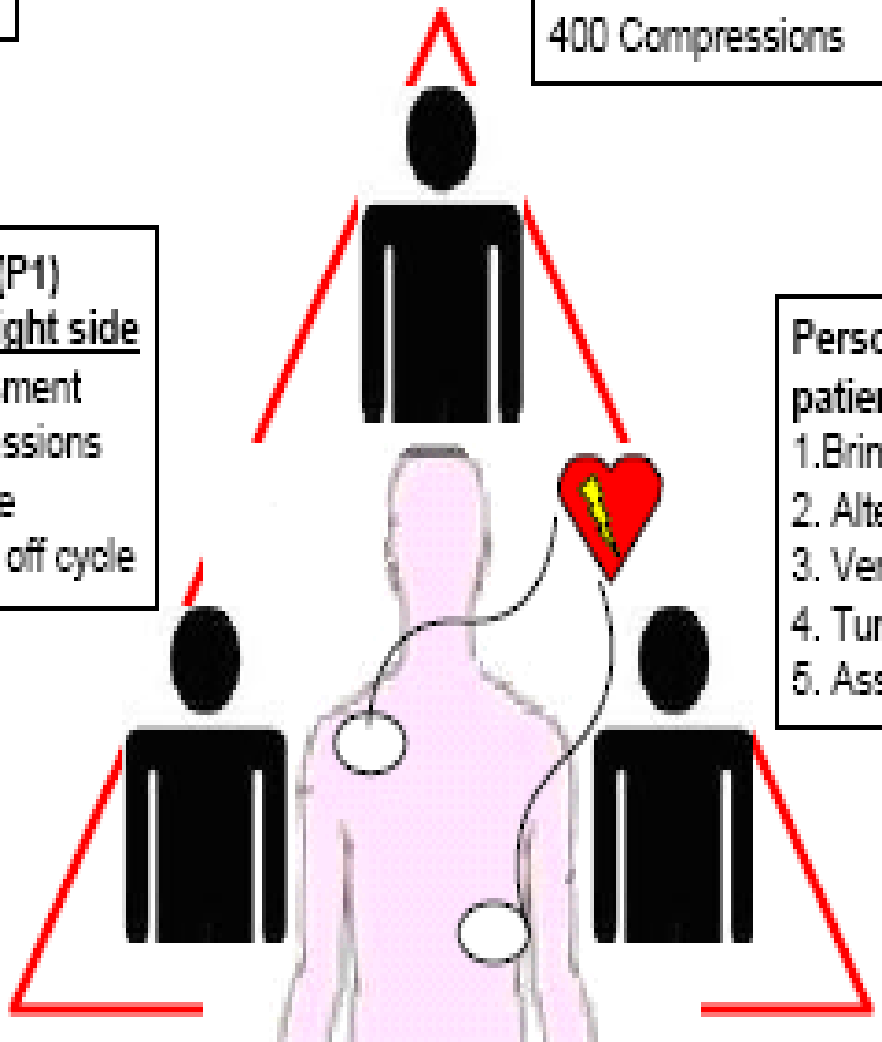


Person in Position 3 (P3) always at patients <u>Head</u>

1. Opens/clears Airway and insert OPA
2. Assembles/apply BVM and ITD
2. Provides 2 hand mask seal
3. Inserts/secures BIAD (King) & ITD & $ETCO_2$ after 400 Compressions

Person in Position 1 (P1) always on patients <u>Right side</u>

1. Initial patient assessment
2. Initiates 100 compressions
3. Ventilates in off cycle
4. BIAD Preparation in off cycle



Person in Position 2 (P2) always on patients <u>Left side</u>

1.Brings and operates AED
2. Alternates 100 compressions with P1
3. Ventilates in off cycle
4. Turns on AED after 200 Compressions
5. Assist with BIAD Preparation if needed

Person in Position 4 (P4) always just outside the "Triangle" of CPR
1. Team Leader Duties
2. May assist with BIAD preparation and securing If needed

Person in Position 3 (P3) always at patients Head
1. Opens/clears Airway and insert OPA
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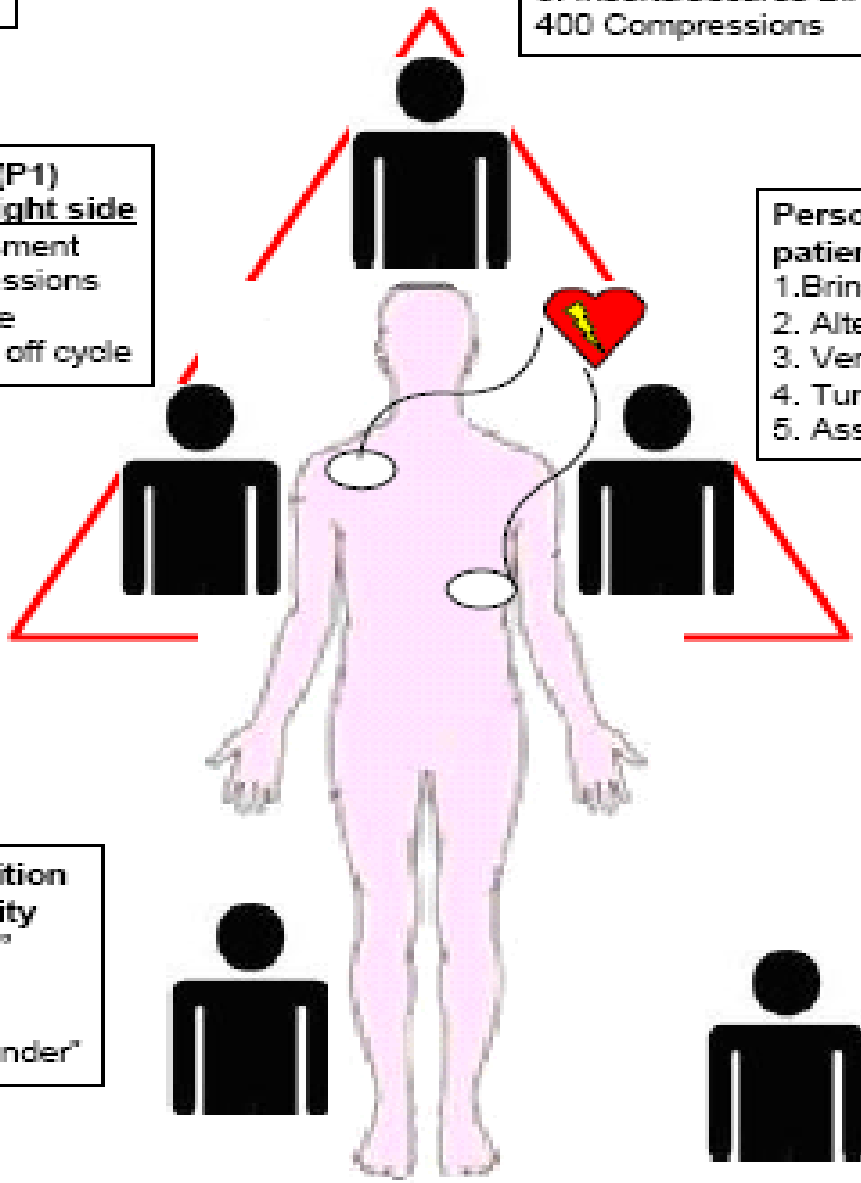
Person in Position 1 (P1) always on patients Right side
1. Initial patient assessment
2. Initiates 100 compressions
3. Ventilates in off cycle
4. BIAD Preparation in off cycle

Person in Position 2 (P2) always on patients Left side
1.Brings and operates AED
2. Alternates 100 compressions with P1
3. Ventilates in off cycle
4. Turns on AED after 200 Compressions
5. Assist with BIAD Preparation if needed



Advanced Provider in Position 6 (P6) always at an area outside the CPR "Triangle" near a lower leg and Operates the Monitor
1. Code Commander
2. Communicates/Interfaces with Team Leader
3. Makes all Patient treatment decisions

Advanced Provider in Position 5 (P5) always at an extremity outside the CPR "Triangle"
1. Initiates IV/IO access
2. Administers Medications requested by "Code Commander"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OFFICE OF THE MEDICAL DIRECTOR

CITY OF AUSTIN/TRAVIS COUNTY EMS SYSTEM

Cardiac Arrest Checklist:

- ❑ Pit crew positions identified
- ❑ Continuous compressions being performed
- ❑ ITD in place w/light activated
- ❑ BVM is attached to oxygen and flowing
- ❑ Monitor visible and in paddles mode
- ❑ Code Commander is identified and positioned at the monitor
- ❑ BVM mask attached to tubing if not being used
- ❑ ETCO2 waveform is present and being monitored
- ❑ IV/IO access has been obtained
- ❑ Gastric distention has been considered/addressed
- ❑ Family is receiving care and is at the patients side

- ❑ HYPOVOLEMIA
- ❑ HYPOXIA
- ❑ HYDROGEN IONS (ACIDOSIS)
- ❑ HYPOTHERMIA
- ❑ HYPER/HYPOKALEMIA
- ❑ HYPOGLYCEMIA
- ❑ TABLETS/TOXINS
- ❑ TAMPONADE
- ❑ TENSION PNEUMOTHORAX
- ❑ THROMBOSIS (MI)
- ❑ THROMBOSIS (PE)
- ❑ TRAUMA

Cardiac Arrest Checklist:

____ Code Commander is identified

____ Monitor is visible and a dedicated provider is viewing the rhythm with all leads attached

____ Continuous compressions are on-going

____ O2 cylinder with oxygen in it is attached to BVM

____ Mask travels with bag, regardless of what airway is in place

____ EtCO2 waveform is present and value is being monitored

____ ITD is in place if appropriate

____ Access has been obtained (IV or IO)

____ Gastric distention is not a factor

____ Esophageal temperature probe is in place and temperature is visible

____ D50 and sodium bicarbonate have been considered and/or administered

____ Tension PTX has been considered

____ Family is receiving care and is at the patient's side

Post-ROSC Checklist:

_____FINGER on pulse, mark with pen, MAINTAIN for 10 minutes

_____ ITD has been removed, ASSESS C02

_____ Check O2 supply and pulse Ox to TITRATE to Sa02 94-99%

_____ 12-lead has been obtained

_____ Obtain B/P IS Pressor agent indicated for MAP of 90

_____ Evaluation for definitive airway with bougie as introducer

_____ If pt is moved, perform CONTINUOUS PULSE CHECK during move

_____ Unless patient is following verbal commands, continue/initiate hypothermia therapy

_____ Assess for & TREAT bradycardia's < 60 bpm

_____ Iced saline is running in 2 lines if possible

_____ Mask is available for BVM in case advanced airway fails

_____ Once in ambulance, confirm SaO2, EtCO2, breath sounds, pulse, and cardiac rhythm

Termination Rules:

- Many different studies have looked at this question
- NAEMSP official position paper revision is in press
- Brief review follows
- Take home: we have sufficient data to adopt termination of resuscitation rules

CARES Registry Study:

BLS Rule

- Not witnessed by EMS
- Non-shockable rhythm
- No ROSC

ALS Rule

- Not witnessed by EMS
- Non-shockable rhythm
- No ROSC
- Not by-stander witnessed
- No bystander CPR

CARES Registry Study:

BLS Rule

- PPV 99.8% (99.6-99.9)
- NPV 13.3% (12.1-14.6)

ALS Rule

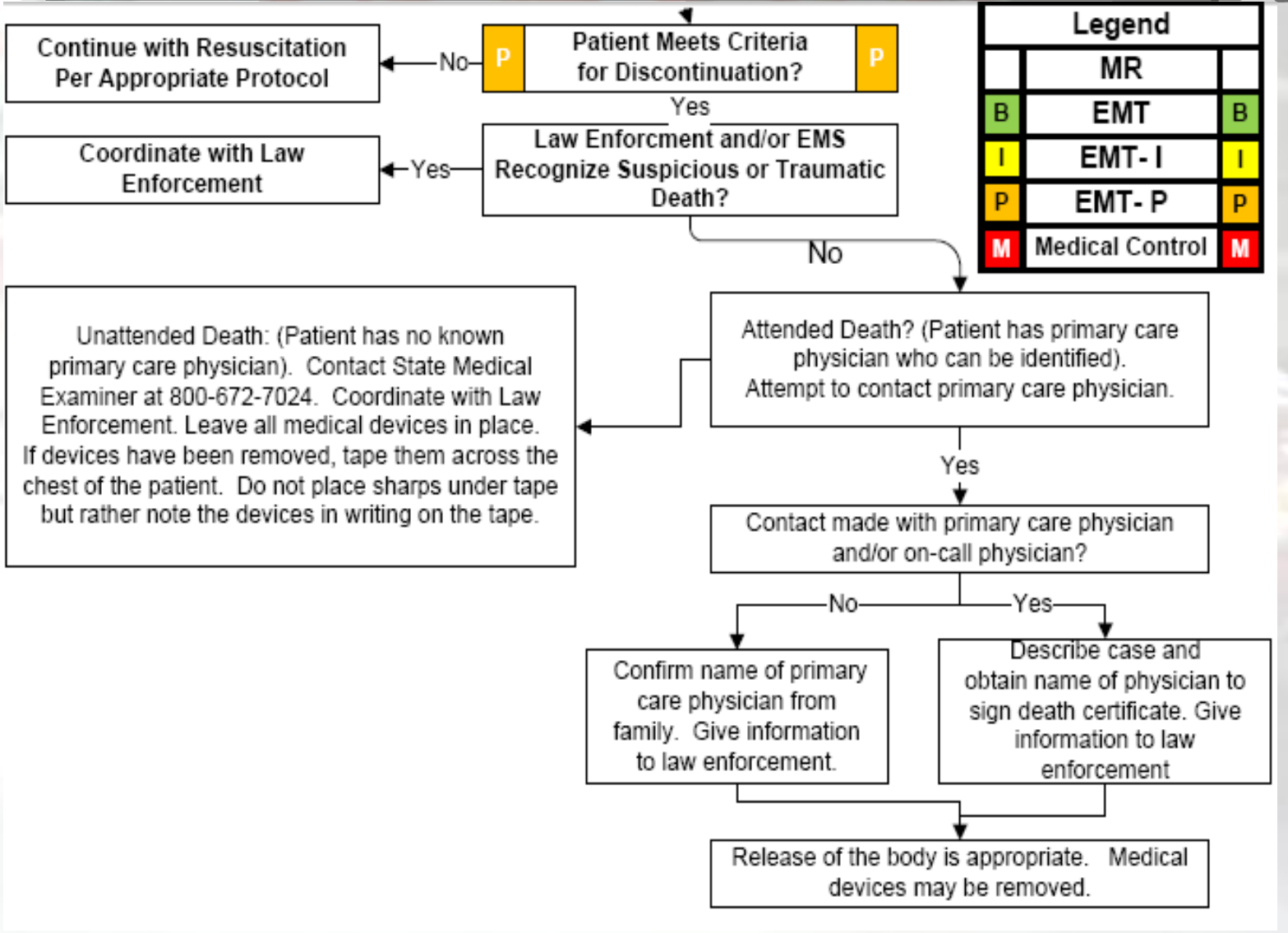
- PPV 100% (99.7-100)
- NPV 9.1% (8.3-10.0)

NAEMSP Position Paper

- Emergency Medical Services Systems should have written protocols for termination of resuscitation (TOR)
- Special exceptions may exist

- Criteria at the time of decision of termination:
  - Arrest not witnessed by EMS personnel
  - Non-shockable rhythm
  - No ROSC

Sample Deceased Protocol:



Conclusions:

- There is no available evidence to suggest improved outcomes as a result of transporting patients in cardiac arrest who have not achieved pre-hospital ROSC
- There is sufficient evidence to conclude that some patients will not survive and do not need transport
- There is not sufficient evidence to determine the appropriate duration of resuscitation attempts on-scene

Conclusions:

- It appears reasonable to:
  - Instruct providers to resuscitate medical cardiac arrest on the scene until ROSC or futility
  - Create exceptions for arrests in public places
  - Avoid “load and go” during initial resuscitation attempts
  - Educate EMS providers on the handling of deceased persons and the grief process

Take Away:

- Choreograph your cardiac arrest
- Focus on priorities
  - Limited interruption
  - Controlled ventilation
  - Timely defib
  - Compressor fatigue
- Continuous reassessment and reengineering
- Research is required to validate compression quality

Perfusion.