Survival Oriented Arrest Resuscitation

Mario J. Weber, JD, MPA, NRP
Alexandria Fire Department

Overview

- Cardiac arrest survival
- High-performance CPR
- Team-level logistics
- Feedback and measurement
- Continuous quality improvement
- "The Alexandria Way"
- Evidence-based resuscitation

Why Am I Here?

- The "Code From Hell"
- A careless suggestion
  - What about a "pit crew"?
- Be careful what you ask for…

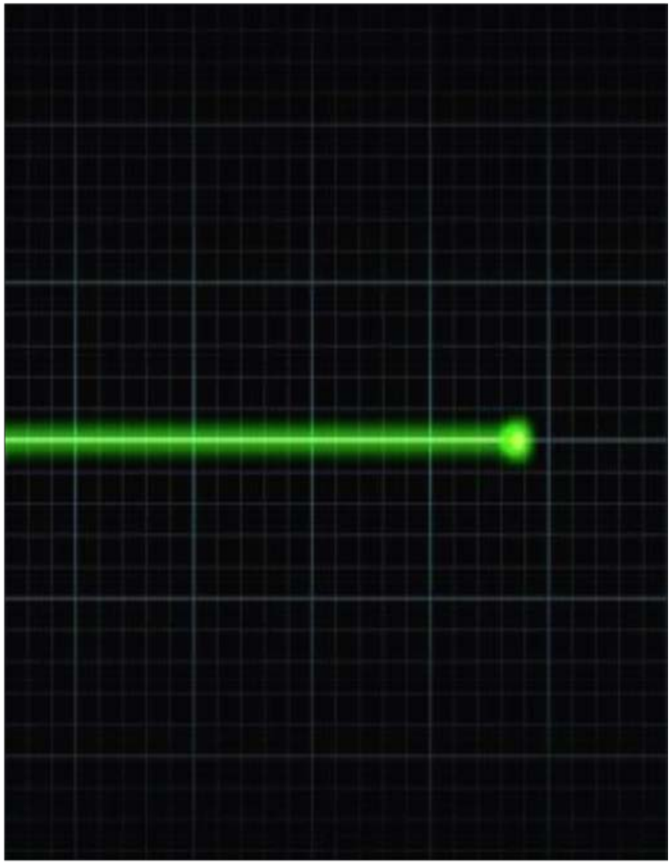
My Big Secret…

I Hate Codes

- They’re nasty
- They’re often loud and disorganized
- Are we just abusing dead bodies?

Dead is Dead, Right?

- Do we spend too much time and effort trying to save dead people?

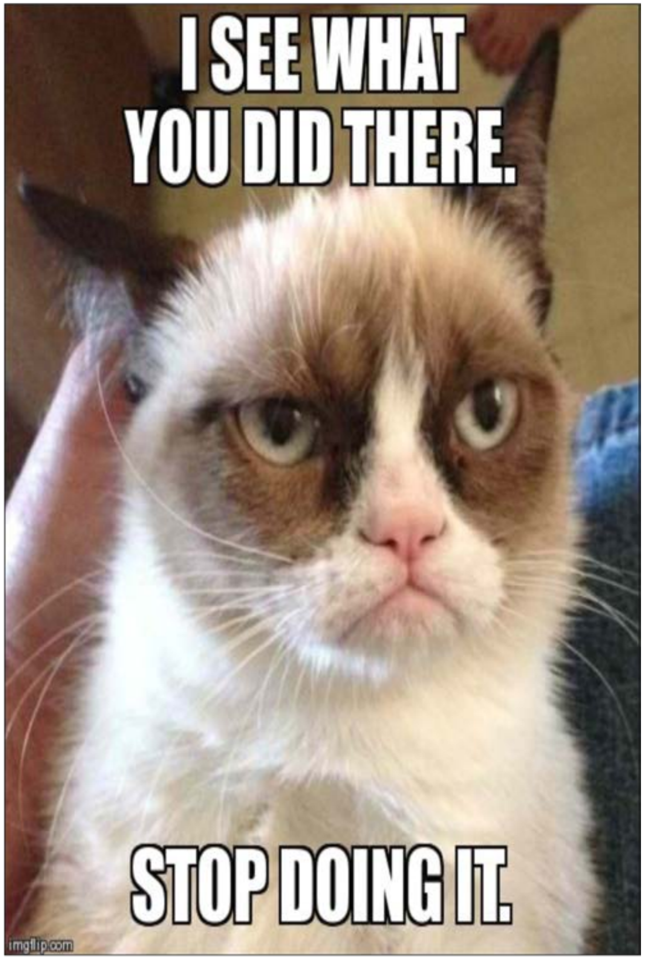


Dead is Dead, Right?

- Do we spend too much time and effort trying to save dead people?

So Why Am I Really Here?

- We aren’t going to stop running codes (are we?)
- More importantly…



We **CAN** Save People in Cardiac Arrest

(More than a few, actually)

What is Cardiac Arrest Survival?

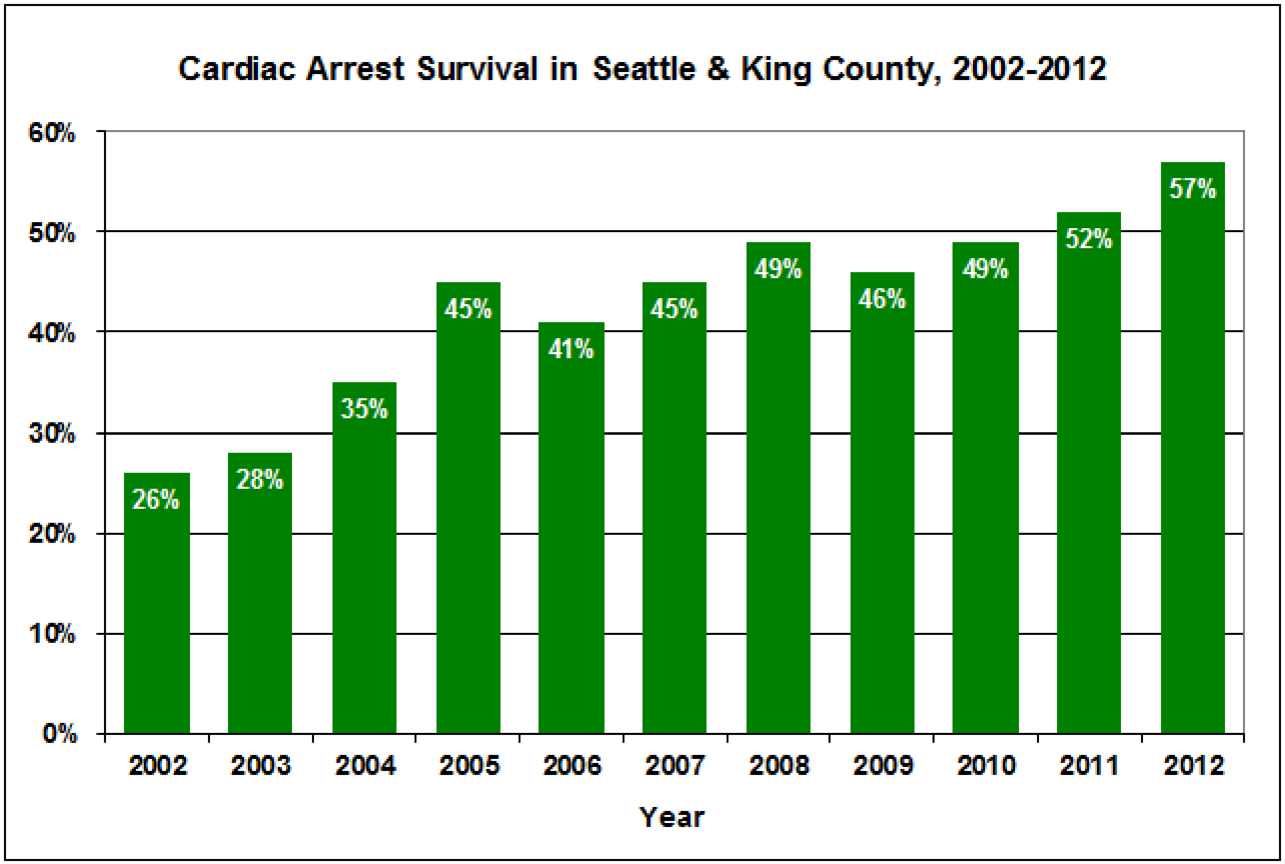
- Return of Spontaneous Circulation (ROSC)
  - Got a pulse?
- Survival to Discharge
  - Leaving the hospital?
  - Good neurological function?

"ROSC [without survival] ain't worth dick."

Dr. Corey Slovis, Medical Director, Metro Nashville FD

Survival Rates Can Exceed 50 percent

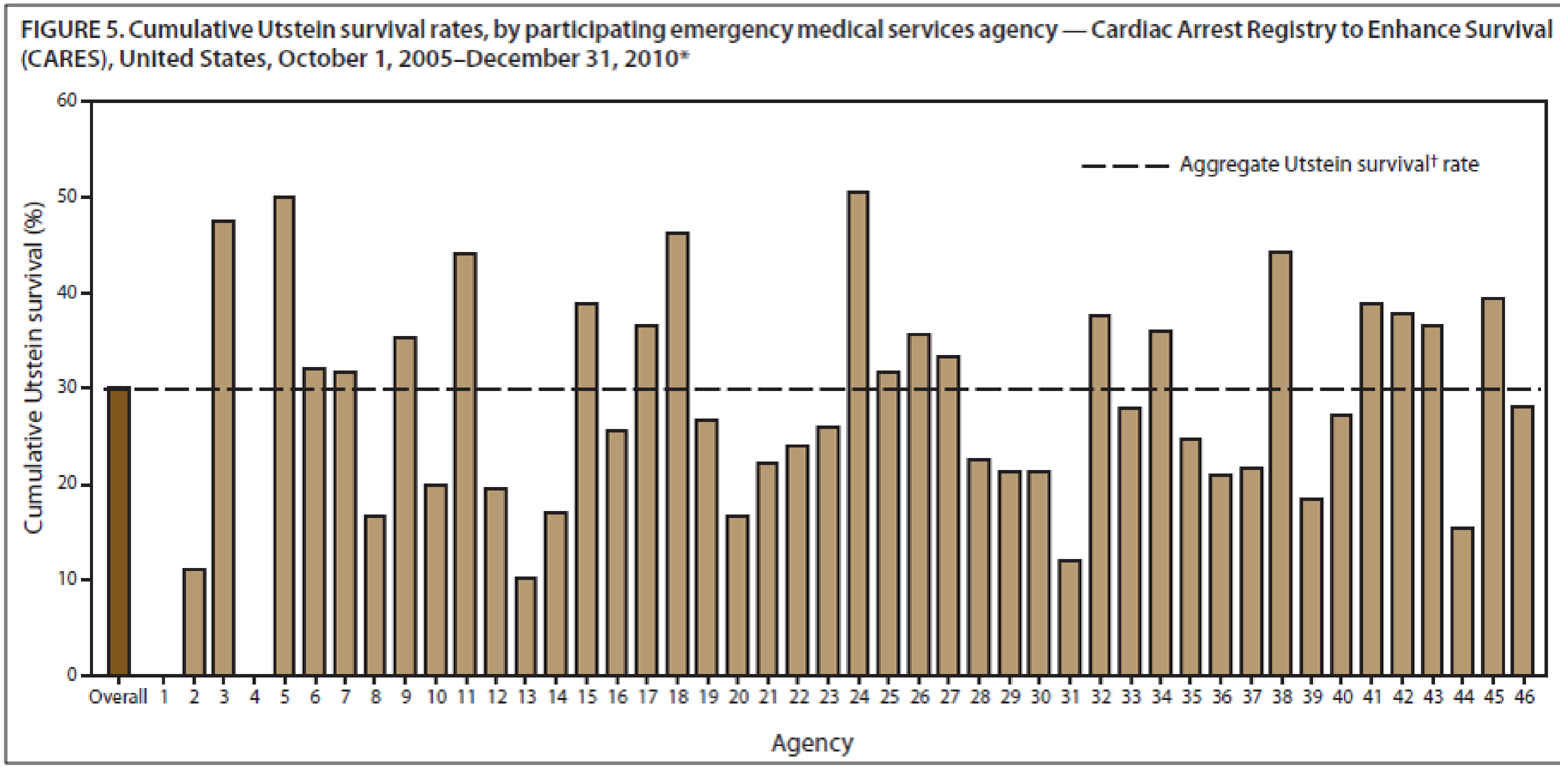
(Cardiac, Witnessed, Shockable Rhythm)



Public Health – Seattle & King County. Division of EMS. (2013). Annual Report to the King County Council. Retrieved from http://www.kingcounty.gov/healthservices/health/ems.aspx.

But Not All Systems Are Created Equal

(Cardiac, Witnessed, Shockable Rhythm)

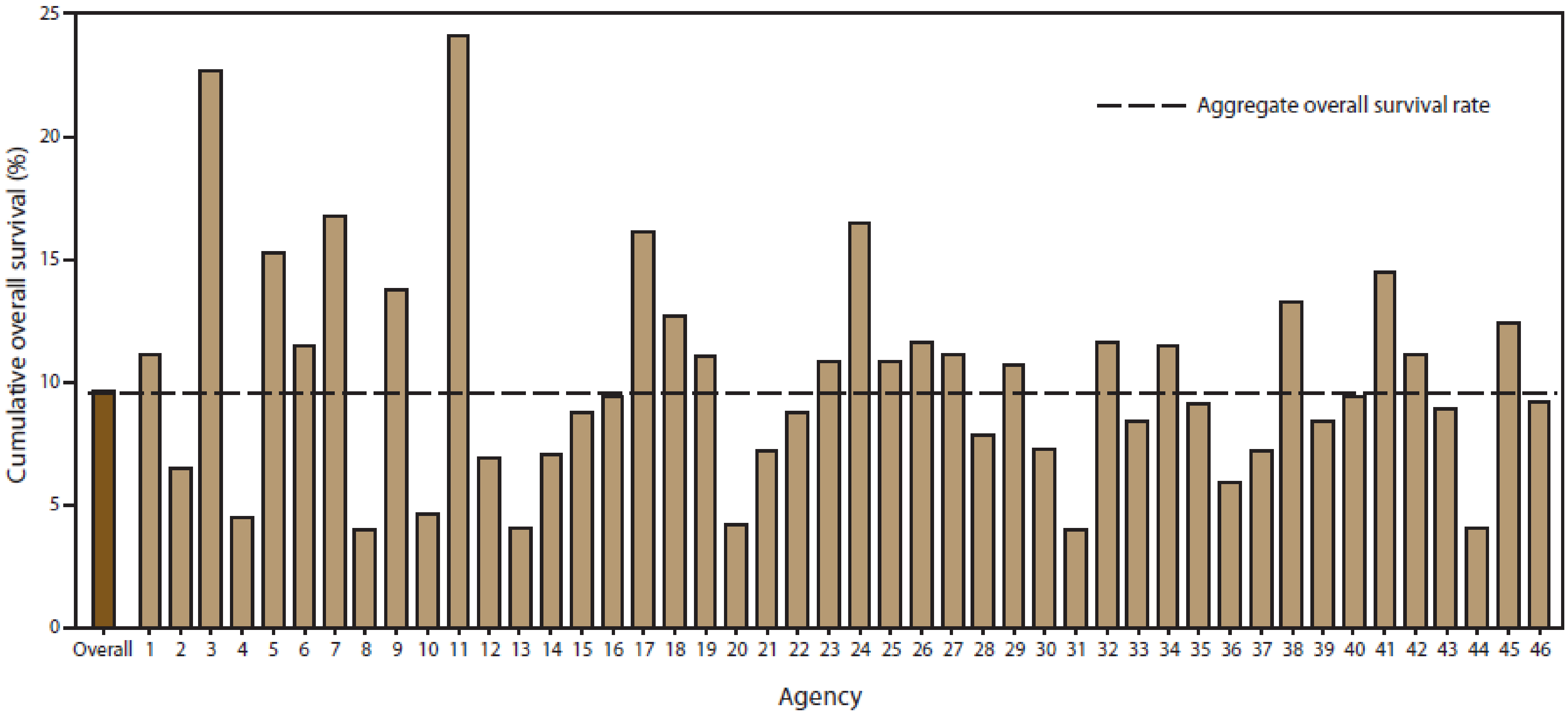


Centers for Disease Control and Prevention. (2011). Out-of-hospital cardiac arrest surveillance – Cardiac Arrest Registry to Enhance Survival (CARES), United States, October 1, 2005-December 31, 2010. *Morbidity and Mortality Weekly Report, 60*(8), 1-19.

Some Systems Are Simply Better

(All Cardiac)

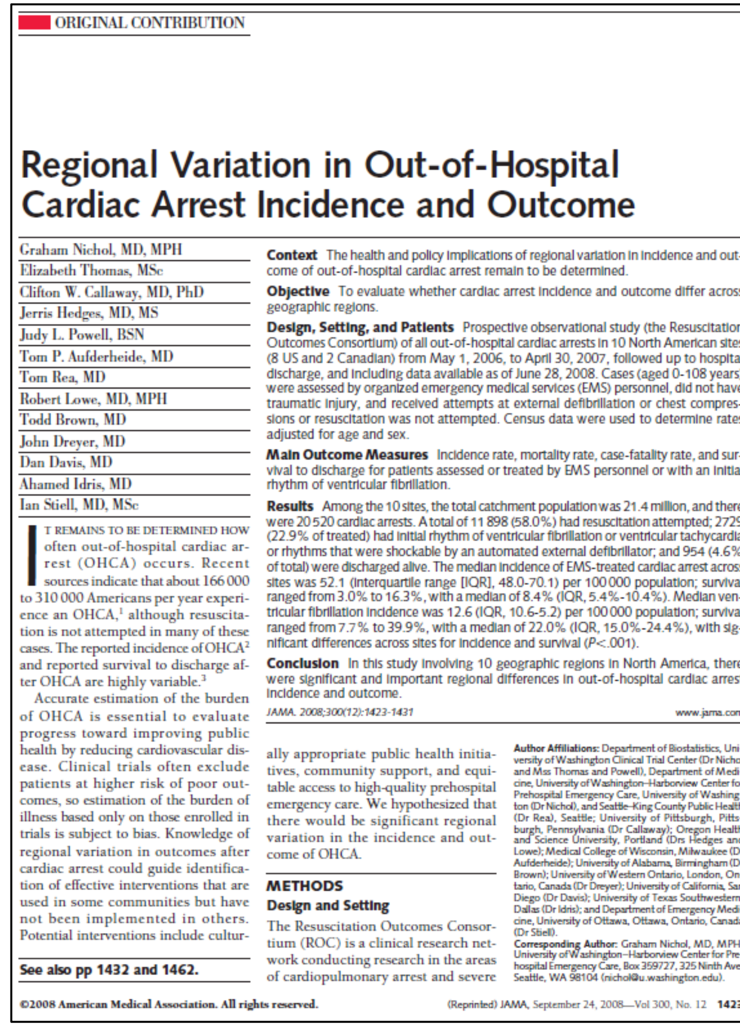
FIGURE 4. Cumulative overall survival rates, by participating emergency medical services agency — Cardiac Arrest Registry to Enhance Survival (CARES), United States, October 1, 2005–December 31, 2010*



Centers for Disease Control and Prevention. (2011). Out-of-hospital cardiac arrest surveillance – Cardiac Arrest Registry to Enhance Survival (CARES), United States, October 1, 2005-December 31, 2010. *Morbidity and Mortality Weekly Report, 60*(8), 1-19.

And It's Not Simply a Matter of Chance

"It seems likely that these differences reflect, in part, regional differences in the availability of emergency cardiac care [including] bystander cpr, lay responder defibrillation programs, **EMS factors such as experience of personnel and types of interventions provided by EMS personnel**…"



ORIGINAL CONTRIBUTION

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

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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 were 20 520 cardiac arrests. A total of 11 898 (58.0%) had resuscitation attempted; 2729 (22.9% of treated) had initial rhythm of ventricular fibrillation or ventricular tachycardia or rhythms that were shockable by an automated external defibrillator; and 954 (4.6% of total) were discharged alive. The median incidence of EMS-treated cardiac arrest across sites was 52.1 (interquartile range [IQR], 48.0-70.1) per 100 000 population; survival ranged from 3.0% to 16.3%, with a median of 8.4% (IQR, 5.4%-10.4%). Median ventricular fibrillation incidence was 12.6 (IQR, 10.6-5.2) per 100 000 population; survival ranged from 7.7% to 39.9%, with a median of 22.0% (IQR, 15.0%-24.4%), with significant differences across sites for incidence and survival ($P<.001$).

Conclusion In this study involving 10 geographic regions in North America, there were significant and important regional differences in out-of-hospital cardiac arrest incidence and outcome.

JAMA. 2008;300(12):1423-1431 www.jama.com

It remains to be determined how often out-of-hospital cardiac arrest (OHCA) occurs. Recent sources indicate that about 166 000 to 310 000 Americans per year experience an OHCA,[1] although resuscitation is not attempted in many of these cases. The reported incidence of OHCA[2] and reported survival to discharge after OHCA are highly variable.[3]

Accurate estimation of the burden of OHCA is essential to evaluate progress toward improving public health by reducing cardiovascular disease. Clinical trials often exclude patients at higher risk of poor outcomes, so estimation of the burden of illness based only on those enrolled in trials is subject to bias. Knowledge of regional variation in outcomes after cardiac arrest could guide identification of effective interventions that are used in some communities but have not been implemented in others. Potential interventions include culturally appropriate public health initiatives, community support, and equitable access to high-quality prehospital emergency care. We hypothesized that there would be significant regional variation in the incidence and outcome of OHCA.

See also pp 1432 and 1462.

METHODS

Design and Setting

The Resuscitation Outcomes Consortium (ROC) is a clinical research network conducting research in the areas of cardiopulmonary arrest and severe

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(Reprinted) JAMA, September 24, 2008—Vol 300, No. 12 1423

Nichol, G. et al. (2008). Regional variation in out-of-hospital cardiac arrest incidence and outcome. *JAMA, 300*(12), 1423-1431.

How Can We Improve Survival?

Improve CPR Quality

AHA Consensus Statement

Cardiopulmonary Resuscitation Quality:
Improving Cardiac Resuscitation Outcomes
Both Inside and Outside the Hospital

A Consensus Statement From the American Heart Association

Endorsed by the American College of Emergency Physicians and the Society of Critical Care Medicine

Meaney, P.A. et al. (2013). Cardiopulmonary resuscitation quality: Improving cardiac resuscitation outcomes both inside and outside the hospital: A consensus statement from the American Heart Association. *Circulation, 128*(4), 417-435.

Improve CPR Quality

- Cardiac arrest survival depends on CPR quality
  - Poor quality CPR is a "preventable harm"
- Four elements related to CPR quality:
  - High-performance CPR
  - Team-level logistics
  - Monitoring and feedback
  - Continuous quality improvement

Meaney, P.A. et al. (2013). Cardiopulmonary resuscitation quality: Improving cardiac resuscitation outcomes both inside and outside the hospital: A consensus statement from the American Heart Association. *Circulation, 128*(4), 417-435.

What Is High-Performance CPR?

Minimally Interrupted Compressions

- Higher chest compression fractions (CCF) are associated with higher rates of survival
- Lower CCF → Decreased Survival

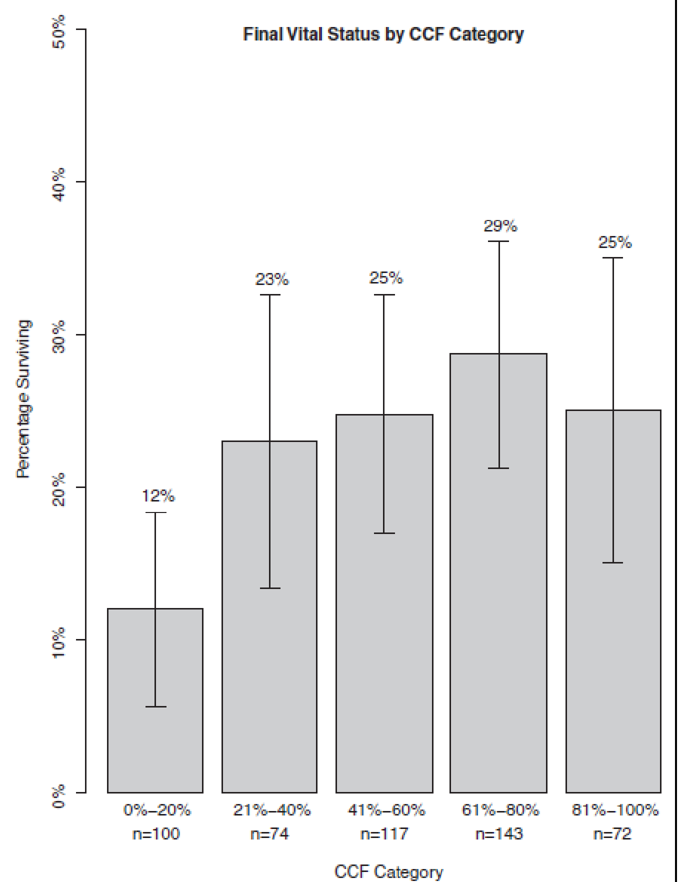
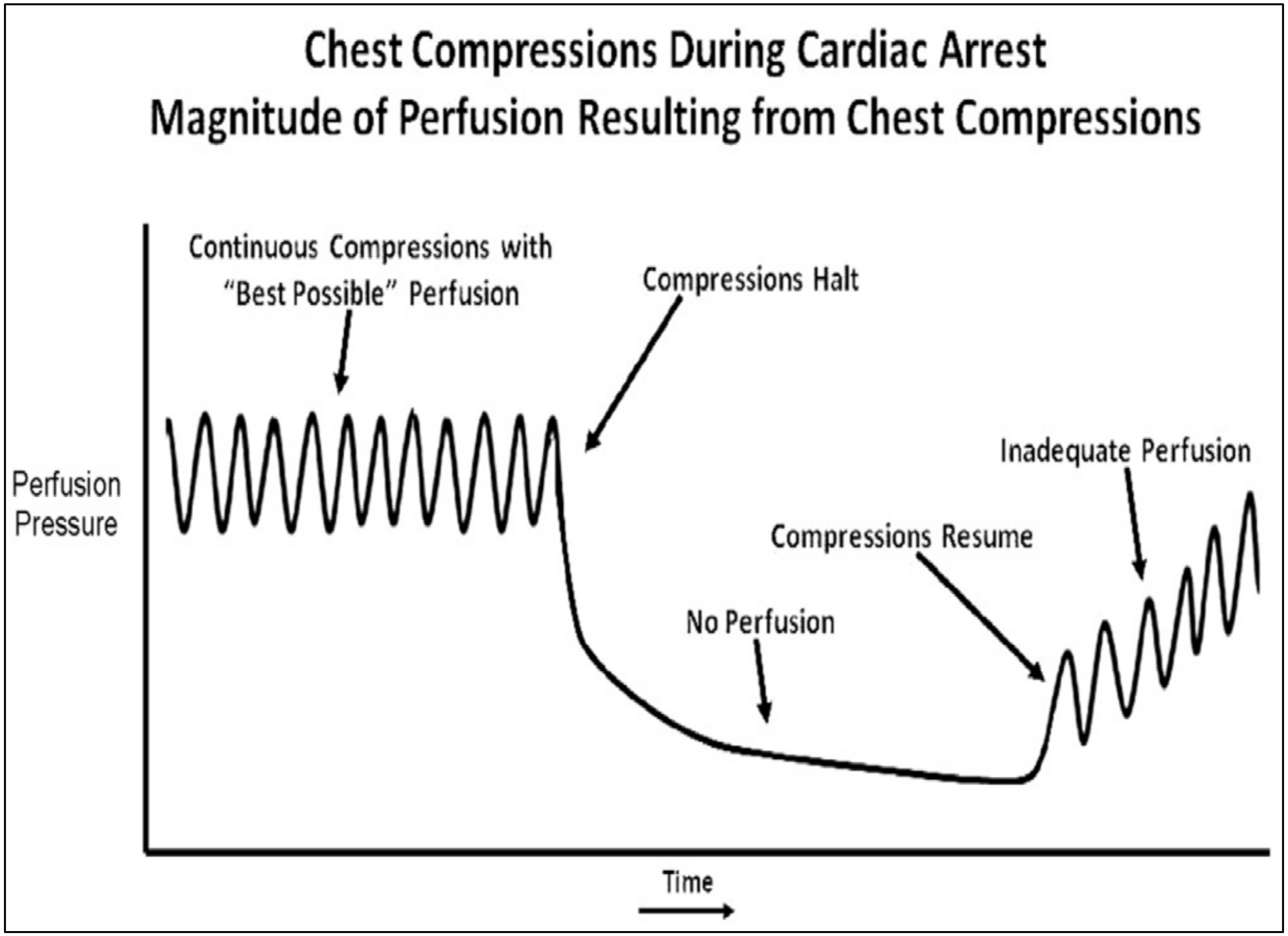


Figure 2. Survival to discharge for each category of chest compression fraction.

Christenson, J. et al. (2009). Chest compression fraction determines survival in patients with out-of-hospital ventricular fibrillation. *Circulation, 120*(13), 1241-1247; Vaillancourt, C. et al. (2011). The impact of increased chest compression fraction on return of spontaneous circulation for out-of-hospital cardiac arrest patients not in ventricular fibrillation. *Resuscitation, 82*(12), 1501-1507.

Minimally Interrupted Compressions

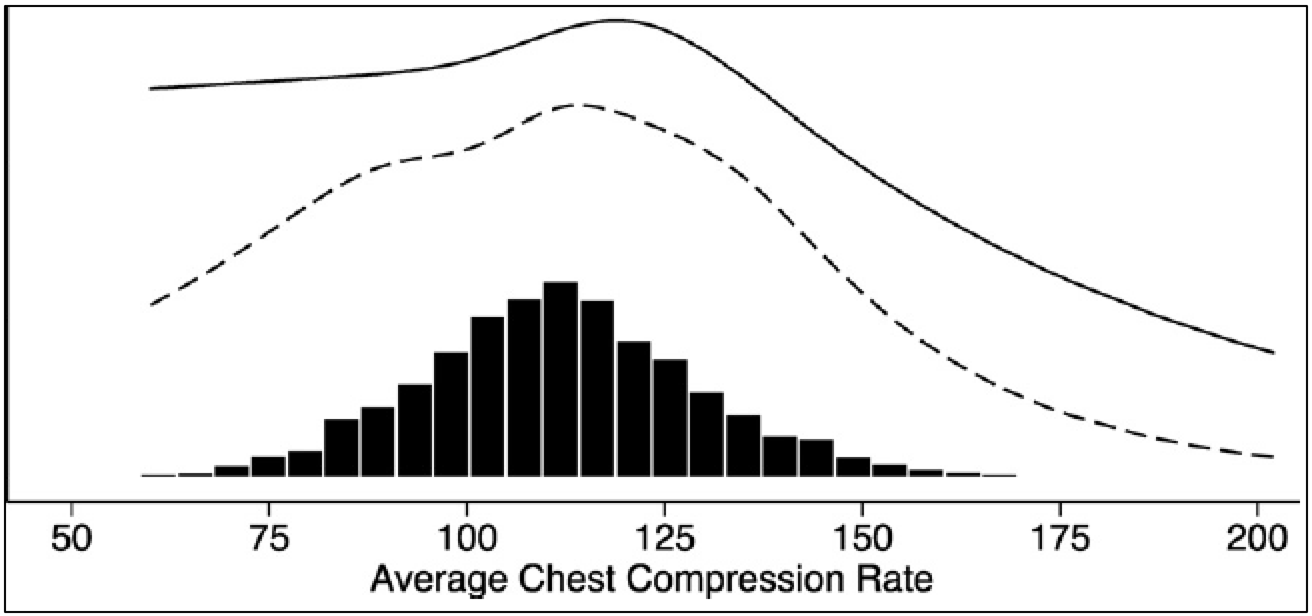


Coronary Perfusion Pressure > 15 mmHg

Cunningham, L.M. et al. (2012). Cardiopulmonary resuscitation for cardiac arrest: the importance of uninterrupted chest compressions in cardiac arrest resuscitation. *AJEM, 30*(8), 1630-1638.; Sutton,

Chest Compression Rate: 100-120/min

- ROSC peaks at 120 compressions/minute and then declines at faster rates



Idris, A.H. et al. (2012). Relationship between chest compression rates and outcomes from cardiac arrest. *Circulation, 125*(24), 3004-3012.

Chest Compression Depth > 2 inches

(1/3 of the chest in children and infants)

- Deeper chest compressions are associated with successful defibrillation

Edelson, D.P. et al. (2006). Effects of compression depth and pre-shock pauses predict defibrillation failure during cardiac arrest. *Resuscitation, 71*(2), 137-145.

Full Chest Recoil: No Leaning

- Incomplete chest wall recoil impedes venous return to the heart, decreasing MAP and both coronary and cerebral perfusion pressures.

Yannopoulos, D. et al. (2005). Effects of incomplete chest wall decompression during cardiopulmonary resuscitation on coronary and cerebral perfusion pressures in a porcine model of cardiac arrest. *Resuscitation, 64*(3), 363-372.

Less Ventilation

> patient in arrest even during chest compressions. When sudden arrhythmic arrest is present, oxygen content is initially sufficient, and high-quality chest compressions can circulate oxygenated blood throughout the body. Studies in animals and humans suggest that compressions without ventilations may be adequate early in nonasphyxial arrests.[51–54] When asphyxia

- Too much ventilation → Decreased survival
  - BVM ventilation decreases CCF
  - BVM ventilation decreases CPP

Meaney, P.A. et al. (2013). Cardiopulmonary resuscitation quality: Improving cardiac resuscitation outcomes both inside and outside the hospital: A consensus statement from the American Heart Association. *Circulation, 128*(4), 417-435.

Less Ventilation

- Most cardiac arrest victims need LESS ventilation
  - Pre-arrest oxygen saturations persist for several minutes due to low blood flow during cardiac arrest
  - Oxygen delivery is limited by blood flow – NOT the amount of oxygen in the blood
- Too much ventilation HARMS victims
  - Ventilation increases intra-thoracic pressure, causing diminished venous return and reduced cardiac output
- Exceptions
  - Hypoxic arrest, pediatric patients

Pepe, P.E. et al. (2005). The detrimental effects of ventilation during low-blood-flow states. *Current Opinion in Critical Care, 11*(3), 212-218; Aufderheide, T.P., & Lurie, K.G. (2004). Death by hyperventilation: A common and life-threatening problem during cardiopulmonary resuscitation. *Critical Care Medicine, 32*(9), s345-s351.

Less Ventilation

- Initial delivery of continuous chest compressions (CCR) prior to defibrillation has been associated with improved survival

Table 2. Comparison of Major Outcomes in the Before and After Analysis

Outcomes	No./Total No. (%) of Patients	
	Before MICR Training	After MICR Training
Primary outcomes		
Survival-to-hospital discharge	4/218 (1.8)	36/668 (5.4)
Survival with witnessed VF	2/43 (4.7)	23/131 (17.6)
Secondary outcomes		
Return of spontaneous circulation	34/218 (15.6)	154/668 (23.1)
Survival-to-hospital admission	35/218 (16.1)	113/668 (16.9)

Bobrow, B.J. et al. (2008). Minimally interrupted cardiac resuscitation by emergency medical services for out-of-hospital cardiac arrest. *JAMA, 299*(10), 1158-1165; Kellum, M.J. et al. (2006). Cardiocerebral resuscitation improves survival of patients with out-of-hospital cardiac arrest. *Am J Med, 119*(4), 335-340.

Less Ventilation

- Similarly, post-shock delivery of chest compressions using a ratio of 50:2 has also been associated with improved survival

Table 2. ROSC and Survivors, Witnessed VF Patient Population

	Preprotocol Cohort, n (%)	Postprotocol Cohort, n (%)	Unadjusted OR (95% CI)
Witnessed VF	143	57	NA
ROSC	54 (37.8)	34 (59.6)	2.44 (1.24–4.80)
Discharge alive	32 (22.4)	25 (43.9)	2.71 (1.34–5.49)

OR indicates odds ratio; VF, ventricular fibrillation; and ROSC, return of spontaneous circulation.

Garza, A.G. et al. (2009). Improved patient survival using a modified resuscitation protocol for out-of-hospital cardiac arrest. *Circulation, 119*(19), 2597-2605.

How Do We Achieve High-Performance CPR?

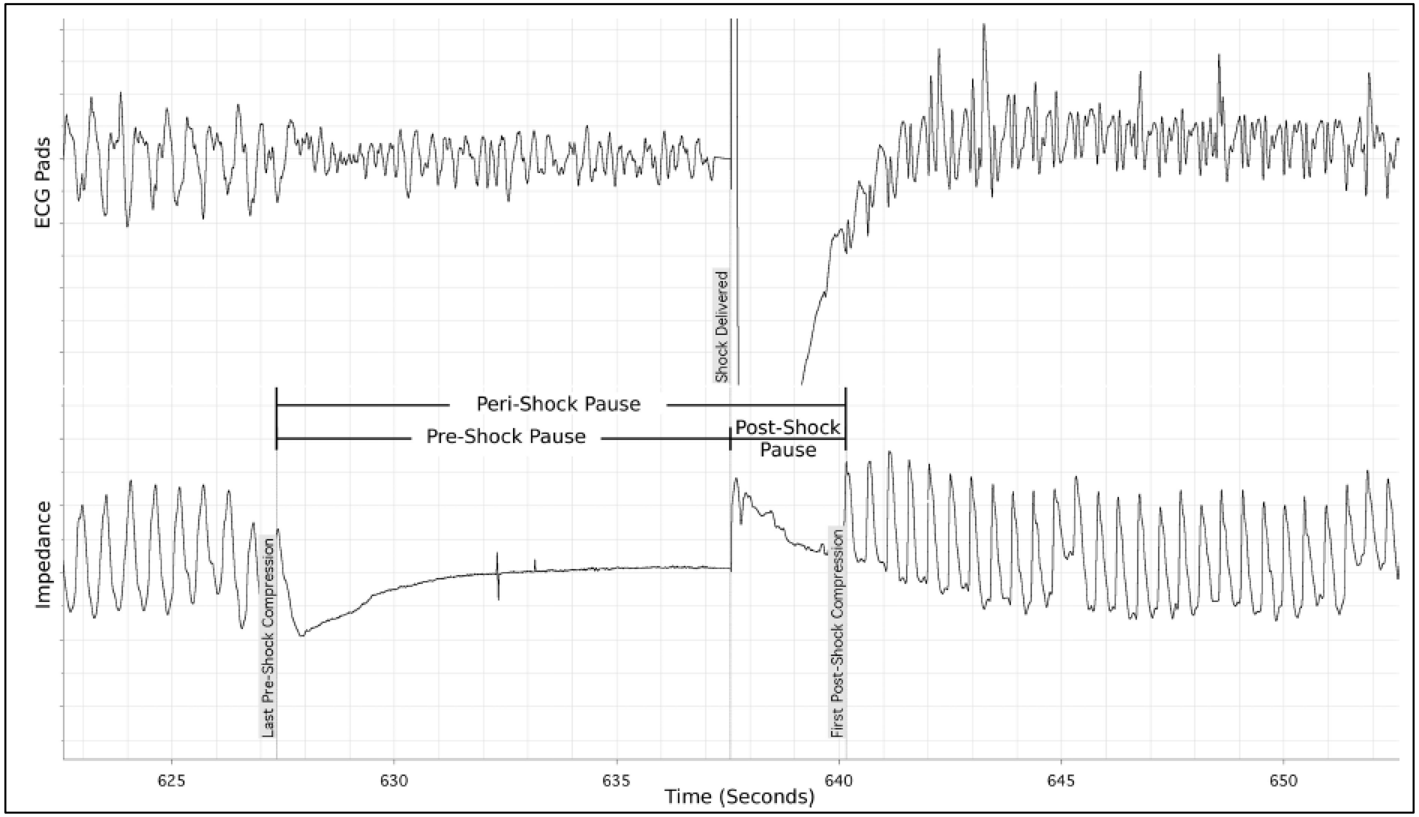
Switch Compressors Efficiently

- CPR quality declines quickly after one minute
  - CPR providers don't recognize their fatigue until after five minutes
- Switch compressors on each pulse check
- One compressor on each side of chest
- Automatically resume compressions after each rhythm check
  - Less than 10 seconds total time off chest
  - Not sure if there's a pulse? Back on the chest!

McDonald, C.H. et al. (2013). Rescuer fatigue under the 2010 ERC guidelines, and its effect on cardiopulmonary resuscitation (CPR) performance. *Emergency Medicine Journal, 30*(8), 623-627; Hightower, D. et al. (1995). Decay in quality of closed-chest compressions over time. *Annals of Emergency Medicine, 26*(3), 300-303.

Reduce the Peri-Shock Pause

- Longer pre-shock and post-shock pauses are associated with a decrease in survival



Cheskes, S. et al. (2011). Perishock pause: An independent predictor of survival from out-of-hospital shockable cardiac arrest. *Circulation, 124*(1), 58-66.

Reduce the Peri-Shock Pause

- Resume compressions while the AED is charging
  - STOP compressions before pushing the SHOCK button
- Pre-charge the defibrillator prior to each pulse check
  - DUMP the charge if non-shockable rhythm
- Resume compressions immediately after each shock
  - Don’t wait for AED or PMIC prompt!

Reduce Ventilations

- Rate less than 12 breaths per minute
  - Advanced Airway: 8-10 breaths/min
- DO NOT ventilate prior to first rhythm check
  - Unless arrest is secondary to asphyxia or hypoxia (choking, drowning, CO poisoning, etc.)
- Ventilate at a ratio of 50:2
  - Deliver each breath over 1 second
  - Only enough volume to produce chest rise

De-Emphasize Intubation

De-Emphasize Intubation

- Studies have shown a NEGATIVE association between intubation and cardiac arrest outcomes compared to BVM*
  - Decreased ROSC
  - Decreased Survival to Discharge
  - Decreased Neurologically-Favorable Outcomes
- Similar results for supra-glottic airways
- <u>Further study needed</u>

De-Emphasize Intubation

- Numerous research articles on the subject
  - Fouche, P.F. et al. (2014). Airways in out-of-hospital cardiac arrest: Systemic review and meta-analysis. *Prehospital Emergency Care 18*(2), 244-256
  - McMullen, J. et al. (2014). Airway management and out-of-hospital cardiac arrest outcome in the CARES registry. *Resuscitation, 85*(5), 617-622
  - Hasegawa, K. et al. (2013). Association of prehospital advanced airway management with neurologic outcome and survival in patients with out-of-hospital cardiac arrest. *JAMA, 309*(3), 257-266
  - Egly, J. et al. (2011). Assessing the impact of prehospital intubation on survival in out-of-hospital cardiac arrest. *Prehospital Emergency Care, 15*(1), 44-49
  - Hanif, M.A. et al. (2010). Advanced airway management does not improve outcome of out-of-hospital cardiac arrest. *Academic Emergency Medicine, 17*(9), 926-931
  - Studnek, J.R. et al. (2010). The association between prehospital endotracheal intubation attempts and survival to hospital discharge among out-of-hospital cardiac arrest patients. *Academic Emergency Medicine, 17*(9), 918-925.

De-Emphasize Intubation

Table 2. Unconditional Logistic Regression Analyses for Outcomes Comparing Prehospital Advanced Airway Management vs Bag-Valve-Mask Ventilation

Model	Total No. of Patients	Bag-Valve-Mask Ventilation, No. (%)	Advanced Airway Management: Overall No. (%)	Overall OR (95% CI) vs Bag-Valve-Mask[a]	Endotracheal Intubation No. (%)	Endotracheal Intubation OR (95% CI) vs Bag-Valve-Mask[a]	Supraglottic Airway No. (%)	Supraglottic Airway OR (95% CI) vs Bag-Valve-Mask[a]
Total	649 359	367 837 (56.7)	281 522 (43.4)		41 972 (6.5)		239 550 (36.9)	
Return of spontaneous circulation								
Unadjusted	649 326	25 904 (7.0)	16 299 (5.8)	0.81 (0.79-0.83)	3514 (8.4)	1.21 (1.16-1.25)	12 785 (5.3)	0.74 (0.73-0.76)
Adjusted for selected variables[b]				0.67 (0.66-0.69)		0.86 (0.82-0.89)		0.64 (0.62-0.65)
Adjusted for all variables[c]				0.57 (0.56-0.58)		0.73 (0.70-0.77)		0.54 (0.52-0.55)
One-month survival								
Unadjusted	649 350	19 643 (5.3)	10 933 (3.9)	0.72 (0.70-0.73)	1757 (4.2)	0.77 (0.74-0.81)	9176 (3.8)	0.71 (0.69-0.72)
Adjusted for selected variables[b]				0.73 (0.71-0.75)		0.83 (0.79-0.88)		0.72 (0.70-0.74)
Adjusted for all variables[c]				0.62 (0.60-0.64)		0.69 (0.65-0.73)		0.61 (0.59-0.63)
Neurologically favorable survival								
Unadjusted	648 549	10 759 (2.9)	3156 (1.1)	0.38 (0.36-0.39)	432 (1.0)	0.35 (0.31-0.38)	2724 (1.1)	0.38 (0.37-0.40)
Adjusted for selected variables[b]				0.38 (0.37-0.40)		0.41 (0.37-0.45)		0.38 (0.36-0.40)
Adjusted for all variables[c]				0.32 (0.30-0.33)		0.32 (0.29-0.36)		0.32 (0.30-0.33)

Abbreviation: OR, odds ratio.
[a] $P < .001$ for all.

Hasegawa, K. et al. (2013). Association of prehospital advanced airway management with neurologic outcome and survival in patients with out-of-hospital cardiac arrest. *JAMA, 309*(3), 257-266.

De-Emphasize Intubation

- ALS providers should weigh the NEED to insert an endotracheal tube …
  - inability to ventilate using a BVM
  - *actual* airway compromise
- … against the CONSEQUENCES of doing so
  - interrupting compressions
  - inadvertent hyperventilation
  - hyperoxia
  - distraction from tasks associated with survival

Delay Mechanical CPR

- Several benefits
  - Improved end-organ perfusion
  - Enhanced cerebral blood flow
  - Higher ETCO2 readings
  - Increased ROSC
  - CPR during transport
- BUT no proven survival benefit*

Westfall, M. et al. (2013). Mechanical versus manual chest compressions in out-of-hospital cardiac arrest: A meta-analysis. *Critical Care Medicine, 41*(7), 1782-1789.

Delay Mechanical CPR

- Only one study has shown improved survival
  - Ong, M.E.H. et al. (2006). Use of an automated, load-distributing band chest compression device for out-of-hospital cardiac arrest resuscitation. *JAMA, 295*(22), 2629-2637
- Others studies have not (RCTs)
  - Wik, L. et al. (2014). Manual vs. integrated automatic load-distributing band CPR with equal survival after out of hospital cardiac arrest. The randomized CIRC trial. *Resuscitation 85*(6), 741-748
  - Rubertsson, S. et al. (2014). Mechanical chest compressions and simultaneous defibrillation vs conventional cardiopulmonary resuscitation in out-of-hospital cardiac arrest: The LINC randomized trial. *JAMA, 311*(1), 53-61
- One study has shown decreased survival
  - Hallstrom, A. et al. (2006). Manual chest compression vs use of an automated chest compression device during resuscitation following out-of-hospital cardiac arrest. *JAMA, 295*(22), 2620-2628.

Delay Mechanical CPR

- Why not apply immediately?
  - Delays or interrupts chest compressions
- Reduction in CCF may explain lack of survival benefit
  - Need to integrate without sacrificing survival!

Lewis, R.J., & Niemann, J.T. (2006). Manual vs device-assisted CPR: Reconciling apparently contradictory results. JAMA, 295(22), 2661-2664.

Team-Level Logistics

Cardiac Resuscitation is a Team Activity

- CPR is not performed in a vacuum
  - Consists of multiple rescuers and tasks
- A team approach leads to improved CPR
  - Manages distractions from non-CPR tasks
  - Coordinates pauses in compressions
- Having a team leader is associated with improved CPR
  - In particular, increased CCF

Monitoring and Feedback

Monitoring and Feedback

- "If you don't measure it, you can't improve it."
- How is the patient doing?
  - ETCO2 > 20 mm Hg
    - ETCO2 reflects cardiac output during CPR
    - ETCO2 < 10 predicts unsuccessful resuscitation
- How are the rescuers performing?
  - Chest compression rate, depth, and recoil
  - Human supervision and direction
  - Real-time feedback

Continuous Quality Improvement

Continuous Quality Improvement

- Conduct a debriefing following codes
  - Brief, focused discussion following a resuscitation
  - Review individual actions and team performance
  - Checklists may help structure the discussion
- Obtain and disseminate retrospective data
  - Objective information regarding CPR metrics
    - Compression ratio (CCF), compression rate, etc.
- Implement a continuous training program
  - Individual CPR skills
  - Resuscitation team performance

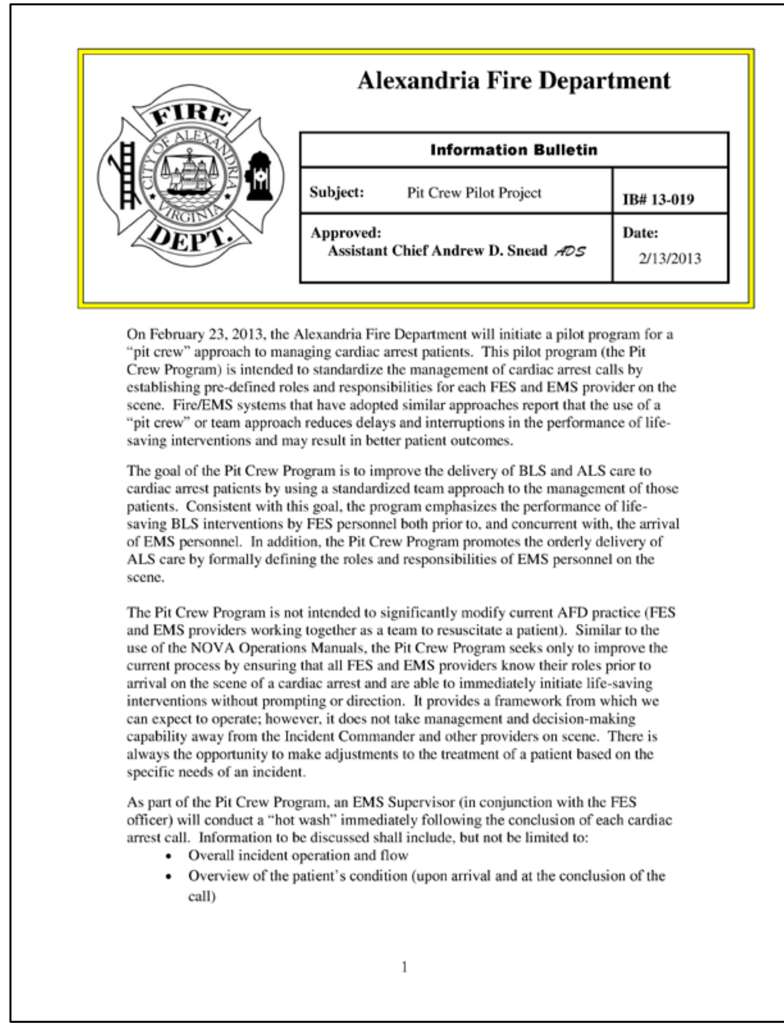
“The Alexandria Way”

From Pit Crew to SOAR

The “Pit Crew”

<u>February 2013</u>

- Pilot program
  - Station 207
  - Focus on roles of both BLS and ALS providers
  - “Pit crew” approach
  - Not evidence-based
  - EMT refresher training



Alexandria Fire Department

Information Bulletin	
Subject: Pit Crew Pilot Project	**IB# 13-019**
Approved: Assistant Chief Andrew D. Snead *ADS*	**Date:** 2/13/2013

On February 23, 2013, the Alexandria Fire Department will initiate a pilot program for a “pit crew” approach to managing cardiac arrest patients. This pilot program (the Pit Crew Program) is intended to standardize the management of cardiac arrest calls by establishing pre-defined roles and responsibilities for each FES and EMS provider on the scene. Fire/EMS systems that have adopted similar approaches report that the use of a “pit crew” or team approach reduces delays and interruptions in the performance of life-saving interventions and may result in better patient outcomes.

The goal of the Pit Crew Program is to improve the delivery of BLS and ALS care to cardiac arrest patients by using a standardized team approach to the management of those patients. Consistent with this goal, the program emphasizes the performance of life-saving BLS interventions by FES personnel both prior to, and concurrent with, the arrival of EMS personnel. In addition, the Pit Crew Program promotes the orderly delivery of ALS care by formally defining the roles and responsibilities of EMS personnel on the scene.

The Pit Crew Program is not intended to significantly modify current AFD practice (FES and EMS providers working together as a team to resuscitate a patient). Similar to the use of the NOVA Operations Manuals, the Pit Crew Program seeks only to improve the current process by ensuring that all FES and EMS providers know their roles prior to arrival on the scene of a cardiac arrest and are able to immediately initiate life-saving interventions without prompting or direction. It provides a framework from which we can expect to operate; however, it does not take management and decision-making capability away from the Incident Commander and other providers on scene. There is always the opportunity to make adjustments to the treatment of a patient based on the specific needs of an incident.

As part of the Pit Crew Program, an EMS Supervisor (in conjunction with the FES officer) will conduct a “hot wash” immediately following the conclusion of each cardiac arrest call. Information to be discussed shall include, but not be limited to:

- Overall incident operation and flow
- Overview of the patient’s condition (upon arrival and at the conclusion of the call)

1

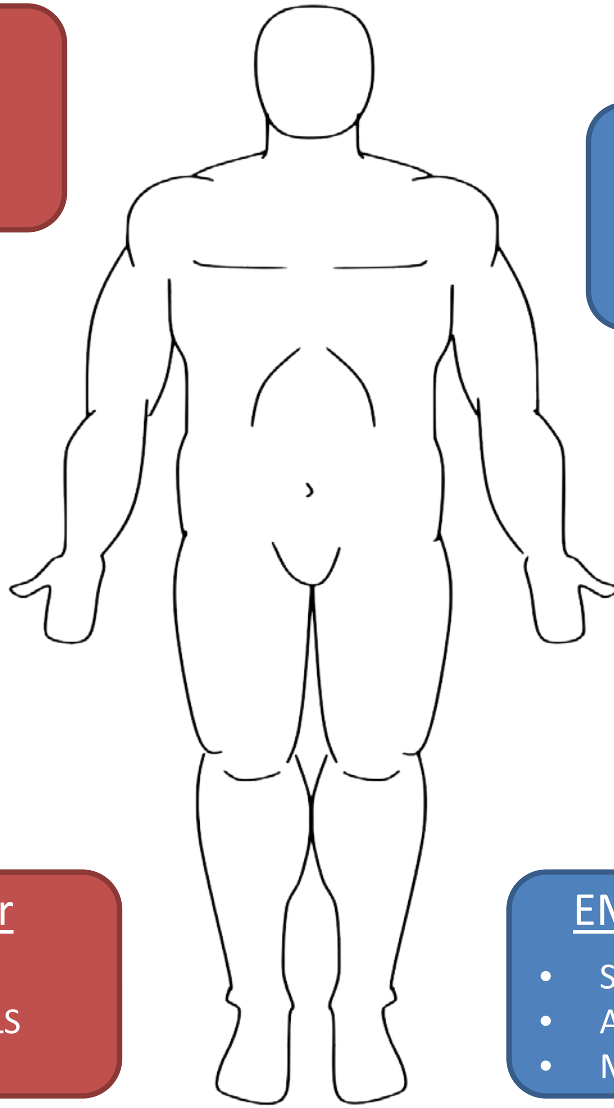
The "Pit Crew"

Firefighter #1
- OPA & BVM
- CPR

Firefighter #2
- CPR
- Autopulse

Firefighter #3
- AED
- Autopulse

Fire Officer
- Scene Mgmt.
- Assists with BLS
- Family Liaison



Medic #1
- EKG / Defibrillator
- Directs Patient Care

Medic #2
- IV/IO Access
- Medications
- Advanced Airway

EMS Supervisor
- Scene Mgmt.
- Assists with ALS
- Medical Liaison

The "Pit Crew"

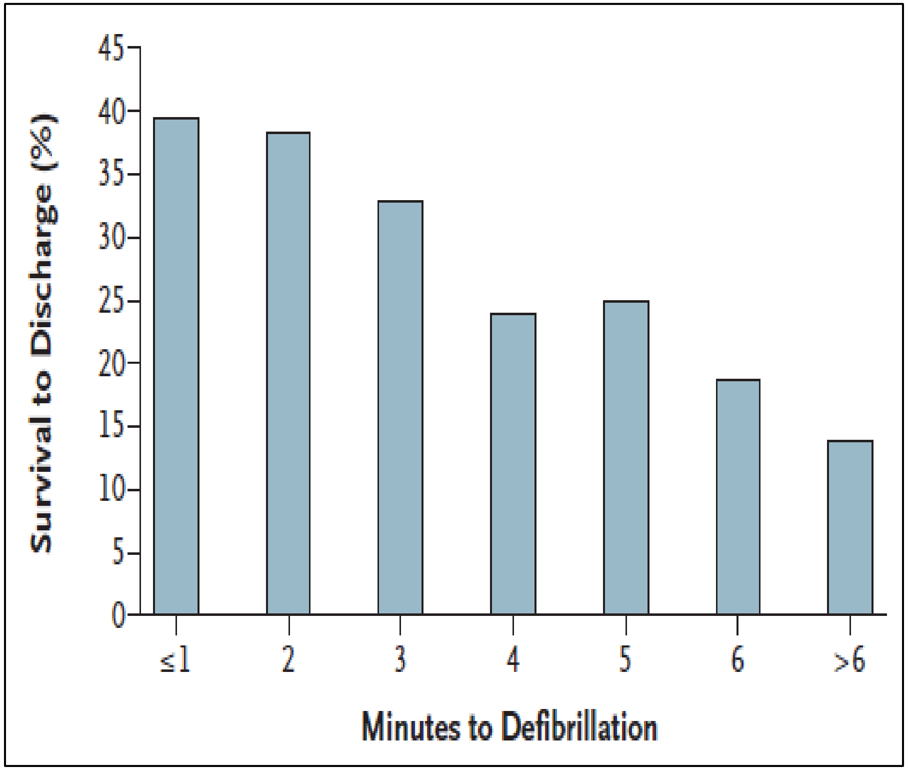
Start CPR	•FF2 begins compressions •FF1 inserts OPA and ventilates using BVM •FF3 readies Autopulse
Apply AED/Defibrillator	•FF3 applies AED/LifePak pads and follows prompts •PM1 interprets rhythm and directs shocks
Resume CPR	•FF2 resumes compressions, rotates with FF1 •FF1 ventilates using BVM, rotates with FF2 •FF2 and FF3 apply Autopulse
Obtain IV/IO Access & Administer Medications	•PM2 obtains IV/IO access, administers medications •EMS Supervisor obtains medical history, alerts hospital
Consider Advanced Airway	•PM2 inserts advanced airway •EMS Supervisor/ALS Firefighter assists as needed

Note: Actions in **Blue** performed after ALS has made patient contact.

SOAR: Phase I

<u>December 2013</u>

- Prepare to expand
  - Examine the evidence
  - Focus on interventions associated with survival
    - Delay ventilation
    - Delay intubation
    - Delay mechanical CPR
  - Begin to measure outcomes
  - Online training



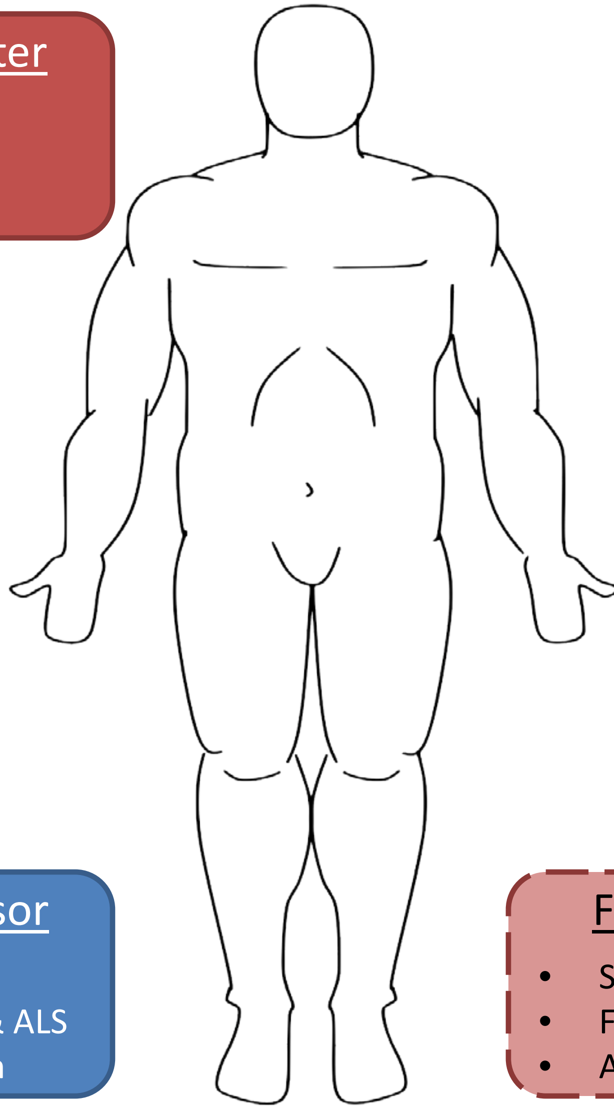
SOAR: Phase I

BVM Firefighter
- OPA & NRB
- BVM
- CPR

CPR Firefighter
- CPR
- BVM

Skills Medic
- IV/IO Access
- Medications
- Advanced Airway

EMS Supervisor
- Scene Mgmt.
- Hypothermia & ALS
- Medical Liaison



AED Firefighter
- AED
- BVM
- AutoPulse

Lead Medic
- EKG / Defibrillator
- Directs Patient Care

Fire Manager
- Scene Mgmt.
- Family Liaison
- AutoPulse

SOAR: Phase I

<u>April 2014</u>

- Expand training
  - Conduct large lectures and practical training sessions
  - Obtain feedback and suggestions from providers
  - Measure AutoPulse application time
    - 45 seconds or longer

Alexandria Fire Department

Training Bulletin	
Subject: SOAR Training	TB#14-006
Approved: Tony Washington FES Training Chief	Date: 3/12/2014

COURSE: Survival Oriented Arrest Resuscitation Training (SOAR)

DATES:
April 14th (A-Fire, B-EMS)
April 16th (C-Fire, C-EMS)
April 17th (B-Fire, A-EMS)
April 18th (C-Fire, D- EMS)

TIME: 0830, 1000, 1300

LOCATION: Joshua A. Weissman Professional Development Center

<u>COURSE DESCRIPTION</u>

All personnel will discuss and practice methods to increase cardiac arrest survival for our patients.

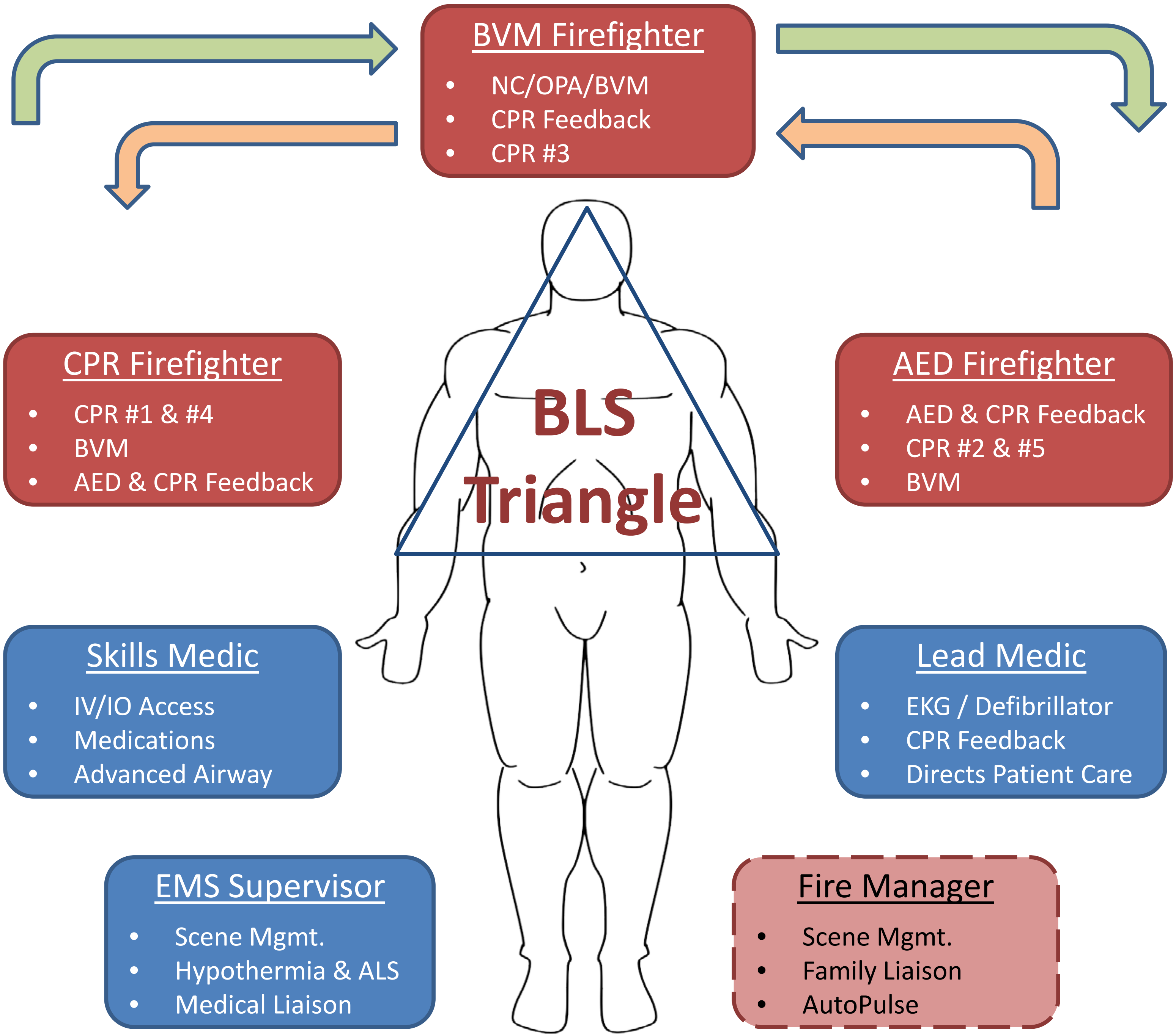
<u>AUDIENCE</u>

All Fire Department response personnel.

<u>PREREQUISITES</u>

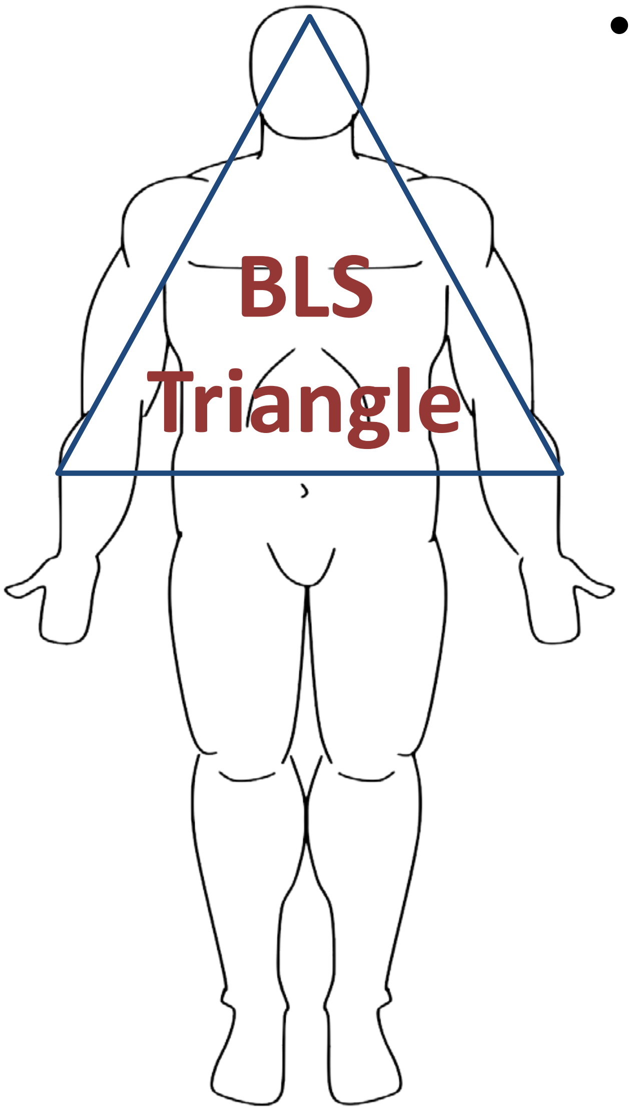
Target Solutions assignment "SOARS" Training.

1


BVM Firefighter
NC/OPA/BVM
CPR Feedback
CPR #3
CPR Firefighter
CPR #1 & #4
BVM
AED & CPR Feedback
BLS
Triangle
AED Firefighter
AED & CPR Feedback
CPR #2 & #5
BVM
Skills Medic
IV/IO Access
Medications
Advanced Airway
Lead Medic
EKG / Defibrillator
CPR Feedback
Directs Patient Care
EMS Supervisor
Scene Mgmt.
Hypothermia & ALS
Medical Liaison
Fire Manager
Scene Mgmt.
Family Liaison
AutoPulse

CPR Firefighter

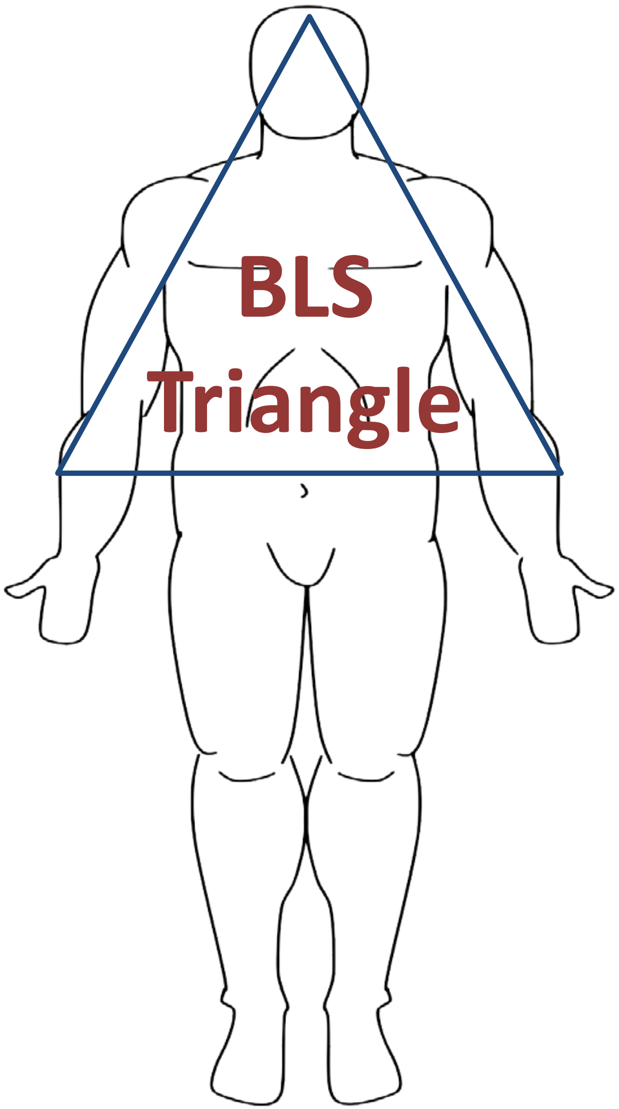
CPR Firefighter
- CPR #1 & #4
- BVM
- AED & CPR Feedback



- Responsibilities
  - Immediately begins manual CPR
  - Resumes CPR after first rhythm check
  - Moves to BVM position after performing 200 compressions

AED Firefighter

- <u>Responsibilities</u>
  - Powers on AED and follows instructions
  - Provides CPR feedback
  - Takes over CPR after CPR Firefighter completes 200 compressions
  - Moves to BVM position after performing 200 compressions



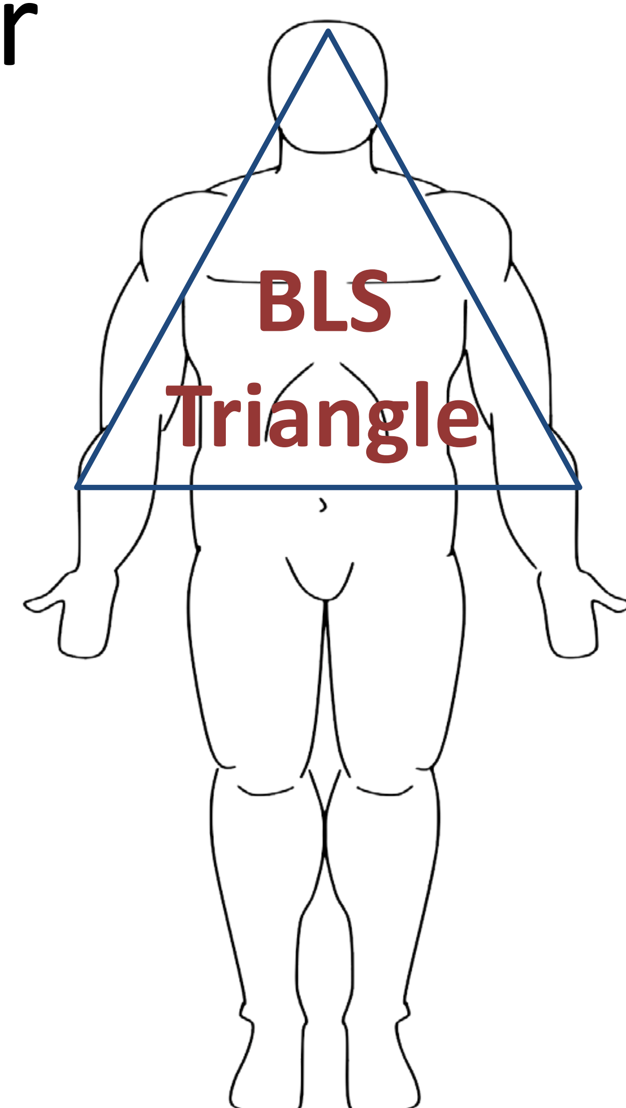
<u>AED Firefighter</u>

- AED & CPR Feedback
- CPR #2 & #5
- BVM

BVM Firefighter

BVM Firefighter

- NC/OPA/BVM
- CPR Feedback
- CPR #3



- Responsibilities
  - Inserts OPA
  - Applies NC and connects to oxygen at 15 lpm
  - Ventilates at 50:2 after first rhythm check
  - Always switches position with last compressor

SOAR: Phase II

July 2014

- New protocol released
  - "Official" expansion to entire department
  - Simplified based on provider feedback
  - Unit-level practical training scenarios

Alexandria Fire Department
Emergency Medical Services Division

Policy and Procedure # 33

Survival Oriented Arrest Resuscitation - SOAR

Date: July 2014

The likelihood of survival from cardiac arrest decreases approximately 10% for each minute that CPR and defibrillation are delayed. Interruptions in chest compressions further reduce the likelihood of survival. The following components are critical to a successful resuscitation:

- Immediate initiation of chest compressions and application of an AED
- Prioritizing uninterrupted manual chest compressions over mechanical CPR, advanced airway management, and medication administration
- Limited number and short duration (< 10 seconds) of interruptions to chest compressions
- Full chest recoil between compressions
- Ventilation targeted to minimal chest rise

INDICATION

- Apneic and pulseless adult (age >8 or signs of puberty)

PROCEDURE

1. **Establish the BLS triangle** (See Figure 1)

   a. The CPR Firefighter shall begin uninterrupted chest compressions.
      - Rate of 100-120 compressions/minute
      - Depth of at least 2 inches
      - No interruptions except to ventilate, analyze rhythm, or defibrillate
      - Full chest recoil.

   b. The AED Firefighter shall turn on the AED and follow its instructions.
      - If ALS is on the scene, the AED Firefighter may instead assist the Lead Medic with application of defibrillator pads to patient's chest.
      - The AED Firefighter may assist the BVM Firefighter with application of supplemental oxygen and airway management (i.e., OPA insertion).

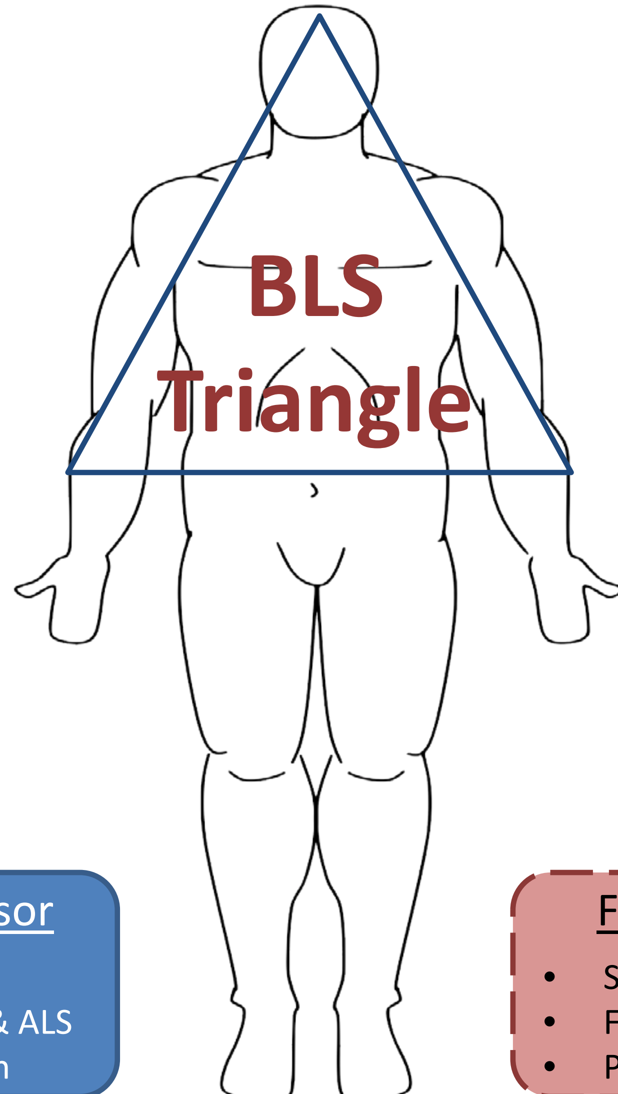
   c. The BVM Firefighter shall apply supplemental oxygen and prepare to ventilate.
      - Apply a nasal cannula and connect to oxygen at 10 liters/min (first bottle).
      - Insert a properly-sized oropharyngeal airway (OPA).
      - Obtain a mask seal with a bag-valve mask (BVM) connected to oxygen at 15 liters/min (second bottle, when it becomes available).

BVM Firefighter

- Nasal Cannula
- OPA
- BVM

CPR Firefighter

- CPR
- AED & CPR Feedback



AED Firefighter

- AED & CPR Feedback
- CPR
- Prepare AutoPulse

Skills Medic

- IV/IO Access
- Medications
- Advanced Airway

Lead Medic

- EKG / Defibrillator
- CPR Feedback
- Directs Patient Care

EMS Supervisor

- Scene Mgmt.
- Hypothermia & ALS
- Medical Liaison

Fire Manager

- Scene Mgmt.
- Family Liaison
- Prepare AutoPulse

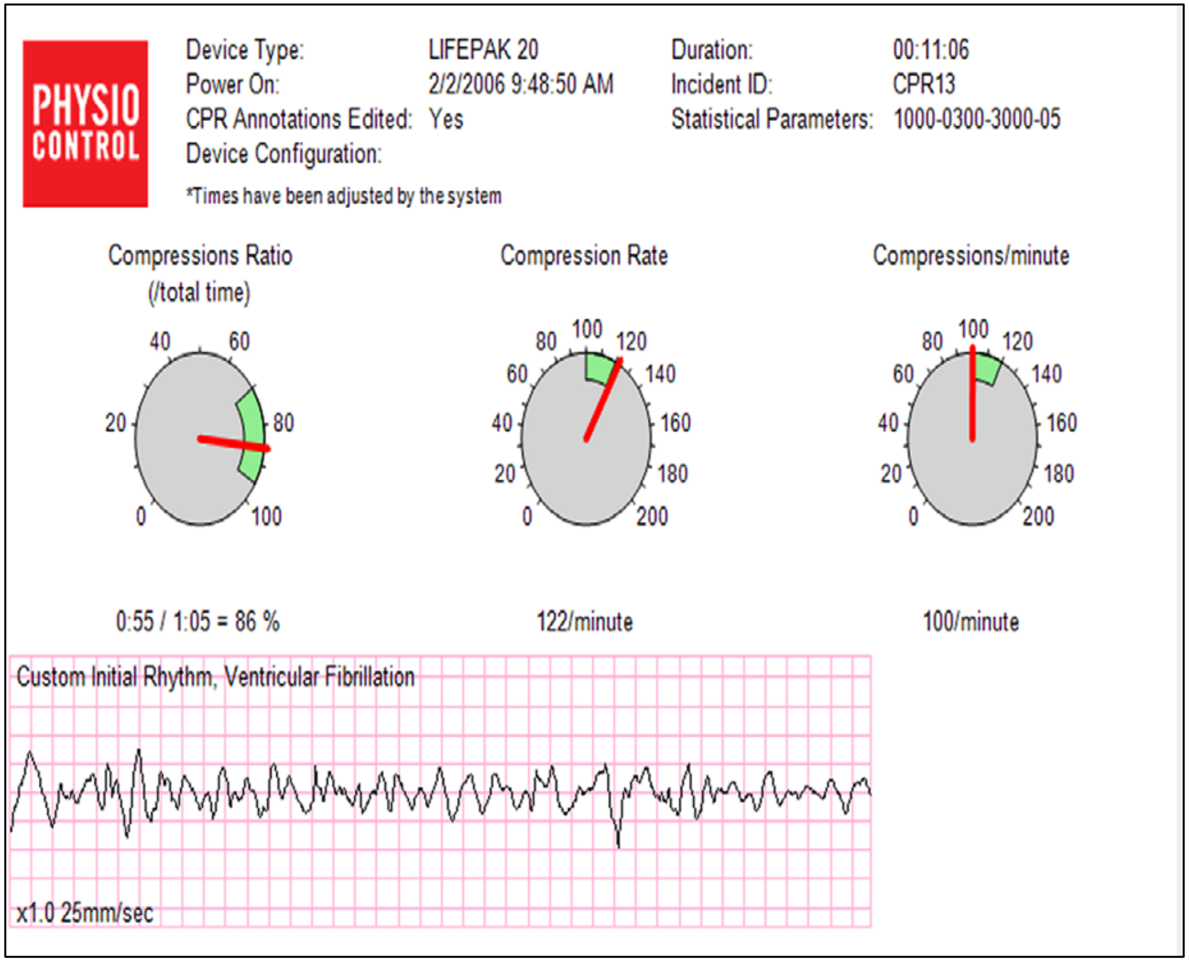
SOAR Checklist

SOAR CHECKLIST		
Establish the BLS Triangle – Start CPR		
Begin chest compressions		
Turn on AED and follow prompts		
Apply NC at 10 lpm		
Insert OPA		
Apply BVM at 15 lpm, prepare to ventilate		
Perform 5 rounds of 200 compressions		
• 100-120/minute • Depth > 2 inches • Full chest recoil • 50:2 ventilation	Round 1	200
	Round 2	200
	Round 3	200
	Round 4	200
Prepare AutoPulse	Round 5	200
Prepare for Transport		
Apply AutoPulse		
Consider advanced airway		
Make a transport decision		

Performance Goals

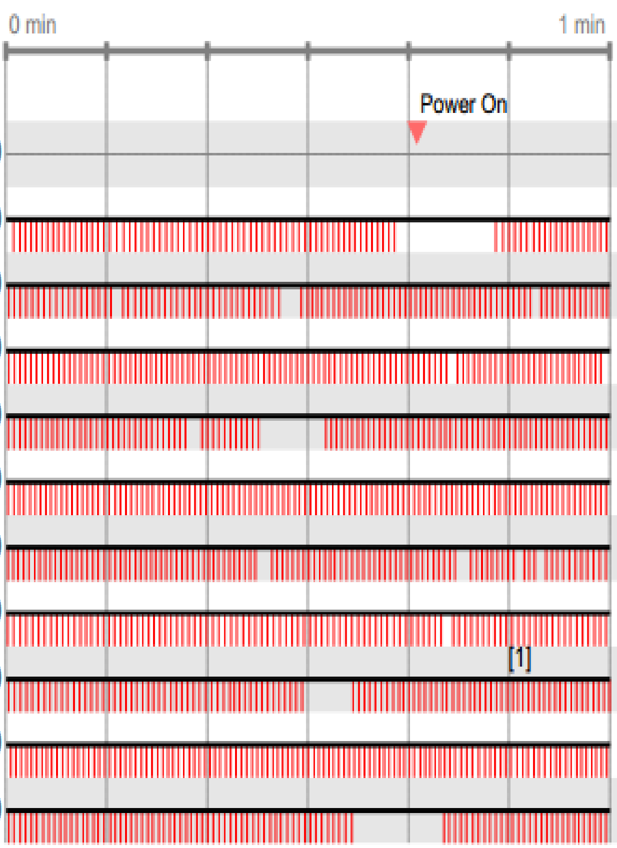
- Compression ratio (CCF) > 80%
- Compression rate between 100 and 120
- Minimal interruptions
- Each CPR pause < 10 seconds
  - Rhythm check
  - Peri-shock pause
  - AutoPulse application (delayed)
  - Intubation (delayed)

Performance Measurement



Quality Improvement

CPR QUIK-VIEW



Interval Statistics

	CPR Ratio, %	Compr. Ratio, %	Compr. Rate	Compr. /min
-1:00	--	--	--	--
0:00	85	84	103	86
1:00	100	100	106	101
2:00	100	100	110	108
3:00	100	90	110	97
4:00	100	100	112	112
5:00	100	100	112	106
6:00	100	100	102	101
7:00	100	93	107	100
8:00	100	100	116	115
9:00	86	86	108	92

Quality Improvement

2014 Cardiac Arrest Statistics

(through the end of September)

Category	Total	Attempted	Cardiac	Witnessed	VF/VT	ROSC	Survival
Attempted	76	76	63	29	9	21	5
Percentage	100%	100%	83%	38%	12%	28%	7%
CARES	63	63	63	24	9	17	5
Percentage	83%	100%	100%	38%	14%	27%	8%
Utstein	7	7	7	7	7	4	2
Percentage	9%	100%	100%	100%	100%	57%	29%

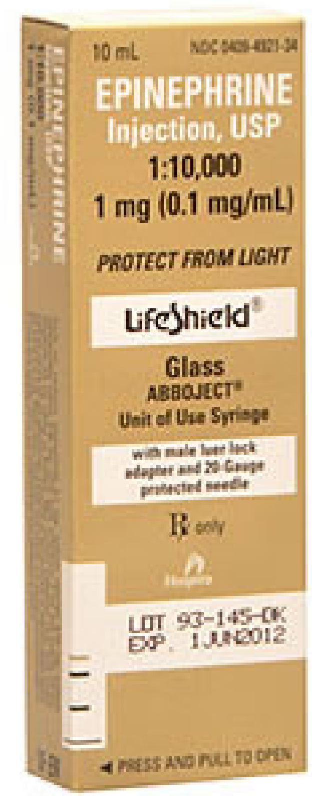
Evidence-Based Resuscitation

Associated with Increased Survival

- High-quality CPR
- Minimally-interrupted chest compressions
- Early defibrillation
- Nothing else!

Not Associated with Increased Survival

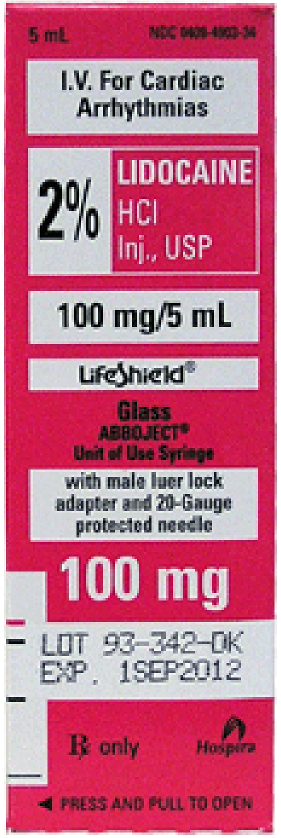
- Epinephrine
  - Maybe if administered early for non-shockable rhythms
  - Otherwise, only improves ROSC (i.e., no survival benefit)



Donnino, M.W. et al. (2014). Time to administration of epinephrine and outcome after in-hospital cardiac arrest with non-shockable rhythms: retrospective analysis of large in-hospital data registry. *BMJ, 348*; Lin, S. et al. (2014). Adrenaline for out-of-hospital cardiac arrest resuscitation: A systematic review and meta-analysis of randomized controlled trials. *Resuscitation, 85*(6), 732-740.

Not Associated with Increased Survival

- Other cardiac medications
  - Vasopressin: no difference
  - Amiodarone: no survival benefit
  - Lidocaine: no survival benefit
  - Magnesium: no difference outside of torsades VT
  - Atropine: insufficient evidence, unlikely to benefit
  - Bicarb: conflicting evidence, evidence of harm
  - Calcium: no survival benefit



Neumar, R.W. et al. (2010). Part 8: Adult advanced cardiovascular life support: 2010 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation, 122*(18 suppl 3), S729-S767.

Not Associated with Increased Survival

- Impedance threshold device (ResQPOD®)
  - No survival benefit when used by itself

Cave, D.M. et al. (2010). Part 7: CPR techniques and devices: 2010 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation, 122*(18 suppl 3), S720-S728.

Not Associated with Increased Survival

- Impedance threshold device (ResQPOD®)
  - No survival benefit when used by itself
  - Survival benefit shown when used in conjunction with active compression-decompression (ACD)
  - CardioPump® has received preliminary FDA approval

Frascone, R.J. et al. (2013). Treatment of non-traumatic out-of-hospital cardiac arrest with active compression decompression cardiopulmonary resuscitation plus an impedance threshold device. *Resuscitation, 84*(9), 1214-1222; Aufderheide, T.P. et al. (2011). Standard cardiopulmonary resuscitation versus active compression-decompression cardiopulmonary resuscitation with augmentation of negative intrathoracic pressure for out-of-hospital cardiac arrest: a randomised trial. *Lancet, 377*(9762), 301-311.

Not Associated with Increased Survival

- Therapeutic hypothermia
  - Questionable benefit of prehospital initiation
  - Concern with side effects (e.g., pulmonary edema)
  - Intra-arrest hypothermia: may be beneficial if initiated early

Kim, F. et al. (2014). Effect of prehospital induction of mild hypothermia on survival and neurological status among adults with cardiac arrest: a randomized clinical trial. *JAMA, 311*(1), 45-52; Bernard, S.A. et al. (2010). Induction of therapeutic hypothermia by paramedics after resuscitation from out-of-hospital ventricular fibrillation cardiac arrest: A randomized controlled trial. *Circulation, 122*(7), 737-742; but see Scolleta, S. et al. (2012). Intra-arrest hypothermia during cardiac arrest: a systematic review. *Critical Care, 16*(2), R41.

Summary

- High-quality CPR is key to improving survival
  - Minimally-interrupted chest compressions
  - Chest compression rate between 100 and 120
  - Chest compression depth greater than 2 inches
  - Full chest recoil (no leaning)
  - Less ventilation
- SOAR is a work in progress
  - It will take some time to show results
- Evidence-based resuscitation is the future!

Questions?

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