

Squad Review

MCEMS

Summer 2013

CPR Update

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Goals:

- 1) Review MCMES save rates for out of hospital cardiac arrests (OOHCA).
- 2) Review current literature regarding effect on survival of strict adherence to minimally interrupted CPR protocols.
- 3) Review current literature regarding EMS “best-practices” for adhering to minimally interrupted CPR protocols.
- 4) Review a commonly used team-based (“Pit-crew”) approach to management of OOHCA.
- 5) Hopefully convince you that although the MCEMS “save rate” for OOHCA is pretty good, we can likely make it much better with some re-thinking and re-training.
- 6) Avoid putting you to sleep.

High Plains Data 2012

CARDIAC ARRESTS

• CARDIAC ARREST DATA:

	<u>Total</u>	<u>Percentage</u>	<u>Comments</u>
Arrests (worked)	95	100%	244 total arrests
SROC→ to ICU	23	24%	
D/C'd from hospital	12	13%	14% 2010, 12% 2011
<u>VF/VT:</u>	28		
D/C'd	8/28	29%	best in US = >50%
<u>Non-VF/VT:</u>	67		
D/C'd	4/67	6%	

• ANALYSIS:

1. Our save rates have been pretty static since 2010
2. We have not seen a change in survival since the minimally-interrupted chest compressions guidelines from AHA were instituted.
3. Many US EMS systems have now passed us by.

Interestingly...

The current published AHA Guidelines for ECC (Circulation, 2010) state:

“Emergency systems... can effectively... achieve VF cardiac arrest survival of almost 50%”. (Ours was 29% in 2012)

They cite several studies to support this:

- Circulation, 2006
- Resuscitation, 2009
- Archives of Internal Medicine, 2009
- Annals of Emergency Medicine, 2009

The current literature argues...

That the likelihood of survival is increased by:

- 1) High-quality, uninterrupted, chest compressions;
- 2) Early defibrillation;
- 3) Controlled or limited ventilations.

- 1) Is the current literature correct-
does increasing the amount of total time during which high-quality compressions are on-going (“compression fraction”) change survival?
- 2) If this really does improve survival-
is there an EMS “best-practice” to consistently create order out of chaos, on-scene, every time, in order to hit these targets?
- 3) If there is such a “best-practice” method:
how can MCEMS make this happen, system-wide?

Does meticulous compliance
with minimally interrupted
CPR matter?

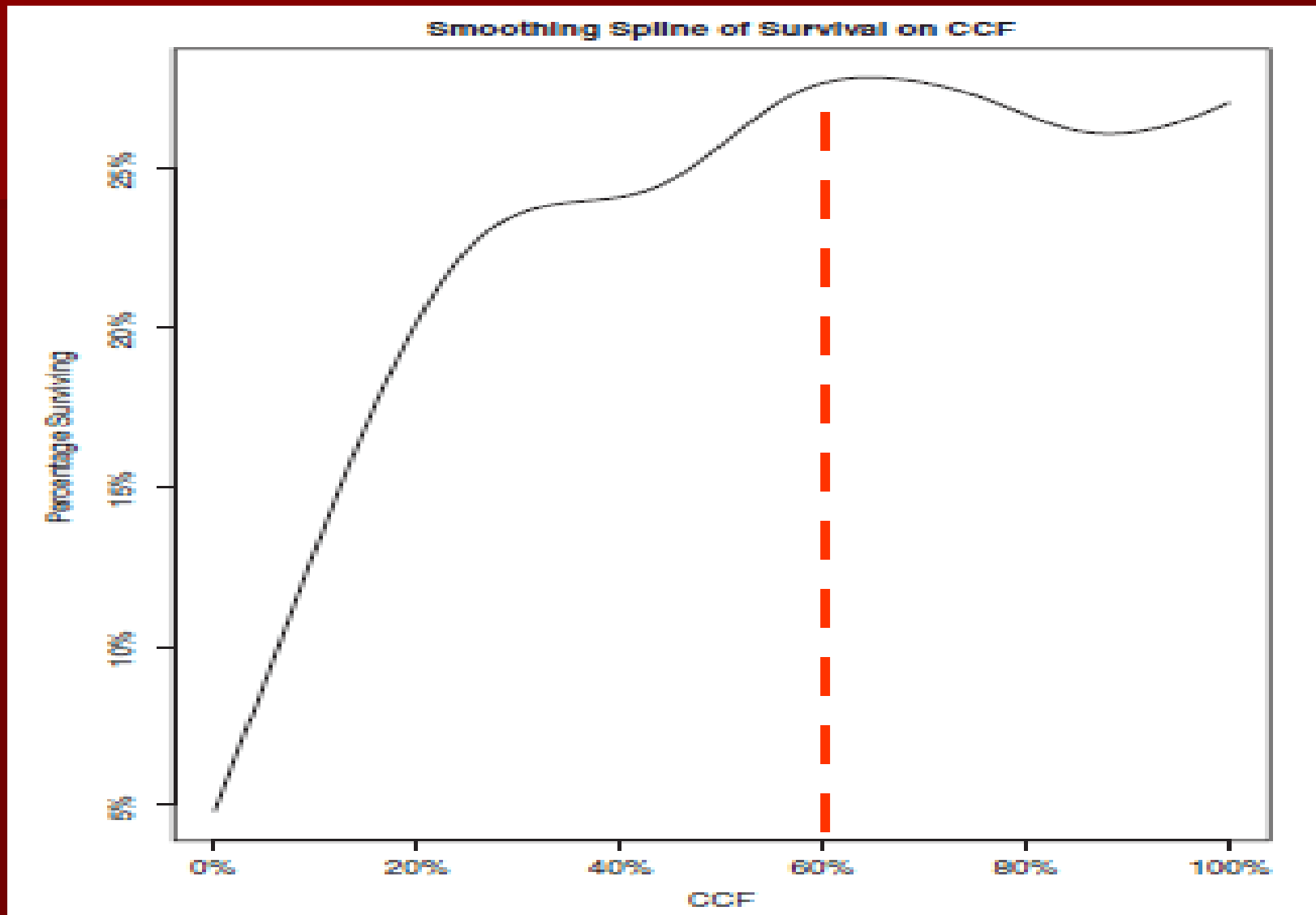
Does meticulous compliance with Minimally Interrupted CPR matter?

Many existing studies...

- There are many studies which show evidence for increased survival in OOHCA patients who receive CPR focused on
 - High fraction of time with compressions ongoing
 - Tightly controlled ventilations
 - Early defibrillation
- Critical Care Medicine, Ornato et al, 1998.
- Circulation, Swensen et al, 1988.
- Archives of Internal Medicine, Kern et al, 1992.
- Circulation, Christenson et al, 2009.

Circulation. 2009 September 29; 120(13): 1241–1247.

5% Percent Surviving 25%

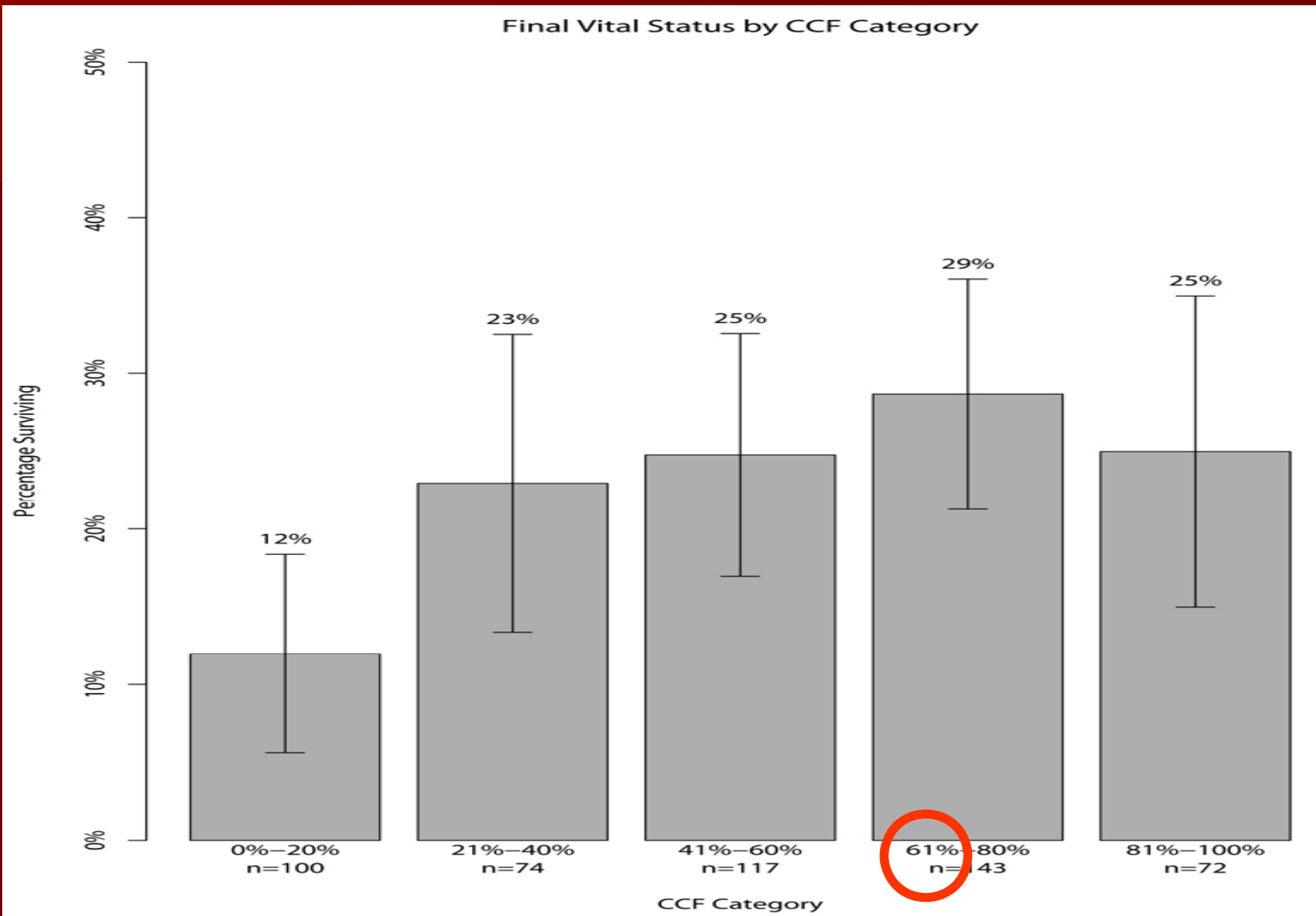


0%

Chest Compression Fraction

100%

Circulation. 2009 September 29; 120(13): 1241–1247.



Does meticulous compliance with Minimally Interrupted CPR matter?

What effected survival most?

“Factors Associated with Survival to Hospital Discharge”:

1) Things EMS cannot control:

- Bystander Witnessed Arrest OR of survival 2.28
- Public Location OR of survival 1.66
- Bystander CPR OR of survival 1.14

2) Things EMS can control:

- Each 10% Increase in CCF OR of survival 1.11

Nothing else effected survival in this study- age, gender, minutes from 911 call to EMS on-scene, etc.

Circulation. 2009 September 29; 120(13): 1241–1247.

Does meticulous compliance with minimally interrupted CPR matter?

There is a lot of convincing evidence that it does

- From the AHA and their Guidelines, including many EMS systems with VT save rates of close to 50%.
- From the recent Circulation paper just discussed.
- From many other papers and expert opinion.

Bottom Line

As best we can tell, from pretty decent and convincing evidence, strict and meticulous EMS compliance with the parameters of high-quality CPR with minimally interrupted cardiac resuscitation saves lives.

Is there an “EMS best-practice” for creating order and hitting these targets- every time- on-scene?

The short answer: Yes, there is.

The long answer: Let’s look at Mesa, Arizona EMS...

Annals of Emergency Medicine On-line, 2013

EMERGENCY MEDICAL SERVICES/ORIGINAL RESEARCH

The Influence of Scenario-Based Training and Real-Time Audiovisual Feedback on Out-of-Hospital Cardiopulmonary Resuscitation Quality and Survival From Out-of-Hospital Cardiac Arrest

Bentley J. Bobrow, MD; Tyler F. Vadeboncoeur, MD; Uwe Stolz, PhD, MPH; Annemarie E. Silver, PhD; John M. Tobin, CEP; Scott A. Crawford, EMT-B; Terence K. Mason, RN; Jerome Schirmer, CEP; Gary A. Smith, MD; Daniel W. Spaite, MD

Study objective: We assess whether an initiative to optimize out-of-hospital provider cardiopulmonary resuscitation (CPR) quality is associated with improved CPR quality and increased survival from out-of-hospital cardiac arrest.

Team-based CPR

2013, Annals of Emergency Medicine, Bobrow et al:

"The Influence of Scenario-Based Training and Real-Time Audiovisual Feedback on Out-of Hospital Cardiopulmonary Resuscitation Quality and Survival From Out-of-Hospital Cardiac Arrest."

Objective:

- To assess whether a brief training program to optimize quality of EMS provider CPR is associated with:
 - improved CPR quality, and
 - increased survival from out-of-hospital cardiac arrest.

What does “optimized CPR quality” really mean?

1. **Compressions:**

- High Quality- deep (2"); fast, not too fast (~100/min)
- LIMITED INTERRUPTIONS

2. **Defibrillation:** with short pre-shock pauses, and immediate post-shock CPR

3. **Controlled ventilation** (max. 10/min.), with NO pauses

Everything else is secondary

A few EMS Agency details...

2013, Annals of Emergency Medicine, Bobrow et al:

"The Influence of Scenario-Based Training and Real-Time Audiovisual Feedback on Out-of Hospital Cardiopulmonary Resuscitation Quality and Survival From Out-of-Hospital Cardiac Arrest."

- Mesa, Arizona EMS.
- 70,000 911 calls/year
- 19 Fire Stations, 202 Paramedics, 171 EMT-B's
- Typical crew: 2 Paramedics and 2 EMT-B's on scene
- EMS system has had a "minimally interrupted cardiac resuscitation" protocol in place since 2006

Team-based CPR

2013, Annals of Emergency Medicine, Bobrow et al:

"The Influence of Scenario-Based Training and Real-Time Audiovisual Feedback on Out-of Hospital Cardiopulmonary Resuscitation Quality and Survival From Out-of-Hospital Cardiac Arrest."

Design:

- Before-after study of 484 consecutive adult OOHCA's
- Phase 1 ("before"): 18 months of baseline CPR quality and survival data collected (232 pts.; 2008-2010)
- Phase 2 ("after"): 16 months of CPR quality and survival data after 4 hour didactic and scenario-based training of 373 providers. (252 pts.; 2010-11)
 - including real-time audio and visual feedback to EMT's, from the defibrillator, during CPR.

Details of the training class

- 2 hours of lecture based teaching by “master trainers”.
 - These 9 trainers took a class with the EMSMD and his staff to become “master trainers”.
- 2 hours of team-centered, hands-on, scenario-based practice.
- Training repeatedly and explicitly emphasized a team approach to resuscitation.
- Training repeatedly and explicitly emphasized a meticulous compliance with the parameters of high-quality CPR and with a minimally interrupted cardiac resuscitation protocol.

Details of the training class...

- Providers were educated about specific positioning and the role of each team member in a “pit crew” model of resuscitation.
- These positions are pre-designated prior to arrival on-scene, with each team member knowing their specific role and tasks in advance.
- The prime importance of uninterrupted, high-quality chest compressions was stressed...
- With the intent that this model would be used during all actual resuscitations by their EMS system.
-

Details of the training class...

- Providers were specifically trained to avoid excessive ventilation (both rate and volume) and
- Were educated to use a CPR interval timer on the defibrillator to space ventilations properly (ie, deliver 1 ventilation every 6 seconds).
- The training emphasized the importance of applying the combination defibrillator pads/accelerometer without interrupting compressions.
-

Team-based CPR

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Effect of training on CPR Quality, Before vs. After:

- Chest compression rate decreased: 128 vs. 106/min.
- Chest compression depth increased: 1.78 vs. 2.15 inches.
- Compression fraction increased: 66% vs. 84% of time with active compressions on-going.
- Duration of pre-shock pauses decreased: 27 vs. 15 seconds.
- Ventilation rate decreased: 11.7 vs. 9.5/minute

Team-based CPR

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Effect of training on Survival, Before vs. After:

- All rhythm survival:

Before- 20/231= 8.7%

After- 35/252= 13.9% (MCEMS= 12-14%, 2010-2012)

- VF/VT survival:

Before- 15/57= 26.3%

After- 20/36= 55.6% (MCEMS= 29%, 2012)

- Their save rate more than doubled in our most savable patients (VT/VF) by implementing and following a team-based, "pit crew", model.

Is there an “EMS best-practice” for creating order and hitting these targets- every time- on-scene?

The experience of Mesa, AZ (and several other systems), clearly demonstrates an EMS “best-practice” does exist.

- Team approach to all resuscitations.
- Solid training and practice to learn and follow pre-defined roles on-scene.
- Laser-like focus by every provider on where the money is:
 - Strict adherence to plan/protocols
 - Absolutely minimal interruptions to compressions

How can MCEMS bring such a best-practice approach on-line such that it is used system-wide, at all times, by all Agencies and providers?

Much of this discussion courtesy of:

Paul R. Hinchey MD MBA,
Medical Director
Austin-Travis County EMS System
Austin, Texas

First: get priorities straight...

- Straight in EVERY (EVERY!) providers head:
 1. Compressions:
 - High Quality- deep (2"); fast, not too fast (~100/min)
 - LIMITED INTERRUPTIONS
 2. Defibrillation: with short pre-shock pauses, and immediate post-shock CPR
 3. Controlled ventilation (max. 10/min.), with NO pauses

Everything else is secondary

A NASCAR Pit Crew has many tasks to accomplish quickly at a pit stop...

- One of them is changing 4 tires simultaneously.
- They do it the same way every time.
- Each member knows their exact role, and does it.

A professional EMS Crew has many tasks to accomplish quickly at a cardiac arrest...

- One of them is high quality CPR.
- We should do it the same way every time.
- Each member knows their exact role, and does it.

"Pit Crew" Model

- One name...many versions
- CPR
 - Maximize compression fraction
 - Effective compression (rate/depth)
 - Provider fatigue
- Controlled ventilations
- Defibrillation
 - Pre-charge @1:45 for assessment at 2 min.
 - Brief pre-shock pause

Why choreograph the process?

- Because it:
 - Improves outcomes
 - Improves efficiency
 - Reduces errors
- Creates uniformity:
 - Accurate assessment of outcomes
 - Links specific interventions to outcomes
 - Baseline for future modifications

It's harder to do than you think

Task Interruptions

- Airway interventions and IV's
- Ventilations
- Pulse checks
- Rhythm analysis
- Defibrillation
- Changing compressors
- ~~Patient movement~~

It's harder to do than you think

We have limited awareness of task time in complex processes....

...so these interruptions should be engineered and choreographed to minimize their time impact.

This is the essence of a team-based or pit-crew approach to CPR.....

It's harder to do than you think

30:2:

- 100 compressions/min = 18s for 30 compressions
- 5 s break for ventilations every 30 compressions?
- 18 of every 23s in active compression is only 78%
- NOT counting other breaks in CPR

Pit Crew:

- Continuous compressions w/asynchronous ventilation (i.e. no break for ventilations).
- 10s break every 2min is 92% CCF
- 5s of break every 2min is 96% CCF

Austin/Travis County EMS

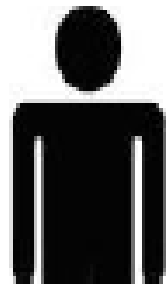
CURRENT GOAL

Less than 10 second break in every 2 minute cycle of CPR

Let's look at how they have chosen to choreograph their cardiac arrests...

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

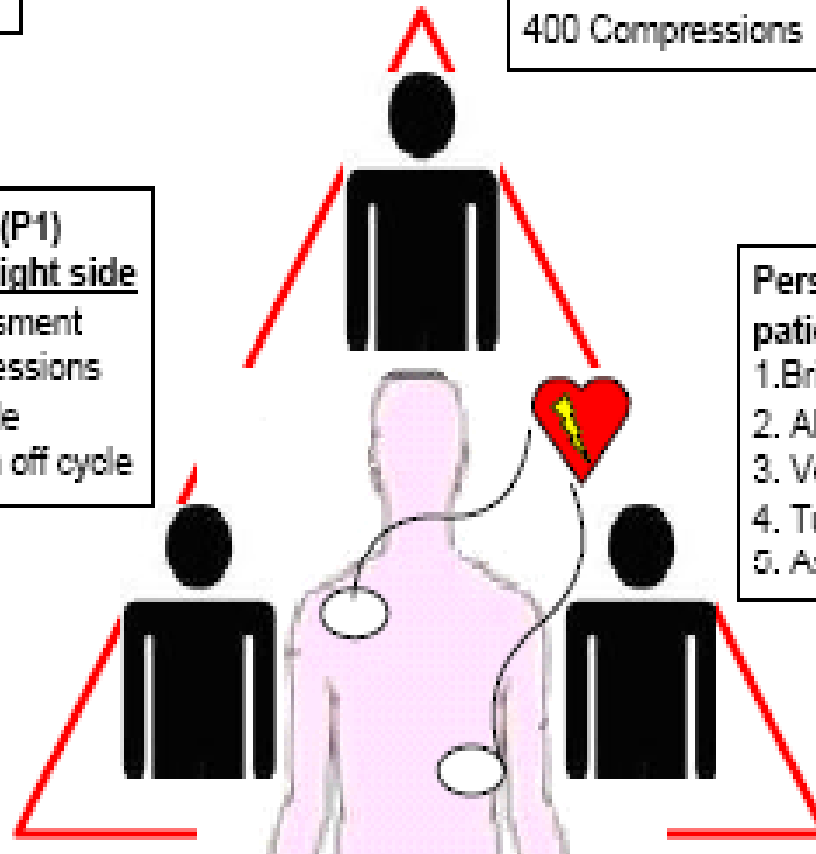
1. Opens/clears Airway and insert OPA
2. Assembles/apply BVM and ITD
2. Provides 2 hand mask seal
3. Inserts/secures BIAD (King) & ITD & ETCO₂ after 400 Compressions

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

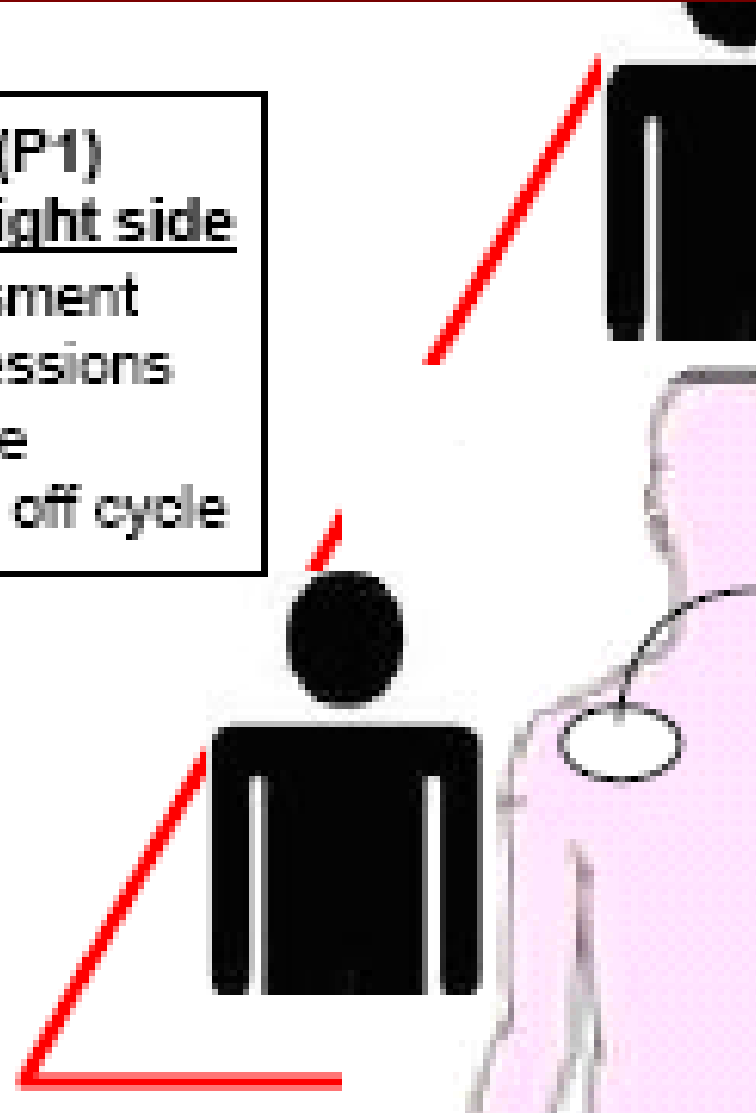
1. Brings and operates AED
2. Alternates 100 compressions with P1
3. Ventilates in off cycle
4. Turns on AED after 200 Compressions
5. Assist with BIAD Preparation if needed



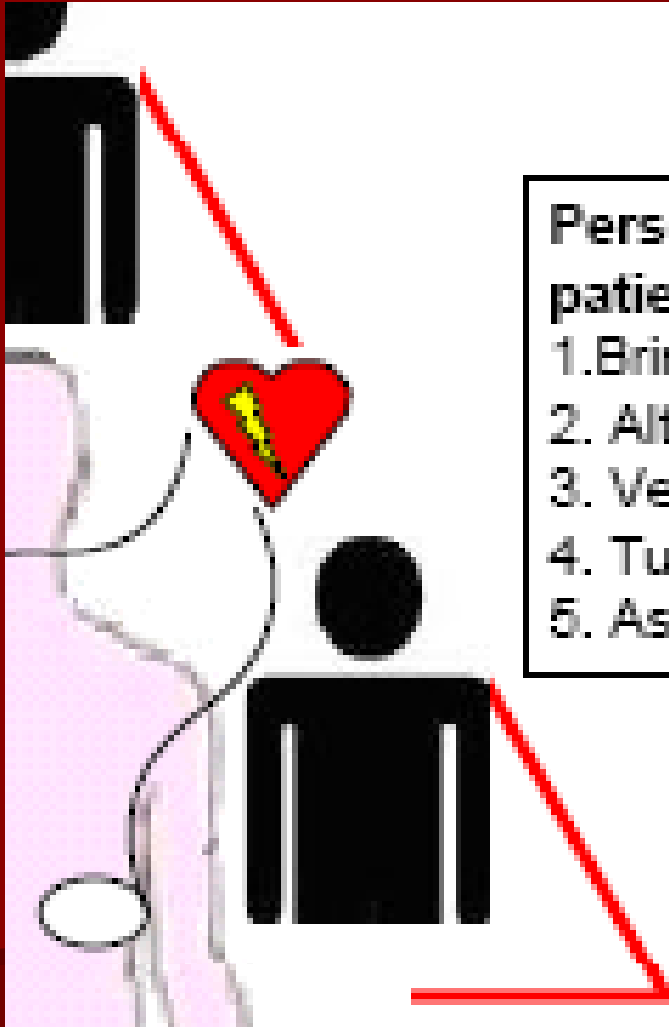
Patients right side- assess/compress

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



Patients left side- AED/compress



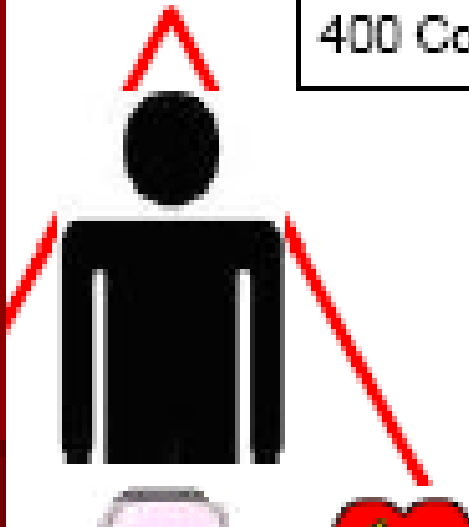
Person in Position 2 (P2) always on patients Left side

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

Patients head- airway/ventilation

Person in Position 3 (P3) always at patients Head

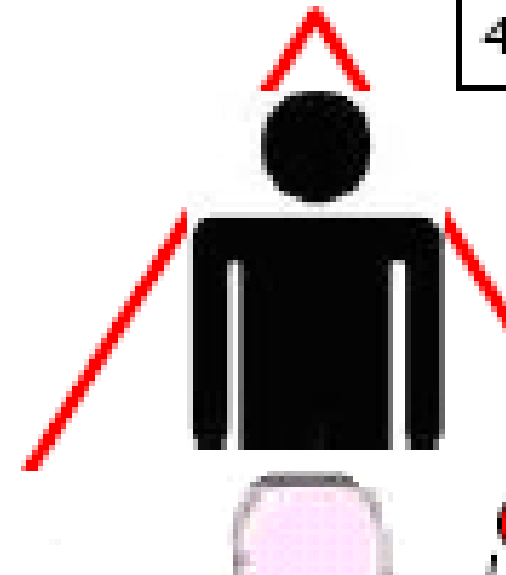
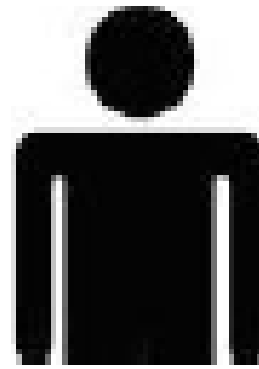
1. Opens/clears Airway and insert OPA
2. Assembles/apply BVM and ITD
2. Provides 2 hand mask seal
3. Inserts/secures BIAD (King) & ITD & ET CO_2 after 400 Compressions



Team Leader- "ATC" for CPR triangle

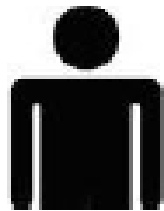
Person in Position 4 (P4)
always just outside the
"Triangle" of CPR

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



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

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

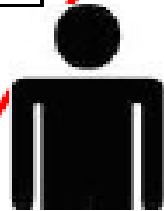


Person in Position 3 (P3) always at patients Head

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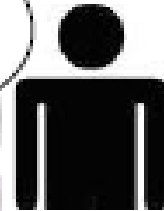
Person in Position 1 (P1) always on patients Right side

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



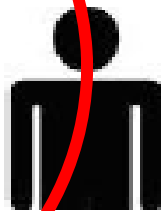
Person in Position 2 (P2) always on patients Left side

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



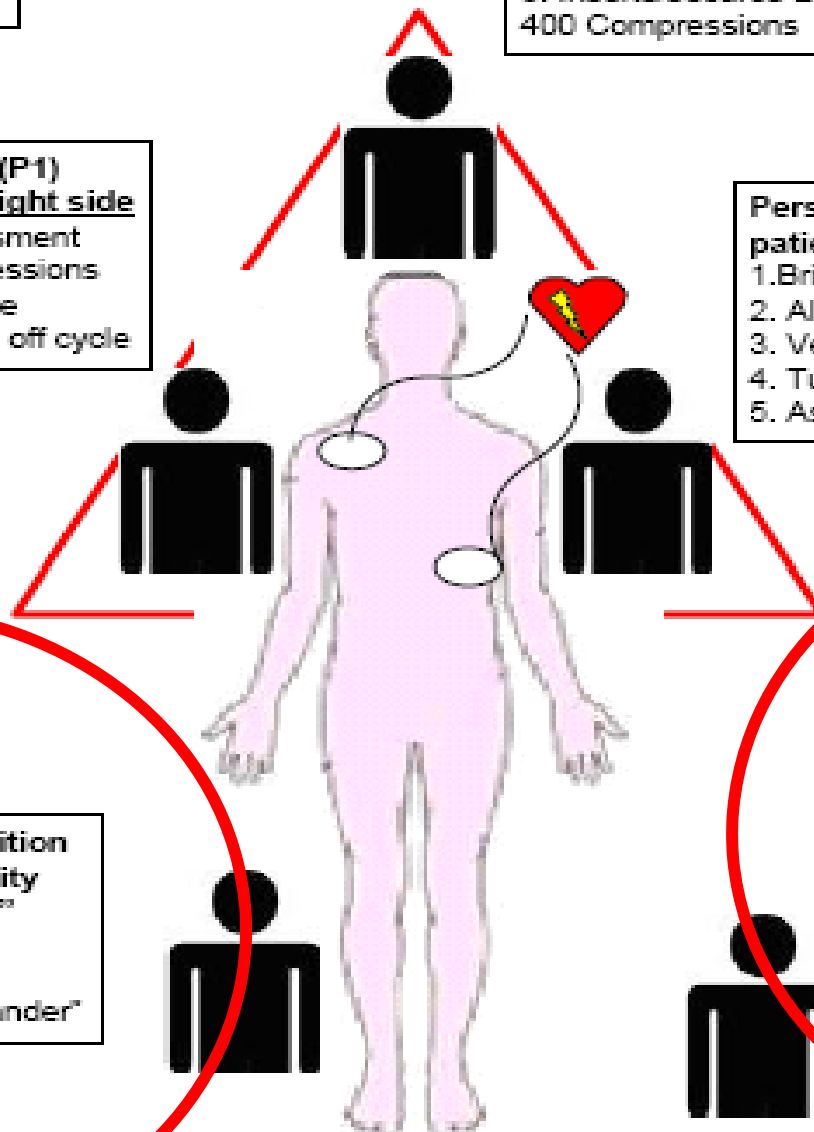
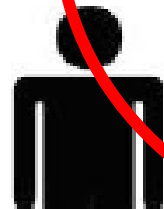
Advanced Provider in Position 5 (P5) always at an extremity outside the CPR "Triangle"

1. Initiates IV/IO access
2. Administers Medications requested by "Code Commander"



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



How can MCEMS bring such a best-practice approach on-line such that it is used system-wide, at all times, by all Agencies and providers?

1. Learn to think differently- put an *incredibly high* priority on the high priorities, and do not get distracted.
2. Train, train, train.
3. Commit ourselves to this process, and to improving our OOHCA save rate County-wide.

What's next?

- Dr. Hall will be working with the QA Committee to design what our “pit crew” is going to look like:
 1. This method of cardiac resuscitation is being introduced around the County at Squad Review this trimester.
 2. He anticipates the actual training to begin this fall.
 3. He anticipates this model of cardiac resuscitation to be in place and “our way” for all Core-0's by January 1, 2014.

What's can you do now?

1. Start digesting these lessons now- especially the incredible emphasis on meticulous compliance with the parameters of high-quality CPR this approach demands.
2. Start practicing like this with your crews now- who will do what- exactly- and get on the chest.
3. Interested in becoming a Master Trainer?- let Dr. Hall know...we need YOU.

Take Home points, for now...

- Choreograph your cardiac arrests
- Focus on priorities
 - Limited interruption
 - Controlled ventilation
 - Timely defibrillation
 - Compressor fatigue
- Continuously reassess and reengineering your teams approach
- go to atcomdce.org to see some nice videos Austin/Travis County EMS have produced on their method.

No mas