Emergency Medicine Research Forum

Keynote Speaker: **Bentley J. Bobrow, MD**
The University of Arizona College of Medicine,
Department of Emergency Medicine

**Wednesday April 26, 2017**
9:00 a.m. – 12:00 p.m.

The University of Arizona College of Medicine – Tucson South Campus,
the Abrams Center,
1st floor Conference Room, 1106/1108
3950 S. Country Club Road
Tucson, Arizona 85713

Emergency Medicine Research: Why Should You Care?
Objectives

• Describe the evolution and current structure of the AEMRC – clinical research + public health

• Translation of concept into practice

• Showcase AEMRC past and current research

• Inspire young physician scientists
Centers:

Our multidisciplinary centers promote collaborative research within the College of Medicine – Tucson, the University of Arizona and beyond. Several centers also provide clinical services and education to the college community and the public.

ARIZONA AIDS EDUCATION AND TRAINING CENTER

ARIZONA CENTER FOR INTEGRATIVE MEDICINE

ARIZONA CENTER ON AGING

*ARIZONA EMERGENCY MEDICINE RESEARCH CENTER

ARIZONA RESPIRATORY CENTER

ARIZONA TELEMEDICINE PROGRAM

STEELE CHILDREN’S RESEARCH CENTER

ARIZONA ARTHRITIS CENTER

THE UNIVERSITY OF ARIZONA CANCER CENTER

SARVER HEART CENTER

THE VALLEY FEVER CENTER FOR EXCELLENCE

VIPER INSTITUTE
Welcome to Arizona Emergency Medicine Research Center

The Arizona Emergency Medicine Research Center (AEMRC) is a collaborative statewide Center of Excellence dedicated to improving the health-care outcomes of patients with acute illness and injuries, in both pre-hospital settings and within the hospital.

The center’s research focus extends from the pre-hospital environment, including 911 and emergency medical services (EMS) care, through the emergency department and critical care settings.

History

The AEMRC was founded in 1990 by Harvey Meislin, MD, FACEP, FAAEM, whose vision included the need to dramatically improve emergency systems and the care of patients with emergent problems in the emergency department or in the field. Today, the center is a national leader in emergency medicine research and training, including the application of new resuscitation techniques and event preparedness training.

Areas of Emphasis

The center brings together collaborative teams of multidisciplinary experts to achieve critical impact in areas affecting lives in Arizona today. Current areas of emphasis include improving outcomes in critical care, optimizing hospital care, trauma care, and disasters.
PECARN

The University of Arizona Emergency Medicine Research Center (AEMRC) – Tucson at the University of Arizona Emergency Medicine Department is home to the Southwest Research Node Center (SW-RNC), one of six U.S. Research Node Centers for the Pediatric Emergency Care Applied Research Network (PECARN).

PECARN is funded through federal grants from the Emergency Medical Services for Children, a branch of the Health Resources Services Administration Maternal and Child Health Bureau. Founded in 2001, it is the nation’s first federally-funded pediatric research network dedicated to the prevention and management of acute illnesses and injuries in children.

PECARN Faculty

Kurt Denningerhoff, MD
Associate Head, Research

Dale Woolridge, MD, PhD
Director, Combined EM & Peds Residency

Aaron Leetch, MD
Associate Director, University Campus and Combined EM & Peds Residencies

PECARN Staff

Isabelle Chea
Research Specialist
Premier Hazmat Training
For All Healthcare Professionals

VIEW OUR COURSES
AEMRC Phoenix

The Arizona Emergency Medicine Research Center (AEMRC) Phoenix is an internationally acclaimed hub for research focusing on improving outcomes for victims of time-sensitive cardiovascular, neurologic, and traumatic medical emergencies. The AEMRC brings together a strong team of seasoned, NIH-funded, prehospital researchers concentrating on measuring and improving the effectiveness of life-saving prehospital medical interventions. The team includes expertise in epidemiology, database integration, advanced biostatistics, and prehospital outcomes research under the direction of Drs. Dan Spaite and Ben Bobrow.

AEMRC Phoenix has partnered with the Arizona Department of Health Services to implement successful public health programs such as the Save Hearts in Arizona Registry & Education (SHARE) Program (www.azshare.gov). The SHARE Program has collected over 20,000 out-of-hospital cardiac arrest events from over 150 EMS agencies, 40 hospitals, and 9 emergency medical dispatch centers in Arizona. SHARE promotes a system of care approach for measuring and improving survival from cardiac arrest in Arizona. This methodology encompasses all "links" in the "chain of survival"
Translational Research

Goal: Human Health Improvements

T0 Identify problems, opportunities and approaches

T1 Discovery or foundational research

T2 Health application to assess efficacy

T3 Health practice; science of dissemination and implementation

T4 Evaluation of health impact on real world populations
- EMS + Hospital data
- Quality Improvement
- Guideline Development
- Statewide Dissemination
- Partnerships

- Data Linkage
- Data Analysis
- Implementation
- Intervention evaluation
- System evaluation
- Public-Private Partnerships
- Peer review publication
Hands-Only CPR really works!
Learn how you too can be a life saver.

3560 Lives Saved & Counting!
Why Cardiac Resuscitation?

- Time critical, time dependent
- Involves multiple EMS skills/system factors
- Teamwork on the scene
- Coordination of stakeholders
- Measurable outcome
- EMS has a predominant influence on outcome
- If EMS is doing this well, most likely doing other things well
Excellence in Prehospital Injury Care (EPIC)

Why is the EPIC Project important?

According to the CDC’s Report to Congress, in 2010, TBIs accounted for approximately 2.5 million emergency department (ED) visits, hospitalizations, and deaths in the United States. Of them:

- 52,844 die
- 283,630 are hospitalized
- >2.2 million are treated and released from EDs

TBI is a contributing factor to a third of all injury-related deaths in the United States.¹

There is growing evidence that the management of TBI in the early minutes after injury profoundly impacts outcome. EMS operates in the ultra-acute setting, usually providing the first care for TBI victims when treatment matters the most. Reports on implementation of evidence-based TBI treatment guidelines inside the hospital are very promising. However, no studies to date have evaluated their impact in the prehospital setting.

The EMS agencies of Arizona have already proven their ability to dramatically improve cardiac arrest survival and, thus, Arizona was selected by the National Institutes of Health to do the same with TBI.
EPIC Project is Unique

- Funded by the NIH
  - 1R01NS071049-01A1 (Adults)
  - 3R01NS071049-S1 (EPIC4Kids)
- This is the first-ever NIH-funded statewide EMS evaluation
The Excellence in Prehospital Injury Care (EPIC) Study

- Statewide, 9-year, before-after system study evaluating the impact of implementing the National TBI Guidelines among the EMS agencies of Arizona

- 122 agencies and the 8 level I trauma centers are participating and will ultimately enroll over 22,000 patients
Purpose: Evaluate the impact of implementing the EMS TBI guidelines throughout Arizona

Implementing the EBGs

Aggressively prevent and treat the “Three H-Bombs of TBI”

- Hypoxemia
- Hypotension
- Hyperventilation

Progress:
- EMS Agencies: 125 certified
  ~93% of TBIs statewide now receive care by EPIC agencies
- Master Trainers: ~600 statewide
- EMS Providers: >11,000 trained & certified (>80% of active providers)
- Estimated cases at end:
  - Total: >20,000; Intubated: 4,000
  - Final Analysis: 2017
UNDERSTANDING THE SYSTEM OF CARE

hospital

data/QI/reports

dispatch

EMS

bystander

training/education

Is the patient breathing normally?

AED
Survival rates of OHCA

- Chicago 1987: 1%
- Ontario 1997: 2%
- New York 1990: ~1%
- Miami 1999: 4%
- Seattle 1999-2000: 5%
- Los Angeles 2000: 1%
- Arizona 2003: 3%

Ann Emergency Medicine 2005; 45: 504
Overall survival from OHCA has been stable for almost 30 years, as have the strong associations between key predictors (witnessed, bystander CPR, found in VF, and ROSC)

Sessions et al
Circ Cardiovasc Qual Outcomes, 2010; 3:63-81
Adverse Hemodynamic Effects of Interrupting Chest Compressions for Rescue Breathing During Cardiopulmonary Resuscitation for Ventricular Fibrillation Cardiac Arrest

Robert A. Berg, MD; Arthur B. Sanders, MD; Karl B. Kern, MD; Ronald W. Hilwig, DVM, PhD; Joseph W. Heidenreich, BA; Matthew E. Porter, BA; Gordon A. Ewy, MD

Figure 1. Aortic (Ao, dark band) and right atrial (RA, light band) pressures during standard CPR, CC+RB, with a 15:2 compression:ventilation ratio. Aortic relaxation, or diastolic, pressure (lower border of dark band) decreases during each set of 2 breaths, resulting in lower CPP during first several compressions of next cycle. Right atrial relaxation, or diastolic, pressure is most interior border. Difference between Ao and RA relaxation pressures is CPP.

Figure 2. Mean CPP of first 2 compressions (bottom line) and last 2 compressions (top line) of each 15-compression cycle during CPR with CC+RB at a compression:ventilation ratio of 15:2. Mean CPP difference: *P<0.05; †P<0.01; ‡P<0.001.
Figure 2. Survival from prolonged cardiac arrest in canines relates to coronary perfusion pressure generated during external chest compressions.

Survival From Prolonged Cardiac Arrest Relates to the Coronary Perfusion Pressures Generated During Chest Compression

The Price of CPR Pauses

CPR “systole”

CPR “diastole”

Paused CPR

Aorta

RA

30 compressions

16 secs

3 secs
CPR studies of 169 non-paralyzed swine and published the results in 6 different publications between 1993 and 2002

Non-paralyzed: allowing them to gasp!

<table>
<thead>
<tr>
<th>CPR Type</th>
<th>Percent 24-48 Hour Neurologically Normal Survival</th>
</tr>
</thead>
<tbody>
<tr>
<td>CCC-CPR</td>
<td>73%</td>
</tr>
<tr>
<td>“Ideal” Std-CPR</td>
<td>70%</td>
</tr>
<tr>
<td>No CPR</td>
<td>13%</td>
</tr>
</tbody>
</table>

University of Arizona Sarver Heart Center CPR Research Group
Outcomes During Simulated Single Lay Rescuer Scenario of VF (3 minutes VF, 12 minutes CPR, then ACLS)

24-Hour Neurological Normal Survival (percent)

- CCC CPR: 80%
- Realistic 2:15 CPR: 13%

P < 0.003

Cardiopulmonary Resuscitation in the Real World: When Will the Guidelines Get the Message?

Arthur B. Sanders, MD
Gordon A. Ewy, MD

The Guidelines for Cardiopulmonary Resuscitation (CPR) and Emergency Cardiovascular Care (ECC) are probably the most widely implemented and best-known guidelines in medicine. In the setting of cardiac arrest, health care professionals want and need simple, practical, and effective guidelines. As the (37%). Although neither of these studies was powered to assess patient survival, Abella et al found a trend showing that patients who had longer periods without chest compression had worse resuscitation outcome.

These reports are consistent with previous studies documenting low chest compression rates and high ventilation rates when CPR is performed by health care professionals. They also complement studies looking at how laypersons and health professionals deliver CPR in cardiac arrest simulations. Assar et al demonstrated that laypersons taught

Sanders AB and Ewy GA  JAMA 2005 293: 363
 Interruptions of Chest Compressions During Emergency Medical Systems Resuscitation

Terence D. Valenzuela, MD; Karl B. Kern, MD; Lani L. Clark, BS; Robert A. Berg, MS; Marc D. Berg, MS; David D. Berg; Ronald W. Hilwig, DVM, PhD; Charles W. Otto, MD; Daniel Newburn, BS; Gordon A. Ewy, MD

<table>
<thead>
<tr>
<th>Year</th>
<th>All Initial Rhythms</th>
<th>VF Initial Rhythm</th>
</tr>
</thead>
<tbody>
<tr>
<td>1992</td>
<td>7</td>
<td>14</td>
</tr>
<tr>
<td>1993</td>
<td>9</td>
<td>13</td>
</tr>
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<td>1994</td>
<td>4</td>
<td>7</td>
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<td>1995</td>
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<td>1996</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>1997</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>1998</td>
<td>7</td>
<td>9</td>
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<tr>
<td>1999</td>
<td>8</td>
<td>10</td>
</tr>
<tr>
<td>2000</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>2001</td>
<td>5</td>
<td>10</td>
</tr>
</tbody>
</table>

TABLE 3. Comparison of First 5 Minutes vs the Entire Resuscitation Effort

<table>
<thead>
<tr>
<th></th>
<th>First 5 Minutes</th>
<th>Entire Effort</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time with CCs, %</td>
<td>40±21</td>
<td>43±18</td>
<td>NS</td>
</tr>
<tr>
<td>Time without CCs, %</td>
<td>60±21</td>
<td>57±18</td>
<td>NS</td>
</tr>
<tr>
<td>Longest period with CCs, seconds</td>
<td>65 (46, 84)</td>
<td>122 (68, 206)</td>
<td>0.0001</td>
</tr>
<tr>
<td>Average period with CCs, seconds</td>
<td>46 (30, 67)</td>
<td>55 (43, 74)</td>
<td>NS</td>
</tr>
<tr>
<td>Longest period without CCs, seconds</td>
<td>95 (70, 147)</td>
<td>172 (109, 246)</td>
<td>0.0001</td>
</tr>
<tr>
<td>Average period without CCs, seconds</td>
<td>56 (41, 87)</td>
<td>57 (40, 78)</td>
<td>NS</td>
</tr>
</tbody>
</table>

CC indicates chest compression. Time interval data are reported as median and (25%, 75% interquartile range).
An AED ECG record from a representative patient.

Cardiocerebral Resuscitation for Cardiac Arrest

EMS arrival

CC-Only

200 chest compressions

Single shock: No pulse check nor rhythm analysis after shock

Analysis

200 chest compressions

Single shock: No pulse check nor rhythm analysis after shock

Analysis

200 chest compressions

Single shock: No pulse check nor rhythm analysis after shock

Passive insufflation of O2, Oral pharyngeal airway, Non-rebreather mask, High flow oxygen
Frees second person to start I.V.

1 = Consider intubation
Cardiocerebral Resuscitation

Saved Lives in Tucson

Hospital Discharge Survival

<table>
<thead>
<tr>
<th></th>
<th>1997-1999</th>
<th>CPR</th>
<th>34/136</th>
<th>25%</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPR</td>
<td>9%</td>
<td>28/314</td>
<td>p &lt; 0.05</td>
<td></td>
</tr>
<tr>
<td>CCR</td>
<td>11/03-8/06</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Terry Valenzuela MD  AHA Resuscitation Science Symposium 2006
Minimally Interrupted Cardiac Resuscitation by Emergency Medical Services for Out-of-Hospital Cardiac Arrest

Bentley J. Bobrow, MD
Lani L. Clark, BS
Gordon A. Ewy, MD
Vatsal Chikani, MPH
Arthur B. Sanders, MD
Robert A. Berg, MD
Peter B. Richman, MD
Karl B. Kern, MD

Context Out-of-hospital cardiac arrest is a major public health problem.

Objective To investigate whether the survival of patients with out-of-hospital cardiac arrest would improve with minimally interrupted cardiac resuscitation (MICR), an alternate emergency medical services (EMS) protocol.

Design, Setting, and Patients A prospective study of survival-to-hospital discharge between January 1, 2005, and November 22, 2007. Patients with out-of-hospital cardiac arrests in 2 metropolitan cities in Arizona before and after MICR training of fire department emergency medical personnel were assessed. In a second analysis of protocol compliance, patients from the 2 metropolitan cities and 60 additional fire departments in Arizona who actually received MICR were compared with patients who

| Table 2. Comparison of Major Outcomes in the Before and After Analysis |
|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
|                        | Before MICR Training    | After MICR Training     | Unadjusted              | Adjusted               |
| Primary outcomes       |                         |                         |                         |                         |
| Survival-to-hospital discharge | 4/218 (1.8)            | 36/668 (5.4)            | 3.0 (1.1-8.6)           | 3.0 (1.1-8.9)           |
| Survival with witnessed VF | 2/43 (4.7)             | 23/131 (17.5)           | 4.4 (1.0-19.1)          | 8.6 (1.8-42.0)          |
| Secondary outcomes     |                         |                         |                         |                         |
| Return of spontaneous circulation | 34/218 (15.6)         | 154/668 (23.1)          | 1.6 (1.1-2.4)           | 1.3 (0.8-2.0)           |
| Survival-to-hospital admission | 35/218 (16.1)         | 113/668 (16.9)          | 1.1 (0.7-1.6)           | 0.8 (0.5-1.2)           |

Abbreviations: CI, confidence interval; CPR, cardiopulmonary resuscitation; EMS, emergency medical services; MICR, minimally interrupted cardiac resuscitation; VF, ventricular fibrillation.

**a** Final model included age, sex, location of cardiac arrest, bystander CPR performed, witnessed arrest, VF, endotracheal intubation, entire EMS dispatch-to-arrival time. The final model included only significant covariates, as indicated.
Survival: MICR v. Standard CPR

Survival to Hospital Discharge (%)

- All cardiac arrests
  - MICR: 3.6
  - ACLS: (55/598) = 9.2%

- Witnessed with VF
  - MICR: (36/128) = 28.1%
  - ACLS: (38/348) = 10.9%

aOR = 3.0

SHARE JAMA 2008 Vol. 299 No. 10
Passive Oxygen Insufflation Is Superior to Bag-Valve-Mask Ventilation for Witnessed Ventricular Fibrillation Out-of-Hospital Cardiac Arrest

Bentley J. Bobrow, MD
Gordon A. Ewy, MD
Lani Clark, BS
Vatsal Chikani, MPH
Robert A. Berg, MD
Arthur B. Sanders, MD
Tyler F. Vadeboncoeur, MD
Ronald W. Hilwig, DVM, PhD
Karl B. Kern, MD

From the Arizona Department of Health Services Bureau of Emergency Medical Services and Trauma System, Phoenix, AZ (Bobrow, Clark, Chikani); Department of Emergency Medicine, Maricopa Medical Center, Phoenix, AZ (Bobrow); the University of Arizona Sarver Heart Center (Bobrow, Ewy, Clark, Sanders, Hilwig, Kern); the Departments of Medicine (Ewy), and Emergency Medicine (Bobrow, Sanders), University of Arizona College of Medicine, Tucson, AZ, and Critical Care Medicine, Children's Hospital of Philadelphia, Philadelphia, PA (Berg); Department of Emergency Medicine, Mayo Clinic, Jacksonville, FL (Vadeboncoeur).

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![Flowchart Image]

- Initial PV: 459
  - Alive: 46
  - Dead: 413

- Initial BVM: 560
  - Alive: 53
  - Dead: 507
Outcomes by Ventilation Method
N=1,019

- Non-Shockable Witnessed with VF
  - POI: 1.3% (4/316)
  - BVM: 3.7% (14/381)
  - Odds ratio 0.3 (0.1-1.0)

- Witnessed with VF
  - POI: 38.2% (39/102)
  - BVM: 25.8% (31/120)
  - Odds ratio 2.5 (1.3 to 4.6)

Public health Intervention

• In 2005 ADHS and the SHC initiated a statewide public COCPR campaign:
  
  – celebrity endorsements,
  – newspaper articles,
  – Radio, billboard and TV spots,
  – flyers sent to households in utility bills
  – No structured DA-CPR

Your Hands - Their Heart
Compression-Only CPR

If you witness someone collapse unexpectedly, follow these steps:

1. Shake the person and shout, "Are you OK?" If the person is unresponsive and not breathing, or breathing abnormally (struggling to breathe, gasping or snoring), direct someone to call 9-1-1 or make the call yourself.

2. Position the patient with their back on the floor. Place the heel of one hand on the center of the chest (between the nipples) and the heel of the other hand on top of the first. Lock your elbows, place your shoulders vertically above your hands and use the weight of your upper body to "fall" downward, compressing the chest 2 inches deep. Lift your hands slightly each time to allow chest wall to recoil. Compress chest at a rate of about one hundred per minute (slightly faster than one compression per second). When you tire, take turns with others until paramedics arrive.

3. If an automated external defibrillator (AED) is available, turn it on and follow the AED’s voice instructions. If no AED is available, continue chest compressions with as few interruptions as possible.

Important:
Struggling to breathe or gasping is not a sign of recovery! Initiate and continue chest compressions even if patient gasps.

Note: For cases of near drowning, drug overdose or unresponsiveness of young children (age 8 or under), follow conventional CPR (2 mouth-to-mouth ventilations followed by 30 chest compressions). However, even in those cases, Compression-Only CPR is better than doing nothing. To learn conventional CPR, a formal training class is recommended.
New CPR developed here.

THE UNIVERSITY OF ARIZONA
Be a Lifesaver.

Learn Continuous Chest Compression CPR.

626-4083
Chest Compression–Only CPR by Lay Rescuers and Survival From Out-of-Hospital Cardiac Arrest

Bentley J. Bobrow, MD  
Daniel W. Spaite, MD  
Robert A. Berg, MD  
Uwe Stolz, PhD, MPH  
Arthur B. Sanders, MD  
Karl B. Kern, MD  
Tyler F. Vadeboncoeur, MD  
Lani L. Clark, BS  
John V. Gallagher, MD  
J. Stephan Stapczynski, MD  
Frank LoVecchio, DO  
Terry J. Mullins, MBA  
Will O. Humble, MPH  
Gordon A. Ewy, MD

**Context** Chest compression–only bystander cardiopulmonary resuscitation (CPR) may be as effective as conventional CPR with rescue breathing for out-of-hospital cardiac arrest.

**Objective** To investigate the survival of patients with out-of-hospital cardiac arrest using compression-only CPR (COCPR) compared with conventional CPR.

**Design, Setting, and Patients** A 5-year prospective observational cohort study of survival in patients at least 18 years old with out-of-hospital cardiac arrest between January 1, 2005, and December 31, 2009, in Arizona. The relationship between layperson bystander CPR and survival to hospital discharge was evaluated using multivariable logistic regression.

**Main Outcome Measure** Survival to hospital discharge.

**Results** Among 5272 adults with out-of-hospital cardiac arrest of cardiac etiology not observed by responding emergency medical personnel, 779 were excluded because bystander CPR was provided by a health care professional or the arrest occurred in a medical facility. A total of 4415 met all inclusion criteria for analysis, including 2900 who received no bystander CPR, 666 who received conventional CPR, and 849 who received COCPR. Rates of survival to hospital discharge were 5.2% (95% confidence interval [CI], 4.4%-6.0%) for the no bystander CPR group, 7.8% (95% CI, 5.8%-9.8%) for conventional CPR, and 13.3% (95% CI, 11.0%-15.6%) for COCPR. The adjusted odds ratio
Bystander CPR: Incidence and Type

2005: 16%
2006: 28.2%
2007: 40%
2008: 60%
2009: 80%
2010: 100%

SHARE - JAMA 2010; Oct
OHCA Survival in Arizona (2005 to 2010)
Compression-Only CPR Advocated and Taught

Survival to Hospital Discharge

All OHCA
- AOR 1.6 (95% CI, 1.08-2.35)
- 30 years 7.6%
- Std-CPR 7.8%
- CO-CPR 13.3%

Witnessed/Shockable
- P < 0.001
- Std-CPR 17.7%
- CO-CPR 33.7%

SHARE JAMA 2010:304:1447-1454
Statewide Regionalization of Postarrest Care for Out-of-Hospital Cardiac Arrest: Association With Survival and Neurologic Outcome

Daniel W. Spaite, MD†; Bentley J. Bobrow, MD; Uwe Stoiz, PhD, MPH; Robert A. Berg, MD; Arthur B. Sanders, MD; Karl B. Kern, MD; Vatsal Chikani, MPH; Will Humble, MPH; Terry Mullins, MBA; J. Stephan Stacpynski, MD; Gordon A. Ewy, MD; for the Arizona Cardiac Receiving Center Consortium†

*Corresponding Author. E-mail: dan@aemrc.arizona.edu.

Study objective: For out-of-hospital cardiac arrest, authoritative, evidence-based recommendations have been made for regionalization of postarrest care. However, system-wide implementation of these guidelines has not been evaluated. Our hypothesis is that statewide regionalization of postarrest interventions, combined with emergency medical services (EMS) triage bypass, is associated with improved survival and neurologic outcome.

Requirements for Being Recognized as an Arizona Cardiac Receiving Center

1. In order to be recognized as a Cardiac Receiving Center, a hospital must have:
   1. a Therapeutic Hypothermia (TH) method and associated protocol for out-of-hospital cardiac arrest (OHCA) patient (NOT just cooled patients) and the one-page data form for ALL EMS and ALL walk-in STEMI patients. The data forms can be found on the SHARE website: http://www.azshare.gov/Info4CACC.htm
   2. primary Percutaneous Coronary Intervention (PCI) capability with protocol for OHCA including consultation with a Cardiology Interventionist for consideration of emergent PCI
   3. a system, included in the protocol, for timely completion and submission of the one-page data form for EACH OHCA patient (NOT just cooled patients) and the one-page data form for ALL EMS and ALL walk-in STEMI patients
   4. an evidence-based termination of resuscitation protocol (including a 72-hour moratorium on termination of care for patients receiving TH)
   5. a protocol to address organ donation
   6. CPR training for the community

Survival to Hospital Discharge

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Odds Ratio [95% CI]</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Rhythms</td>
<td>2.22 [1.47, 3.34]</td>
</tr>
<tr>
<td>Witnessed Arrest &amp; Initial Shockable Rhythm</td>
<td>2.96 [1.63, 5.38]</td>
</tr>
<tr>
<td>Initial Shockable Rhythm</td>
<td>2.39 [1.46, 3.91]</td>
</tr>
<tr>
<td>Initial Rhythm of Asystole or PEA</td>
<td>1.65 [0.79, 3.42]</td>
</tr>
</tbody>
</table>

Positive Neurological Outcome

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Odds Ratio [95% CI]</th>
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</thead>
<tbody>
<tr>
<td>All Rhythms</td>
<td>2.26 [1.37, 3.73]</td>
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<tr>
<td>Witnessed Arrest &amp; Initial Shockable Rhythm</td>
<td>2.12 [1.14, 3.93]</td>
</tr>
<tr>
<td>Initial Shockable Rhythm</td>
<td>2.06 [1.18, 3.60]</td>
</tr>
<tr>
<td>Initial Rhythm of Asystole or PEA</td>
<td>1.69 [0.55, 5.22]</td>
</tr>
</tbody>
</table>

Spaite et al., Annals of EM—2014
HeartRescue Partners
Telephone CPR Instructions in Emergency Dispatch Systems: A Qualitative Survey of 9-1-1 Call Centers

John Sutter, BS*1
Micah Panczyk, MS*
Daniel W. Spaite, MD†
Jose Ferrer, MD‡
Jason Roosa, MD, MS§
Christian Dameff, MD*\nBlake Langlais*\nRyan A. Murphy, MD†
Bentley J. Bobrow, MD‡

*Arizona Department of Health Services, Phoenix, Arizona
†University of Arizona, Department of Emergency Medicine, Arizona Emergency Medicine Research Center, Tucson, Arizona
‡American Heart Association
§Lutheran Medical Center, Wheat Ridge, Colorado
*University of Arizona College of Medicine – Phoenix, Phoenix, Arizona

Table 2. Structured script and guideline-based protocol use at public safety answering points that provide instructions for medical emergencies

<table>
<thead>
<tr>
<th>Script/guideline use</th>
<th>n</th>
<th>%</th>
<th>Type of script/aid</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structured script</td>
<td>834</td>
<td>83</td>
<td>A manual system (e.g. printed cards)</td>
<td>507</td>
<td>61</td>
</tr>
<tr>
<td>Written guidelines</td>
<td>138</td>
<td>14</td>
<td>A computer-based system</td>
<td>318</td>
<td>39</td>
</tr>
<tr>
<td>No script or guidelines</td>
<td>30</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1,002</td>
<td>100</td>
<td>Total</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

Figure 1. Number of responding public safety answering points in the United States. 
PSAP, public safety answering point
Original Investigation
Implementation of a Regional Telephone Cardiopulmonary Resuscitation Program and Outcomes After Out-of-Hospital Cardiac Arrest

Brentley J. Bobrow, MD; Daniel W. Spalte, MD; Tyler F. Videbanceur, MD; Chengcheng Hu, PhD; Terry Mullins, MBA; Wayne Tormala, MSW; Christian Dameff, MD; John Gallagher, MD; Gary Smith, MD; Micah Panczyk, MS

**Importance:** Bystander cardiopulmonary resuscitation (CPR) significantly improves survival from out-of-hospital cardiac arrest but is provided in less than half of events on average. Telephone CPR (TCPR) can significantly increase bystander CPR rates and improve clinical outcomes.

**Objective:** To investigate the effect of a TCPR bundle of care on TCPR process measures and outcomes.

**Design, Setting, and Participants:** A prospective, before-after, observational study of adult patients with out-of-hospital cardiac arrest not receiving bystander CPR before the 9-1-1 call between October 1, 2010, and September 30, 2013.

**Interventions:** A TCPR program, including guideline-based protocols, telecommunicator training, data collection, and feedback, in 2 regional dispatch centers servicing metropolitan Phoenix, Arizona. Audio recordings of out-of-hospital cardiac arrest calls were audited and linked with emergency medical services and hospital outcome data.

---

**Arizona Survival and CPC P1 vs. P2**

<table>
<thead>
<tr>
<th>Survival to Hospital Discharge (CPC = 1 or 2)</th>
<th>P1</th>
<th>P2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent</td>
<td>8.3</td>
<td>11.0</td>
</tr>
<tr>
<td><strong>p</strong></td>
<td>0.005</td>
<td>0.01</td>
</tr>
</tbody>
</table>

**T- CPR Process Times P1 vs. P2**

<table>
<thead>
<tr>
<th>Dispatcher recognized cardiac arrest</th>
<th>P1 (Pre)</th>
<th>P2 (Post)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median Time (seconds)</td>
<td>76</td>
<td>71</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dispatcher gave CPR instructions</th>
<th>148</th>
<th>130</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median Time (seconds)</td>
<td>183</td>
<td>156</td>
</tr>
</tbody>
</table>

* p<0.05
** p<0.001

ReSS 2014
Clinical paper

Barriers to telephone cardiopulmonary resuscitation in public and residential locations


Arizona Department of Health Services, Bureau of EMS and Trauma System, 150 North 18th Avenue, Phoenix, AZ 85007, United States

University of Arizona, Department of Emergency Medicine, Arizona Emergency Medicine Research Center, 714 East Von Buren St, Phoenix, AZ 85006, United States

Department of Emergency and Critical Care Medicine, Nara Medical University, Shijo-cho, 840, Kashihara City, Nara 6348522, Japan

University of Arizona College of Medicine Phoenix, 550 East Von Buren St, Phoenix, AZ 85004, United States

Maricopa Medical Center, 2601 East Roosevelt St, Phoenix, AZ 85008, United States

University of Arizona, Department of Epidemiology and Biostatistics, Mel and Enid Zimmerman College of Public Health, 1295 North, Martin Avenue, Tucson, AZ 85724, United States

Lund Medical AS, Tonke Svalandsgate 30, N-4002 Stavanger, Norway

Arizona State University, School of Mathematical and Statistical Science, University Drive and Mill Avenue, Tempe, AZ 85287, United States

Table 2
TCPR process analysis.

<table>
<thead>
<tr>
<th></th>
<th>Public locations (N = 187)</th>
<th>Residential locations (N = 1500)</th>
<th>p value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Telecommunicator recognized CPR need</td>
<td>145 (81.9%)</td>
<td>1332 (91.4%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>TCPR instructions started</td>
<td>93 (50.5%)</td>
<td>992 (66.8%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>TCPR (instruction given and compressions started)</td>
<td>70 (38.5%)</td>
<td>853 (58.5%)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Table 3
Distribution of barriers to TCPR.

<table>
<thead>
<tr>
<th></th>
<th>Public locations (N = 187)</th>
<th>Residential locations (N = 1500)</th>
<th>p value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Difficulties to access to the patient</td>
<td>6 (3.2%)</td>
<td>21 (1.4%)</td>
<td>0.063</td>
</tr>
<tr>
<td>Language</td>
<td>3 (1.6%)</td>
<td>35 (2.3%)</td>
<td>0.526</td>
</tr>
<tr>
<td>Caller left the phone</td>
<td>8 (4.3%)</td>
<td>82 (5.5%)</td>
<td>0.495</td>
</tr>
<tr>
<td>Caller hung up the phone</td>
<td>5 (2.7%)</td>
<td>77 (5.1%)</td>
<td>0.140</td>
</tr>
<tr>
<td>Caller was not with patient</td>
<td>22 (11.8%)</td>
<td>40 (2.7%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Caller refused CPR instruction</td>
<td>12 (6.4%)</td>
<td>133 (8.9%)</td>
<td>0.260</td>
</tr>
<tr>
<td>Telecommunicator was unable to calm callers</td>
<td>4 (2.1%)</td>
<td>127 (8.5%)</td>
<td>0.002</td>
</tr>
<tr>
<td>Caller's physical limitation to perform CPR</td>
<td>1 (0.5%)</td>
<td>18 (1.2%)</td>
<td>0.416</td>
</tr>
<tr>
<td>Caller was unable to get patient to hard flat surface</td>
<td>26 (13.9%)</td>
<td>381 (25.4%)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

CPR, cardiopulmonary resuscitation; TCPR, telephone CPR.

* Chi-square test or Fischer’s exact test. The cases in which CPR was already in progress were removed from both groups.
Clinical paper

Disparities in telephone CPR access and timing during out-of-hospital cardiac arrest

Tomas Nuño a,b,c,1, Bentley J. Bobrow a,b,d, Karen A. Rogge-Miller a, Micah Panczyk d, Terry Mullins d, Wayne Tormala e, Antonio Estrada e, Samuel M. Keim a,b, Daniel W. Spaite a,b

a Arizona Emergency Medicine Research Center, College of Medicine, University of Arizona, Phoenix, AZ, United States
b Department of Emergency Medicine, College of Medicine, University of Arizona, Tucson, AZ, United States
c Division of Public Health Practice & Translational Research, Mel and Enid Zuckerman College of Public Health, University of Arizona, Phoenix, AZ, United States
d Bureau of Emergency Medicine and Trauma System, Arizona Department of Health Services, Phoenix, AZ, United States
e Department of Mexican-American Studies, College of Social & Behavioral Sciences, University of Arizona, Tucson, AZ, United States

Table 2
Association between language barriers and TCPR Process Measures.

<table>
<thead>
<tr>
<th>Variable</th>
<th>No language barrier indicated (n = 3344)</th>
<th>Spanish language barrier indicated (n = 30)</th>
<th>All other languages combined barrier indicated (n = 15)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age of victim (mean years)</td>
<td>60.0 (SD = 20.5)</td>
<td>52.9 (SD = 22.9)</td>
<td>71.4 (SD = 13.8)</td>
<td>0.02</td>
</tr>
<tr>
<td>Percent of telecommunicators that recognized need for CPR %</td>
<td>89.7 (SD = 30.4)</td>
<td>89.7 (SD = 30.7)</td>
<td>100.0 (SD = 0)</td>
<td>0.42</td>
</tr>
<tr>
<td>Percent of telecommunicators that began CPR instructions %</td>
<td>56.6 (SD = 49.6)</td>
<td>74.4 (SD = 44.2)</td>
<td>53.3 (SD = 51.6)</td>
<td>0.08</td>
</tr>
<tr>
<td>Percent of patients that had CPR compressions started %</td>
<td>50.0 (SD = 49.2)</td>
<td>48.7 (SD = 50.6)</td>
<td>46.7 (SD = 51.6)</td>
<td>0.27</td>
</tr>
<tr>
<td>Percent of patients that experienced delay of CPR %</td>
<td>22.0 (SD = 41.4)</td>
<td>48.7 (SD = 50.6)</td>
<td>60.0 (SD = 50.7)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Time until telecommunicator recognized need for CPR (mean s)</td>
<td>87.4 (SD = 63.8)</td>
<td>160.6 (SD = 97.6)</td>
<td>130.5 (SD = 84.6)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Time until telecommunicator began CPR instructions (mean s)</td>
<td>144.4 (SD = 73.6)</td>
<td>231.3 (SD = 103.2)</td>
<td>170.4 (SD = 62.7)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Time until first compression (mean s)</td>
<td>174.4 (SD = 88.0)</td>
<td>290.9 (SD = 144.4)</td>
<td>174.0 (SD = 83.4)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>
B-CPR Rates by Year in Maricopa County

CPR Public Awareness Campaign

T-CPR Program

% B-CPR

2005: 24.2
2006: 27.4
2007: 25.8
2008: 30.3
2009: 32.0
2010: 37.5
2011: 44.7
2012: 50.6
2013: 52.4
Analysis of out-of-hospital cardiac arrest location and public access defibrillator placement in Metropolitan Phoenix, Arizona

Sungwoo Moon, Tyler F. Vadeboncoeur, Wesley Kortuem, Marvis Kisakye, Madalyn Karamooz, Bernadette White, Paula Brazil, Daniel W. Spaite, Bentley J. Bobrow

Arizona Department of Health Services Bureau of Emergency Medical Services and Trauma System, Phoenix, AZ, United States
Arizona Emergency Medicine Research Center, University of Arizona College of Medicine, Tucson, AZ, United States
Department of Emergency Medicine, Korea University Ansan Hospital, Ansan, Gyeonggi-do, South Korea
Department of Emergency Medicine, Mayo Clinic, Jacksonville, FL, United States
Arizona Department of Health Services Bureau of Public Health Statistics, Phoenix, AZ, United States
University of Pennsylvania School of Medicine, Philadelphia, PA, United States
Department of Emergency Medicine, Maricopa Medical Center, Phoenix, AZ, United States

Table 2
Top 5 location types of out-of-hospital cardiac arrest (OHCA) incidents and number of automated external defibrillators (AEDs) at the same location type.

<table>
<thead>
<tr>
<th>Rank</th>
<th>Location type</th>
<th>OHCAs (n=654)</th>
<th>AEDs (n=1704), no. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Male, no. (%)</td>
<td>Age, mean (±SD)</td>
</tr>
<tr>
<td>1</td>
<td>In a Car/Road/Parking lot</td>
<td>190 (29.1)</td>
<td>146 (76.8)</td>
</tr>
<tr>
<td>2</td>
<td>Public business/Office/Workplace</td>
<td>65 (9.9)</td>
<td>46 (75.4)</td>
</tr>
<tr>
<td>3</td>
<td>Public street/Sidewalk/Bus stop/station</td>
<td>60 (9.2)</td>
<td>48 (80.0)</td>
</tr>
<tr>
<td>4</td>
<td>Parks/Outdoor recreation</td>
<td>43 (6.6)</td>
<td>37 (86.0)</td>
</tr>
<tr>
<td>5</td>
<td>Store/Mall</td>
<td>39 (5.9)</td>
<td>28 (71.8)</td>
</tr>
</tbody>
</table>

* There are total 26 location types in OHCA database.
* When event occurred in a car or victims were driving.
* When event occurred in a pedestrian way, bus stop, or victims were walking.

Table 3
Top 5 location types according to the number of placed automated external defibrillators (AEDs) and out-of-hospital cardiac arrest (OHCA) incidents in the same location type.

<table>
<thead>
<tr>
<th>Rank</th>
<th>Location type</th>
<th>AEDs (n=1704), no. (%)</th>
<th>OHCAs (n=654), no. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Public business/Office</td>
<td>663 (38.9)</td>
<td>65 (9.9)</td>
</tr>
<tr>
<td>2</td>
<td>Schools</td>
<td>558 (32.8)</td>
<td>5 (0.8)</td>
</tr>
<tr>
<td>3</td>
<td>Federal/State/City government building</td>
<td>108 (6.3)</td>
<td>12 (1.8)</td>
</tr>
<tr>
<td>4</td>
<td>Place of worship</td>
<td>71 (4.2)</td>
<td>13 (2.0)</td>
</tr>
<tr>
<td>5</td>
<td>Retirement community or complex</td>
<td>60 (3.5)</td>
<td>10 (1.5)</td>
</tr>
</tbody>
</table>

* There are total 27 location types in AED registry.
WE PICKED OPTION C
BY APPLYING THE
EENIE MEENIE MINEYMO™
METHODOLOGY

AS LONG AS IT WASN'T BASED JUST ON YOUR GUT

LIBERATING CONSUMER INTELLIGENCE, EMPOWERING MARKETERS.
Hypothesis:

BCPR provision and TCPR provision would be associated with an increased likelihood of a shockable initial rhythm.
Using Real-time CPR Feedback

Combined with Scenario-based Training and Debriefing Sessions
(avoiding pauses and excessive ventilation)
Clinical paper

Chest compression release velocity: Association with survival and favorable neurologic outcome after out-of-hospital cardiac arrest®®

Alexander Kovacs®, Tyler F. Vadeboncoeur®, Uwe Stolz®, Daniel W. Spaite®, Taro Irisawa®, Annemarie Silver®, Bentley J. Bobrow®, C. C.®

* University of Arizona College of Medicine–Phoenix, 550 W Van Buren St, Phoenix, AZ 85004, United States
® Department of Emergency Medicine, Mayo Clinic Florida, 4800 San Pablo Road, Jacksonville, FL 32224, United States
☆ Department of Emergency Medicine, University of Arizona, PO Box 245807, 5801 N. Campbell, Tucson, AZ 85724-5807, United States
☆☆ Department of Traumatology and Acute Critical Care, Osaka University Hospital, 2-15 Yamadaoka, Suita, Osaka 565-0871, Japan
☆☆☆ Zoll Medical Corporation, 268 Mill Rd, Chelmsford, MA 01824, United States
☆☆☆☆ Bureau of Emergency Medical Services and Trauma System, Arizona Department of Health Services, 150 N. 18th Avenue, #540, Phoenix, AZ 85007-3248, United States

Resuscitation 2015
Survival to discharge improved from 26% - 56%

- Depth = 2.15 in
- CC Fraction = 83.7%
- Pre-shock pause = 15.5 s
Emergency Department CPR Quality

- Average depth: 1.83 in
- # of compressions >2 in: 36%
- Average rate: 124/min
- Average CC fraction: 79%
- Preshock pause: 11.5 s
Statewide Regionalization of Postarrest Care for Out-of-Hospital Cardiac Arrest: Association With Survival and Neurologic Outcome

Survival to Hospital Discharge

- All Rhythms: 2.22 [1.47, 3.34]a
- Witnessed Arrest & Initial Shockable Rhythm: 2.96 [1.63, 5.38]b
- Initial Shockable Rhythm: 2.39 [1.46, 3.91]c
- Initial Rhythm of Asystole or PEA: 1.65 [0.79, 3.42]c

Positive Neurological Outcome

- All Rhythms: 2.26 [1.37, 3.73]a
- Witnessed Arrest & Initial Shockable Rhythm: 2.12 [1.14, 3.93]b
- Initial Shockable Rhythm: 2.06 [1.18, 3.60]c
- Initial Rhythm of Asystole or PEA: 1.69 [0.55, 5.22]c
CPRU Videos

Initial Patient Assessment

Initial Patient Assessment

QUICK AND EFFICIENT ASSESSMENT START CPR WITHIN 10 SECONDS

Chest Compression Mechanics

Chest Compression Mechanics

ARMS PERPENDICULAR TO THE GROUND
SURVIVORS SHARE

Five Years, 10,000 Saves & Just Getting Started

The HeartRescue Project changes hearts & minds, one life at a time

DON'T TREAD ON ME

Meet Arizona survivor José García and his wife Gissi, who prevented Septembre CPR with the help of a 911 dispatcher.
Excellence in Prehospital Injury Care (EPIC)

Why is the EPIC Project important?

According to the CDC’s Report to Congress, in 2010, TBIs accounted for approximately 2.5 million emergency department (ED) visits, hospitalizations, and deaths in the United States. Of them:

- 52,844 die
- 283,630 are hospitalized
- >2.2 million are treated and released from EDs

TBI is a contributing factor to a third of all injury-related deaths in the United States.¹

There is growing evidence that the management of TBI in the early minutes after injury profoundly impacts outcome. EMS operates in the ultra-acute setting, usually providing the first care for TBI victims when treatment matters the most. Reports on implementation of evidence-based TBI treatment guidelines inside the hospital are very promising. However, no studies to date have evaluated their impact in the prehospital setting.

The EMS agencies of Arizona have already proven their ability to dramatically improve cardiac arrest survival and, thus, Arizona was selected by the National Institutes of Health to do the same with TBI.
Risk adjustment/severity measures\textsuperscript{91,108,109} (from EMS patient care reports and the ASTR)

**Demographics/history/EMS system response:** Age, sex, mechanism of injury (ICD-9/10-CM E-code Injury Descriptors), preexisting medical conditions, EMS time intervals\textsuperscript{150} (e.g., interval from 9-1-1 call to trauma center arrival).

**Prehospital data:** Initial and additional respiratory rate; heart rate; sBP; Glasgow Coma Scale (GCS) score; $O_2$ saturation and $ETCO_2$; prehospital procedures including IV fluids given (mL), ETI, rapid sequence intubation, supraglottic airway use, RTS, prehospital impression (conditions/"diagnoses") by EMS.

**Trauma center data:** The ASTR data set contains nearly 200 data elements related to demography, severity, risk adjustment, treatment, procedures, and outcomes. Examples (detailed data set in Data Supplement S3)—initial and additional vital signs, GCS, RTS, probability of survival (TRISS), procedures (ICD-9/10-CM procedure codes), need for emergent surgery, need for emergent neurosurgery, intracranial pressure monitoring (yes/no), Abbreviated Injury Scale score, ISS, injury diagnoses (ICD-9/10-CM N-codes), preexisting comorbidities, hospital complications, hospital/ICU length of stay.

**Outcome measures**\textsuperscript{7,8,10,11,17,18,23,85,86,95,96}

**Primary outcome measure:** Survival to hospital discharge.

**Secondary outcomes:** Prehospital mortality (patients with spontaneous circulation on EMS arrival who then require cardiopulmonary resuscitation by EMS and have no signs of life on arrival at the trauma center), hospital days, ICU days, total ventilator days, hospital complications, discharge disposition (e.g., home, long-term care facility, inpatient rehabilitation), and trauma center costs (charges).
Mortality and Prehospital Blood Pressure in Patients With Major Traumatic Brain Injury Implications for the Hypotension Threshold

Daniel W. Spaite, MD; Chengcheng Hu, PhD; Bentley J. Bobrow, MD; Vatsal Chikanl, MPH; Duane Sherrill, PhD; Bruce Barnhart, RN, CEP; Joshua B. Gaither, MD; Kurt R. Denninghoff, MD; Chad Viscusi, MD; Terry Mullins, MBA; P. David Adeison, MD

Figure 1. Unadjusted Moving Average of Death Rate by Lowest Systolic Blood Pressure (SBP)

Figure 2. Adjusted Probability of Death by Lowest Systolic Blood Pressure (SBP)

The solid line represents the moving average of the estimated death rate for each interval spanning 10 consecutive values, and the dotted lines represent the pointwise 95% CIs.
Title: The Effect of Combined Out-of-Hospital Hypotension and Hypoxia on Mortality in Major Traumatic Brain Injury

Authors:
Daniel W. Spaite, MD
Chengcheng Hu, PhD
Bentley J. Bobrow, MD
Vatsal Chikani, MPH
Bruce Barnhart, RN, CEP
Joshua B. Gaither, MD
Kurt R. Denninghoff, MD
P. David Adelson, MD
Samuel M. Keim, MD, MS
Chad Viscusi, MD
Terry Mullins, MBA
Duane Sherrill, PhD

*Corresponding Author. E-mail: dan@emrc.arizona.edu

Diagram:
- Pre-Intervention group: n = 17,105
- Eligible subjects: n = 15,039
- Study Cohort: n = 13,151

Graph:
- Figure 2. Crude mortality rate by hypotension and hypoxia status. Error bars represent 95% CIs.
Conclusions

In a statewide, multisystem analysis of patients with major TBI, we found a linear association between the lowest prehospital SBP and the severity-adjusted probability of death across an exceptionally wide range. This suggests that there may not be a clinically meaningful threshold. Furthermore, for the injured brain, physiologically detrimental hypotension may occur at significantly higher levels than current guidelines suggest. These findings highlight the need for specific trials comparing various blood pressure treatment thresholds well above the classic 90 mm Hg.
Balancing the Potential Risks and Benefits of Out-of-Hospital Intubation in Traumatic Brain Injury: The Intubation/Hyperventilation Effect

Joshua B. Gaither, MD, Daniel W. Spaite, MD, Bentley J. Bobrow, MD, Kurt R. Denningerhoff, MD, Uwe Stolz, PhD, MPH, Daniel L. Beskind, MD, Harvey W. Meislin, MD

From the Arizona Emergency Medicine Research Center, Department of Emergency Medicine, University of Arizona College of Medicine, Tucson, AZ (Gaither, Spaite, Bobrow, Denningerhoff, Stolz, Beskind, Meislin); and the Department of Emergency Medicine, Maricopa Integrated Healthcare System, Phoenix, AZ (Bobrow).

Figure. Mechanisms of secondary injury induced during hyperventilation. ETI, intubation; O₂, oxygen; Hb, hemoglobin; CNS, central nervous system; JVP, jugular venous pressure.
Refereed Journal Articles: Full-Length Publications


Evaluation of Prehospital Hypoxia “Depth-Duration Dose” and Mortality in Major Traumatic Brain Injury

Case Example 1: Hypoxia Depth-Duration Dose

Depth-Duration Dose (DDD) = 56.7 percent-min
(total area of shaded region)

Percentage Probability of Death (Adjusted)

Hypoxia Depth-Duration Dose (percent*min)
The fever in these studies is thought to be related to either a hospitalization and poor outcomes in major Traumatic Brain Injury (TBI). Several studies have demonstrated a correlation between fever during hospitalization and poor outcomes in major TBI. In this study, using a large, statewide population of moderate and severe TBI cases, an elevated ITCT was independently associated with higher mortality in patients with major TBI, a finding that has not been previously reported. Future work is needed to identify the epidemiology and the causes of temperature elevation during the prehospital interval and to identify whether initiation of in-field measures to prevent high ITCT might improve outcome.

**Summary and Conclusions**

In this study, using a large, statewide population of moderate and severe TBI cases, an elevated ITCT was independently associated with higher mortality in patients with major TBI, a finding that has not been previously reported. Future work is needed to identify the epidemiology and the causes of temperature elevation during the prehospital interval and to identify whether initiation of in-field measures to prevent high ITCT might improve outcome.

**Acknowledgements**

This research is part of the Excellence in Prehospital Injury Care (EPIC) TBI Study, a statewide, before/after, controlled study of the impact of implementing the EMS TBI Treatment Guidelines. Funding Source: NIH/NINDS: 1R01NS071049
Hypotension

- Current Guidelines recommend treating hypotension in TBI
- Our findings in the hypotensive and normotensive cohorts support the concept of restoring/optimizing cerebral perfusion in EMS TBI management
Opioid Sales, Opioid Treatment Admissions, and Opioid-related Deaths

Sources: CDC Wonder, 2015; DEA ARCOS, 2015; TEDS, 2015
www.drugabuse.gov
APPROACH: NCBP System Reporting
**APPROACH: Data Integration**

- **EMS Data (Statewide)**: EMS data are collected by agencies per NEMSIS Version 3 standards.

- **AZ-PIERS System (AZDHS)**: EMS data entered into the AZ-PIERS System.

- **Opiate/MM Program Database (UA)**: EMS data uploaded to secure, interactive, relational database (similar to SHARE/EPIC).

- **NCBP System**: De-identified data are uploaded to the NCBP System daily allowing rapid case identification, queries, monitoring and reporting.
Artificial hearts that are powered by a battery that fits in a backpack; use of radiofrequency energy as a better way to treat certain arrhythmias — these are a couple of advances from Server Heart Center researchers that are in use worldwide. The UA Server Heart Center Resuscitation Research Group has spent the past several years making sure that Cardiocerebral Resuscitation also is known around the world.

Most people familiar with the Resuscitation Research Group’s work think primarily of compression-only CPR, a simple, lifesaving response for bystanders who witness sudden cardiac arrest, but it is only the first step in the processes that have been researched and advocated by Server Heart Center members. The group, which includes members from cardiology, emergency medicine, anesthesiology, pediatrics, medicine and veterinary medicine, also has developed new protocols for 911 dispatchers, emergency responders and hospitals.

Together, each new protocol has been developed to continue to increase survival rates from sudden cardiac arrest, one of the leading causes of death in the United States. In fact, communities that implement these protocols see a three- to four-fold increase in survival.

The group has four frequent flyers, with a growing list of places they have been invited to evangelize on advances.

The map only reflects the travels of Gordon A. Frye, MD (red), Karl R. Kern, MD (blue), Bentley J. Bobrow, MD (green), and Daniel Spatric, MD (yellow).

Besides lecturing about various aspects of Cardiocerebral Resuscitation throughout the United States, these researchers have lectured in the following countries:
“世界急救日”急救技能推广普及活动

让更多的普通市民有兴趣学习徒手心肺复苏操作
You DO care about this stuff because:

• It has lead to improved patient outcomes

• It advances our specialty

• It can enrich your personal career satisfaction

• Being from UA people will ask you about it

• It’s really cool!
Wait a minute… they’re not doing CPR on you! They’re doing Cardiocerebral Resuscitation!
Thank you
Bentley.Bobrow@azdhs.gov