STRIVE TO REVIVE: HOUSTON

American Heart Association

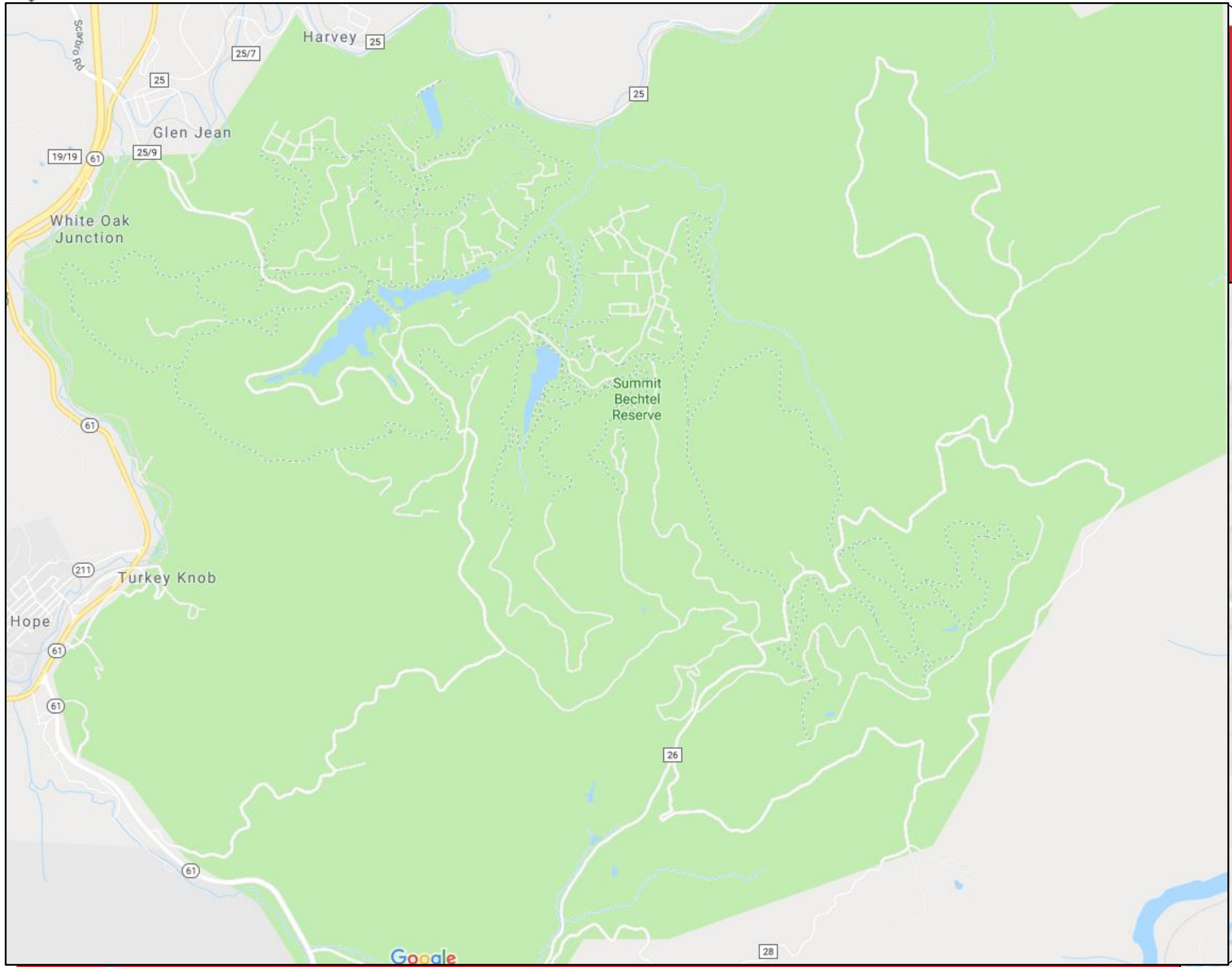
April 12, 2019

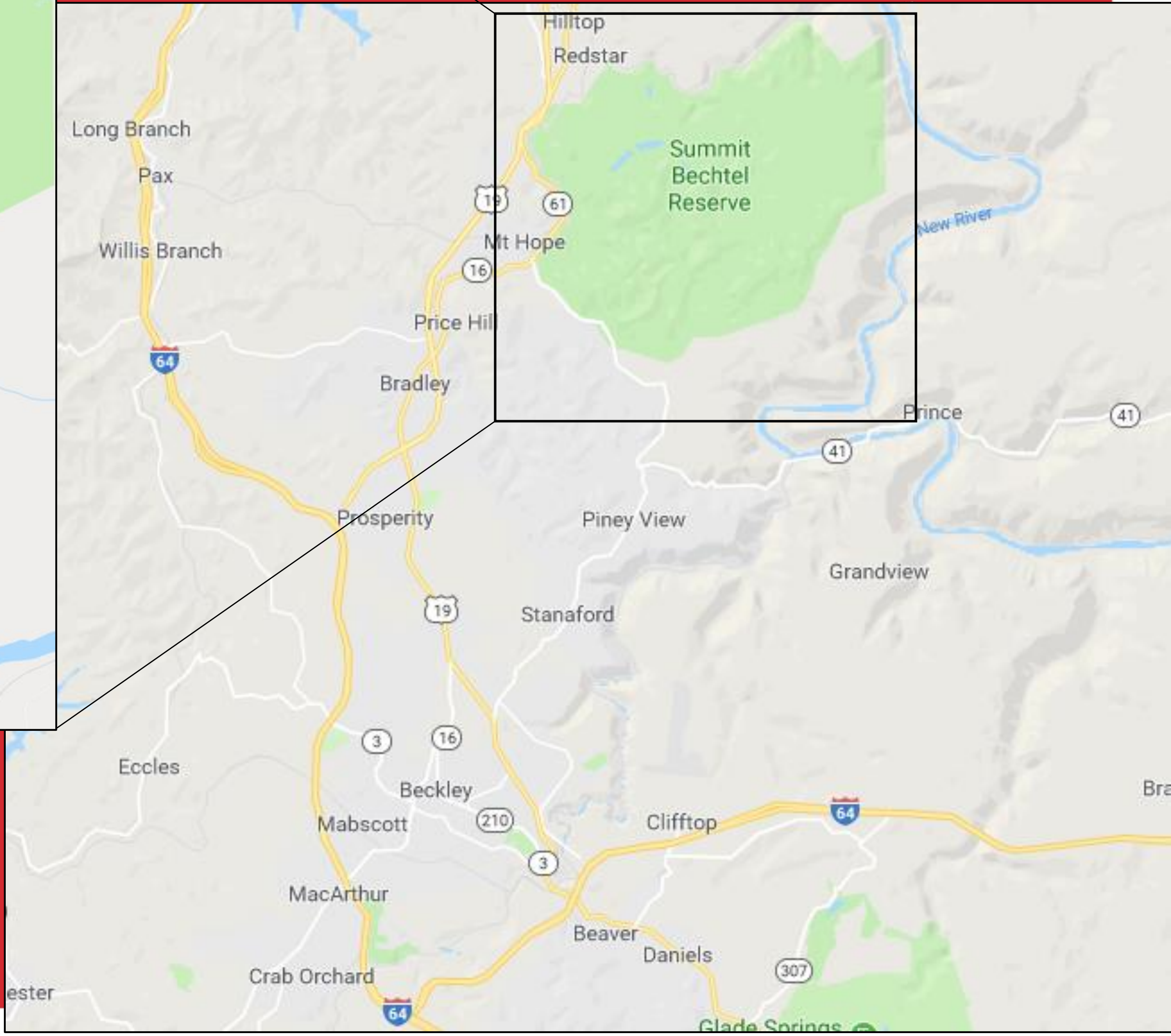
Denton A. Cooley, MD and Ralph C. Cooley, DDS University Life Center

WHEN RESUSCITATION HITS HOME

Keith Ozenberger

NATIONAL BOY SCOUT JAMBOREE
JULY 2017
NEAR GLEN JEAN AND MT HOPE, WV





West Virginia

LIVE SCOUTING'S ADVENTURE
2017
NATIONAL JAMBOREE
VENTURING, BSA
NATIONAL
JAMBOREE
2017
WIHINIPA HINSA 113 WWW
VENTURING, BSA

FIRST FOUR DAYS OF JAMBOREE WERE UNEVENTFUL

WHILE WALKING AROUND THE JAMBOREE ON SATURDAY, JULY 22

I SAW …


GEMS
AMBULANCE


HealthNet
N135H

SUNDAY, JULY 23, ALL STARTED OUT OKAY, BUT IN THE AFTERNOON …


30


RN


2018
NATIONAL


FIRE
Raleigh
General
Hospital
OUR MISSION
Making
CCRN


FIRE
Raleigh
General
Hospital
CCRN
LEAGUE CITY


24th WORLD SCOUT JAMBOREE SCOUT MONDIAL
MEDICAL SERVICES
NORTH AMERICA 2019

RESUSCITATION 2019:
STATE OF THE UNION

Strive to Revive Conference
American Heart Association
April 12, 2019

Javier J. Lasa, MD, FAAP
Cardiology & Critical Care Medicine
Texas Children's Hospital
Baylor College of Medicine

DISCLOSURES:

- **Financial Disclosures:** none
- **Unlabeled/Unapproved Uses Disclosures:** none

CONFLICTS OF INTEREST:

- Author/co-author of GWTG®-R manuscripts
- Current volunteer member of AHA GWTG®-R Pediatric Research Task Force
- 2018 and current AHA PALS Guidelines Evidence Reviewer and co-author

OUTLINE AND OBJECTIVES

OUTLINE

- Current landscape of resuscitation in the United States
- Out-of-Hospital Cardiac Arrest: USA and the World
- In-Hospital Cardiac Arrest: Why Get With the Guidelines—Resuscitation?
- Summary

OBJECTIVES

1. Describe current approach to resuscitation research for both IN and OUT of Hospital Cardiac Arrest (IHCA/OHCA)
2. Demonstrate direct association between quality of care captured in retrospective databases and improved survival and neurologic outcomes after IHCA/OHCA.

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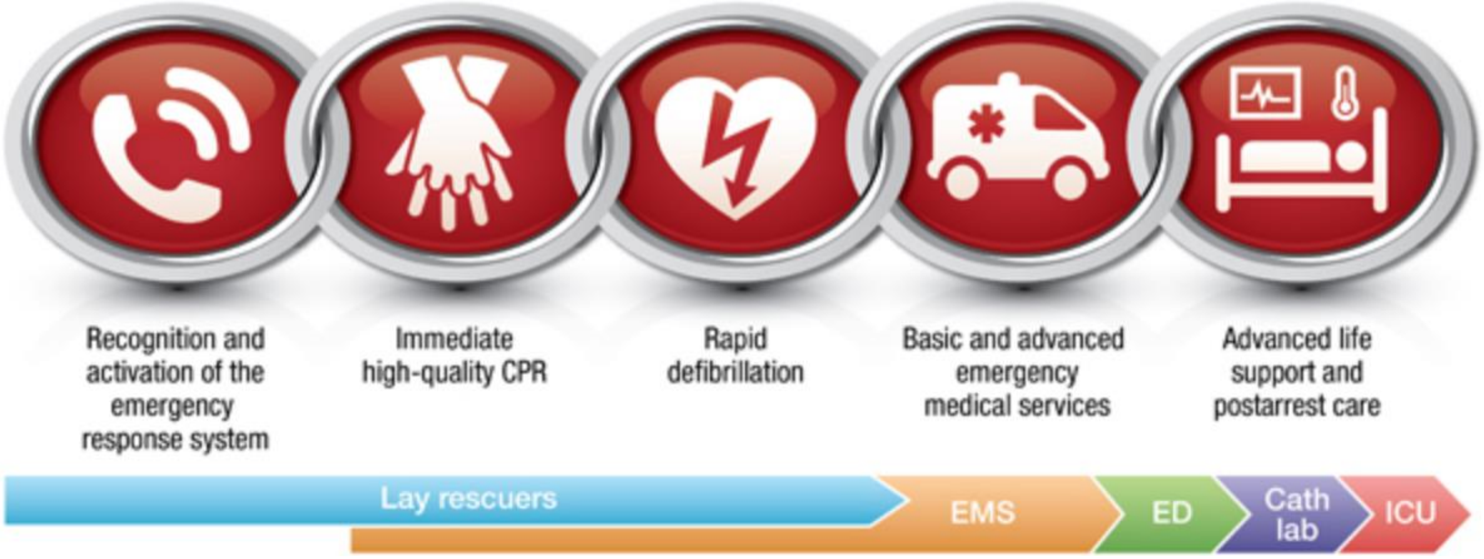
Systems of Care

Out-of-Hospital



In-Hospital

FIRST STEPS – GATHERING DATA ON RESUSCITATION

- ANIMAL RESEARCH (INCLUDING RANDOMIZED TRIALS)
- HUMAN STUDIES

→ **RETROSPECTIVE DATABASES**

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ROC

Resuscitation Outcomes Consortium

ROC is a clinical trial network focusing on research in the area of prehospital cardiopulmonary arrest and severe traumatic injury

NIH National Heart, Lung, and Blood Institute

American Heart Association

US Army Medical Research & Materiel Command

CIHR IRSC
Canadian Institutes of Health Research
Instituts de recherche en santé du Canada

HEART & STROKE FOUNDATION OF CANADA

DEFENCE DÉFENSE
Defense R&D Canada

OUT-OF-HOSPITAL CARDIAC ARREST

2019

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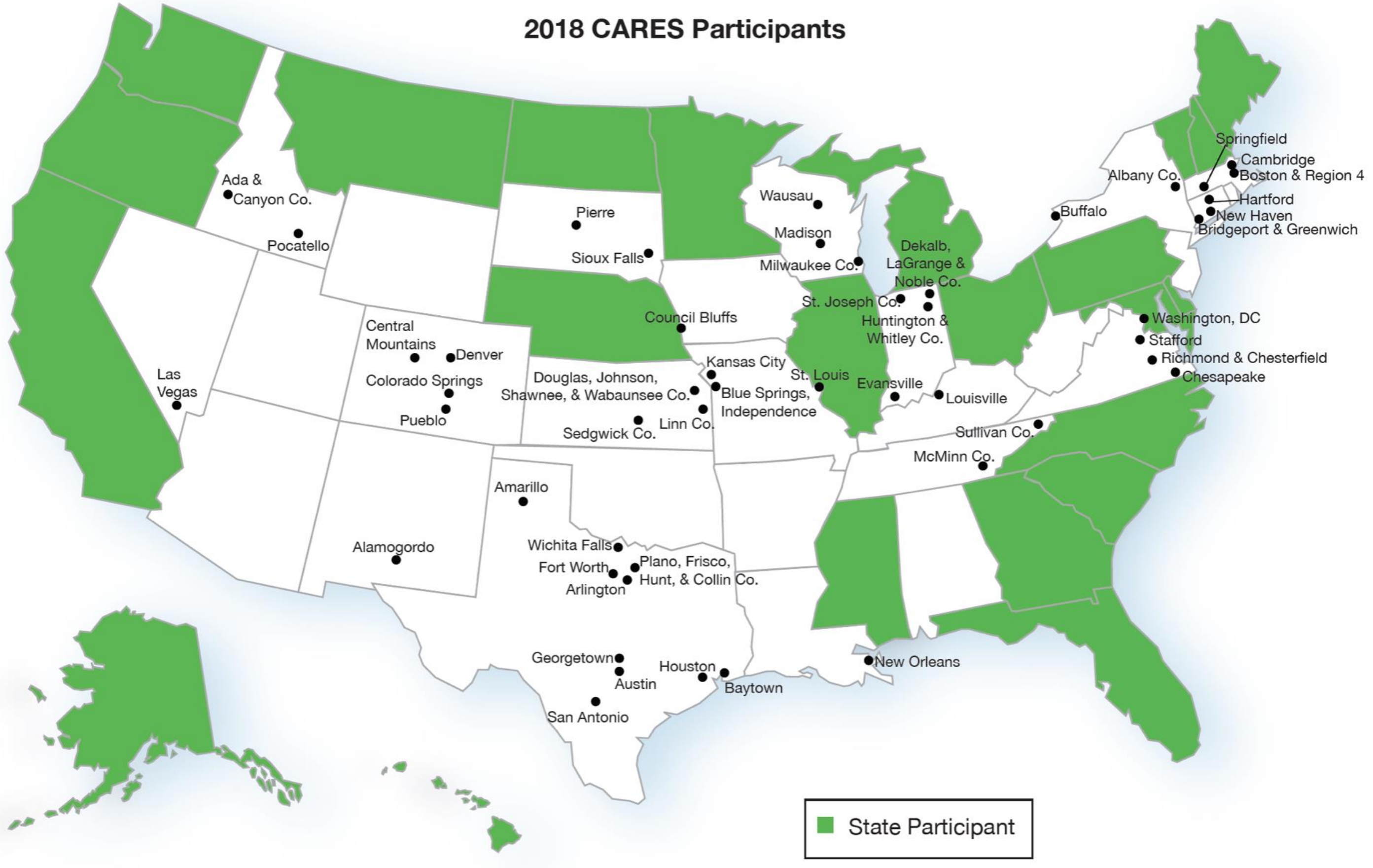
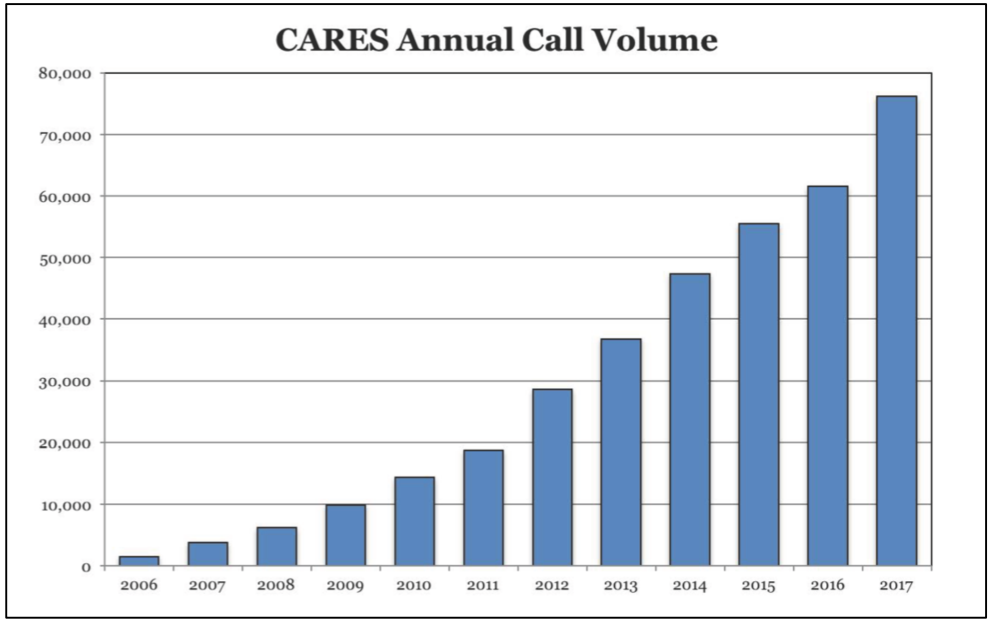
CARES
Cardiac Arrest Registry to Enhance Survival

OUT-OF-HOSPITAL CARDIAC ARREST (OHCA)

- SETS STANDARD MEASURES
- FACILITATES QUALITY IMPROVEMENT EFFORTS AND BENCHMARKING CAPABILITY TO IMPROVE CARE AND INCREASE SURVIVAL.



- 23 statewide registries
- 63 additional communities in 18 states
- Covers a catchment area of 115 million
- More than 1,400 EMS agencies
- More than 1,900 hospitals



CARES
Cardiac Arrest Registry
to Enhance Survival

- Uses a secure Web database with restricted access for authorized users.
- Has software that collects and links data sources to create a single de-identified record for each OHCA event.
- Uses a simple, HIPAA-compliant methodology to protect confidentiality.
- Accepts a variety of input methods, such as uploaded data files or online data entry.
- Collects 9-1-1 computer-aided dispatch data for EMS response times.
- Allows longitudinal, internal benchmarking of key performance indicators.
- Provides multiple reporting features, including charts, graphs, and maps.

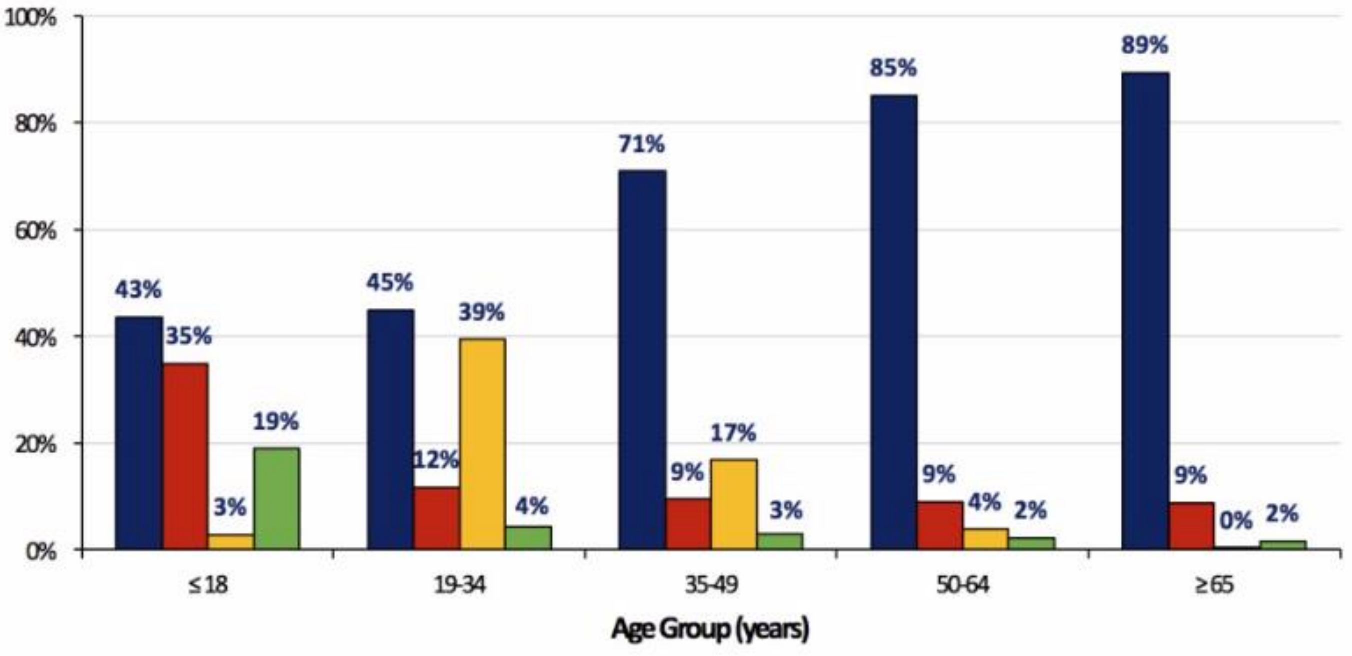


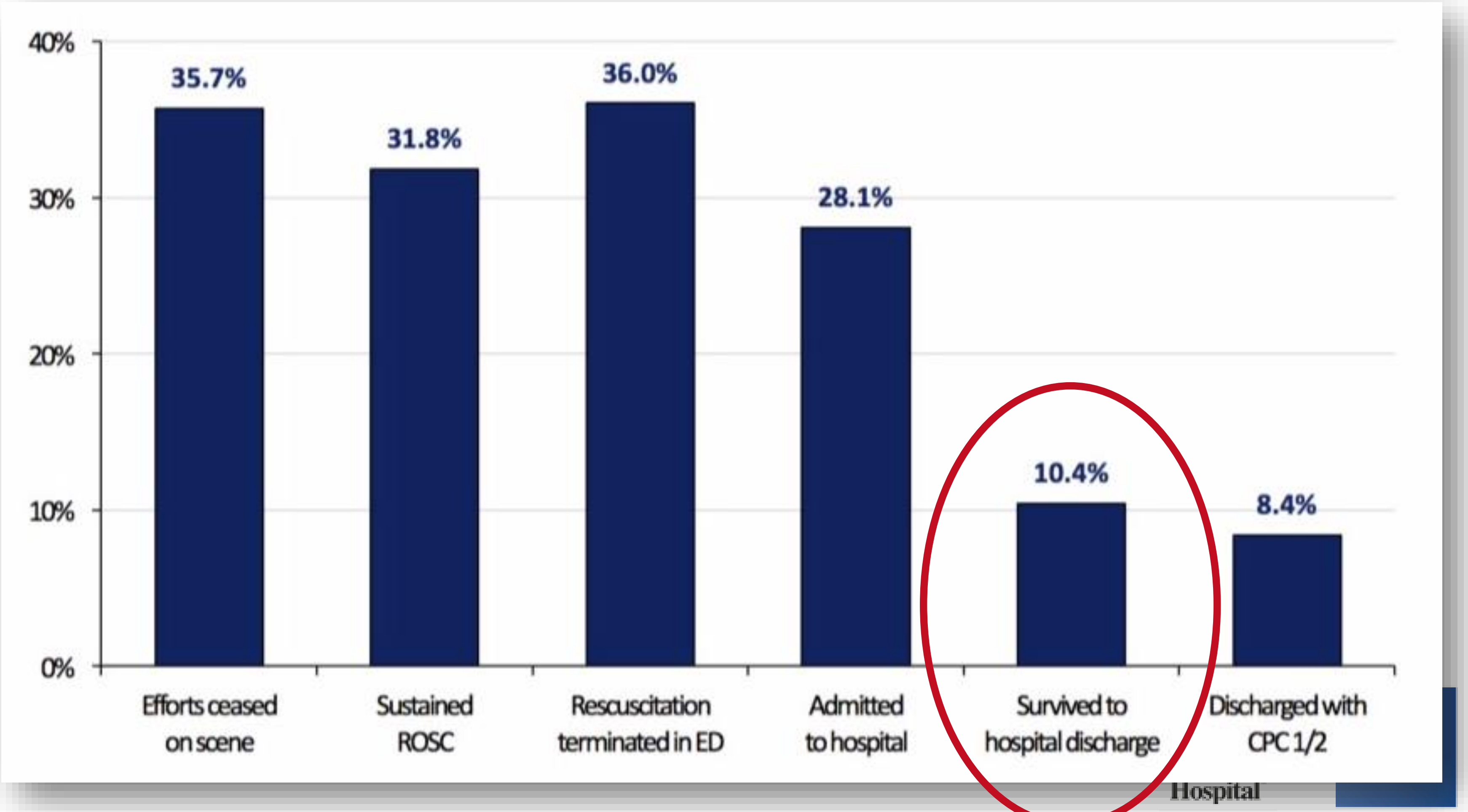
Figure 5. Etiology of arrest by age group.

2017 Report – Cause of Arrest by Age Group

can
Association.

CARES
Cardiac Arrest Registry to Enhance Survival

2017 Report -- Survival Outcomes



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CARES
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to Enhance Survival

2017 Report -- Survival Outcomes

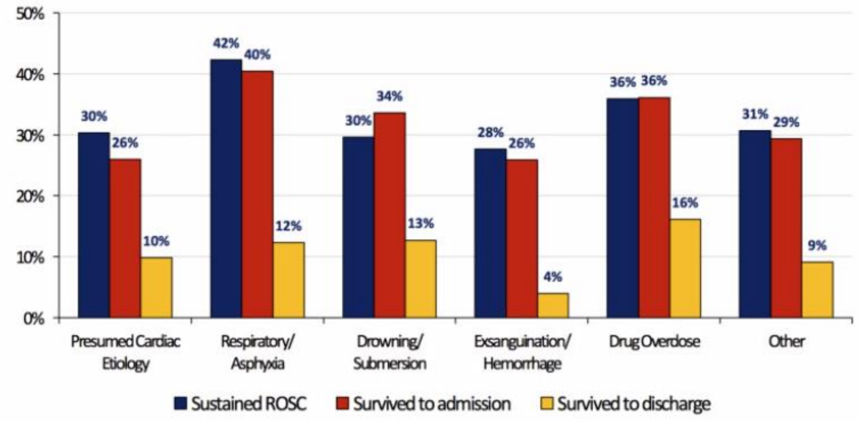

Figure 17. Unadjusted survival outcomes by arrest etiology.

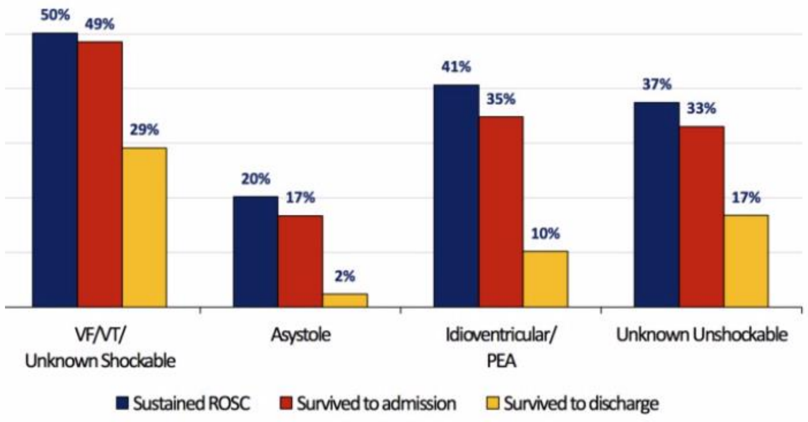

Figure 18. Unadjusted survival outcomes by presenting arrest rhythm.

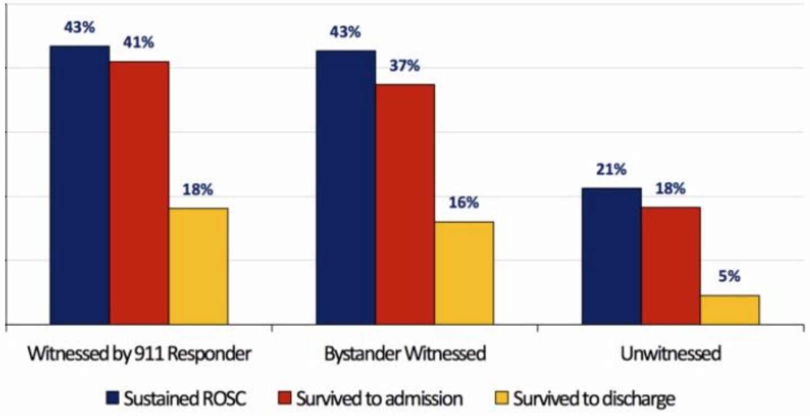

Figure 19. Unadjusted survival outcomes by arrest witness status.

Arrest Etiology

Presenting Rhythm

Witness Status

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CARES Publications

Shah M, Bartram C, Irwin K, Vellano K, McNally B, Gallagher T, Swor R. Evaluating Dispatch-Assisted CPR Using the CARES Registry. Prehosp Emerg Care. Dec 8:1-7 (2017).

Fordyce CB, Hansen CM, Kragholm K, Dupre ME, Jollis JG, Roettig ML, Becker LB, Hansen SM, Hinohara TT, Corbett CC, Monk L, Nelson RD, Pearson DA, Tyson C, van Diepen S, Anderson ML, McNally B, Granger CB. Association of Public Health Initiatives With Outcomes for Out-of-Hospital Cardiac Arrest at Home and in Public Locations. JAMA Cardiol. 2(11):1226-1235 (2017).

Hansen ML, Lin A, Eriksson C, Daya M, McNally B, Fu R, Yanez D, Zive D, Newgard C, CARES surveillance group. A comparison of pediatric airway management techniques during out-of-hospital cardiac arrest using the CARES database. Resuscitation. 120:51-56 (2017).

van Diepen S, Girotra S, Abella BS, Becker LB, Bobrow BJ, Chan PS, Fahrenbruch C, Granger CB, Jollis JG, McNally B, White L, Yannopoulos D, Rea TD. Multistate 5-Year Initiative to Improve Care for Out-of-Hospital Cardiac Arrest: Primary Results From the HeartRescue Project. J Am Heart Assoc. 22;6(9) (2017).

Kragholm K, Malta Hansen C, Dupre ME, Xian Y, Strauss B, Tyson C, Monk L, Corbett C, Fordyce CB, Pearson DA, Fosbøl EL, Jollis JG, Abella BS, McNally B, Granger CB. Direct Transport to a Percutaneous Cardiac Intervention Center and Outcomes in Patients With Out-of-Hospital Cardiac Arrest. Circ Cardiovasc Qual Outcomes. 10(6) (2017).

Tobin JM, Ramos WD, Pu Y, Wernicki PG, Quan L, Rossano JW. Bystander CPR is associated with improved neurologically favourable survival in cardiac arrest following drowning. Resuscitation. 115:39-43 (2017).

Mader TJ, Westafer LM, Nathanson BH, Villarroel N, Coute RA, McNally BF. Targeted Temperature Management Effectiveness in the Elderly: Insights from a Large Registry. Ther Hypothermia Temp Manag. 7(4):222-230 (2017).

Adabag S, Hodgson L, Garcia S, Anand V, Frascone R, Conterato M, Lick C, Wesley K, Mahoney B, Yannopoulos D. Outcomes of sudden cardiac arrest in a state-wide integrated resuscitation program: Results from the Minnesota Resuscitation Consortium. Resuscitation. 110:95-100 (2017).

Naim MY, Burke RV, McNally BF, Song L, Griffis HM, Berg RA, Vellano K, Markenson D, Bradley RN, Rossano JW. Association of Bystander Cardiopulmonary Resuscitation With Overall and Neurologically Favorable Survival After Pediatric Out-of-Hospital Cardiac Arrest in the United States: A Report From the Cardiac Arrest Registry to Enhance Survival Surveillance Registry. JAMA Pediatr. 171(2):133-141 (2017).

CARES
Cardiac Arrest Registry to Enhance Survival

American Heart Association.

Additional OHCA Research

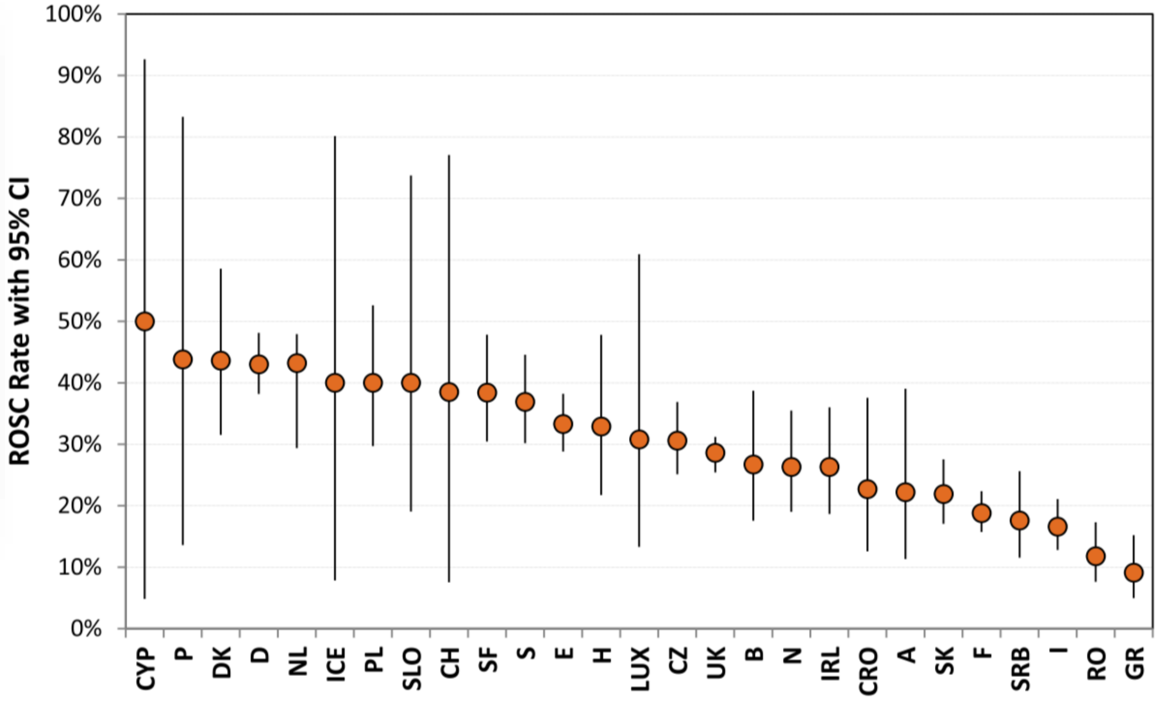
- **EuReCa ONE/TWO Studies: European Registry of Cardiac Arrest Studies**
    - Multicenter 3-month survey of Epidemiology, Treatment, Outcome of OHCA patients across Europe
    - Data collection completed
- **Out of Hospital Cardiac Arrest Outcomes project (OHCAO)**
    - UK based initiative to link EMS data with NHS identifiers
    - Ongoing projects

EuReCa ONE – VALUE IN COLLABORATION

EuReCa ONE—27 Nations, ONE Europe, ONE Registry
A prospective one month analysis of out-of-hospital cardiac arrest outcomes in 27 countries in Europe[☆]

Jan-Thorsten Gräsner[a,b,*], Rolf Lefering[c], Rudolph W. Koster[d], Siobhán Masterson[e], Bernd W. Böttiger[f], Johan Herlitz[g], Jan Wnent[a,b], Ingvild B.M. Tjelmeland[h], Fernando Rosell Ortiz[i], Holger Maurer[j], Michael Baubin[k], Pierre Mols[l], Irzal Hadžibegović[m], Marios Ioannides[n], Roman Škulec[o], Mads Wissenberg[p], Ari Salo[q], Hervé Hubert[r], Nikolaos I. Nikolaou[s], Gerda Lóczi[t], Hildigunnur Svavarsdóttir[u], Federico Semeraro[v], Peter J. Wright[w], Carlo Clarens[x], Ruud Pijls[y], Grzegorz Cebula[z], Vitor Gouveia Correia[aa], Diana Cimpoesu[ab], Violetta Raffay[ac], Stefan Trenkler[ad], Andrej Markota[ae], Anneli Strömsöe[af], Roman Burkart[ag], Gavin D. Perkins[ah], Leo L. Bossaert[ai], on behalf of EuReCa ONE Collaborators[1]

Resuscitation 105 (2016) 188–195



Abbreviations: ROSC= Return of spontaneous circulation. Abbreviations for Countries names are explained in Table 1.

Fig. 2. ROSC rate in patients with CPR attempted. The vertical lines represent the 95% confidence intervals (CI). The graph includes 6963 patients from 27 countries (range per country 4 – 1475). The overall result is 28.6%. *Abbreviations*: ROSC = return of spontaneous circulation. Abbreviations for Countries names are explained in Table 1.

Additional OHCA Research

- EuReCa ONE/TWO Studies: European Registry of Cardiac Arrest – Study Two
  - Multicenter 3-month survey of Epidemiology, Treatment, Outcome of OHCA patients across Europe
  - Data collection completed
- Out of Hospital Cardiac Arrest Outcomes project (OHCAO)
  - UK based initiative to link EMS data with NHS identifiers
  - Ongoing projects

OHCAO – UNIFYING NATIONAL EFFORTS IN UK

Epidemiology and outcomes from out-of-hospital cardiac arrests in England☆

Claire Hawkes[a], Scott Booth[a], Chen Ji[a], Samantha J. Brace-McDonnell[a,b], Andrew Whittington[a], James Mapstone[j], Matthew W. Cooke[a], Charles D. Deakin[c], Chris P. Gale[d], Rachael Fothergill[e], Jerry P. Nolan[f], Nigel Rees[g], Jasmeet Soar[h], A. Niroshan Siriwardena[i], Terry P. Brown[a], Gavin D. Perkins[a,b,*], on behalf of OHCAO collaborators[1]

Resuscitation 110 (2017) 133–140

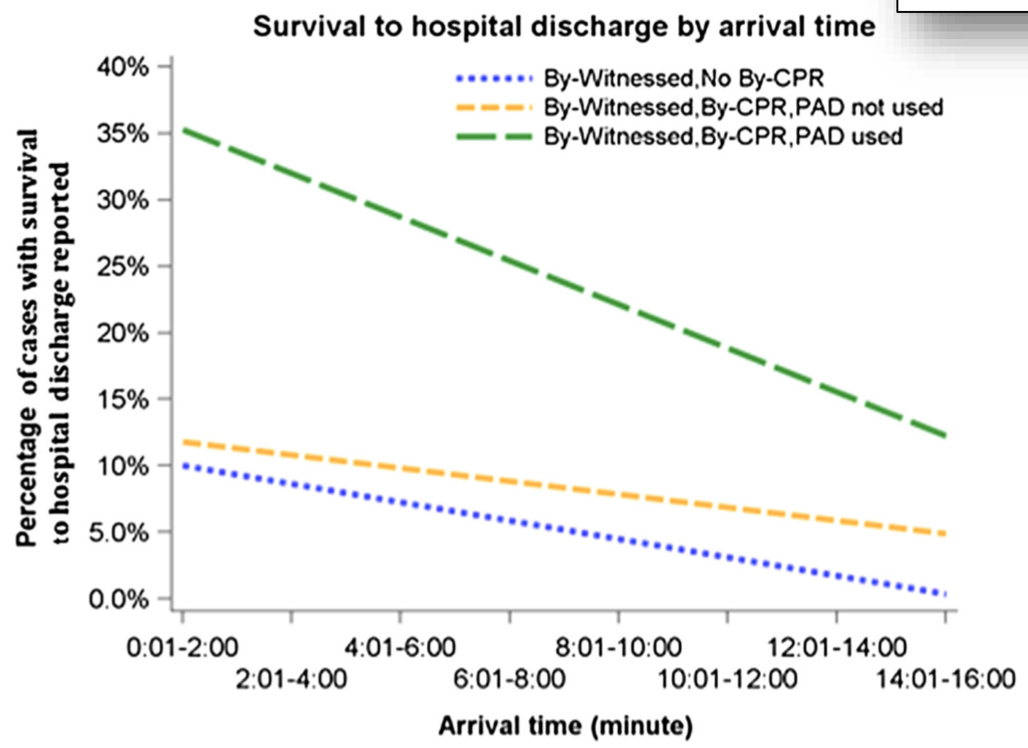


Fig. 5. Shockable rhythm in Utstein groups by EMS arrival time and survival to hospital discharge in Utstein groups by EMS arrival time.

- ***Survival to Hospital Discharge = 7.9%***
- ***Bystander CPR = 55%***

"Potential for doubling the survival rate in England remains."

American Heart Association.

IN-HOSPITAL CARDIAC ARREST

2019

CHARACTERISTICS OF IN-HOSPITAL CARDIAC ARREST

IN 2015, THE INSTITUTE OF MEDICINE (IOM) RELEASED A REPORT TITLED *STRATEGIES TO IMPROVE CARDIAC ARREST SURVIVAL: A TIME TO ACT*. THE REPORT LOOKED AT THE MANY OBSTACLES AND CHALLENGES IN TREATING SUDDEN CARDIAC ARREST (SCA).

- SCA STRIKES MORE THAN ½ MILLION PEOPLE EACH YEAR
- 3RD LEADING CAUSE OF DEATH FOLLOWING CANCER AND HEART DISEASE
- IN-HOSPITAL CARDIAC ARREST (IHCA) ACCOUNTS FOR APPROXIMATELY 209,000 CASES[2]
- THE IOM COMMISSIONED PAUL CHAN, MD, TO AUTHOR A REVIEW OF AHA'S GET WITH THE GUIDELINES ® - RESUSCITATION (GWTG-R) REGISTRY TITLED:

PUBLIC HEALTH BURDEN OF IN-HOSPITAL CARDIAC ARREST

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American Heart Association.

SURVIVABILITY OF IHCA

UTILIZING GWTG-RESUSCITATION DATA, DR. CHAN LOOKED AT *SURVIVABILITY* AFTER IHCA

- NEARLY 80% OF IHCA OCCUR IN MEDICINE WARDS AND ICU'S
- 1 IN 5 IHCA OCCUR IN "SURGICAL" PATIENTS
- CARDIAC ETIOLOGIES COMPRISE > 50% IHCA
- PATIENTS WHO ARREST WITH A MEDICAL, NON-CARDIAC ETIOLOGY WERE LESS LIKELY TO SURVIVE TO HOSPITAL DISCHARGE
- OVERALL SURVIVABILITY FOR IHCA = 24.4%

Etiology	Survived to Discharge: Yes n=4016	Survived to Discharge: No n=12,420	Total N=16,436
Medical: Cardiac	40.2%	36.2%	37.2%
Medical: Non-cardiac	36.6%	48.9%	45.9%
Surgical: Cardiac	11.3%	5.1%	6.6%
Surgical: Non-cardiac	11.9%	9.8%	10.4%

Chan, *Public Health Burden in In-hospital Cardiac Arrest 2015*

American Heart Association.

Common Assumption Made without Data:

Outcomes after in-hospital cardiac arrest (IHCA) are acceptable because the hospital environment contains large numbers of highly qualified health-care providers with the necessary training and equipment to respond promptly to the event.

American Heart Association | American Stroke Association

Focus on Quality

heart.org/quality

GET WITH THE GUIDELINES. STROKE

GET WITH THE GUIDELINES. HEART FAILURE

GET WITH THE GUIDELINES. RESUSCITATION

GET WITH THE GUIDELINES. AFIB

ACTION Registry-GWTG™

THE GUIDELINE ADVANTAGE™
American Cancer Society | American Diabetes Association | American Heart Association | American Stroke Association

MISSION: LIFELINE™

HOSPITAL Accreditation & Certification

TARGET: STROKE℠

TARGET: HF℠

GET WITH THE GUIDELINES® RESUSCITATION

RETROSPECTIVE IHCA REGISTRY

MISSION: TO SAVE MORE LIVES BY PREVENTING IHCA AND OPTIMIZING OUTCOMES THROUGH BENCHMARKING, QUALITY IMPROVEMENT, KNOWLEDGE TRANSLATION, AND RESEARCH

VISION: SAVING MORE LIVES IN EVERY HOSPITAL THROUGH **DATA-DRIVEN RESUSCITATION CARE**

APPROACH: GWTG-R FACILITATES EFFICIENT CAPTURE, ANALYSIS, AND REPORTING OF DATA → SUPPORTING IMPLEMENTATION OF GUIDELINES, DISSEMINATION OF NEW KNOWLEDGE, DEVELOPMENT OF EVIDENCE-BASED PRACTICE IN RESUSCITATION SCIENCE

Texas Children's Hospital® Baylor College of Medicine American Heart Association.

GWTG-R Participation:

Adult/Pediatric/Neonate

(as of 2/28/2019)

Report Type	Total Patient Records
ARC	65,588
CPA	461,501
MET	722,004
PCAC	2,353
ARC + CPA + MET+ PCAC	**1,251,446**

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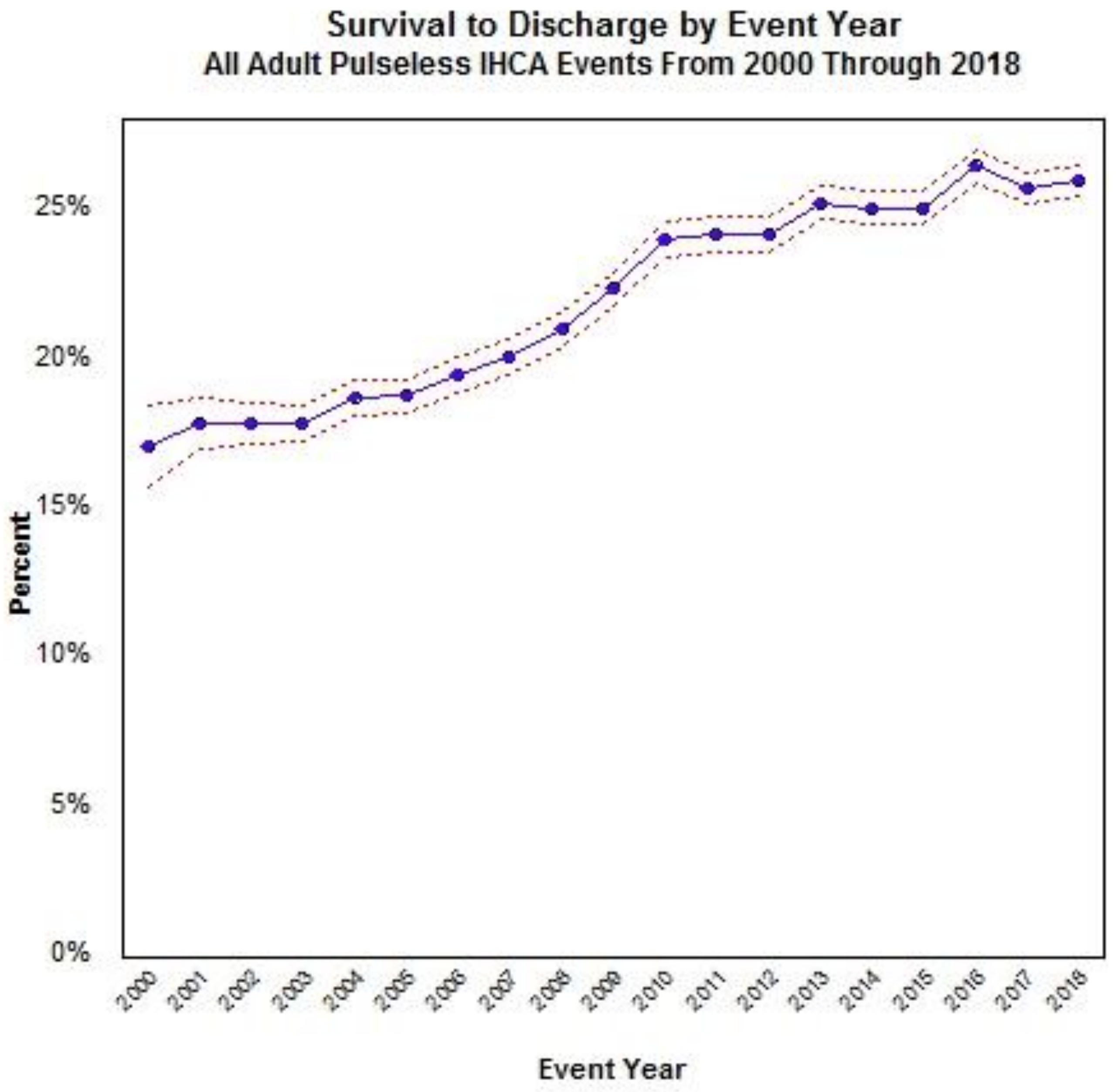
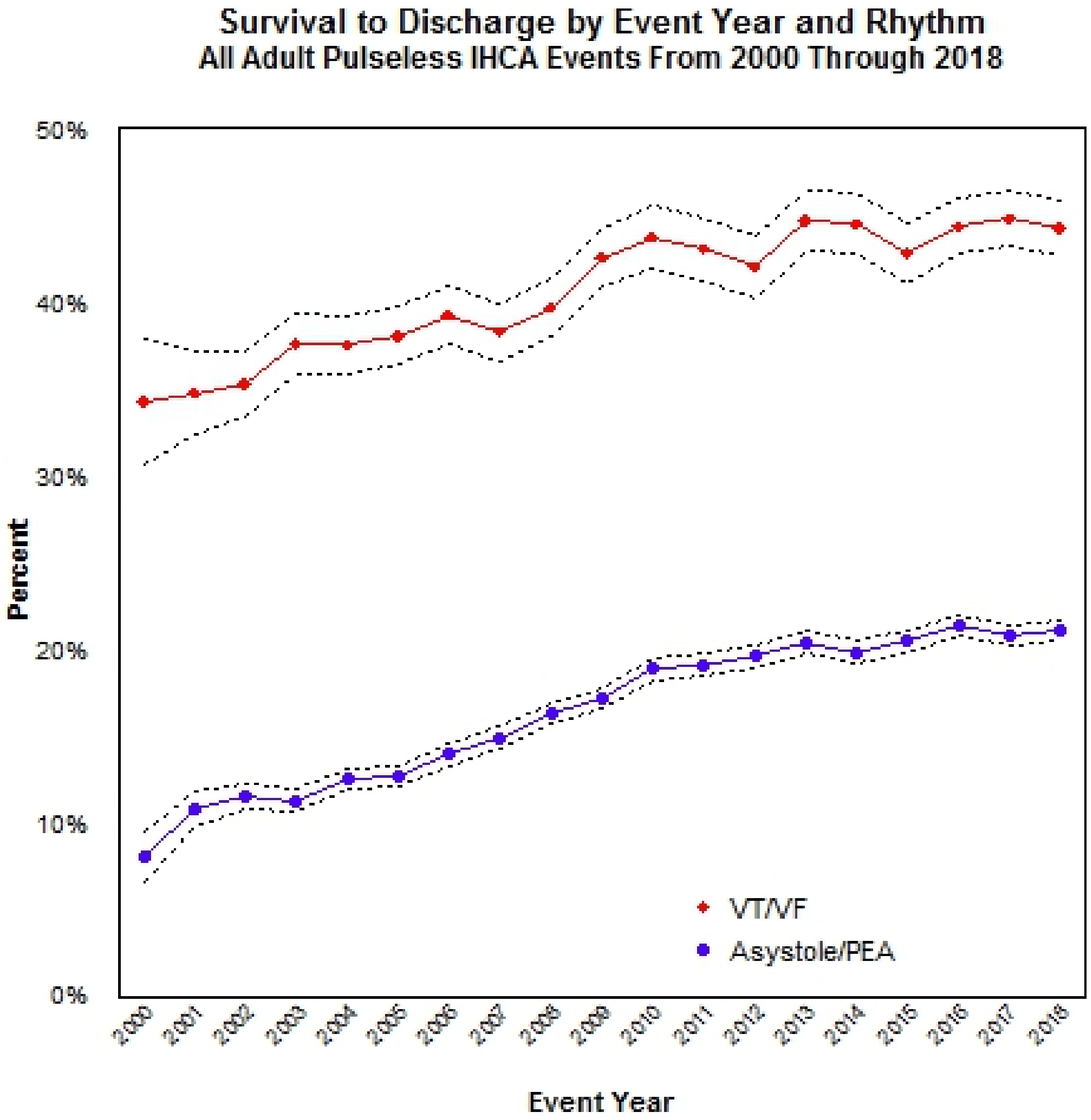


GWTG-R Data Adult

- **50% improvement in survival to DC since 2000**
- **Improved survival to DC of ~ 0.5% per year since 2000**
- **Overall Survival to DC = 25.8%**

Texas Children's Hospital · Baylor College of Medicine · American Heart Association



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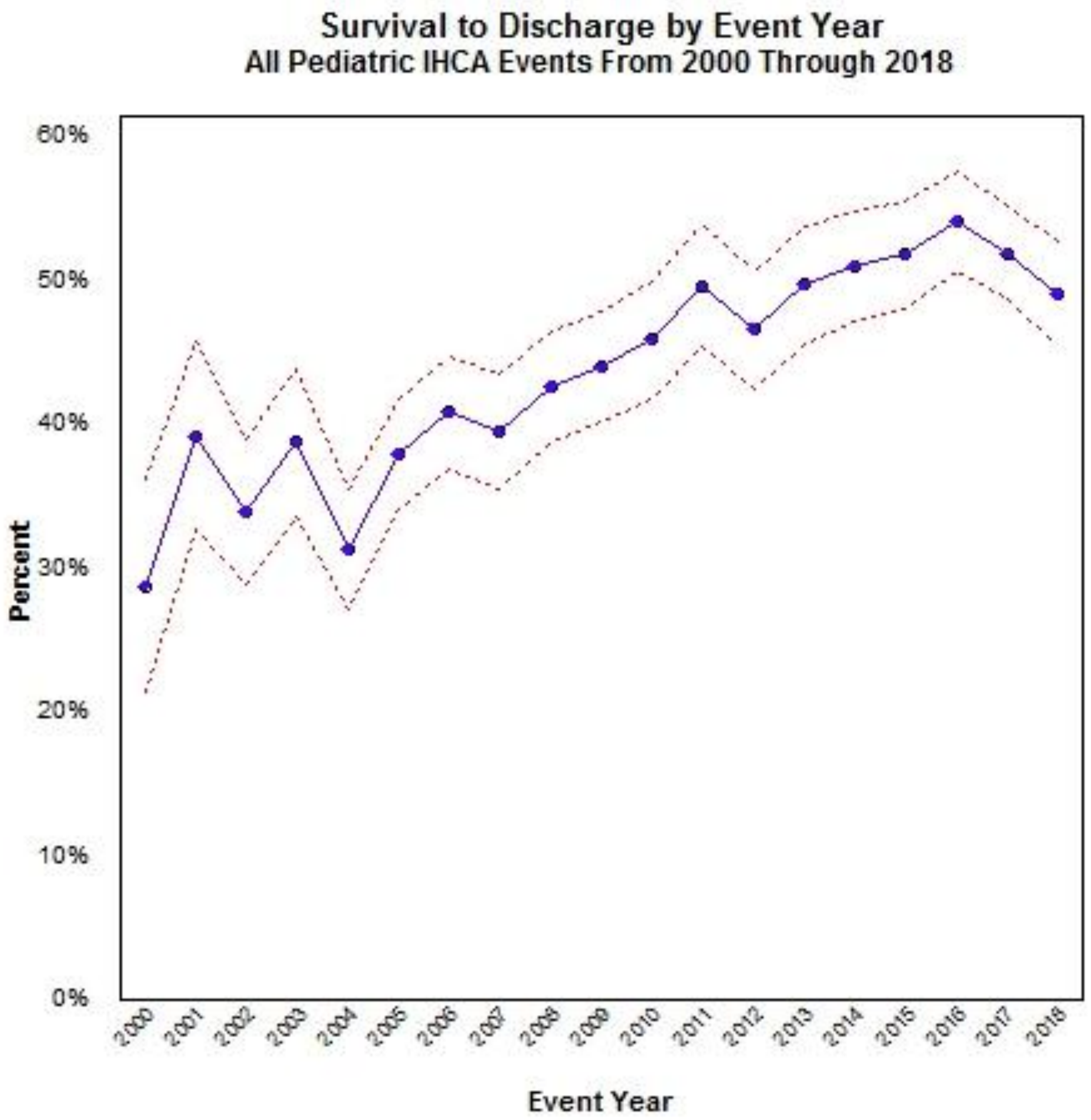
Baylor College of Medicine
American Heart Association.



GWTG-R Data Pediatric

- **50% improvement in survival to DC since 2000**
- **Overall Survival to DC = 41.1%**

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American Heart Association.

Why Get With The Guidelines®- Resuscitation?

- In 2018, >200,000 Americans suffered in-hospital cardiac arrest and….
- ***Less*** than 25% of adults and 41% of children ***survived***.
- GWTG®-R is the American Heart Association's collaborative quality improvement program demonstrated to improve adherence to evidence-based care of adult, pediatric and neonatal/newborn patients who experience an in-hospital resuscitation event.

The goal of Get With The Guidelines-Resuscitation is to help hospital teams save more lives threatened by cardiopulmonary emergencies by consistently applying the most up-to-date scientific guidelines for in-hospital resuscitation and post-cardiac resuscitation care.

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Original Investigation

Association Between Hospital Process Composite Performance and Patient Outcomes After In-Hospital Cardiac Arrest Care

Monique L. Anderson, MD, MHS; Graham Nichol, MD, MPH; David Dai, PhD; Paul S. Chan, MD, MSc; Laine Thomas, PhD; Sana M. Al-Khatib, MD, MHS; Robert A. Berg, MD; Steven M. Bradley, MD, MPH; Eric D. Peterson, MD, MPH; for the American Heart Association's Get With the Guidelines–Resuscitation Investigators

- Is IHCA survival variation due to differences in quality of care?
- GWTG-R 35,282 adults at 261 hospitals 2010-2012
- Calculated hospital composite performance score using 5 AHA guideline-recommended process measures and divided scores into quartiles

Monitored, witnessed	Time to CPR	Time to epi	Time to defib	ETT confirmation

- Scores by quartile were associated with risk standardized survival rates and neurological status

Anderson, JAMA Cards, 2016

Figure 1. Hospital Process Composite Performance Scores

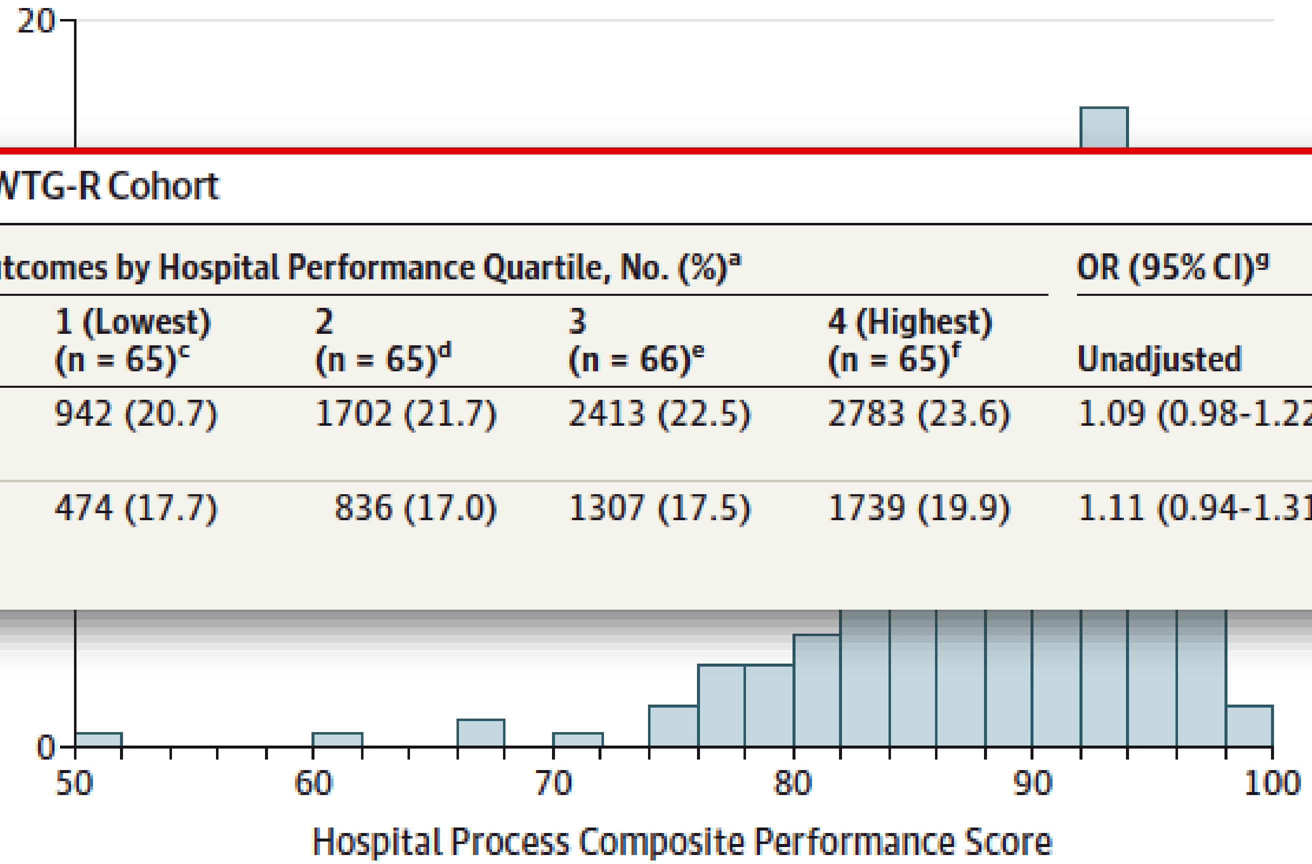

Table 4. Outcomes of IHCA for GWTG-R Cohort

Outcome	Unadjusted Outcomes by Hospital Performance Quartile, No. (%)[a]					OR (95% CI)[g]		P Value
	Overall (n = 261)[b]	1 (Lowest) (n = 65)[c]	2 (n = 65)[d]	3 (n = 66)[e]	4 (Highest) (n = 65)[f]	Unadjusted	Adjusted	
Survival to discharge	7840 (22.4)	942 (20.7)	1702 (21.7)	2413 (22.5)	2783 (23.6)	1.09 (0.98-1.22)	1.22 (1.08-1.37)	.001
Favorable neurologic status (CPC 1 or 2)[h]	4356 (18.3)	474 (17.7)	836 (17.0)	1307 (17.5)	1739 (19.9)	1.11 (0.94-1.31)	1.32 (1.11-1.58)	.003

 Anderson, JAMA Cards, 2016

Original Investigation

Resuscitation Practices Associated With Survival After In-Hospital Cardiac Arrest

A Nationwide Survey

- Survey of resuscitation practices at GWTG-R hospitals with >20 IHCA events from 2012-2013 to try and identify what ***resuscitation practices*** are associated with improved rates of IHCA survival

- 150 (78%) of 190 eligible hospitals completed survey

- Risk standardized survival rates calculated and used to categorize hospitals into quintiles based on performance

 Chan, JAMA Cards 2016

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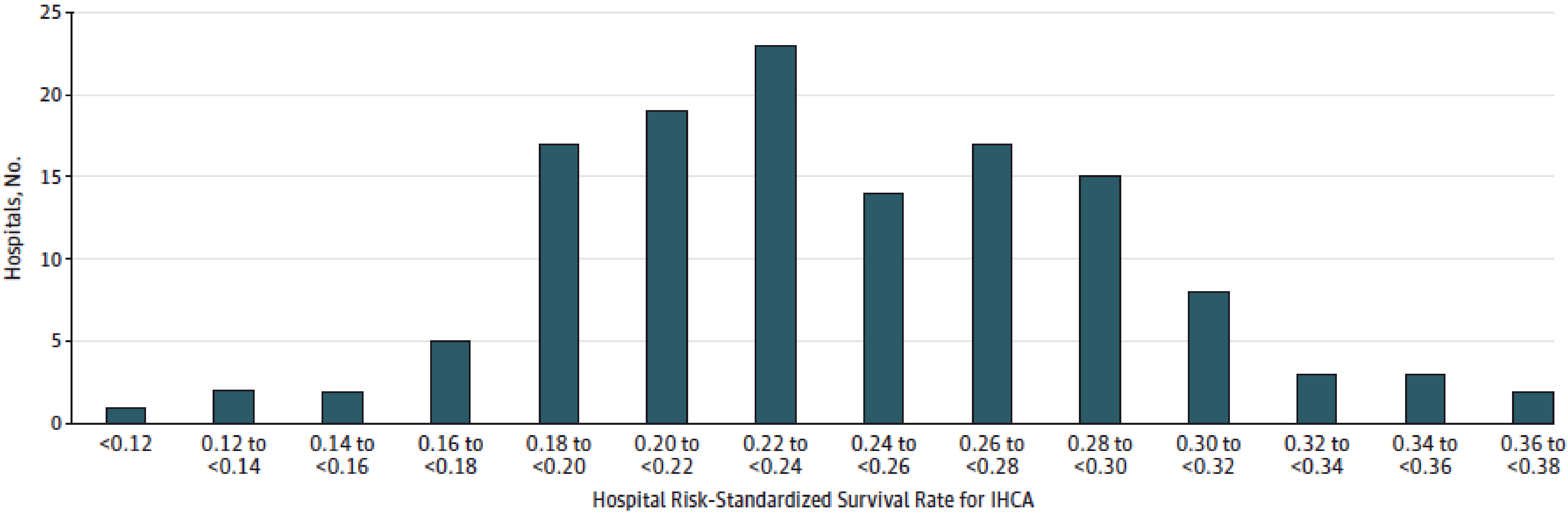
Figure 1. Distribution of Risk-Standardized Survival Rates for In-Hospital Cardiac Arrest (IHCA) Among Study Hospitals



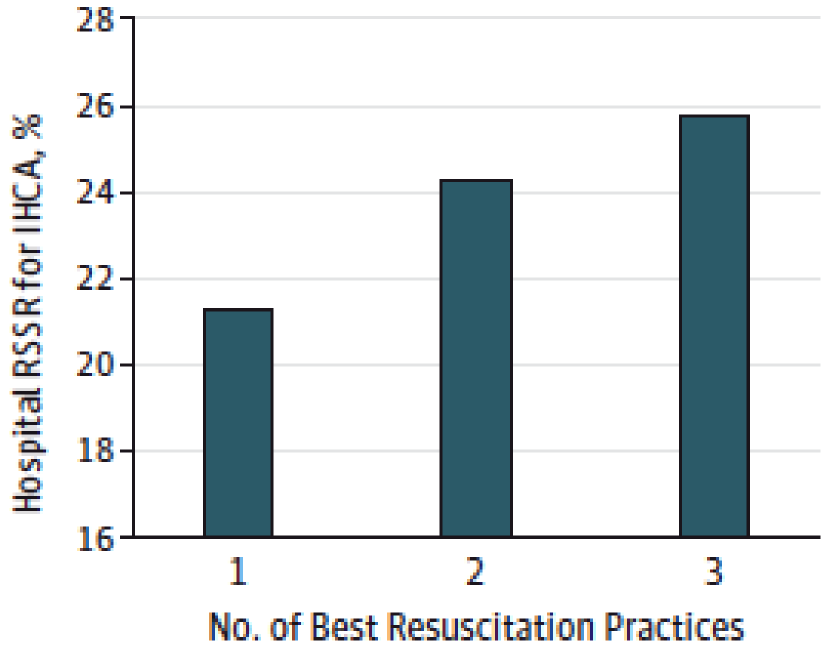
- RSSRs varied ***widely*** across hospitals: median 23.7% and range 9.2%- 37.5%

Chan, JAMA Cards 2016

Table 3. Adjusted Associations Between Hospital Factors and Risk-Standardized Survival Rates for In-Hospital Cardiac Arrest

Hospital Resuscitation Strategy or Factor	Adjusted Odds Ratio (95% CI)	*P* Value
Frequency of review of in-hospital cardiac arrest cases		
Less than once quarterly	1 [Reference]	.03
At least once monthly	8.55 (1.79-40.00)	
At least once quarterly	6.85 (1.49-31.30)	
Monitoring for interruptions of chest compressions	2.71 (1.24-5.93)	.01
Adequate resuscitation training at one's hospital (not a barrier or only mild barrier)	3.23 (1.21-8.33)	.02
Monitoring of times to defibrillation	1.89 (0.74-4.83)	.18
Frequency of immediate code debriefing		
Not at all or <10% of all resuscitations	1 [Reference]	.65
10%-49% of all resuscitations	1.19 (0.44-3.23)	
50%-100% of all resuscitations	1.56 (0.61-4.00)	
Presence of intensive care specialist in hospital ICUs at all times	1.84 (0.84-4.00)	.13
Lack of resuscitation champion is a moderate to severe barrier at one's hospital	0.56 (0.21-1.49)	.25

Figure 2. Risk-Standardized Survival Rates (RSSRs) for In-Hospital Cardiac Arrest (IHCA) for Hospitals Using 1, 2, or All 3 Resuscitation Practices



Chan, JAMA Cards 2016

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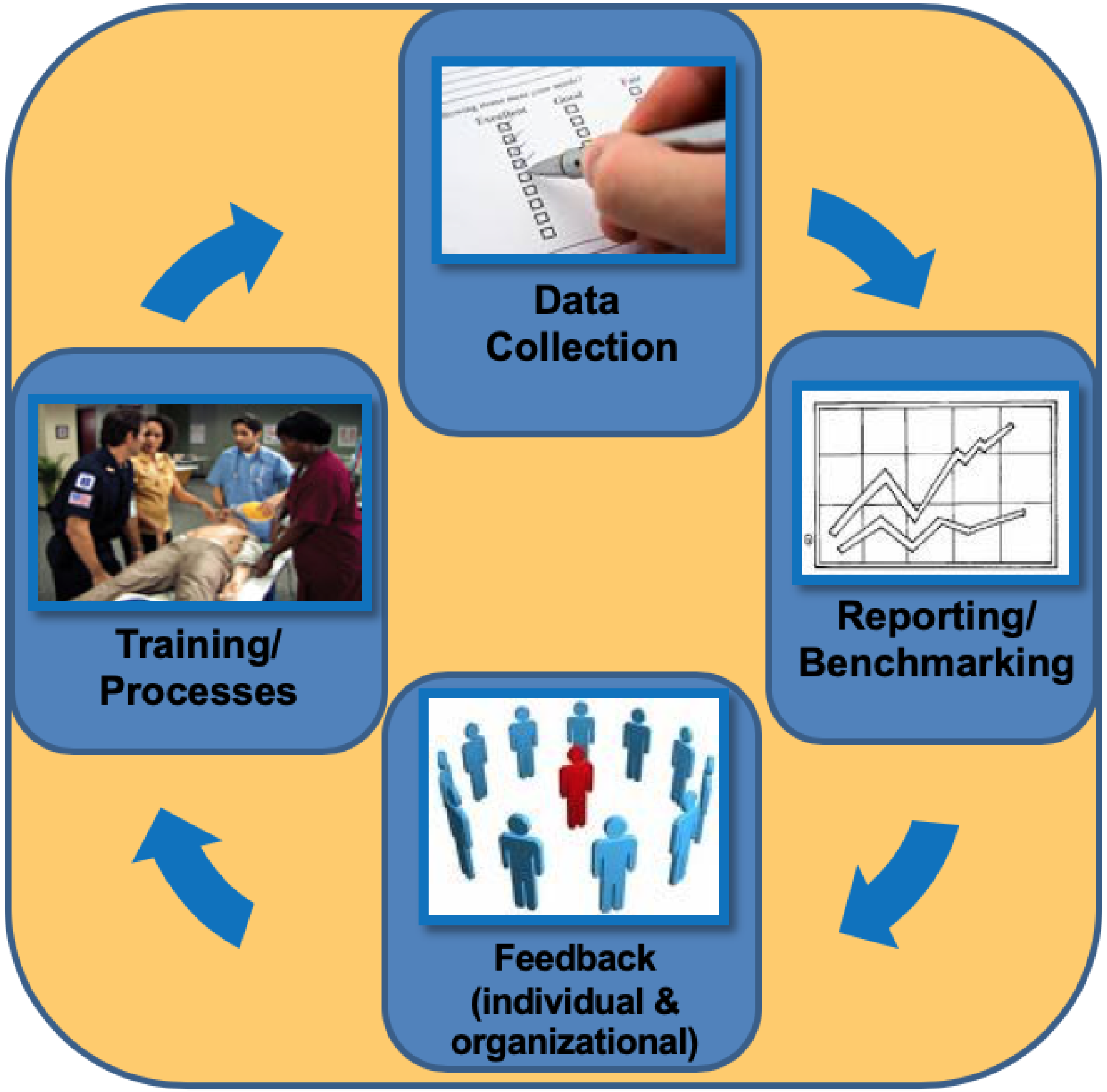
Developing A Culture Of ***High-Quality*** Resuscitation



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EVENTS CAPTURED BY GWTG® - RESUSCITATION

Pre-Event Care
Medical Emergency Teams

Medical Emergency Team Activation (MET)
Patient condition is deteriorating – team response needed to intervene for the crisis

Pre- Cardiac Arrest Care
Acute Respiratory Compromise

Acute Respiratory Compromise (ARC)
Patient requires emergency assisted ventilation

Managing the Cardiac Arrest

Cardio-Pulmonary Arrest (CPA)
Patient requires chest compressions or shock by a defibrillator.

Post Cardiac Arrest Care

Post Cardiac Arrest Care (PCAC)
Care of patient with in-hospital or out of hospital event

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Focus on CPR Quality

CPA 7.1 CPR Quality	*CPR Quality Tab*

Was performance of CPR monitored or guided using any of the following? (Check all that apply)

❑ None

❑Waveform Capnography /End Tidal CO2 (ETCO2)
❑ Arterial Wave Form /Diastolic Pressure
❑CPR mechanics device (e.g. accelerometer, force transducer, TFI device)
❑ CPR quality coach
❑ Metronome
❑ Other, Specify: ________________

If CPR mechanics device (e.g. accelerometer, force transducer, TFI device) used:

Average compression rate: ___________ (per minute) ❑ Not Documented

Average compression depth: ________ ❑ mm ❑ cm ❑ inches ❑ Not Documented

Compression fraction: ___________ (enter number between 0 and 1) ❑ Not Documented

Percent of Chest Compressions with complete release: ___________(%) ❑ Not Documented

Average Ventilation Rate: ___________ (per minute) ❑ Not Documented

Longest Pre-shock pause ______ (seconds) ❑ Not Documented

HOW GWTG®-R CAN BE USED TO *IMPROVE* PERFORMANCE

Data to Consider:

- Identify specific problem areas within the facility by reviewing the Events by Time/Location Report.
- Compare median times with your comparison group.
- Compare event locations with comparison group: ICU vs. Telemetry vs. General Floor
- Evaluate first pulseless rhythm and compare with comparison group: shockable vs. non-shockable
- Compare percent of witnessed vs. un-witnessed CPA with your comparison group.

Example of positive organizational changes within member facilities as a result of related data:

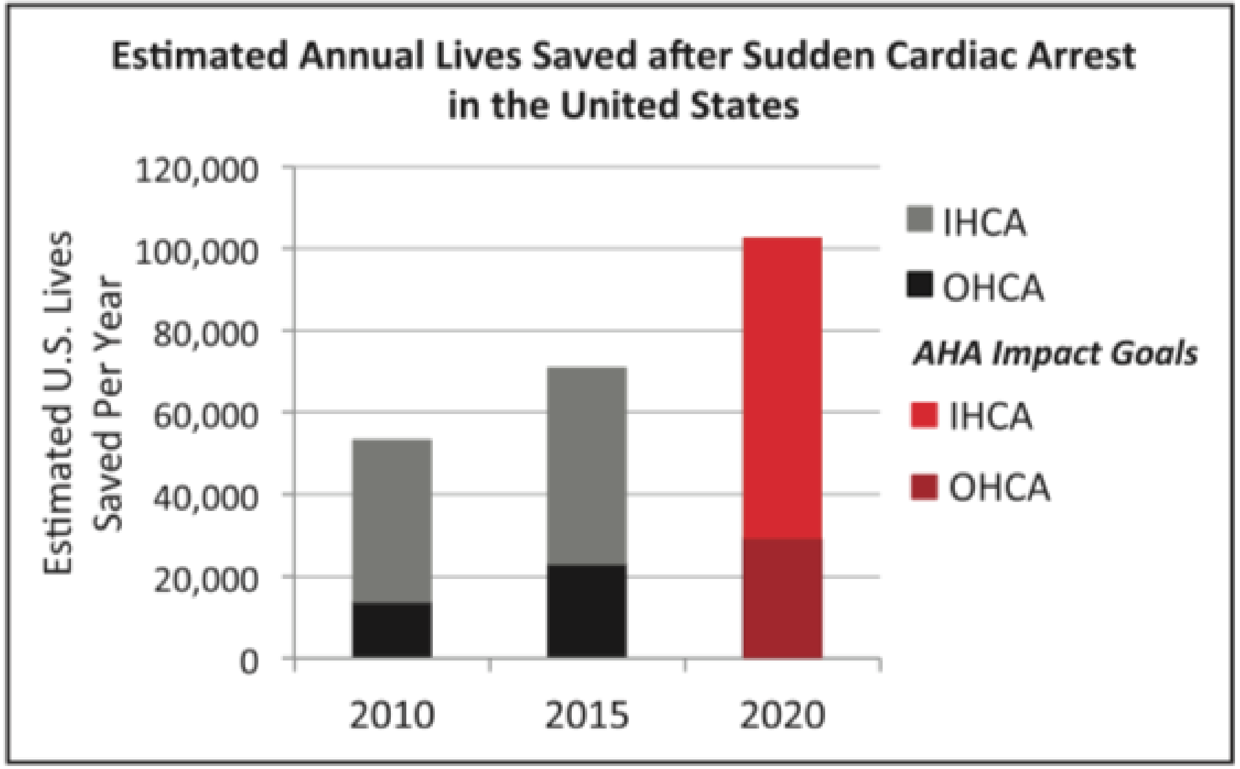
- Purchased AEDs for certain areas.
- Trained personnel in use of AEDs
- Established "First Responder" Protocols
- Include use of hands-free pads (which decrease preshock pause)
- Increased monitored bed capacity

Doubling Cardiac Arrest Survival by 2020

Achieving the American Heart Association Impact Goal

<u>Survival 2020 Goals</u>

- **Adults**: From 19% → **38%**
- **Children**: From 35% → **50%**



Neumar RW. *Circulation* 2016

American Heart Association.

SUMMARY

- RESUSCITATION PRACTICES AND OUTCOMES FOR OHCA ARE HIGHLY VARIABLE.
- IHCA SURVIVAL RATES HAVE INCREASED OVER LAST 15 YEARS BUT LEAVE ROOM FOR IMPROVEMENT
- PARTICIPATION IN NATIONAL CARDIAC ARREST REGISTRIES FUELS RESEARCH AND QUALITY IMPROVEMENT INITIATIVES
- COLLABORATIVE LEARNING BEYOND HOSPITAL WALLS IS THE KEY TO...

SAVING LIVES

Texas Children's Hospital

Baylor College of Medicine

THANK YOU

YOUR EFFORTS ARE SAVING LIVES

Texas Children's Hospital

Baylor College of Medicine

OUT OF HOSPITAL CARDIAC ARREST:
UNIQUE CHALLENGES AND WHAT'S TO COME

David Persse, MD FACEP FAEMS
EMS Director
Public Health Authority

Strive to Revive Conference

April 12, 2019

PRESENTER DISCLOSURE INFORMATION

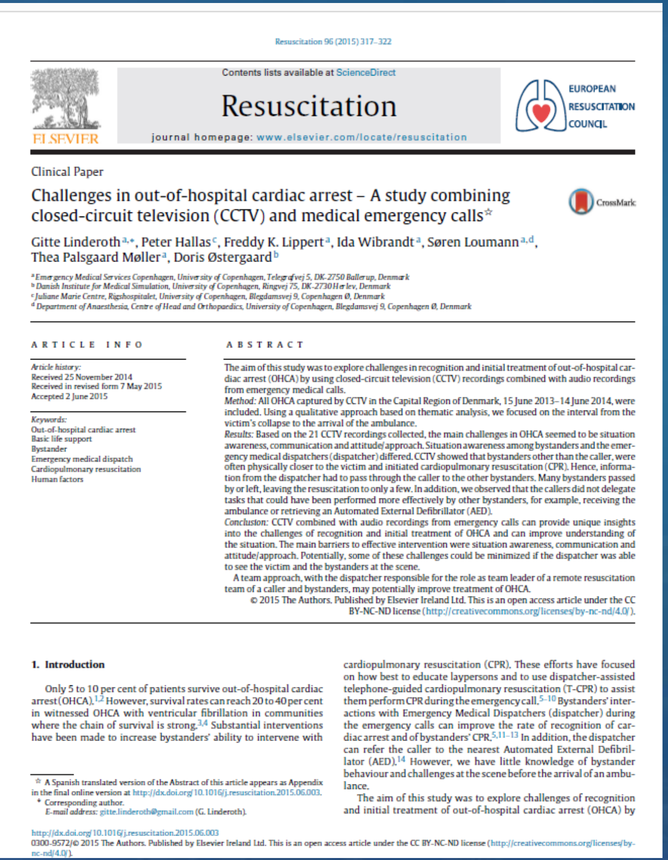
- David Persse, MD
- Out of hospital cardiac arrest:
  Unique Challenges and What's to Come
- Financial Disclosure: NONE
- Unlabeled/Unapproved Uses Disclosure: NONE

OOH CPA: UNIQUE CHALLENGES

- Time is the Enemy
  - Chances of Survival Drop 10%/minute
- Callers can be……Clueless
- Callers can be……Afraid
- Callers can be……Fantastic
- Responders can be……Busy doing something else
- Responders can be……Afraid
- Responders can be……Fantastic.

ANATOMY OF A CALL TO 9-1-1

- 9-1-1 Neutral
- Call Location
- What is the Emergency?
- Is the Patient Conscious?
- Is the Patient Breathing Normally?
- Pre-Arrival Instructions
  - Chest Compression Only CPR
  - Obtain/Use AED.



Resuscitation 96 (2015) 317–322

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journal homepage: www.elsevier.com/locate/resuscitation

Clinical Paper

Challenges in out-of-hospital cardiac arrest – A study combining closed-circuit television (CCTV) and medical emergency calls☆

Gitte Linderoth[a,*], Peter Hallas[c], Freddy K. Lippert[a], Ida Wibrandt[a], Søren Loumann[a,d], Thea Palsgaard Møller[a], Doris Østergaard[b]

[a] Emergency Medical Services Copenhagen, University of Copenhagen, Telegrafvej 5, DK-2750 Ballerup, Denmark
[b] Danish Institute for Medical Simulation, University of Copenhagen, Ringvej 75, DK-2730 Herlev, Denmark
[c] Juliane Marie Centre, Rigshospitalet, University of Copenhagen, Blegdamsvej 9, Copenhagen Ø, Denmark
[d] Department of Anaesthesia, Centre of Head and Orthopaedics, University of Copenhagen, Blegdamsvej 9, Copenhagen Ø, Denmark

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Basic life support
Bystander
Emergency medical dispatch
Cardiopulmonary resuscitation
Human factors

ABSTRACT

The aim of this study was to explore challenges in recognition and initial treatment of out-of-hospital cardiac arrest (OHCA) by using closed-circuit television (CCTV) recordings combined with audio recordings from emergency medical calls.

Method: All OHCA captured by CCTV in the Capital Region of Denmark, 15 June 2013–14 June 2014, were included. Using a qualitative approach based on thematic analysis, we focused on the interval from the victim's collapse to the arrival of the ambulance.

Results: Based on the 21 CCTV recordings collected, the main challenges in OHCA seemed to be situation awareness, communication and attitude/approach. Situation awareness among bystanders and the emergency medical dispatchers (dispatcher) differed. CCTV showed that bystanders other than the caller, were often physically closer to the victim and initiated cardiopulmonary resuscitation (CPR). Hence, information from the dispatcher had to pass through the caller to the other bystanders. Many bystanders passed by or left, leaving the resuscitation to only a few. In addition, we observed that the callers did not delegate tasks that could have been performed more effectively by other bystanders, for example, receiving the ambulance or retrieving an Automated External Defibrillator (AED).

Conclusion: CCTV combined with audio recordings from emergency calls can provide unique insights into the challenges of recognition and initial treatment of OHCA and can improve understanding of the situation. The main barriers to effective intervention were situation awareness, communication and attitude/approach. Potentially, some of these challenges could be minimized if the dispatcher was able to see the victim and the bystanders at the scene.

A team approach, with the dispatcher responsible for the role as team leader of a remote resuscitation team of a caller and bystanders, may potentially improve treatment of OHCA.

1. Introduction

Only 5 to 10 per cent of patients survive out-of-hospital cardiac arrest (OHCA).[1,2] However, survival rates can reach 20 to 40 per cent in witnessed OHCA with ventricular fibrillation in communities where the chain of survival is strong.[3,4] Substantial interventions have been made to increase bystanders' ability to intervene with cardiopulmonary resuscitation (CPR). These efforts have focused on how best to educate laypersons and to use dispatcher-assisted telephone-guided cardiopulmonary resuscitation (T-CPR) to assist them perform CPR during the emergency call.[5–10] Bystanders' interactions with Emergency Medical Dispatchers (dispatcher) during the emergency calls can improve the rate of recognition of cardiac arrest and of bystanders' CPR.[5,11–13] In addition, the dispatcher can refer the caller to the nearest Automated External Defibrillator (AED).[14] However, we have little knowledge of bystander behaviour and challenges at the scene before the arrival of an ambulance.

The aim of this study was to explore challenges of recognition and initial treatment of out-of-hospital cardiac arrest (OHCA) by

☆ A Spanish translated version of the Abstract of this article appears as Appendix in the final online version at http://dx.doi.org/10.1016/j.resuscitation.2015.06.003.

* Corresponding author.
E-mail address: gitte.linderoth@gmail.com (G. Linderoth).

http://dx.doi.org/10.1016/j.resuscitation.2015.06.003

EMS TRAINING

- Emergency Medical Technician
  - 120 - 150 hours
    - 3 – 4 weeks of classroom/skills training
    - Advanced first aid/CPR
- Paramedic
  - 1,200 – 1,800 hours
    - 7.5 – 11.25 months of classroom/skills training
    - Anatomy & Physiology, Medical/Legal, Ethics, Patient Assessment, Airway Management, Trauma, Pathophysiology, Pharmacology, Cardiology, Pulmonology, Pediatrics, Obstetrics, Psychiatry, Patients with Special Needs
    - HFD: Additional 220 hours Field Internship and Oral Board-Style Physician Testing

"GET THE PARAMEDICS!"

- Skill Proficiency
- Skill Dilution
- Skill…or Expertise?!

AMIODARONE, LIDOCAINE, OR PLACEBO IN OUT-OF-HOSPITAL CARDIAC ARREST

- Kudenchuk P, Brown S, Daya M, et al. NEJM May, 2016
- Randomized, Double-Blind, Placebo Controlled Trial, 10 US Urban EMS Systems, 3,026 Shockable Rhythm Patients
- Survival to Hospital Discharge:
  - Amiodarone 24.4%
  - Lidocane 23.7%
  - Placebo 21.0%
- Non-Statistically Different Survival Rates: $p=0.70$
- No Difference in mRS ≤ 3: $p=0.44$.

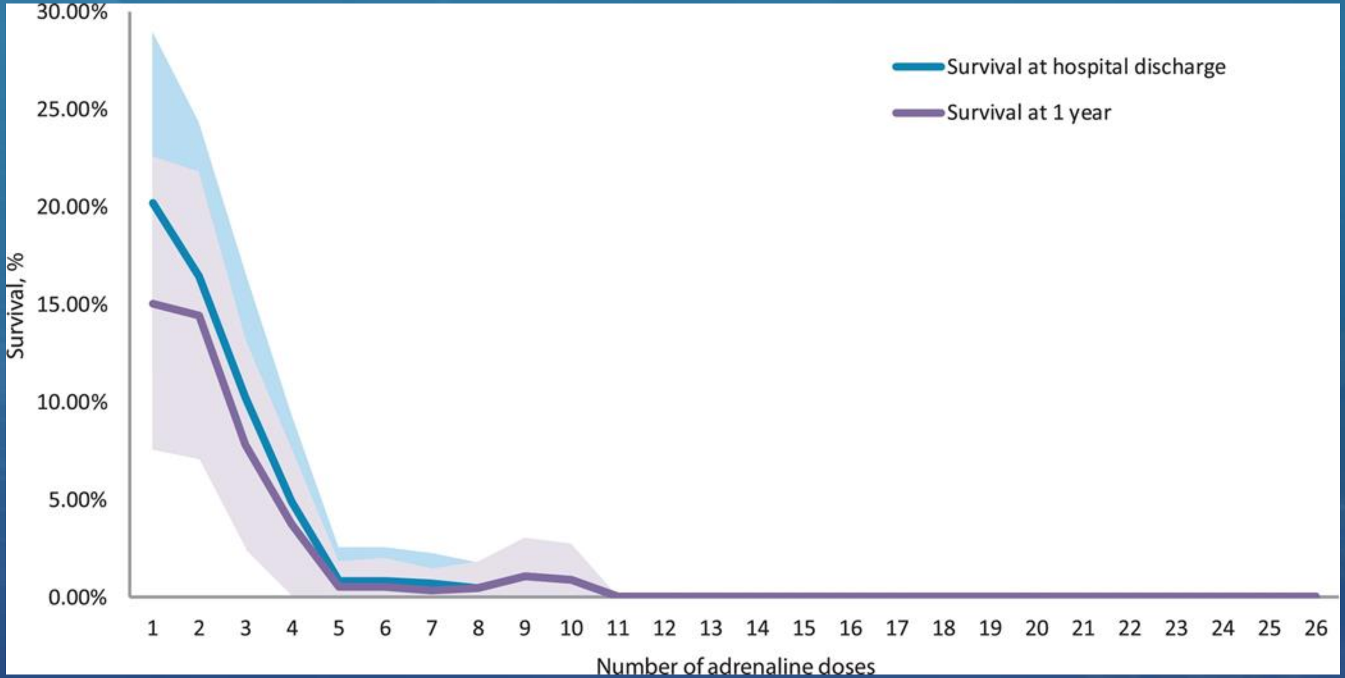
EPINEPHRINE DOSING INTERVAL AND SURVIVAL OUTCOMES DURING PEDIATRIC IN-HOSPITAL CARDIAC ARREST

- Resuscitation, Aug 2017
- Retrospective Review*
- Epi Dosing Intervals: 1-5,>5-<8, 8-<10 minutes
- OR Survival to Hosp Discharge:
  - 1-5 minutes: ref.
  - >5-<8: 1.81 (1.26-2.59)
  - 8-<10: 2.67 (1.14-5.04)
- Did not

REPEATED ADRENALINE DOSES AND SURVIVAL FROM AN OUT-OF-HOSPITAL CARDIAC ARREST

FOTHERGILL R, EMMERSON A, IYER R, LAZARUS J, WHITBREAD M, NOLAN JP, DEAKIN CD, PERKINS GD. RESUSCITATION JAN. 2019

- 3151 OOHCA
- Significant Inverse Relationship Was Found Between Increasing Cumulative Doses of Adrenaline and Survival



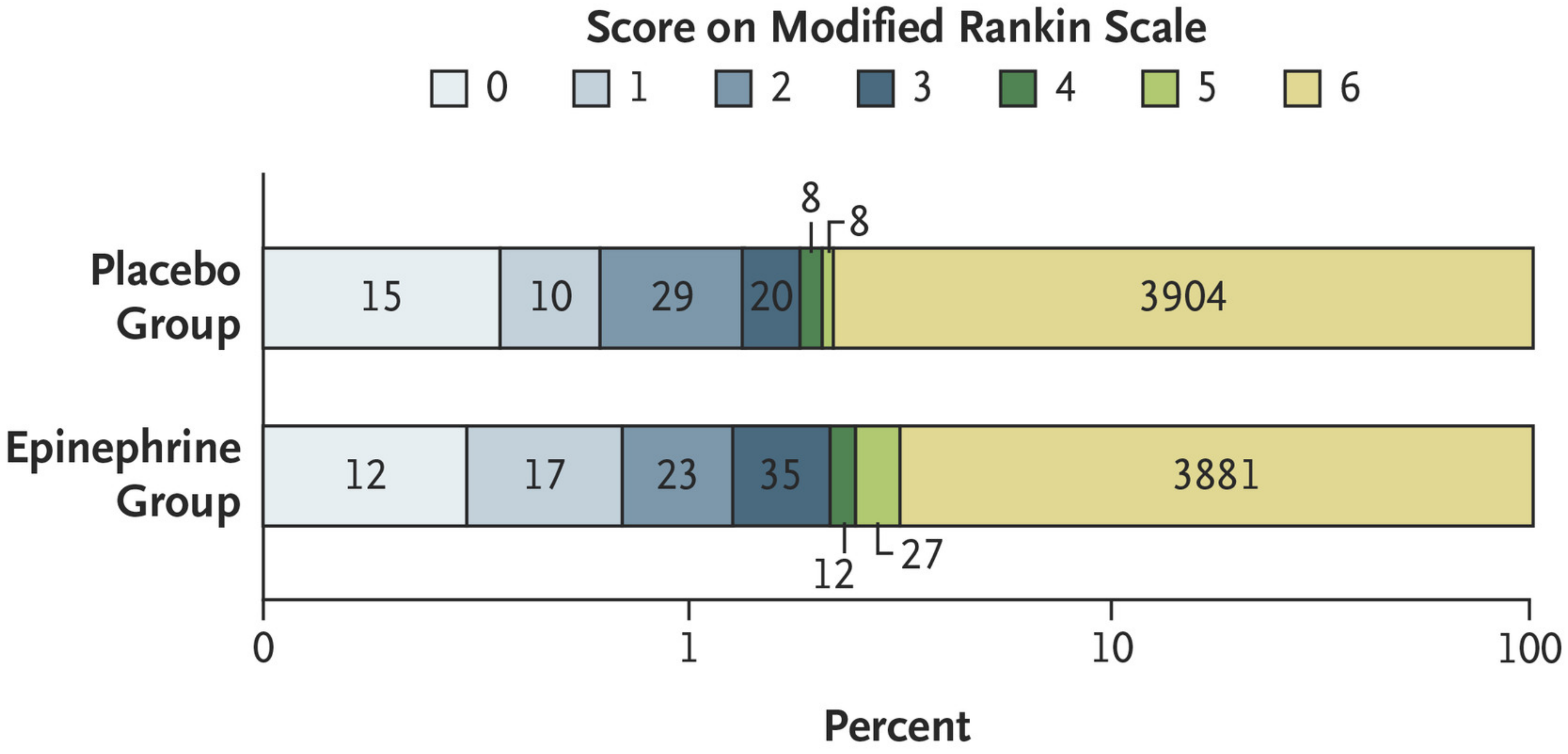
LOWER-DOSE EPINEPHRINE ADMINISTRATION AND OUT-OF-HOSPITAL CARDIAC ARREST OUTCOMES

- Fisk CA, Olsufka M, Yin L, et al. Resuscitation Jan. 2018
- 2255 OOHCA
- Jan 1, 2008 – Sept 30, 2012: 1 mg. epi @ 4min, q 8min if shockable; q 2min if non-shockable
- Oct 1, 2012 – June 30, 2016: .5 mg. epi @ 4min, q 8min if shockable; q 2min if non-shockable
- No difference in survival to hospital discharge
- No difference in favorable neurological status at discharge.

A RANDOMIZED TRIAL OF EPINEPHRINE IN OUT-OF-HOSPITAL CARDIAC ARREST (AKA PARAMEDIC-2)

- NEJM August 23, 2018
- Randomized, Double-Blind Trial; 8014 OOHCA in UK
- Epinephrine v. Placebo
- 3.2% Survival in Epi Group; 2.4% Survival in Placebo Group: p=0.02, OR 1.06 to 1.82
- NO Difference in Survival to Discharge with Favorable Neurologic Outcome (2.2% epi v. 1.9% placebo)
- Severe Neurologic Impairment in 31% of Epi v. 17.8% of Placebo Group.

PARAMEDIC-2



Score on Modified Rankin Scale
0
1
2
3
4
5
6
Placebo Group
15
10
29
20
8
8
3904
Epinephrine Group
12
17
23
35
12
27
3881
0
1
10
100
Percent

IS EPINEPHRINE DURING CARDIAC ARREST ASSOCIATED WITH WORSE OUTCOMES IN RESUSCITATED PATIENTS?

- Dumas F, Bougouin W, Geri G, et al. J Am C Card Dec. 2014
- Observational Study, 2000 – 2012, 1,556 patients
- Dose of Epi/Corrected for Duration of Resuscitation
- 73% Received Epi
- Adjusted Odds Ration for Survival:
  - No Epi: ref.
  - 1 mg. epi: 0.48
  - 2-5 mg: 0.30
  - >5mg: 0.23
- Good Neurologic Outcome:
  - 17% Epi Group
  - 63% No Epi Group.

ECPR

- Population-Based Study – Japan
- 10,971 OHCA pts., 518 Refractory VF/VT
- Favorable Neurological Outcome:
  - 22.9% ECPR Facilities 8.5% CCPR Facilities

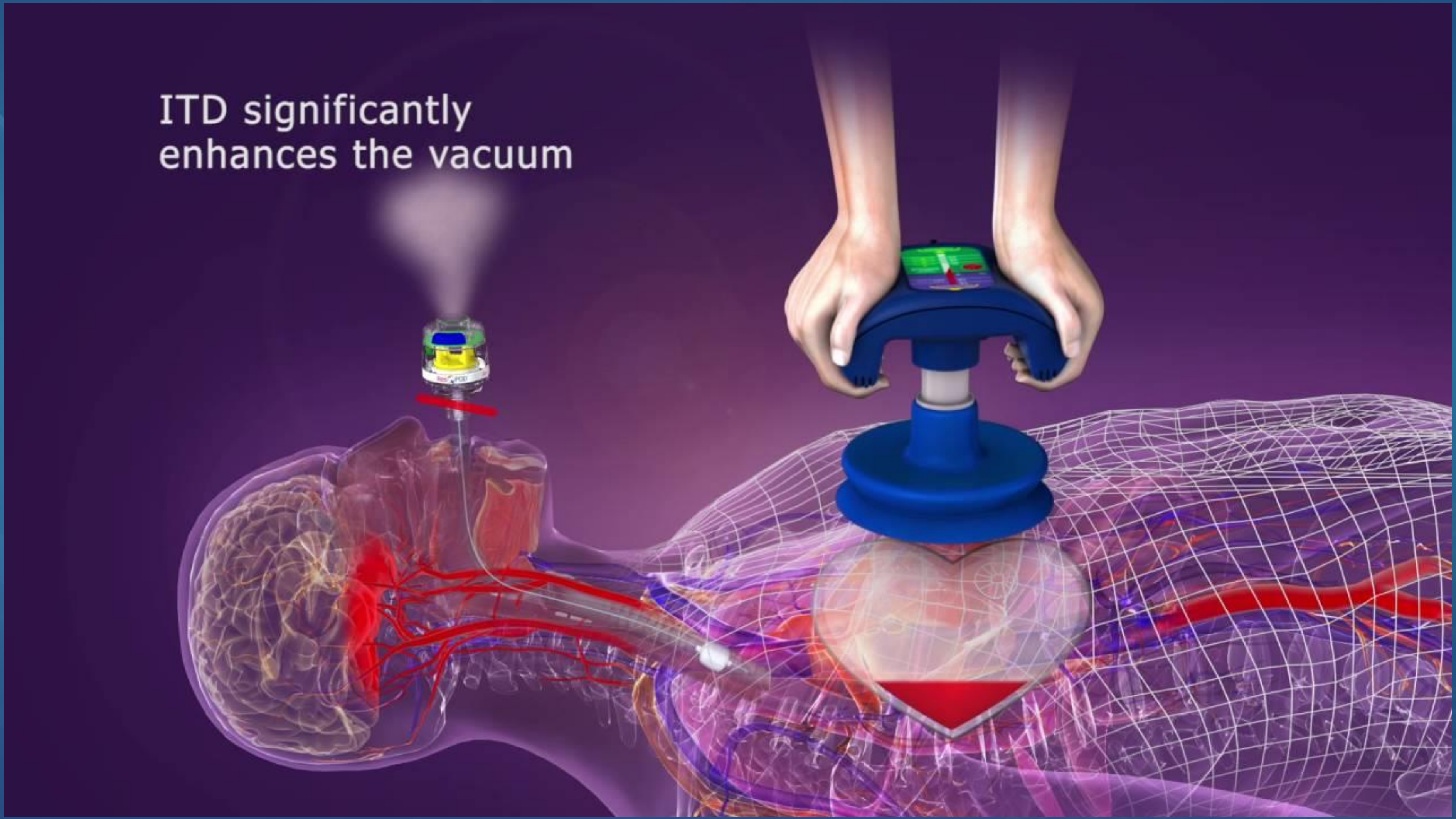
Hospitals' extracorporeal cardiopulmonary resuscitation capabilities and outcomes in out-of-hospital cardiac arrest: A population-based study

- Matsuoka Y, Ikenoue T, Hata N, et al. Resuscitation March 2019

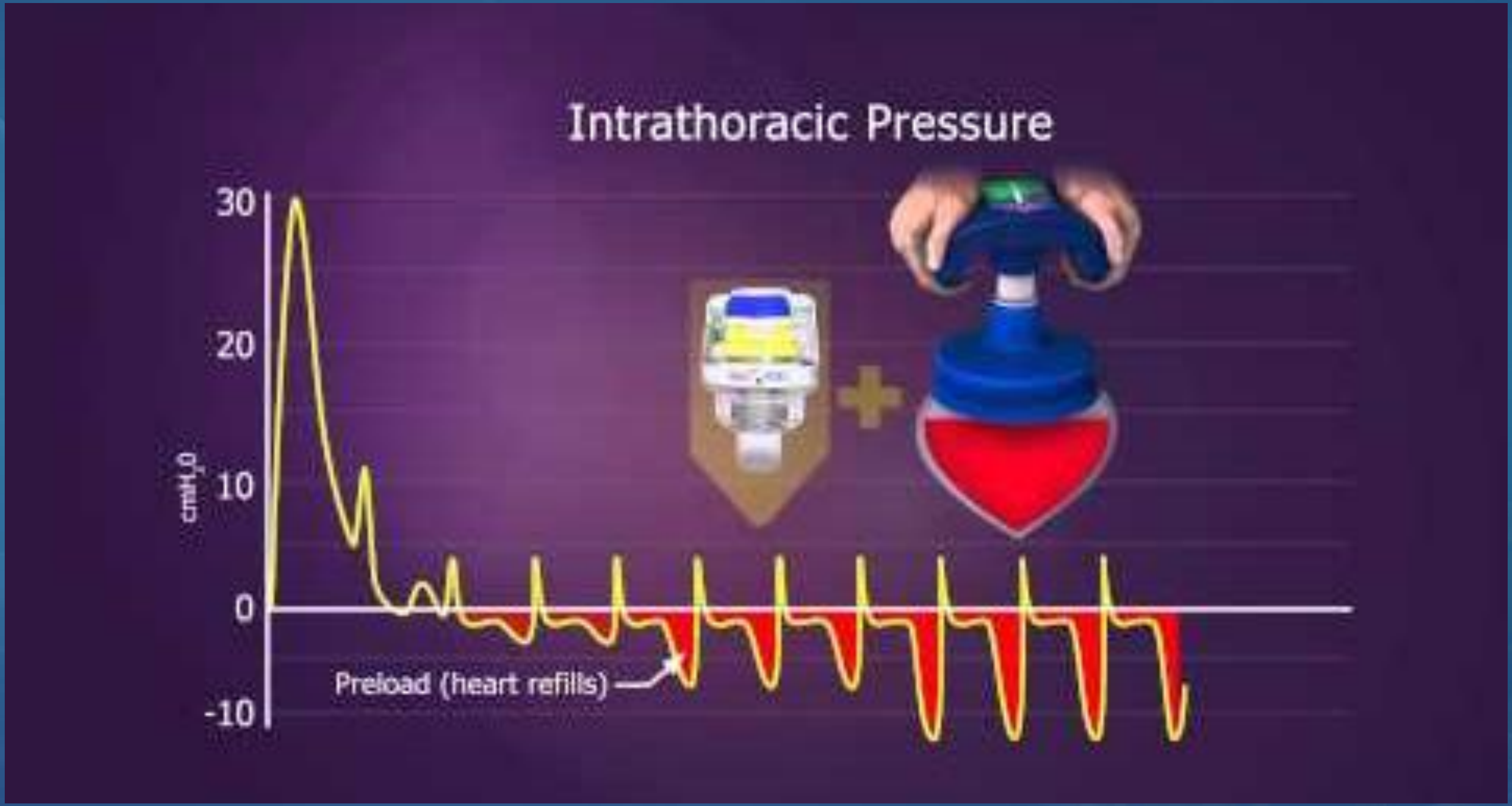
ACD-CPR

ACD-CPR DECOMPRESSION:
• Actively lifts to: -10 kgs
• Returns blood to heart
• Draws air in
• Lowers ICP

ACD WITH ITD CPR

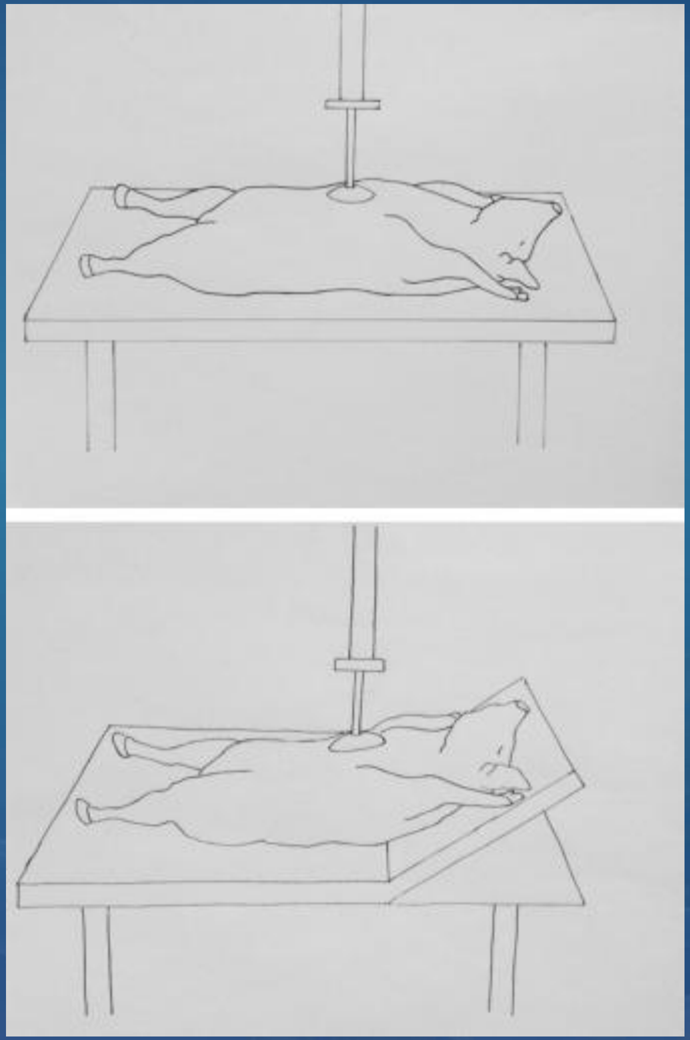


NEGATIVE INTRATHORACIC PRESSURE?!

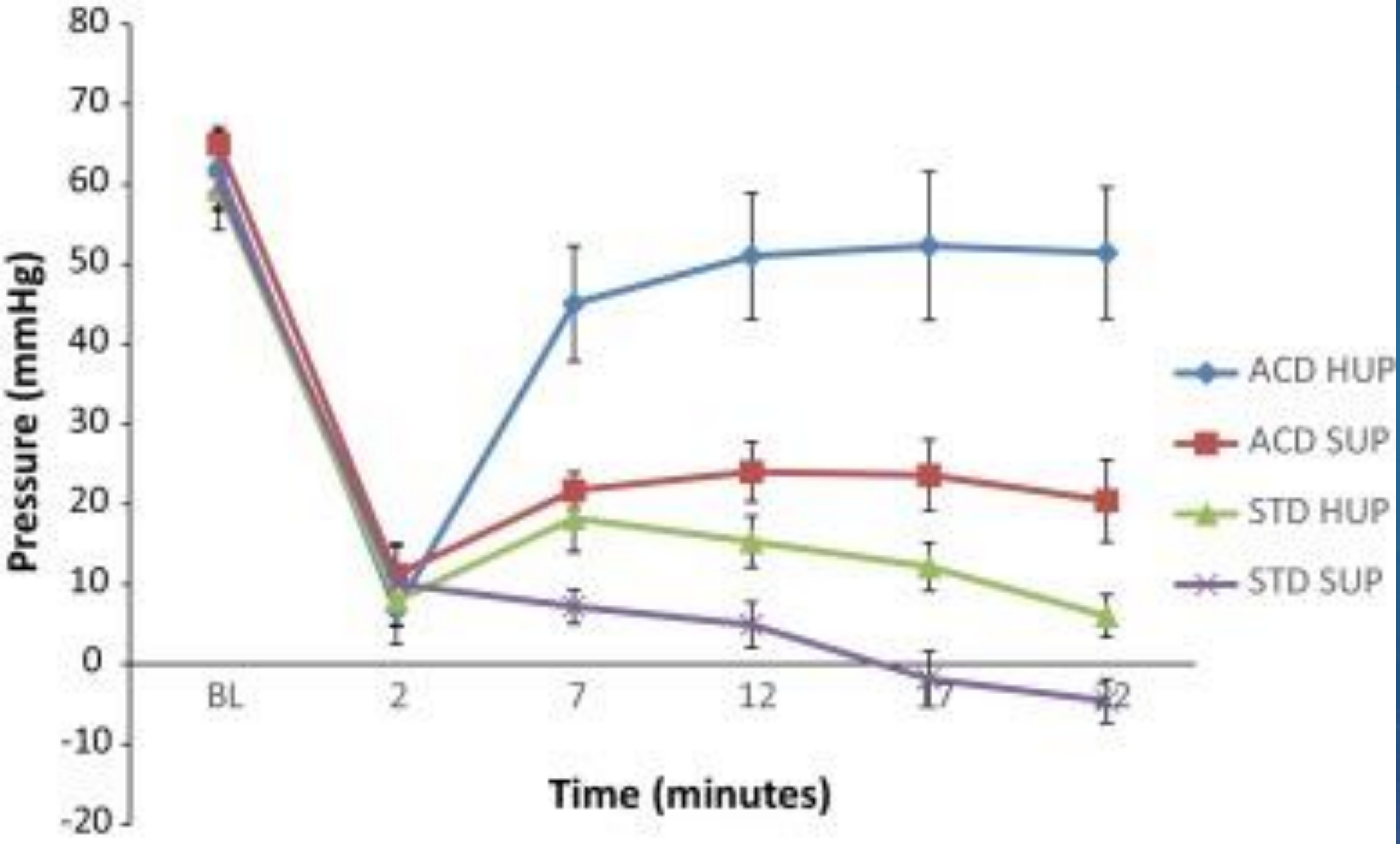


CPR IN A SMALL ELEVATOR?

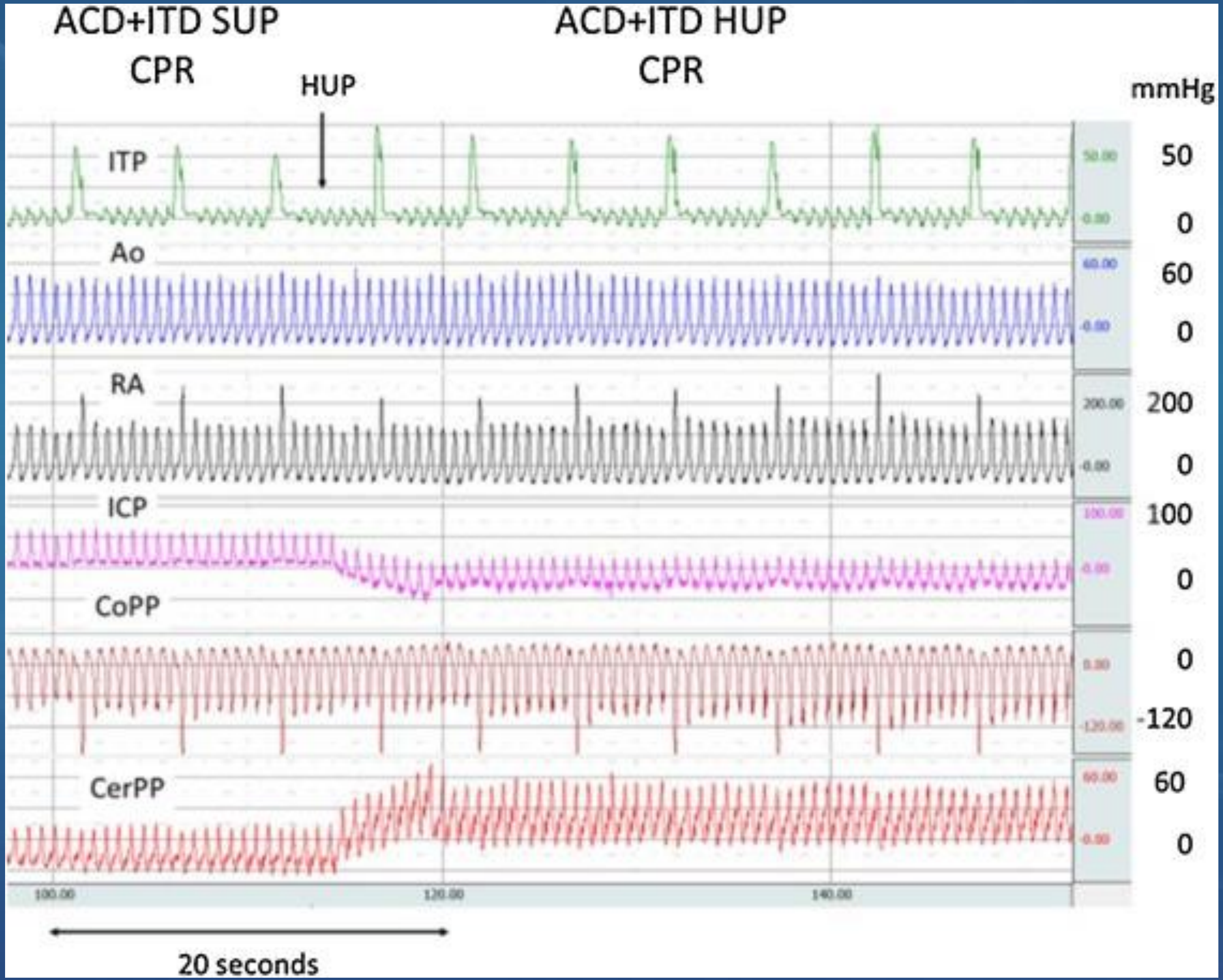
- Head Up?
- Head Down?
- Let’s go to the lab….



CEREBRAL PERFUSION PRESSURES PORCINE MODEL



MULTIPLE MEASURES HUMAN CADAVER MODEL



- Normal
  - ICP: 4-13 mmHg
  - CerPP: 50-70 mmHg

THE FUTURE??

QUESTIONS?

MORNING BREAK (15 MINUTES)

Measuring and Communicating Resuscitation Quality Improvement

Keith Ozenberger BS, LP

Assistant Training Manager

Life Support Education

Presenter Disclosure Information

Keith Ozenberger

Measuring and Communicating Resuscitation Quality Improvement

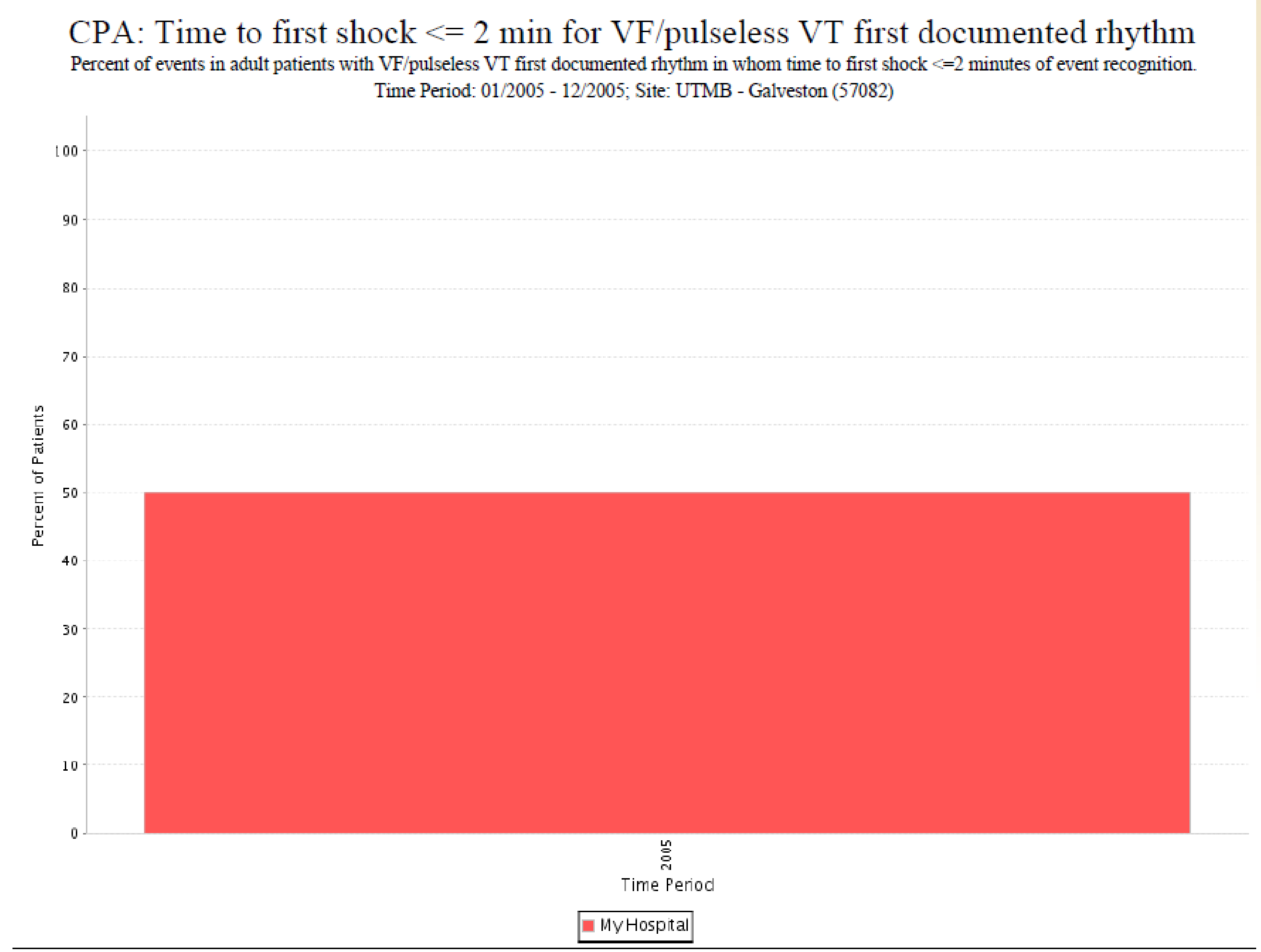
FINANCIAL DISCLOSURE:
None

UNLABELED/UNAPPROVED USES DISCLOSURE:
None

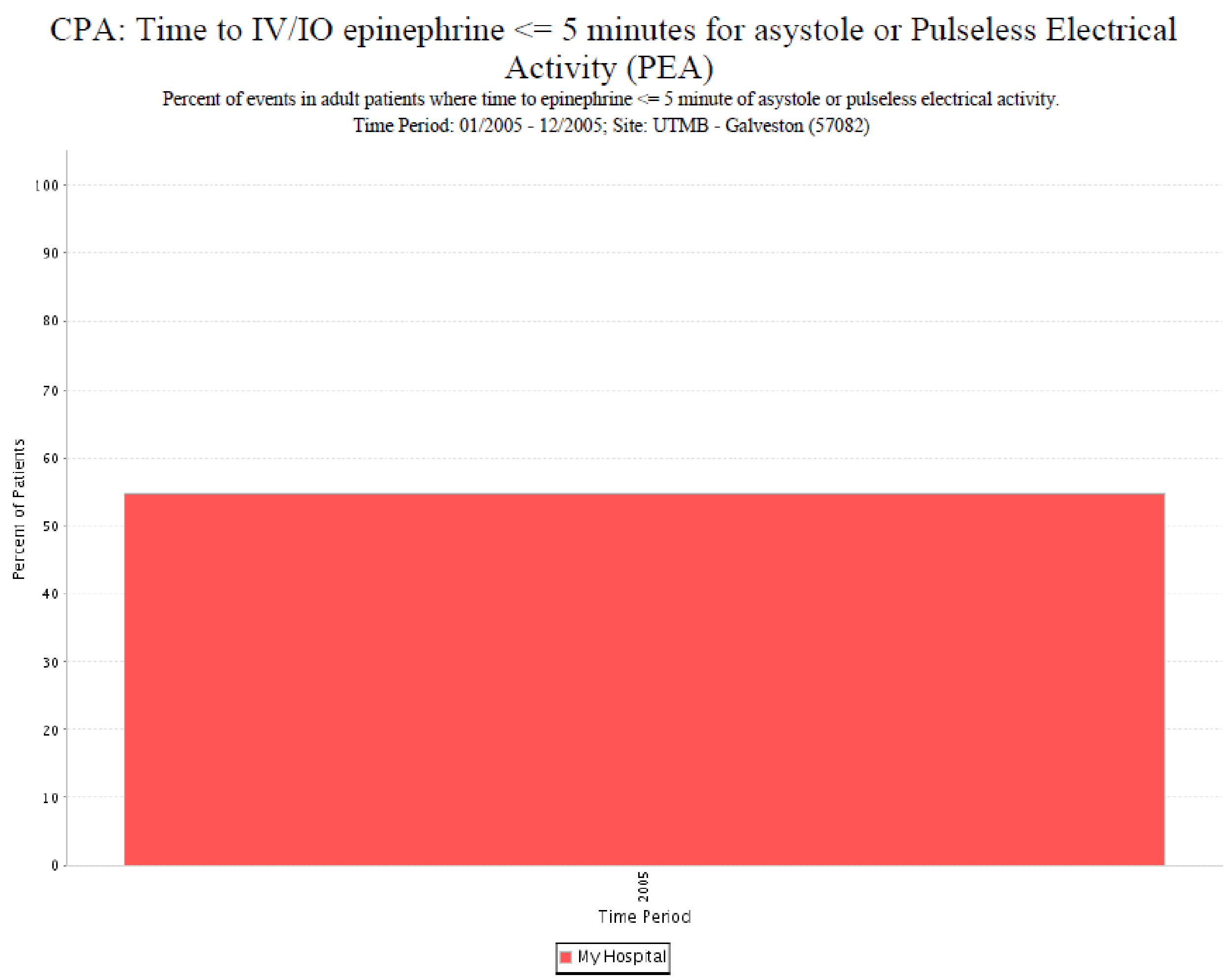
Get With The Guidelines – Resuscitation at UTMB: History

- Started with NRCPR in 2005
- Had representation on National Education Committee with NRCPR
- With initial reports, saw some “unknown” weaknesses in our resuscitation program
- First achieved Gold Award status with GWTG-R in 2013
- Maintained Gold Award status every year since 2013

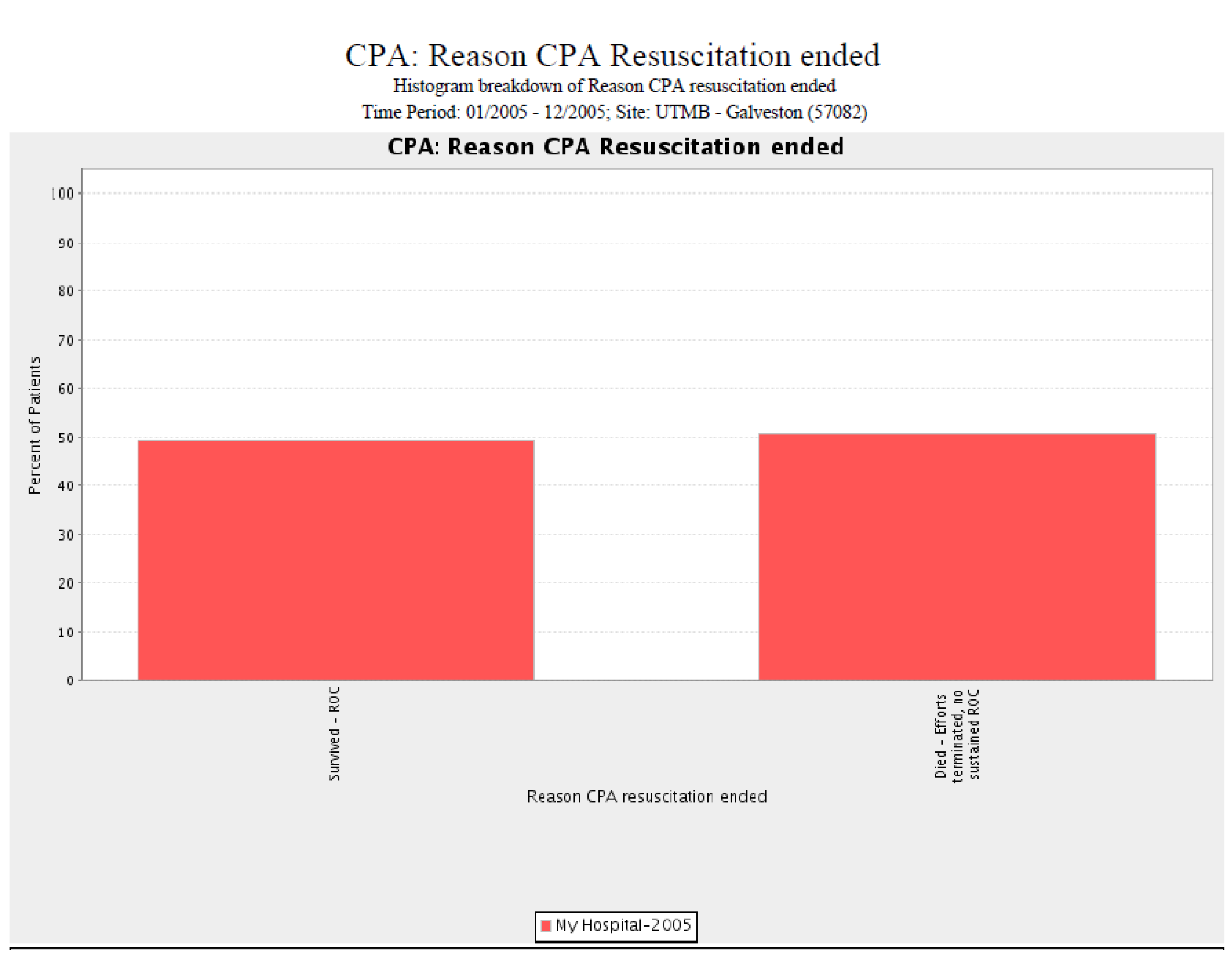
Reports from 2005



Reports from 2005



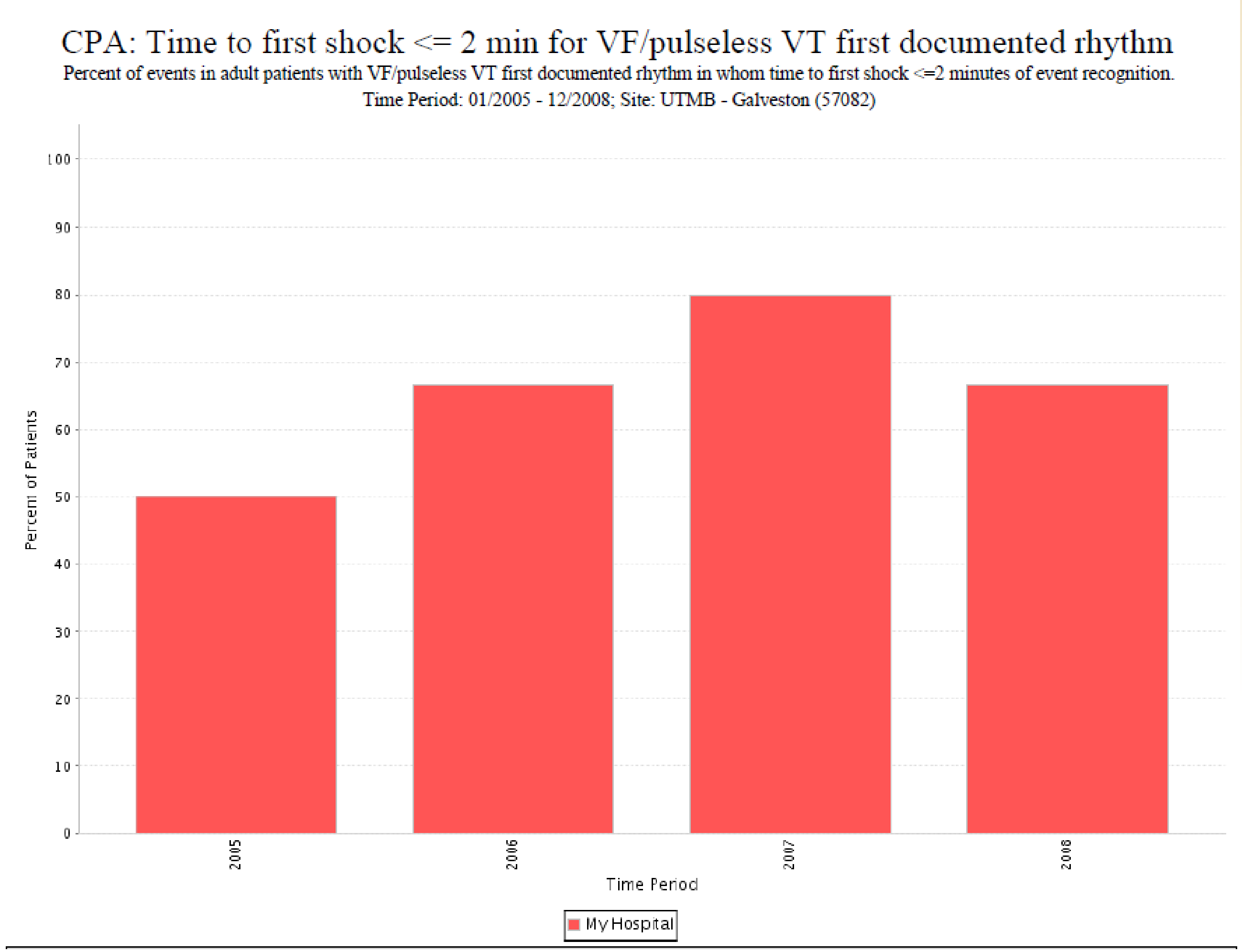
Reports from 2005



Changes to be Made

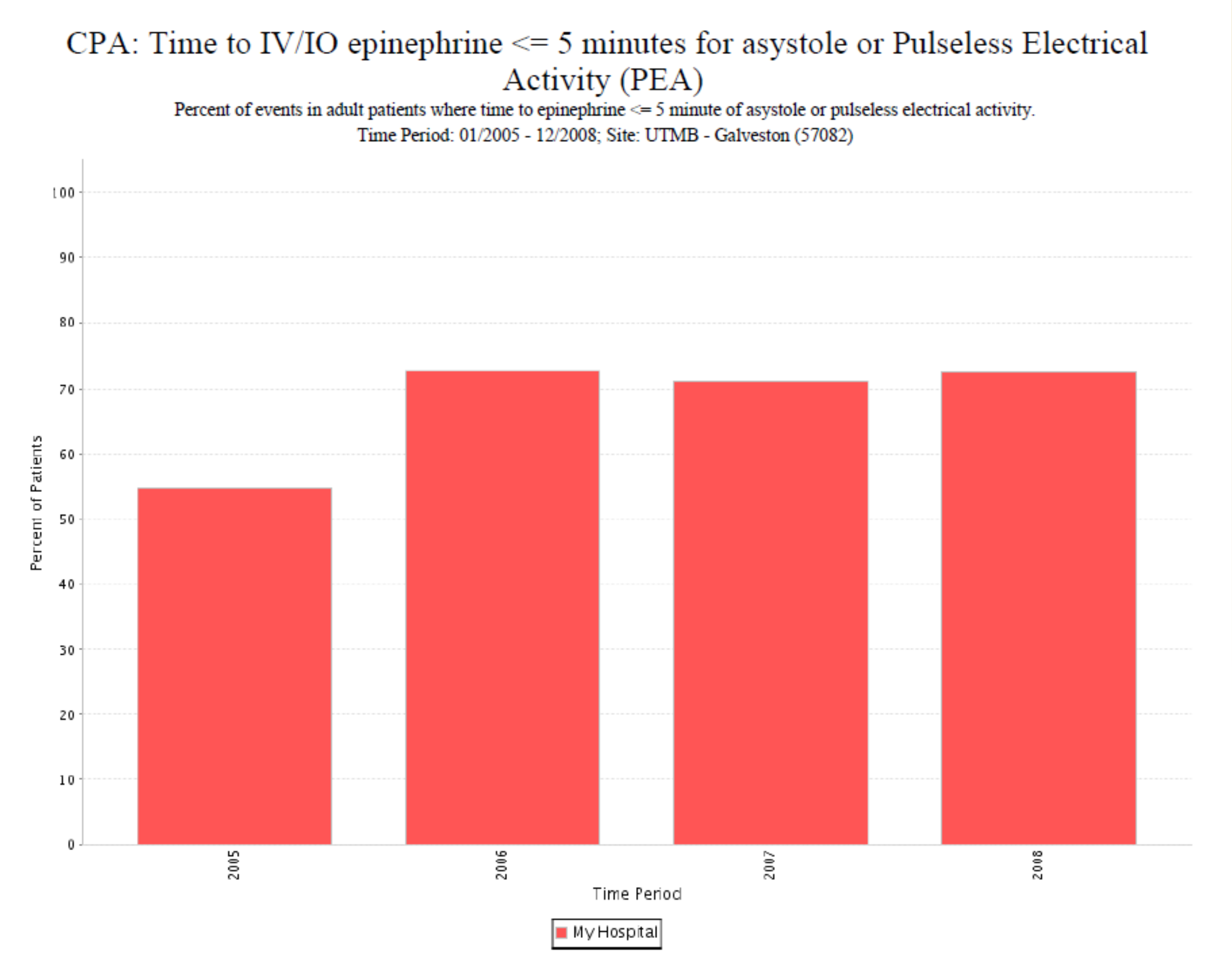
- Brought reports to Resuscitation Committee
- Started including the report Gold Standards in Life Support Education Classes
- Realized some of the causes were documentation, made changes to Code Flow Sheet

2005 - 2008



CPA: Time to first shock <= 2 min for VF/pulseless VT first documented rhythm
Percent of events in adult patients with VF/pulseless VT first documented rhythm in whom time to first shock <=2 minutes of event recognition.
Time Period: 01/2005 - 12/2008; Site: UTMB - Galveston (57082)
Percent of Patients
100
90
80
70
60
50
40
30
20
10
0
2005
2006
2007
2008
Time Period
My Hospital

2005 - 2008

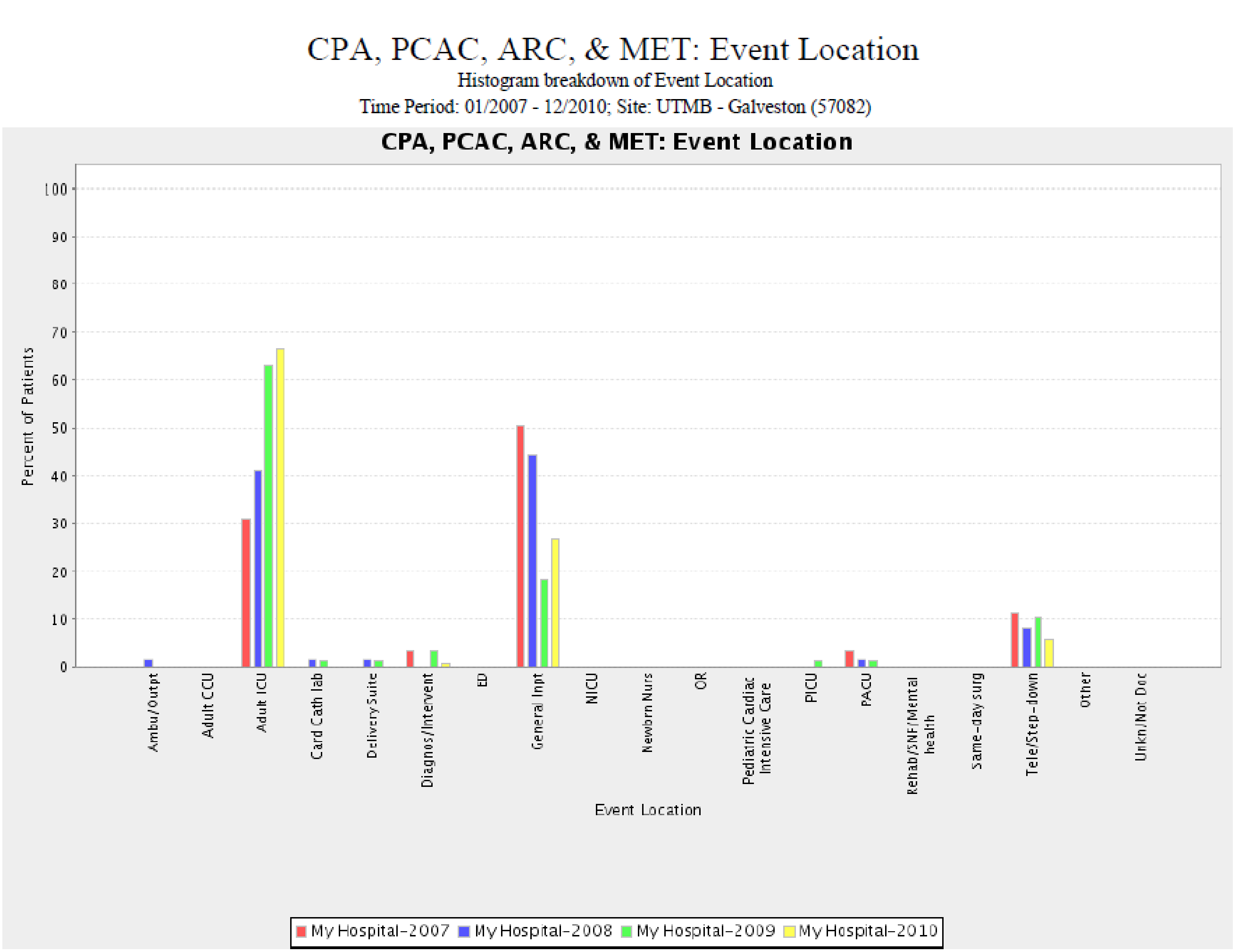

CPA: Time to IV/IO epinephrine <= 5 minutes for asystole or Pulseless Electrical Activity (PEA)
Percent of events in adult patients where time to epinephrine <= 5 minute of asystole or pulseless electrical activity.
Time Period: 01/2005 - 12/2008; Site: UTMB - Galveston (57082)
Percent of Patients
100
90
80
70
60
50
40
30
20
10
0
2005
2006
2007
2008
Time Period
My Hospital

Then along came IKE

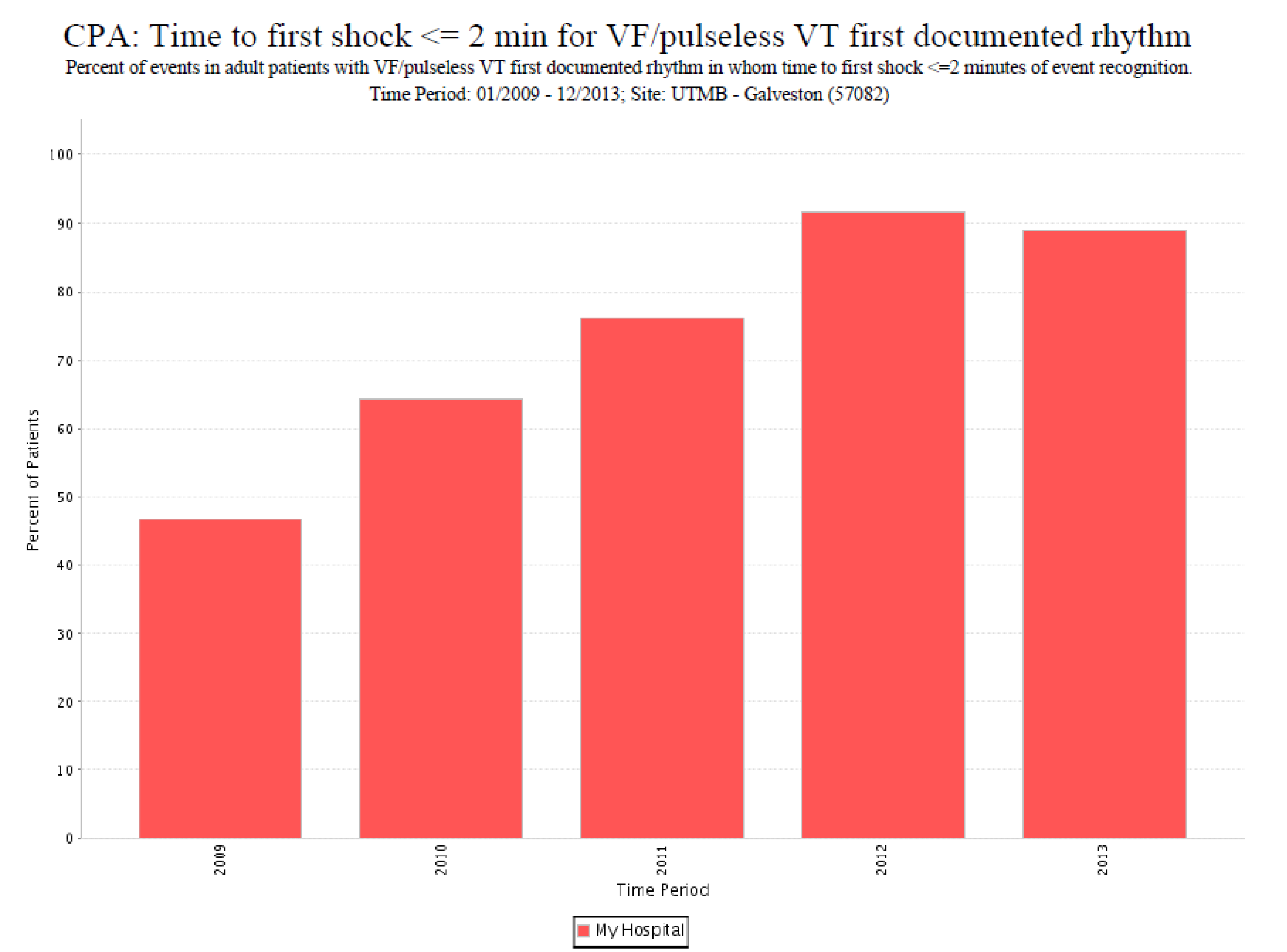
Life after IKE

- Hospital full capacity closed down for rest of 2008
- Started back up slowly in late 2008 into 2009
- As staff returned, used time to educate on better resuscitation team operations

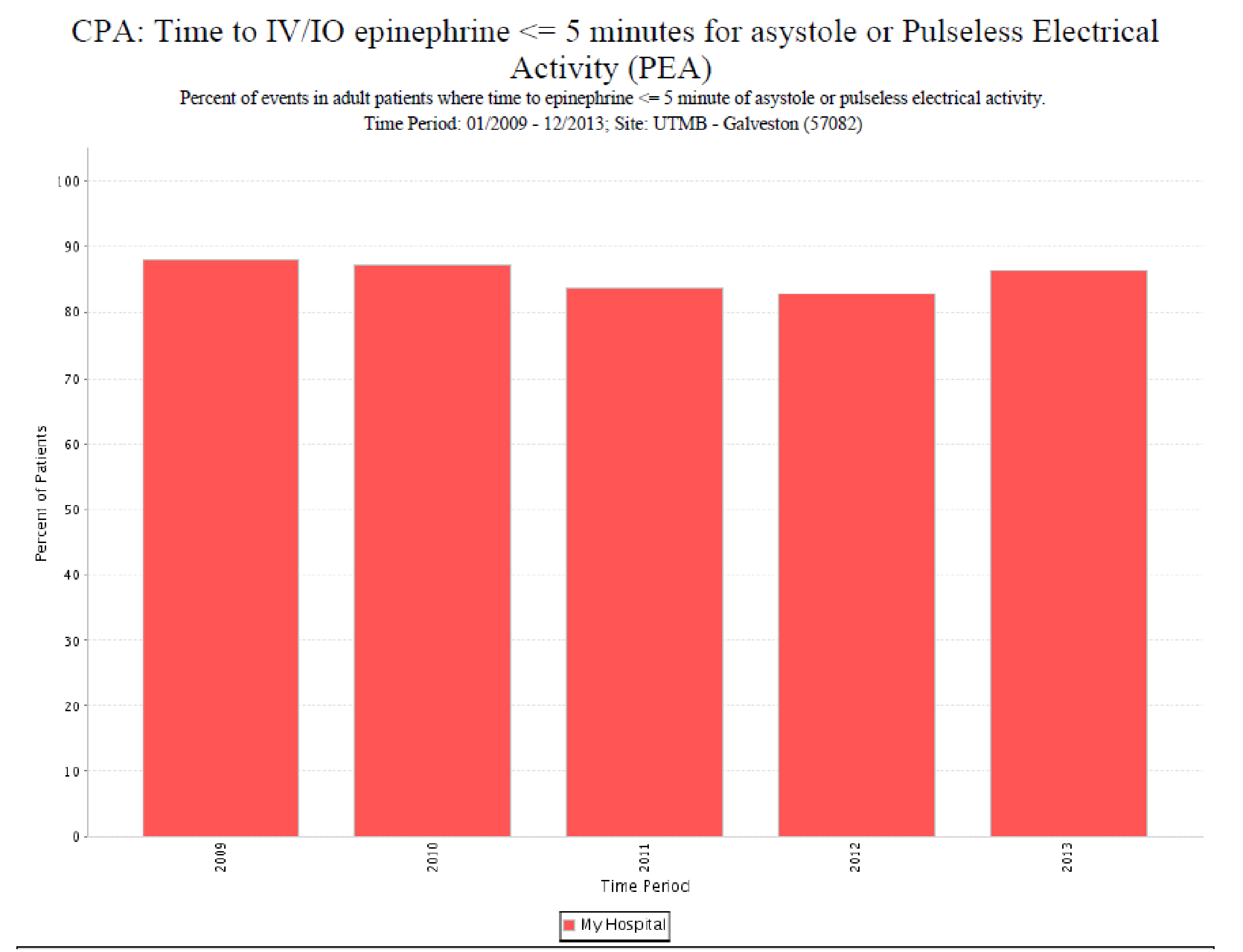
Code Location



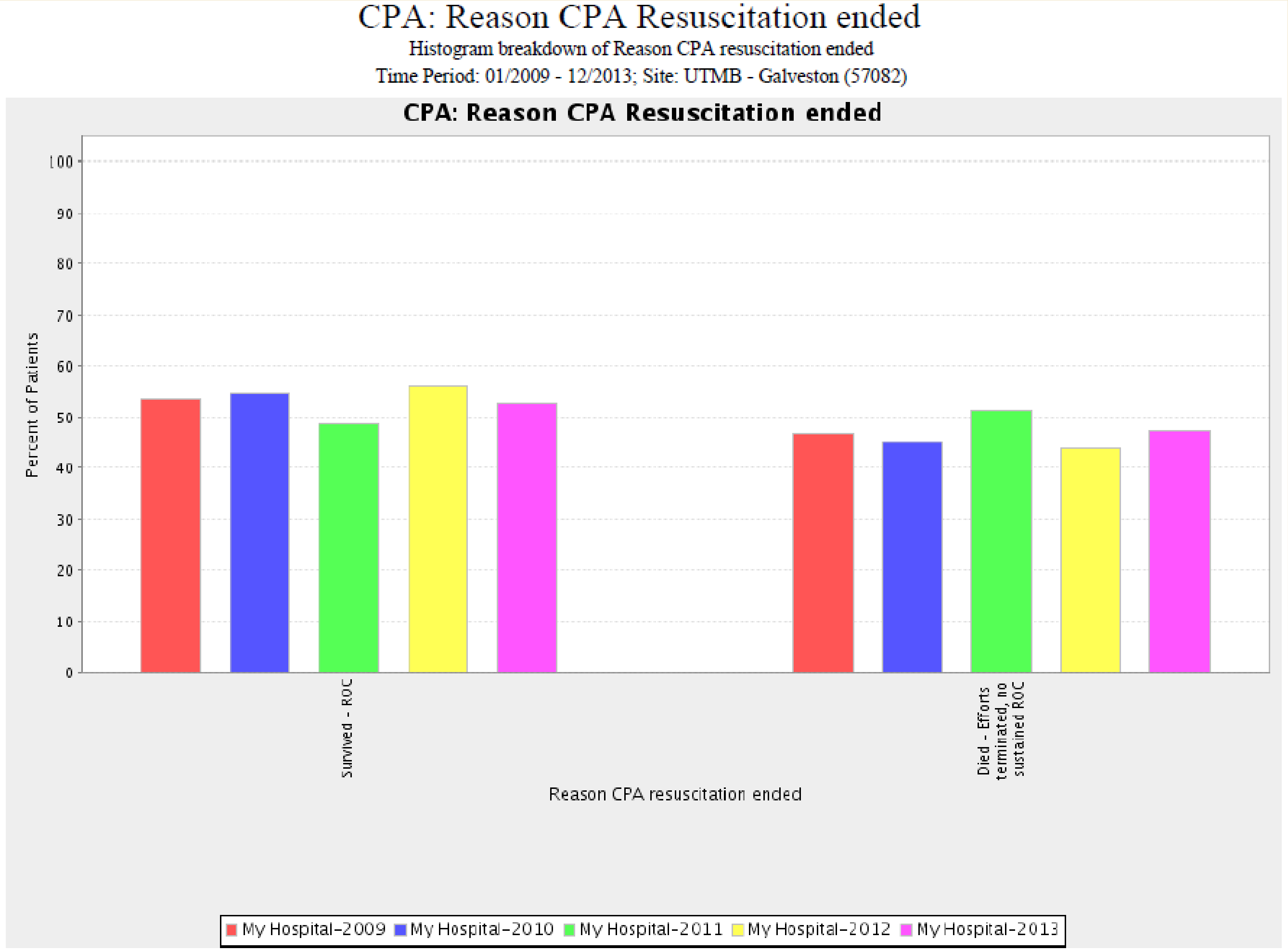
Reports 2009 - 2013



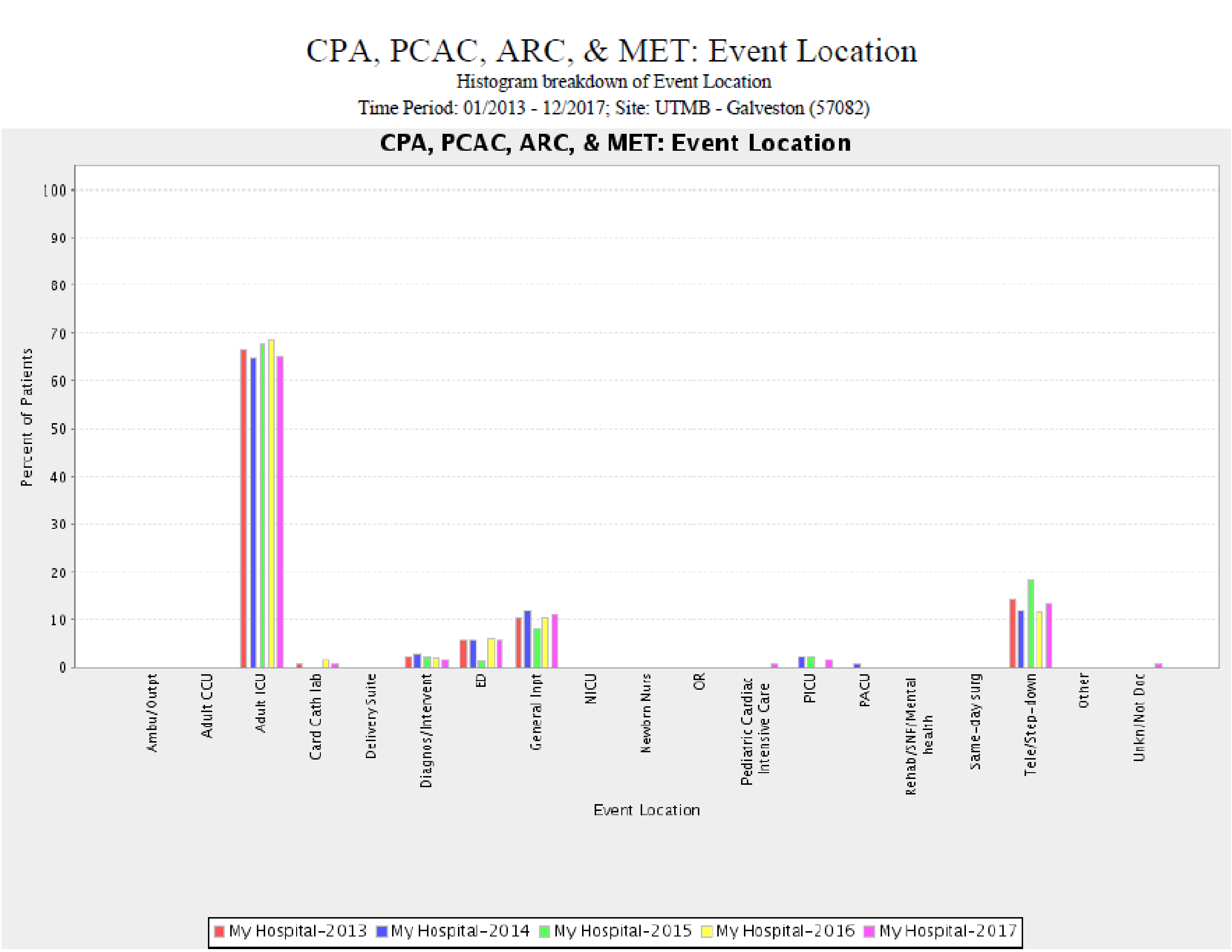
Reports 2009 - 2013



Reports 2009 - 2013



Golden Times



Get With The Guidelines-Resuscitation on a Daily Basis

- Use the Gold Standards as the measure criteria when reviewing a code at all campuses
- Development of a “Hot” Debriefing Form for staff to use after code is complete.
- Monthly Code Report to Resuscitation Committee is based off of GWTG-R

Hot Debrief Form

UTMB Resuscitation Debriefing Form

Instructions: Please complete this debrief form after each code with as many people involved in the code as possible. Please pick a quiet isolated space if possible. The purpose of debriefing is education, quality improvement, and emotional processing. Please be objective; the focus is on the event and not the person(s).

Participants: ☐MD- Med/Pedi ☐MD- Anesthesia ☐ ICU RN ☐Respiratory Therapist ☐Nurse Administrator ☐Other ____________

1. What went well during our care of the patient? ____

   ____

2. What could have gone better during our care for the patient, and what is the potential solution for that? ____________________

   ____

3. Was there confusion at any time during the resuscitation about who the team leader was? ☐YES ☐NO ____________________ (comment)
4. On a scale of 1-5, rate the teamwork of this resuscitation effort. (1=poor teamwork; 5=great teamwork)

   1 (poor) 2 3 4 5 (great)

5. Was the family or patient's support person at the hospital? ☐YES ☐NO ☐N/A Comment: ____________________

   If yes, were they given a chance to be at the bedside and/or provided support? ☐YES ☐NO Comment: ____________________
6. Were there any medication, equipment, or supply problems? ☐YES ☐NO Comment: ____________________

Other Comments: ____

This debriefing form does NOT become a part of the medical record. Privileged and Confidential Pursuant to Texas Health and Safety Code Section 161.032.033.

Monthly Code Review

UTMB Resuscitation Committee-Code Review: ____________________ (Month, Year)

Location:	UH #	Code Within 24 hours of admission to Hospital: YES NO
Admit Dx:		Initial Rhythm:
Age:		AED Use: YES NO
Code DATE & START time:		Time of first defib:
Code END time:		Time of first compressions:
Time of Responder arrival:		Summary of Medications:
ECG/Telemetry Monitoring prior to code: YES NO		
Final Disposition of Code:		IV access:
Cause of Arrest:		Survived to Discharge: YES NO
Prior Vital Signs- Time and Data		Strengths:
Prior Rapid Response Activation (Date/Time/Reason)		Opportunities:

Location:	UH #	Code Within 24 hours of admission to Hospital: YES NO
Admit Dx:		Initial Rhythm:
Age:		AED Use: YES NO
Code DATE & START time:		Time of first defib:
Code END time:		Time of first compressions:
Time of Responder arrival:		Summary of Medications:
ECG/Telemetry Monitoring prior to code: YES NO		
Final Disposition of Code:		IV access:
Cause of Arrest:		Survived to Discharge: YES NO
Prior Vital Signs- Time and Data		Strengths:
Prior Rapid Response Activation (Date/Time/Reason)		Opportunities:

Code Flow Sheet

The University of Texas Medical Branch Hospitals-Galveston, Texas
Medical Record Form 7105-08/16

IF PATIENT ID CARD OR LABEL IS UNAVAILABLE, WRITE DATE, PT NAME AND UH# IN SPACE ABOVE

Date ____________ Area ____________

MD Team Leader Name ____________

RN Code Recorder Name ____________

Patient Survived/Transferred to ____________

Patient Expired/Pronounced time ____________

CODE TIMES	
Time Code Called	
CPR Started	
BVM Started	
Code Team Arrival	

Adult Resuscitation Flow Sheet

Please respond to all boxes

Prior to Code or Code Team Arrival: ECG/Telemetry Monitor Prior to Code Y / N; Was Code witnessed Y / N; AED used Y / N

Airway- Adjuncts & Intubation: Nasal Airway/Oral Airway; O2 %______; Intubation Time:______; Placement confirmed with : Auscultation Y / N ETCO2 used Y / N

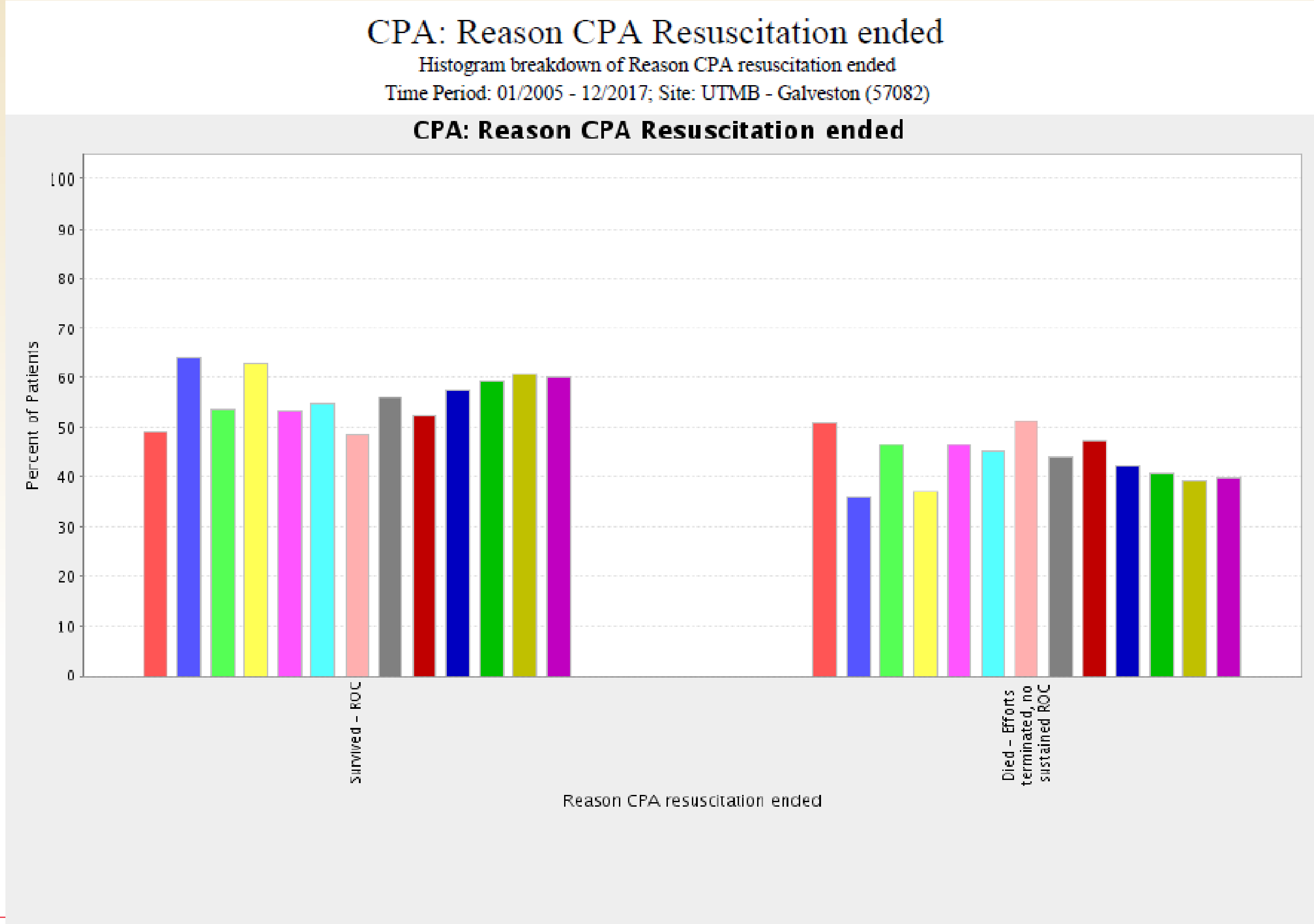
TIME																
Breathing- Resp/BVM Rate																
O2 Saturation %																
ETCO2																
Blood Gases: pH																
PaCo2																
PaO2																
HCO3																
Glucose																
Potassium																
Circulation-Pulse / Heart Rate																
CPR/Compressions (Please Circle)	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N
Blood Pressure																
Cardiac Rhythm																
Defib/Sync Cardioversion	D / S	D / S	D / S	D / S	D / S	D / S	D / S	D / S	D / S	D / S	D / S	D / S	D / S	D / S	D / S	D / S
(Please Write In Joules delivered) **Cardioversion** 50-200 per ACLS guidelines **Zoll** (defib 120 - 150 - 200) **Lifepak** (defib 200 - 300 - 360)																
EKG Rhythm after shock																
Drugs- Administration Route	IV / IO	IV / IO	IV / IO	IV / IO	IV / IO	IV / IO	IV / IO	IV / IO	IV / IO	IV / IO	IV / IO	IV / IO	IV / IO	IV / IO	IV / IO	IV / IO
Epinephrine 1mg (Q 3-5 min)																
Lidocaine 1-1.5mg/kg (max 3mg/kg)																
Amiodarone 300mg OR 150mg (dilute)																
Magnesium Sulfate 1-2 Gms/50cc																
Atropine 0.5-1mg (max 3.0mg)																
Sodium Bicarbonate 1meq/kg (Q 10 min)																
Fluid Bolus																
Other:																
Other:																

Additional Procedures/Documentation

Original- Medical Record Part 2- Respiratory Care Service/Education Lab Team Leader Signature____________ Date____________ Time____________

UTMB FORMS MGT. STRICTLY PROHIBITS CHANGES TO THIS FORM

Code Results

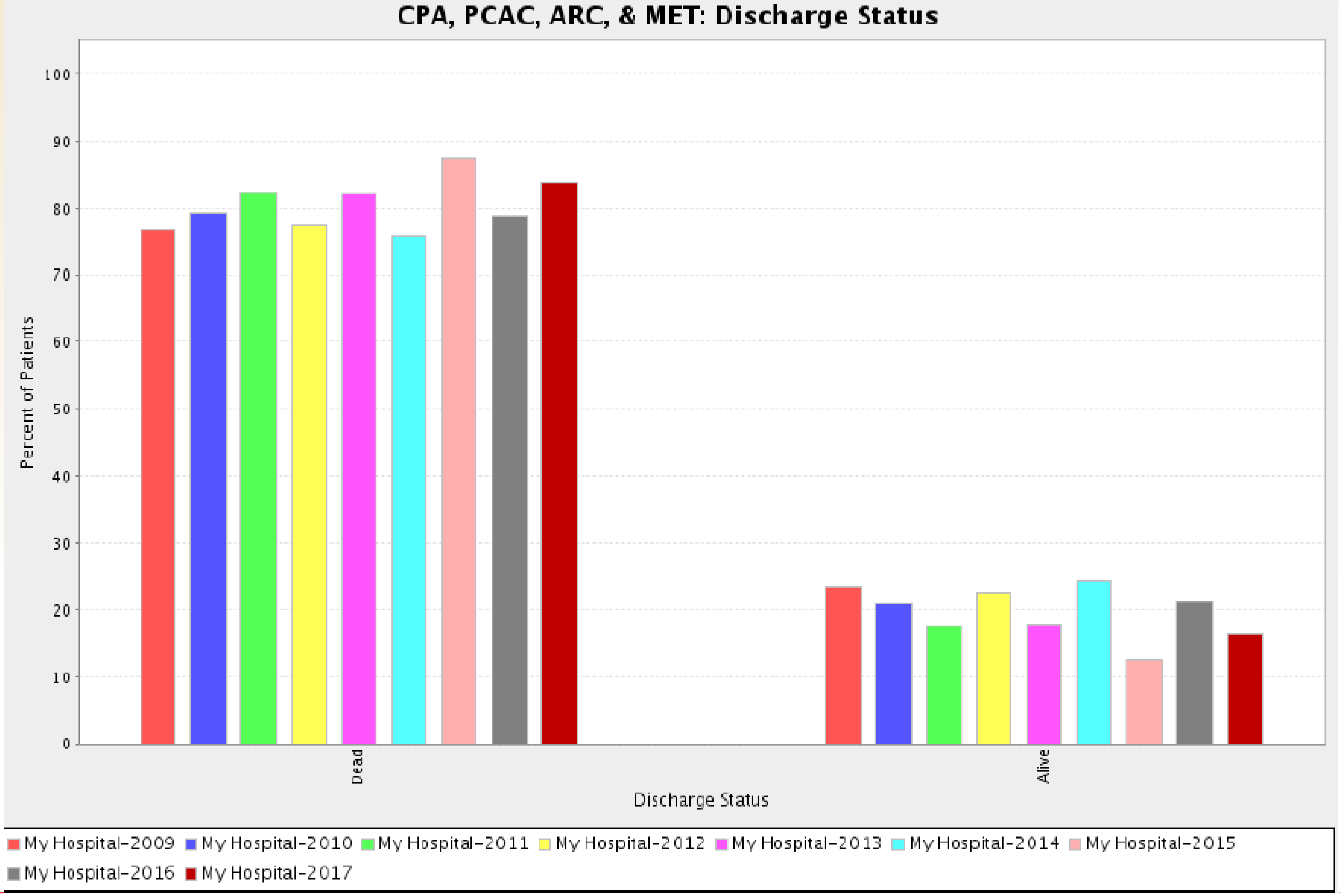


Discharge Status

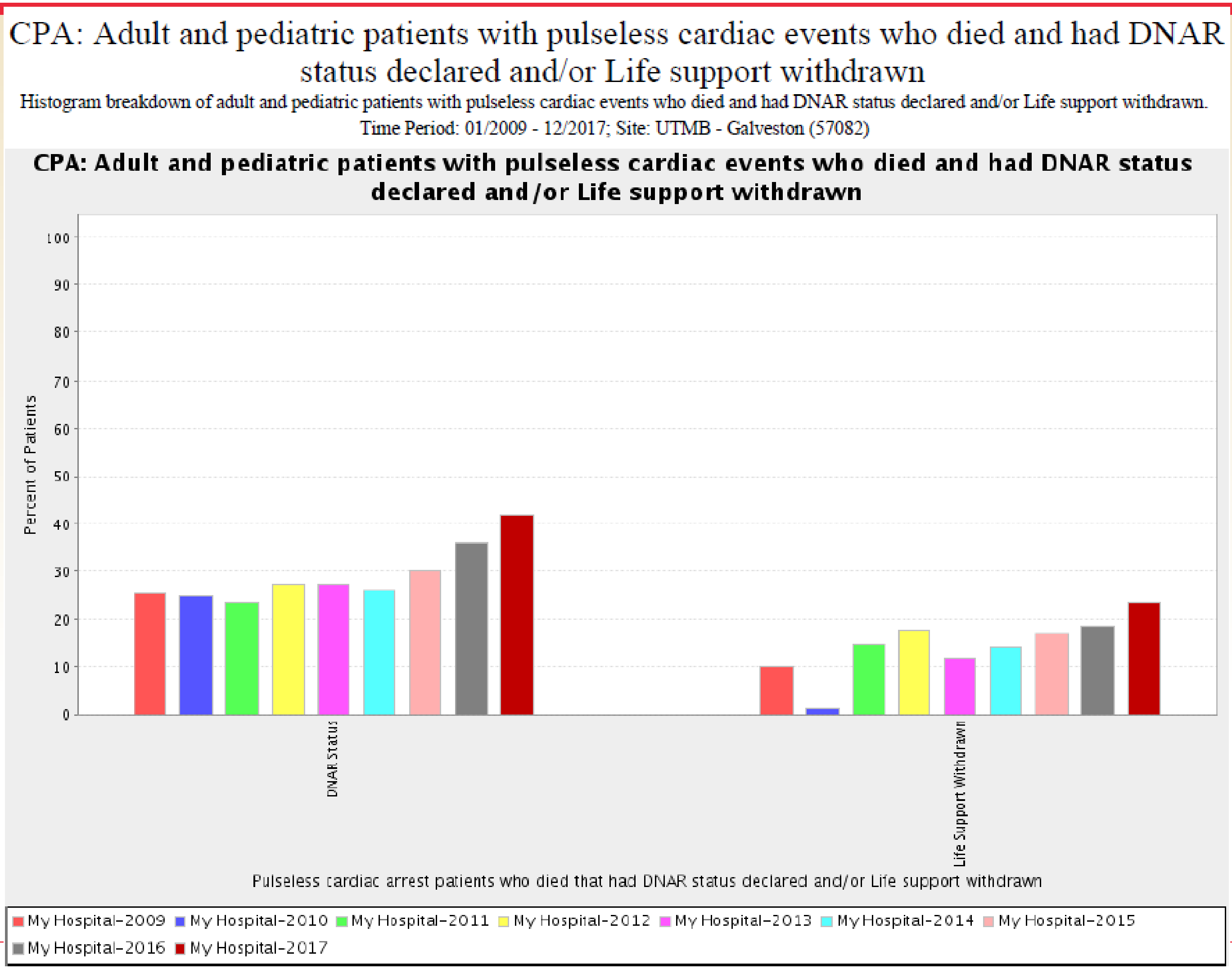
CPA, PCAC, ARC, & MET: Discharge Status

Histogram breakdown of admissions by discharge status (alive or dead)

Time Period: 01/2009 - 12/2017; Site: UTMB - Galveston (57082)



DNR Status



CPA: Adult and pediatric patients with pulseless cardiac events who died and had DNAR status declared and/or Life support withdrawn
Histogram breakdown of adult and pediatric patients with pulseless cardiac events who died and had DNAR status declared and/or Life support withdrawn.
Time Period: 01/2009 - 12/2017; Site: UTMB - Galveston (57082)
CPA: Adult and pediatric patients with pulseless cardiac events who died and had DNAR status declared and/or Life support withdrawn
Percent of Patients
100
90
80
70
60
50
40
30
20
10
0
DNAR Status
Life Support Withdrawn
Pulseless cardiac arrest patients who died that had DNAR status declared and/or Life support withdrawn
My Hospital-2009
My Hospital-2010
My Hospital-2011
My Hospital-2012
My Hospital-2013
My Hospital-2014
My Hospital-2015
My Hospital-2016
My Hospital-2017

In Conclusion

- GWTG-R has given us a standard to gauge our performance in resuscitation
- A guide to augment our training classes
- A support for Instructors to be more open to share feedback to help our students do better every time they are involved in resuscitation
- Support for higher participation in mock code drills

THIS VS. THAT: FINDING YOUR CODE BLUE GURU

DRS. BABITH MANKIDY AND KEVIN ROY

Code Process
Baylor St Luke's Medical Center

Babith Mankidy MD, FCCP

Department of Pulmonary and Critical Care

Baylor College of Medicine

Baylor College of Medicine

Finding the Code Blue Guru

Rethinking the Code process

Challenges for the new CPR Chair

Baylor St. Luke’s Experience

Disclosures

Disclosures: None

Code Committee Restructuring

Executive Sponsor : Chief Nursing officer

Members:

- Cardiology MD
- Emergency Dept MD
- Anesthesia MD
- Pharmacy
- Respiratory therapy
- Informatics
- Nursing Education
- IM residency
- Rapid response
- Quality Improvement

Code Committee Mission

Monitoring CPR quality

Performance benchmarking GWTG –R

Catalyst for code process education

Policy creation and maintenance

QI projects

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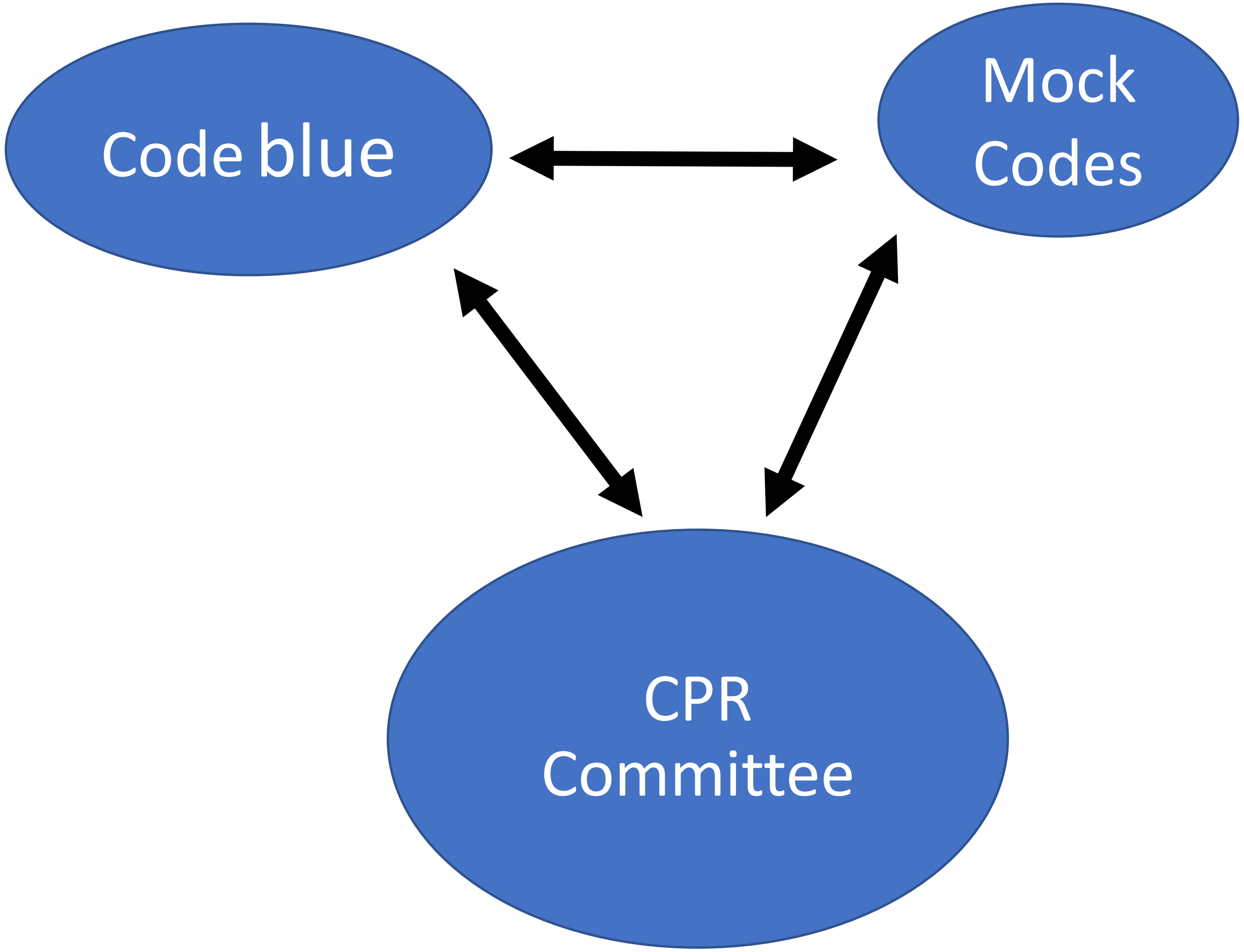
Integration of Code Process with CPR Committee



Code Committee Restructuring

Going beyond business as usual…

Monthly meeting from quarterly

Chair :

Deep dive: Code case review now evolved into a subcommittee – Precode review

Monthly Dash-board

Reliable Data Collection and reporting

Reconciling overhead pages with code sheets

Developed a process with rapid response to call units every morning after review of Overhead calls

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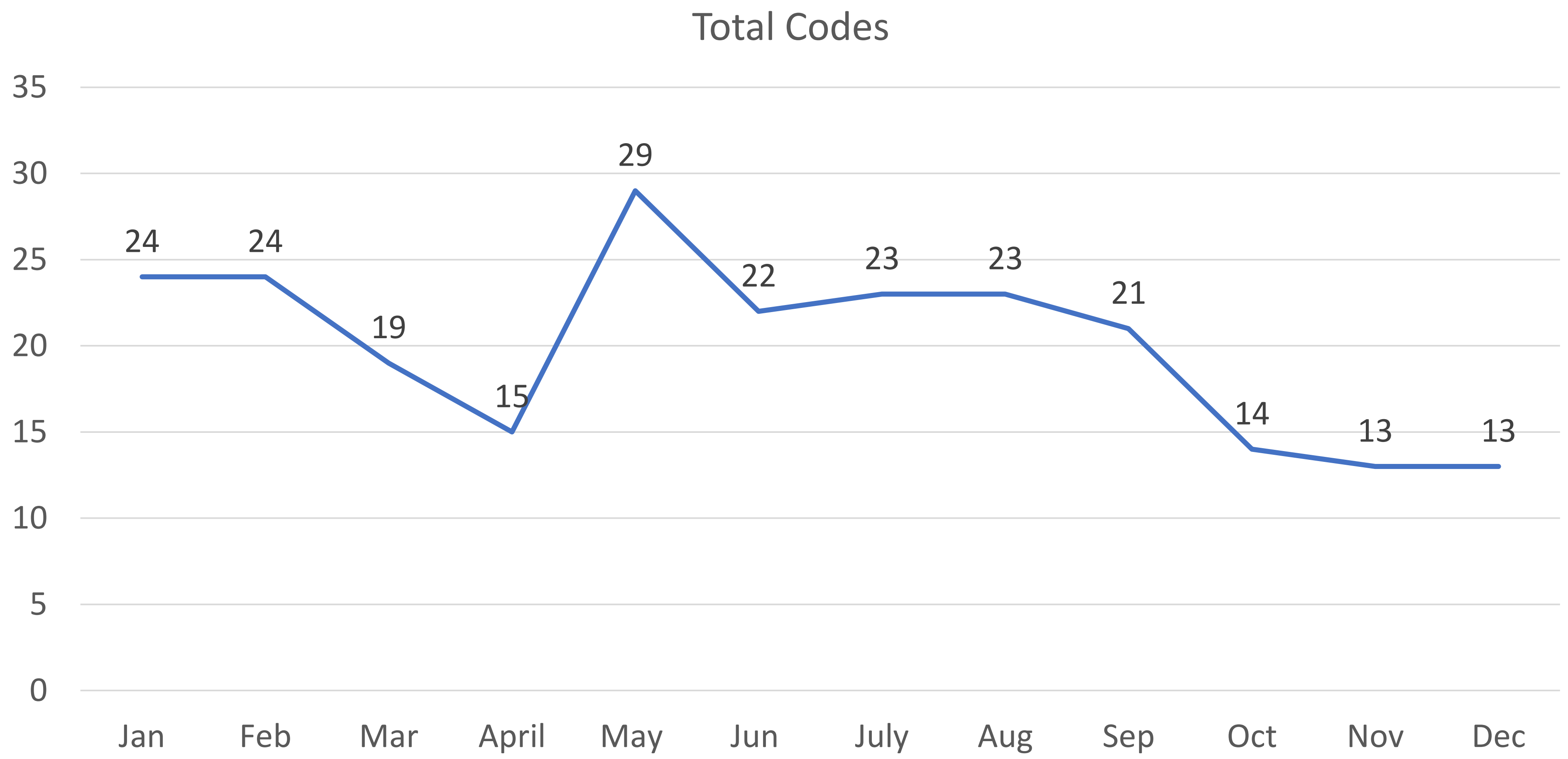
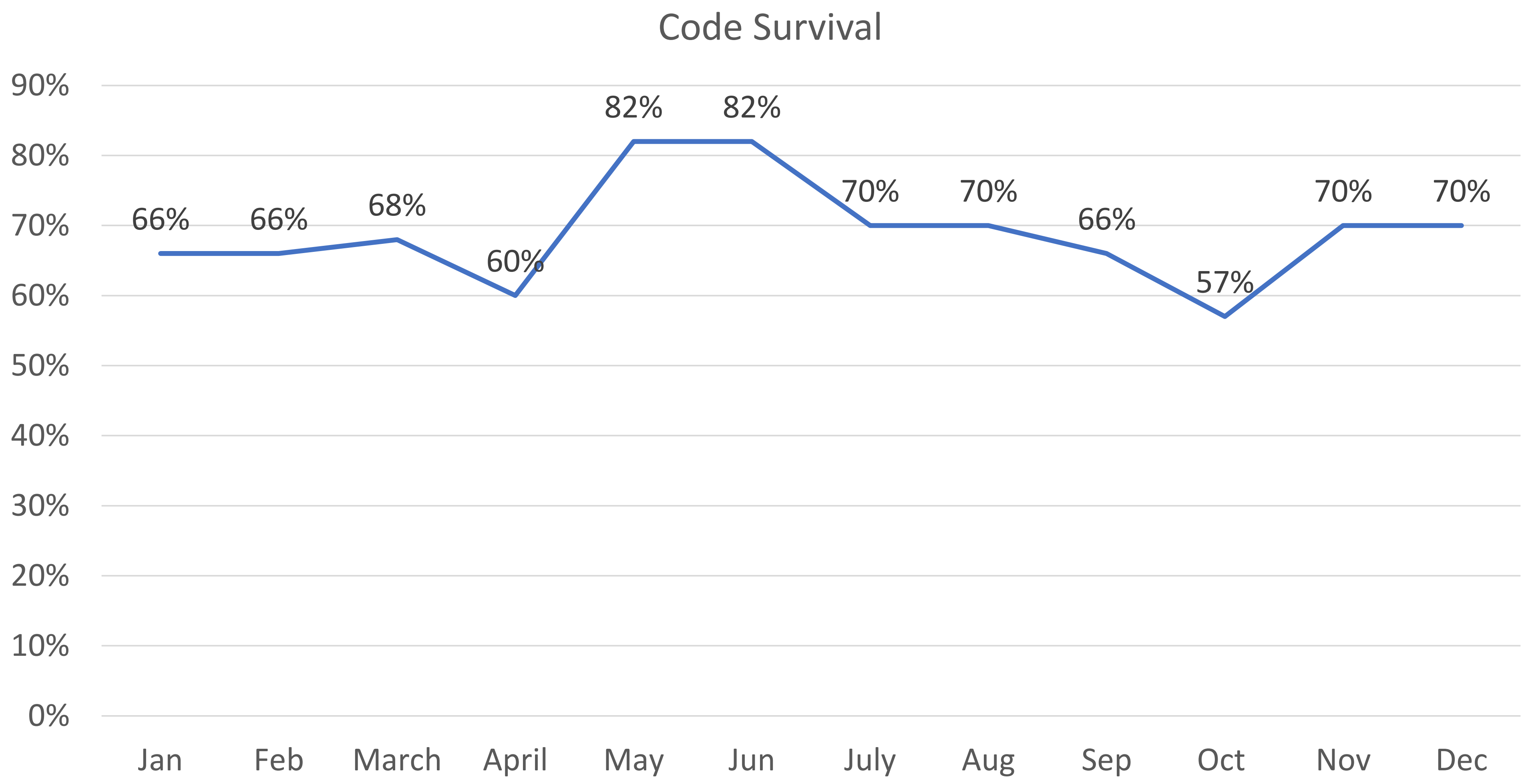
Dashboard

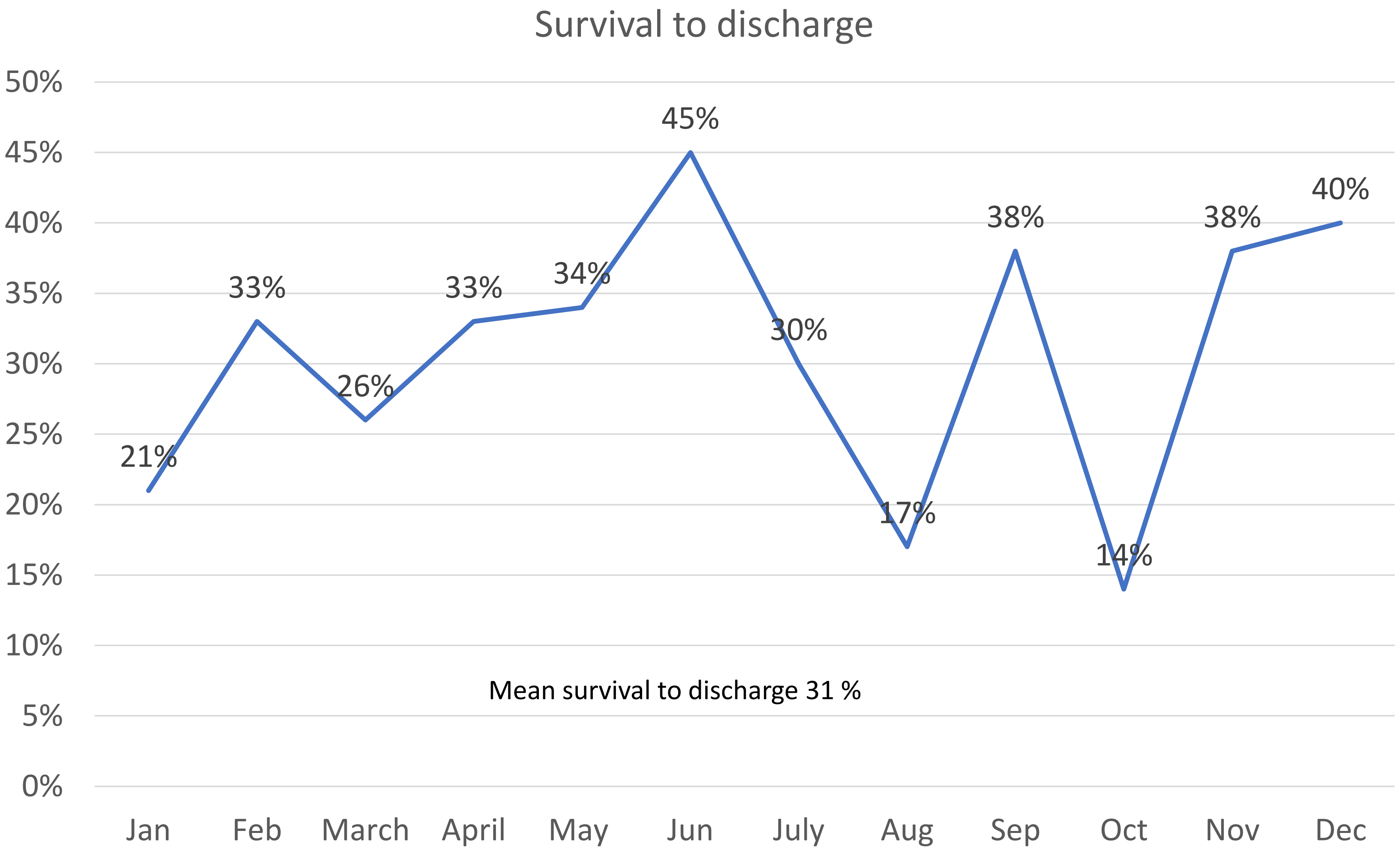


Dashboard

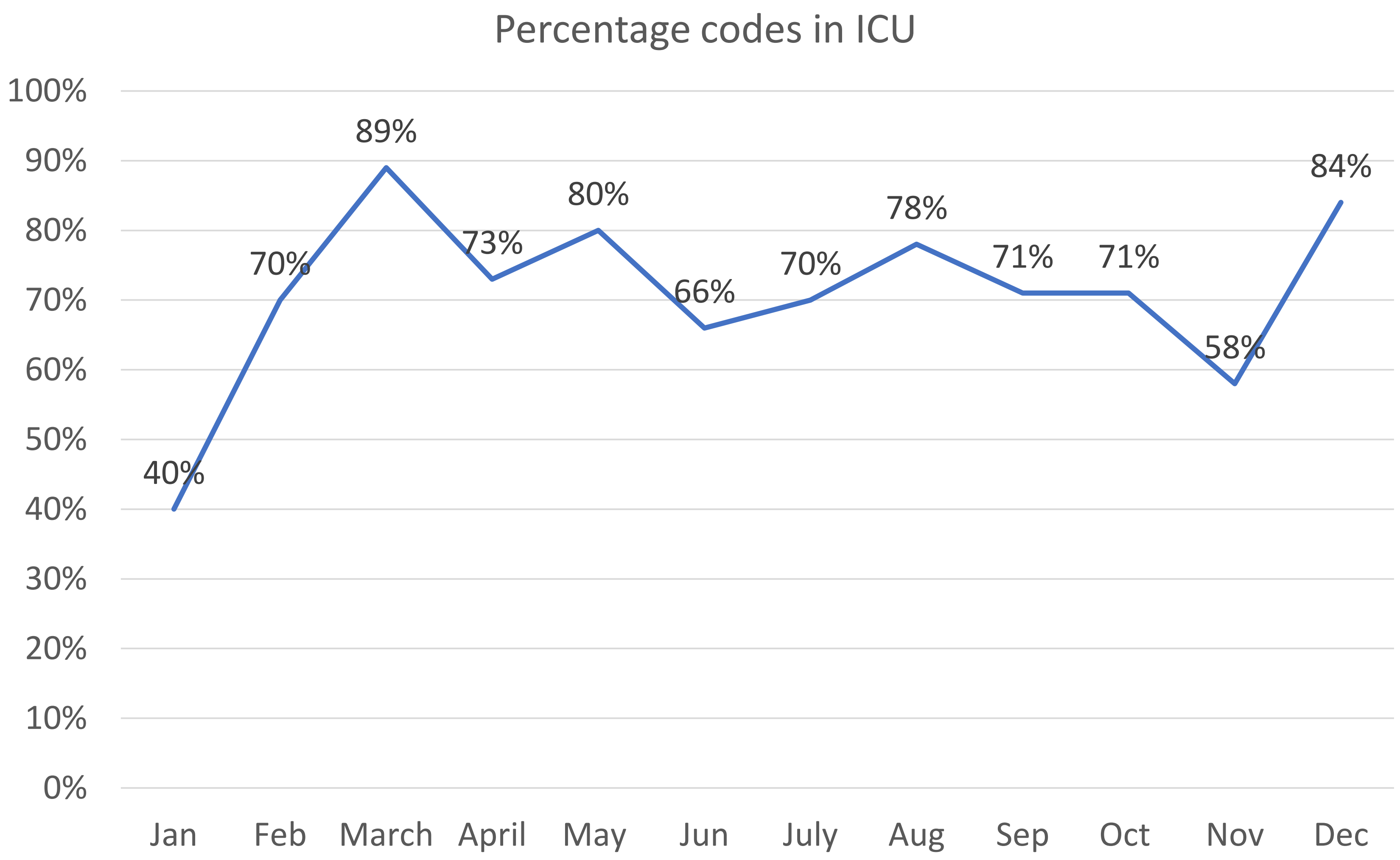


Mean survival 69%

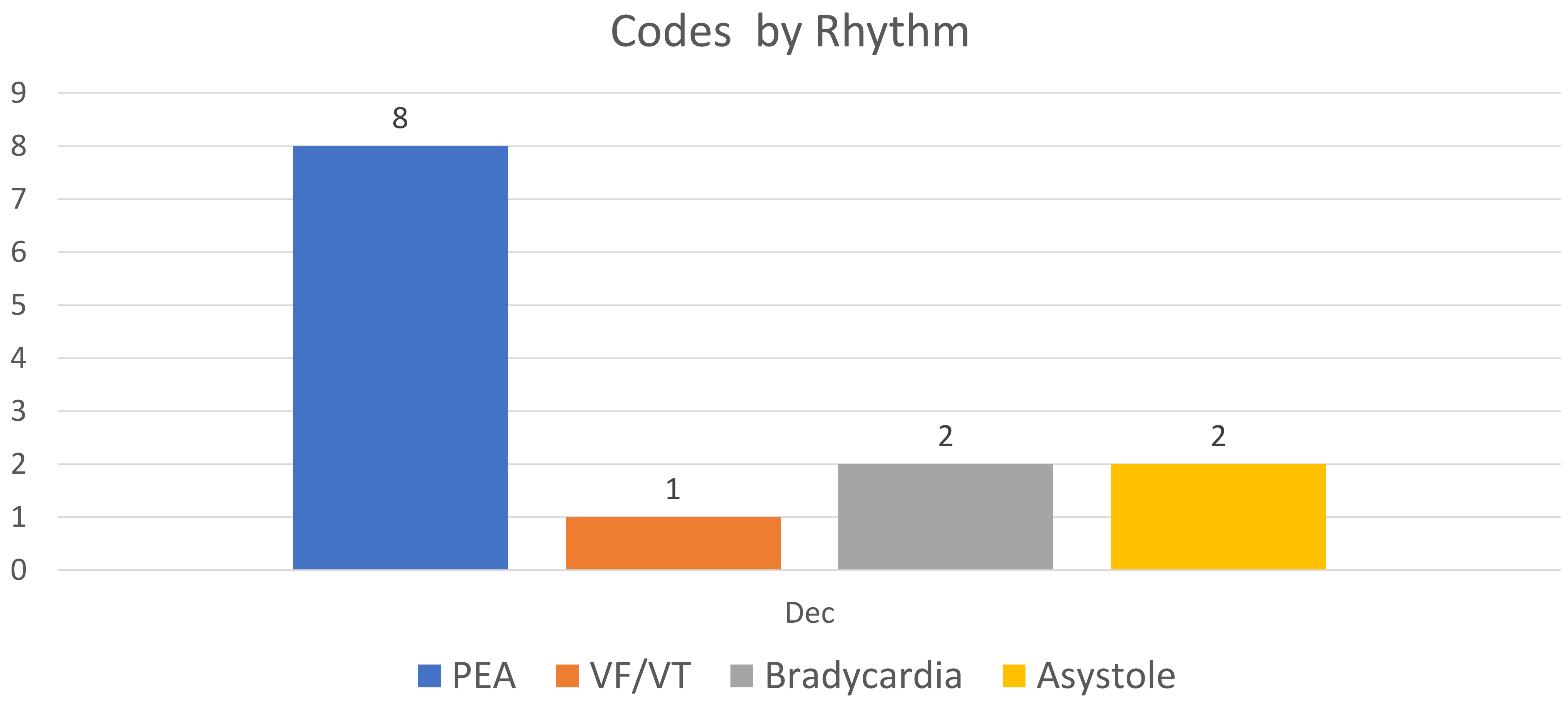
Dashboard


Survival to discharge
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
21%
33%
26%
33%
34%
45%
30%
17%
38%
14%
38%
40%
Jan
Feb
March
April
May
Jun
July
Aug
Sep
Oct
Nov
Dec
Mean survival to discharge 31 %

Dashboard

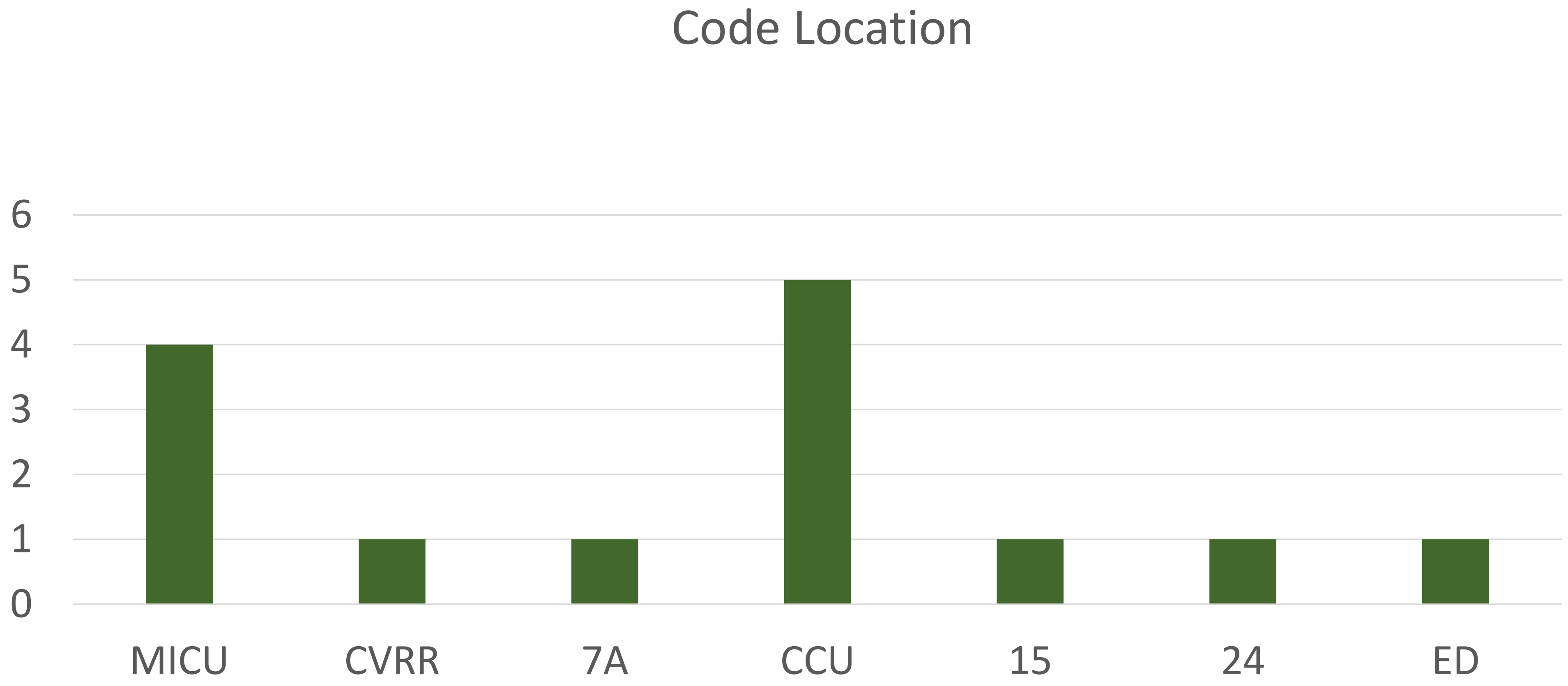

Percentage codes in ICU
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
40%
70%
89%
73%
80%
66%
70%
78%
71%
71%
58%
84%
Jan
Feb
March
April
May
Jun
July
Aug
Sep
Oct
Nov
Dec

Dashboard

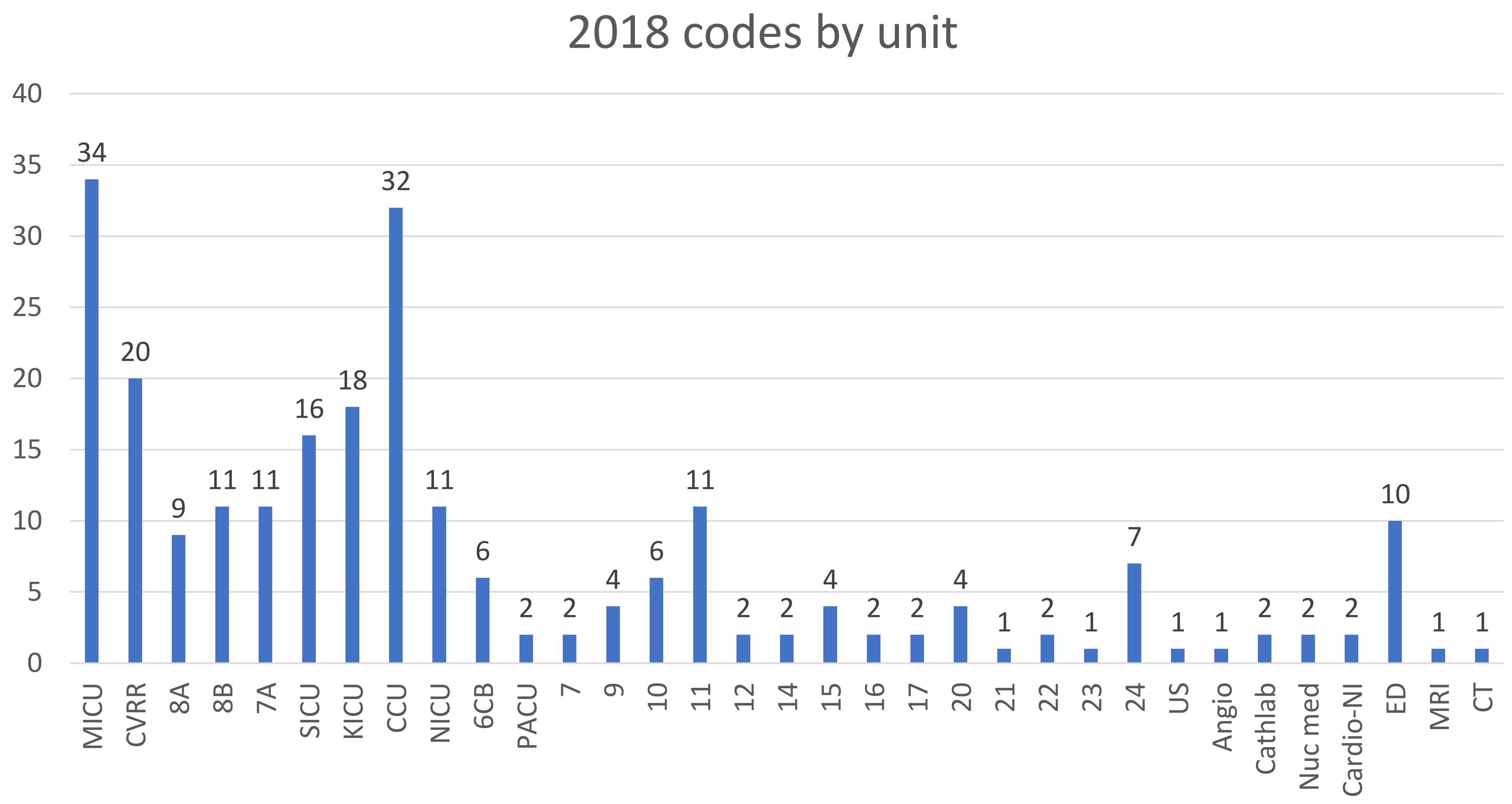


Codes by Rhythm
9
8
7
6
5
4
3
2
1
0
8
1
2
2
Dec
PEA
VF/VT
Bradycardia
Asystole

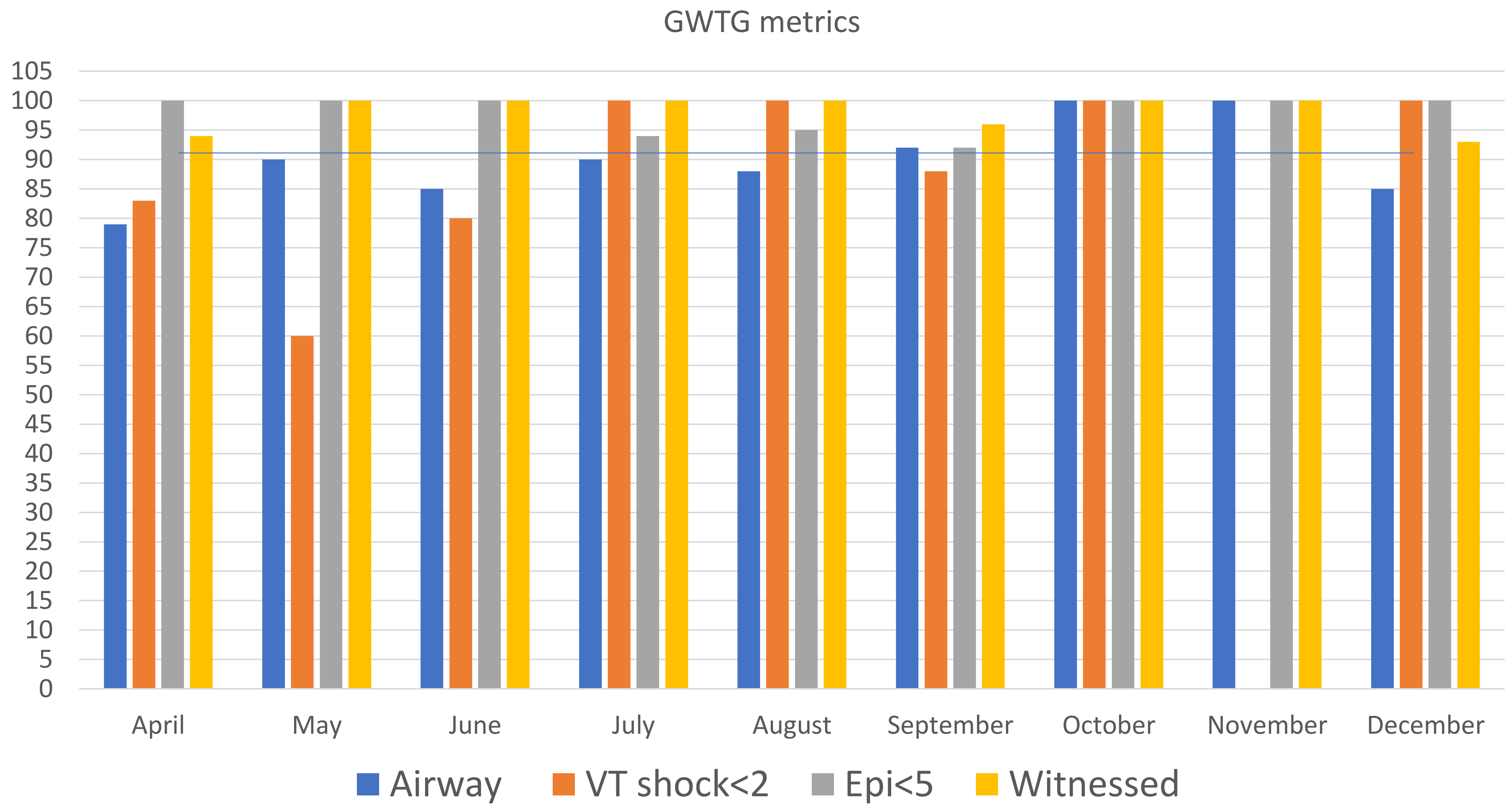
Dashboard



Dashboard


2018 codes by unit
40
35
30
25
20
15
10
5
0
34
20
9
11
11
16
18
32
11
6
2
2
4
6
11
2
2
4
2
2
4
1
2
1
7
1
1
2
2
2
10
1
1
MICU
CVRR
8A
8B
7A
SICU
KICU
CCU
NICU
6CB
PACU
7
9
10
11
12
14
15
16
17
20
21
22
23
24
US
Angio
Cathlab
Nuc med
Cardio-NI
ED
MRI
CT

Dashboard


GWTG metrics
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
April
May
June
July
August
September
October
November
December
Airway
VT shock<2
Epi<5
Witnessed

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CHI St. Luke's Health

CODE EVALUATION & DEBRIEFING

Date: ____________________ UNIT: ____________________

			YES	NO
1.	Team Leader ____________________ CCU fellow ____________________ Anesthesia ____________________ Code Manager ____________________	Arrived Without delay		
2.	Chest compressions started in less than 1 min			
3	Defibrillation < 2mins for VT/VFIB			
4	Confirmation of Airway			
5.	Was PEA witnessed			
6.	Adequate depth and rate of chest compressions (high quality chest compressions)			
7.	a) Was the code orderly b) Orders came from team leader			
8.	**DEBRIEFING** 1. What went wrong? • Process • Equipment/Drugs • Personnel 2. What went right? 3. What lessons were learned? 4. ICU team handoff given? Yes/No			

Comments:

Quality Gaps

Code Chaos and insufficient team dynamic

Performance measures –GWTG metrics

Quality Gaps
Solutions

Code Chaos and insufficient team dynamic

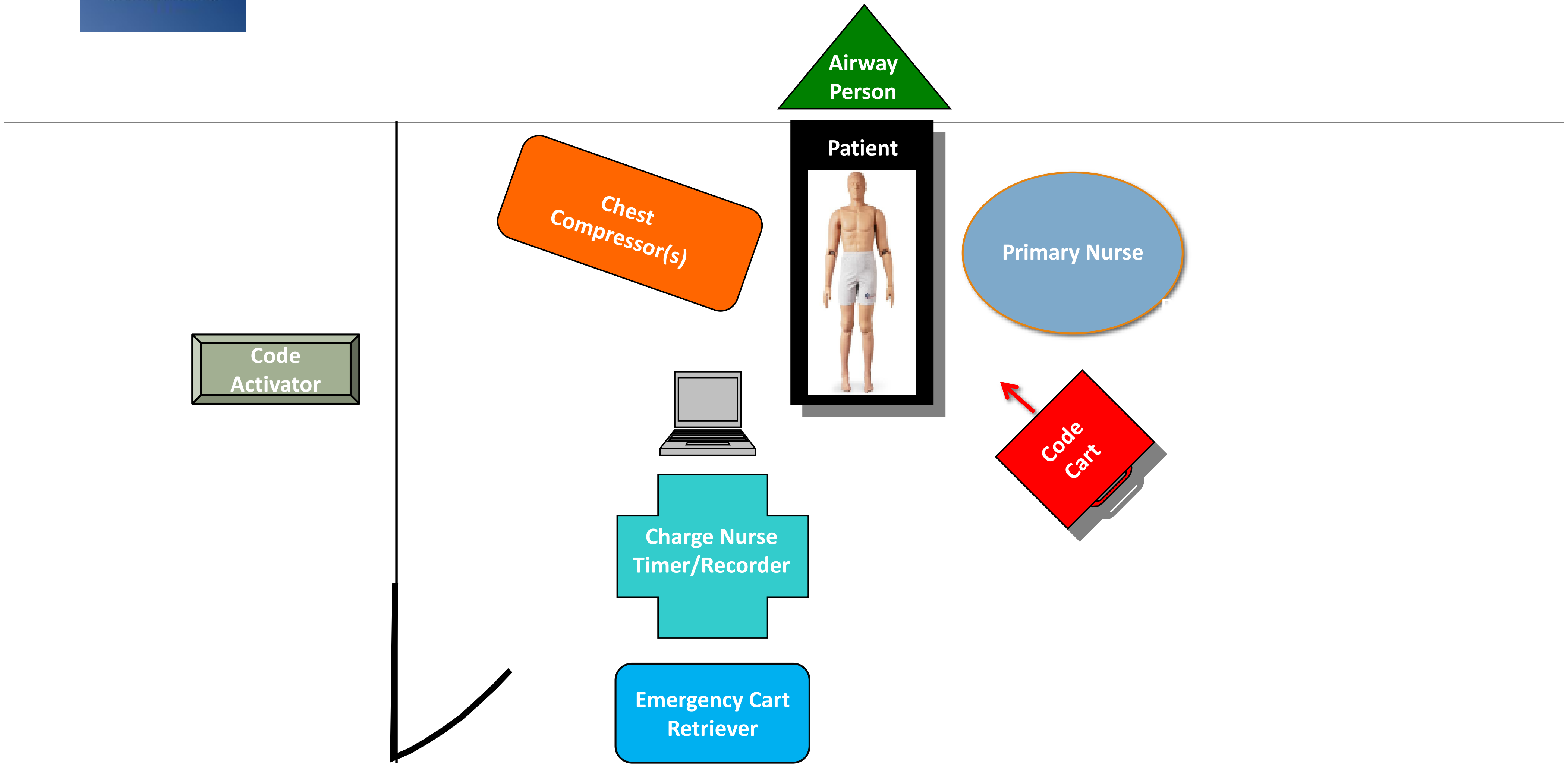
1. Role assignment
2. Code Process manager

Quality Gaps
Solutions

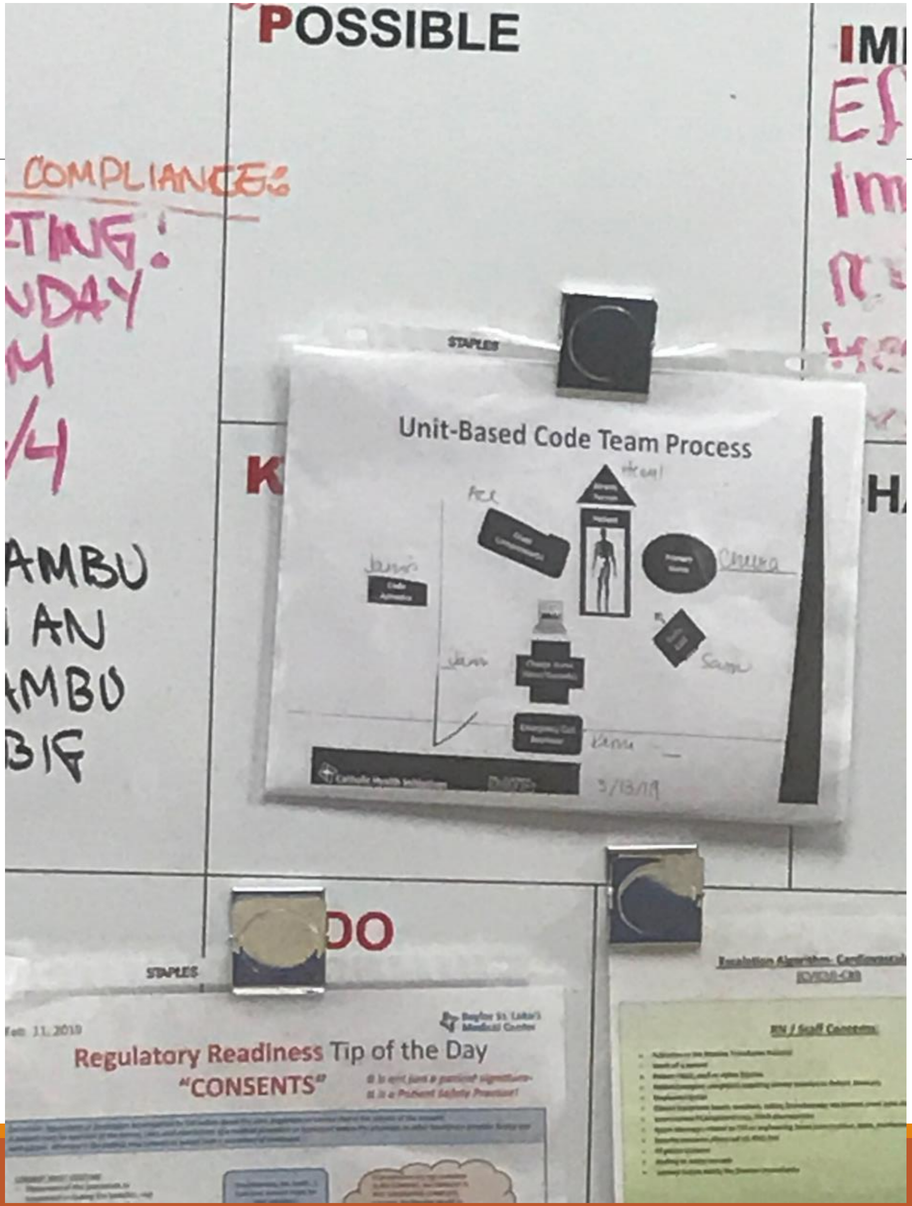
Code Chaos and insufficient team dynamic

1. Role assignment
2. Code Process manager

Role Assignment



Role Assignment in Action



Regular Role assignment Audits

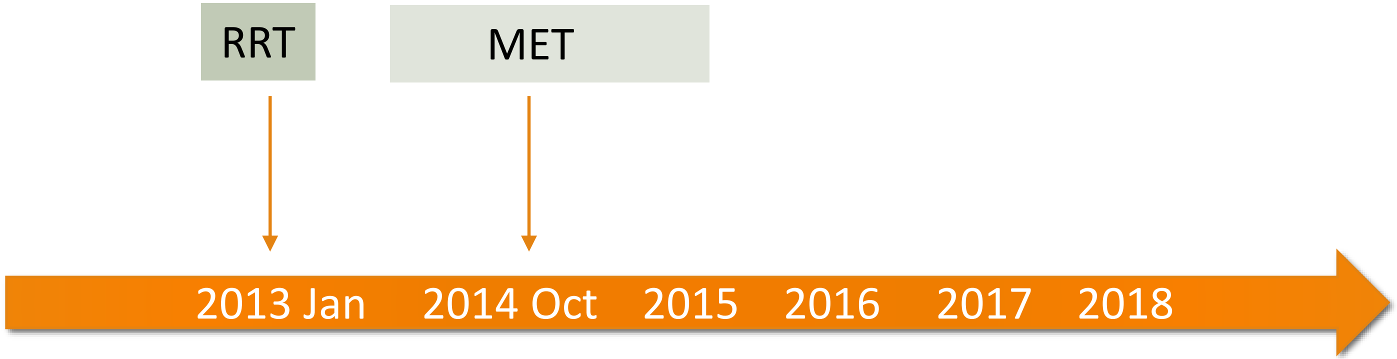
Quality Gaps

Solutions

Code Chaos and insufficient team dynamic

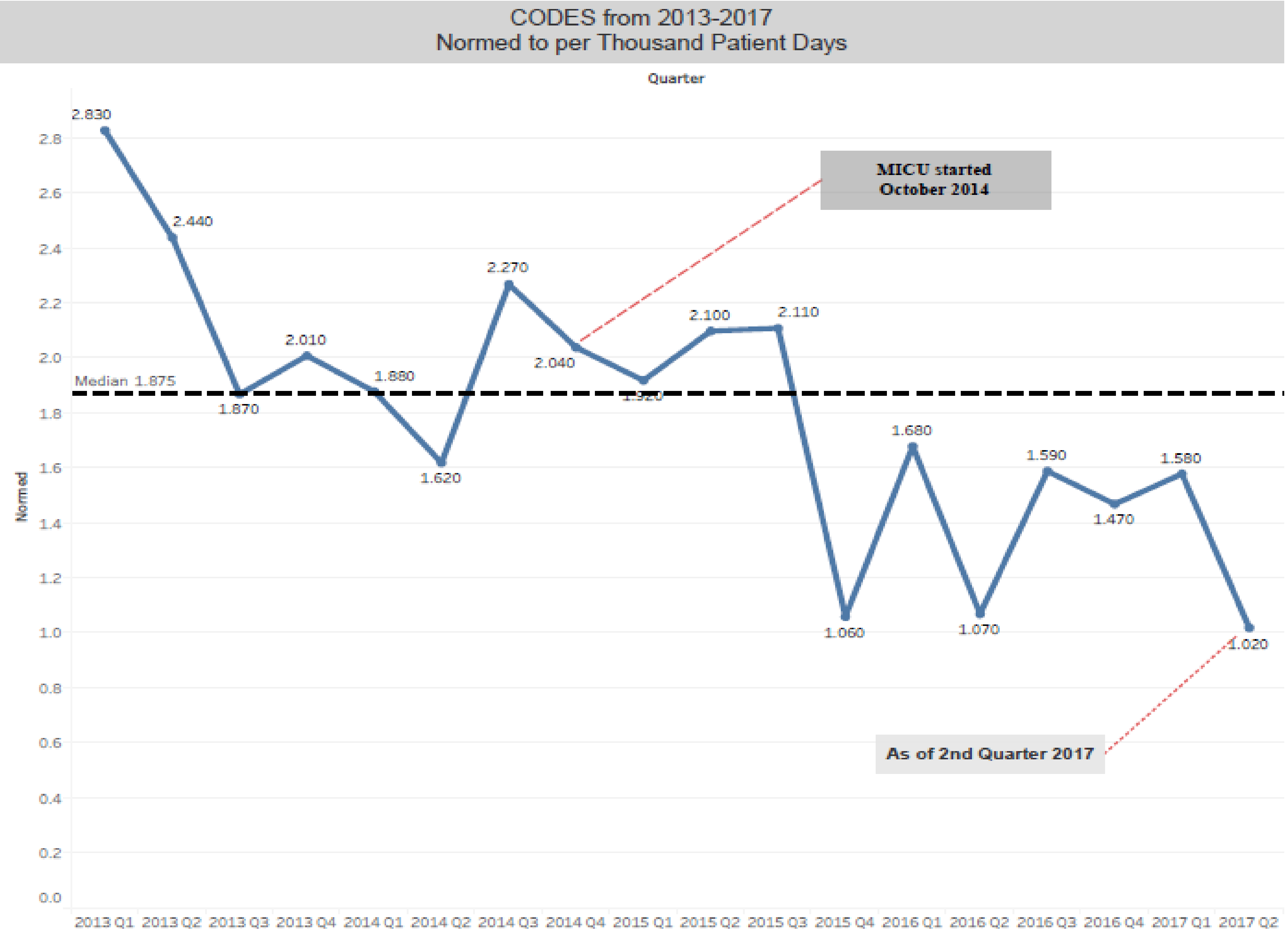
1. Role assignment
2. Code Process manager-Rapid response team

Evolution of Rapid Response System at BSLMC



Time line of RRT and MET at BSLMC

Codes Per 1,000 Patient Days



Role of Code Process Manger

Ensure role assignment

Identify team leader

Back board, ETCo2

Vascular Access (EzIO)

Point of care labs (Glu, ABG, CMP, Lactate)

Bring POC Echo to codes

Facilitate communication, Chaos control

Debrief

Quality Gaps

Code Chaos and insufficient team dynamic

Performance measures

- Defib time <2 min
- Etco2 measurement

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GWTG Metrics
Defib < 2min

AED Mode

Manual Mode

GWTG metrics

Monitoring End tidal C02

All respiratory therapist equipped with EtCo2 monitors

Get With The Guidelines Metrics

Resident Code note

1. Standardization
2. Helps with abstraction
3. GWTG metrics

My Note

Baylor College of Medicine

Type: | Service: Surgical ICU | Date of Service: 3/30/2019 | 09:45 PM

Cosign Required

Insert SmartText

Code Blue Note

Briefly [redacted] y.o. female with *** admitted on 3/28/2019 for ***.

Hospital course notable for ***.

Situation: Code Blue called at *** {Time; am/pm:31393}.
- Was cardiac arrest witnessed or captured on the monitor? {YES/NO:23497}

Background: ***
Assessment
- On arrival, CPR was {CODE Initial CPR:25924}
- Initial airway/ventilation: {CODE Airway:25923}
- Initial pulse check: {CODE Pulse:25925}
- Initial rhythm: {CODE rhythm:25915}
-Time to first chest compressions: {CODE time to compressions:25929}
- Was there high quality, uninterrupted, CPR? {yes no:315493::"Yes"}

Recommendations: ACLS protocol was initiated with the details below.

Details of Code
- Access established: {CODE access:25926}
- Method of airway confirmation: {CODE airway confirmation:25928}
- Procedures: ***
- Medications administered: {CODEMEDS:25111}
    - Time to IV/IO epinephrine <= 5 minutes for asystole or PEA? {YES:23483}
- IVF administered:***
- Shocks delivered:{yes/no:310449}
    - If initial rhythm VT/VF, time to first shock <= 2 minutes (i.e. time from the placement of pads)? {yes/no:310449}
    - If yes, number of shocks***
- Pertinent code labs: ***

Additional narrative of events and clinical reasoning (5H/Ts considered): ***

After *** minutes, {CODEBLUEEND:25120} at *** {Time; am/pm:31393}.

Plan of further care (if applicable) ***

Targeted temperature management considered {YES/NO:23497}, if not, contraindicated because of ***.

Patient handed off to ICU Attending ***.

Family notified at *** {Time; am/pm:31393}.
Primary attending notified at *** {Time; am/pm:31393}

Abstract to the AHA Quality of Care and Outcomes Research Scientific Sessions to be held in Arlington, VA on April 5-6, 2019.

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GIVING LIFE TO POSSIBLE

Improving Compliance with Get with the Guidelines-Resuscitation Metrics by Standardizing Code Note Documentation

Benjamin Moss, MD, Katherine Richards, MD, Babith Mankidy, MD, Seanna D'Avignon, BSN, RN, and Christopher K. Morgan, MD
Baylor College of Medicine and Baylor-St. Luke's Medical Center, Houston, TX

CHI St Luke's Health

OBJECTIVE

To increase adherence to Get with the Guidelines-Resuscitation (GWTG-R) measures by improving the quality of documentation of cardiac arrests by resident code leaders through the implementation of a standardized code note template.

BACKGROUND

- The American Heart Association created GWTG-R to facilitate reporting and analysis of cardiac arrest data.
- GWTG-R criteria include witnessed events, confirmation of airway, two minute time-to-shock for ventricular tachycardia or fibrillation, and five minute time-to-first dose of epinephrine for pulseless electrical activity.

METHODS

A retrospective chart review was performed on resident-authored code notes before and after implementation of a standardized code note. An electronic medical record template was developed which highlighted GWTG-R metrics. This note was made available to all resident physician code leaders. Reviewed notes were assessed for documentation of GWTG-R metrics and clinical reasoning.

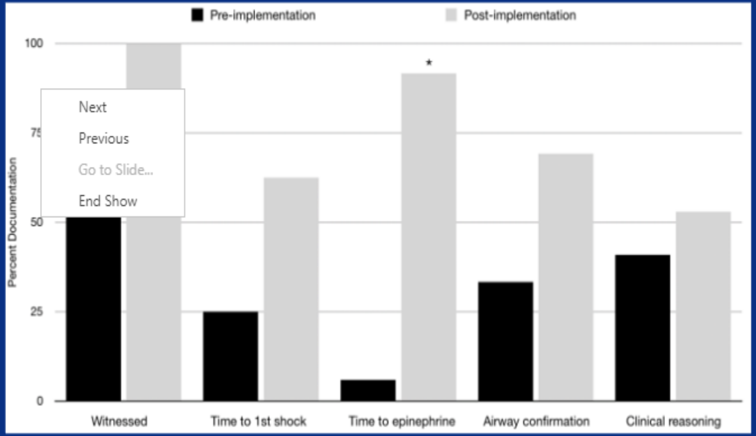

Figure 1: Percent of notes documenting GTWG-R criteria and clinical reasoning before and after implementation of the stnada code blue note.

Code Blue Note

Briefy, @NAME@ is a @AGE@ @SEX@ with *** admited on @ADMITDT@ for ***.

Hospital course notable for ***.

Situation: Code Blue called at *** {Time; am/pm:31393}.
- Was cardiac arrest witnessed or captured on the monitor? {YES/NO:23497}

Background: ***
Assessment
- On arrival, CPR was {CODE Initial CPR:25924}
- Initial airway/ventilation: {CODE Airway:25923}
- Initial pulse check: {CODE Pulse:25925}
- Initial rhythm: {CODE rhythm:25915}
-Time to first chest compressions: {CODE time to compressions:25929}
- Was there high quality, uninterupted, CPR? {yes no:315493}

Recommendations: ACLS protocol was initiated with the details below.

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  - Time to IV/IO epinephrine <= 5 minutes for asystole or PEA? {YES:23483}
- IVF administered:***
- Shocks delivered {yes/no:310449}
  - If initial rhythm VT/VF, time to first shock <= 2 minutes? {yes/no:310449}
  - If yes, number of shocks***
- Pertinent code labs: ***

Additional narrative of events and clinical reasoning (5H/Ts considered): ***

After *** minutes, {CODEBLUEEND:25120} at *** {Time; am/pm:31393}.

Plan of further care (if applicable) ***

Targeted temperature management considered {YES/NO:23497}, if not, contraindicated because of ***.

Patient handed off to ICU Attending ***.

Family notified at *** {Time; am/pm:31393}.
Primary attending notified at *** {Time; am/pm:31393}.
Debriefing occurred {YES/NO:23497}

Team leader during code ***

Figure 2: Template code blue note with GWTG-R criteria highlighted in red.

RESULTS

- 22 notes reviewed prior to and 17 notes after implementation of a standardized code note template (Figure 2).
- 14/17 (82%) of post-implementation code notes used the standardized template.
- All GWTG-R categories and clinical reasoning documentation trended toward improvement (Figure 1)
- Documentation of time-to-epinephrine significantly increased from 5.9% to 91.7% (Figure 1).

CONCLUSIONS

- Development of a standardized code note template improved documentation of GWTG-R quality measures for in-hospital cardiac arrest.
- Hospital compliance with guidelines improved following this intervention, now qualifying it for GWTG-R Bronze for three consecutive months of compliance.
- Expansion of the standardized code note for widespread use by providers throughout the hospital is expected to continue to improve code documentation and hospital compliance with GWTG-R.

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Lessons Learned:

“Find the code blue guru”

Proper collection of code data - keep a good grip on the data

Get leadership buy in as “high priority”

Set achievable goals

Audit your PDSA interventions until things are “hard-wired”

Give feed back to your team as well as rest of the hospital

Utilize your Rapid response services: Include RRS /MET leaders in code committee

Simplifying CPR Committees in a Complex System

Kevin Roy, MD, FAAP
Texas Children's Hospital
Baylor College of Medicine

Disclosures

Kevin Roy has no relevant financial disclosures

Introduction

- What does a CPR Committee do within a system?
- How does a Committee evolve over time?
- What are common guiding principles?

COMPLEX SYSTEMS – SIMPLIFIED RESPONSES

- 3 Campuses
- 941 Licensed Beds
- Neonatal, Pediatric, Adult
- Inpatient, Outpatient, Satellite Offices
- Main Campus: 5 Separate Buildings

- 1 Code Activation System
- 2 Code Carts (1 Defibrillator)
- One Code Navigator
- Common Internal Reporting
- External Reporting

Designing Structure to Match Complexity

- Main CPR Committee: Every other month
- Sub Committees: RRT, CPR Quality
- Sub Committee Structure: Event Review vs. Summary Reporting

American Heart Association.

Diverse Perspectives

- Membership CPR Committee
- Membership in Subcommittee
- Workgroups
- System wide implications pilot projects
- Assess, recruit, re-recruit

Defining Leadership

- Requires Multiple Leaders
- Committee Chair, Co-Chairs, Administrative Leader
  - Term Limits?
- Other Leaders:
  - Sub Committees
  - Project based
  - Specific Areas
  - Former Chairs

Evolving Goals: Is there a Hierarchy of Needs

1. Understand
2. Standardize
3. Assess Standardization
4. Disseminate – Internal/External
5. Improve

American Heart Association.

Final Thoughts

- Chance favors a prepared system
- Thoughts on mistakes
- Learning from others
- Contact Info: kmroy@texaschildrens.org

Risk-Standardized Survival Ratesfor In-Hospital Cardiac Arrest:

How were they created, What the rates mean, and Why is survival higher at some hospitals?

Paul Chan, MD MSc

Clinical Scholar, Mid America Heart Institute
Professor, University of Missouri - Kansas City

Disclosures

- Speaker's Bureaus: None
- Grant Support:
  - NHLBI
  - American Heart Association
- Consultant: none

1700's

- Cardiac Arrest Treatment Device used to Blow Smoke up One's Rectum
- Hung along major waterways (e.g., River Thames)


AUTOMATED EXTERNAL
DEFIBRILLATOR
AED


Saint Luke's Hospital

American Heart Association | American Stroke Association

GET WITH THE GUIDELINES® RESUSCITATION

- Formerly the National Registry for CPR (NRCPR)
- Launched in 2000; over 250,000 IHCA cases to date from >700 sites


READ ALL
ABOUT IT!
EXTRA!

The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 JANUARY 3, 2008 VOL. 358 NO. 1

Delayed Time to Defibrillation after In-Hospital Cardiac Arrest

Paul S. Chan, M.D., Harlan M. Krumholz, M.D., Graham Nichol, M.D., M.P.H., Brahmajee K. Nallamothu, M.D., M.P.H., and the American Heart Association National Registry of Cardiopulmonary Resuscitation Investigators*

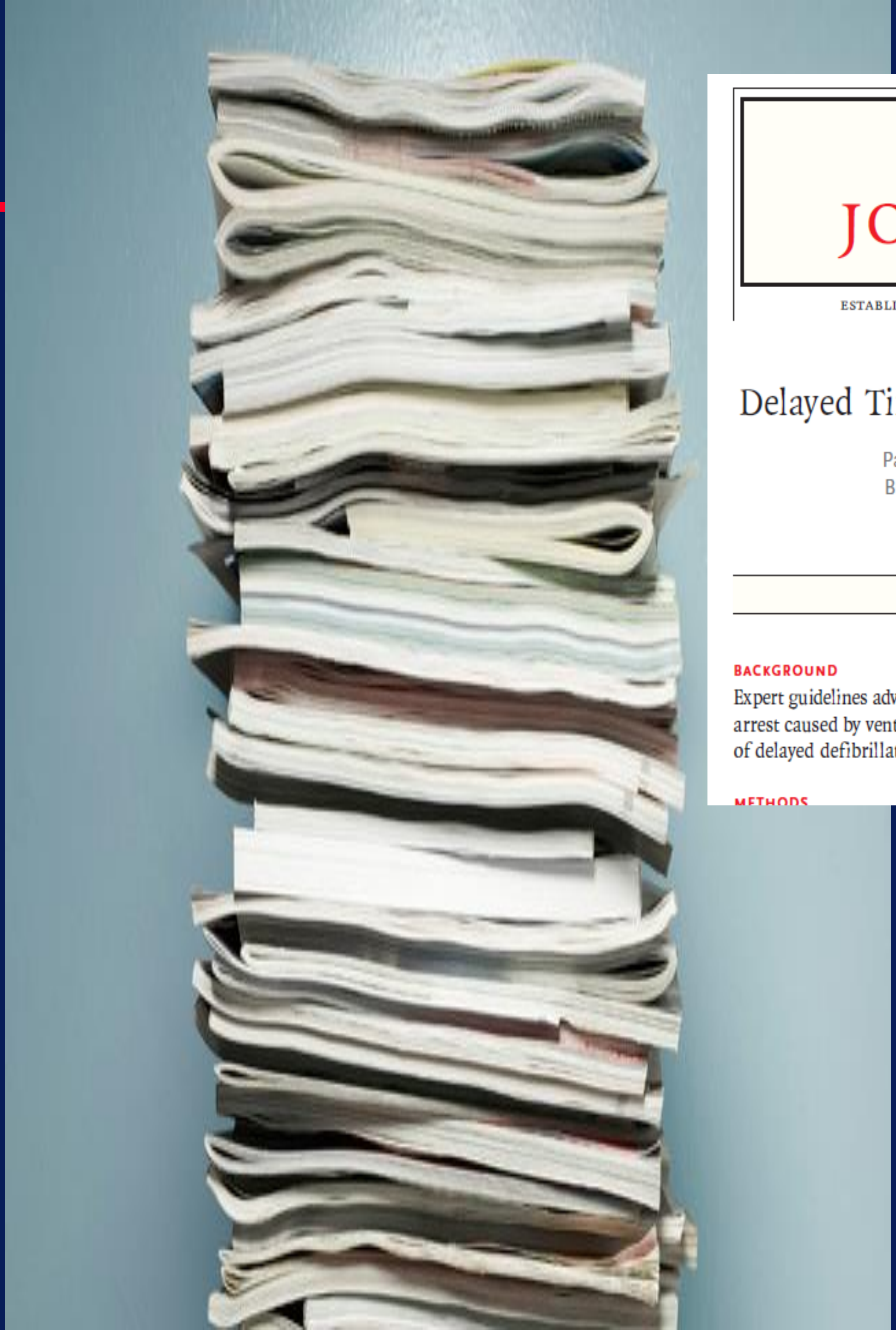
ABSTRACT

BACKGROUND

Expert guidelines advocate defibrillation within 2 minutes after an in-hospital cardiac arrest caused by ventricular arrhythmia. However, empirical data on the prevalence of delayed defibrillation in the United States and its effect on survival are limited.

METHODS

From Saint Luke's Mid-America Heart Institute, Kansas City, MO (P.S.C.); the University of Michigan Division of Cardiovascular Medicine, Ann Arbor (P.S.C., B.K.N.); the Section of Cardiovascular Medicine and the Robert Wood Johnson Clinical



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Delayed Tim

Paul
Brah

BACKGROUND
Expert guidelines advoc
arrest caused by ventric
of delayed defibrillatio

METHODS

ORIGINAL CONTRIBUTION

Racial Differences in Survival After In-Hospital Cardiac Arrest

Paul S. Chan, MD, MSc
Graham Nichol, MD, MPH
Harlan M. Krumholz, MD, SM
John A. Spertus, MD, MPH
Philip G. Jones, MS
Eric D. Peterson, MD, MPH
Saif S. Rathore, MPH
Brahmajee K. Nallamothu, MD, MPH
for the American Heart Association National Registry of Cardiopulmonary Resuscitation (NRCPR) Investigators

Context Racial differences in survival have not been previously studied after in-hospital cardiac arrest, an event for which access to care is not likely to influence treatment.

Objectives To estimate racial differences in survival for patients with in-hospital cardiac arrests and examine the association of sociodemographic and clinical factors and the admitting hospital with racial differences in survival.

Design, Setting, and Patients Cohort study of 10 011 patients with cardiac arrests due to ventricular fibrillation or pulseless ventricular tachycardia enrolled between January 1, 2000, and February 29, 2008, at 274 hospitals within the National Registry of Cardiopulmonary Resuscitation.

Main Outcome Measures Survival to hospital discharge; successful resuscitation from initial arrest and postresuscitation survival (secondary outcome measures).

Results Included were 1883 black patients (18.8%) and 8128 white patients (81.2%). Rates of survival to discharge were lower for black patients (25.2%) than for white patients (37.4%) (unadjusted relative rate [RR], 0.73; 95% confidence interval [CI], 0.67-0.79). Unadjusted racial differences narrowed after adjusting for patient characteristics (adjusted RR, 0.81 [95% CI, 0.75-0.88]; $P<.001$) and diminished further after additional adjustment for hospital site (adjusted RR, 0.89 [95% CI, 0.82-0.96]; $P=.002$).

SURVIVAL FOLLOWING IN-HOSPITAL cardiac arrest repre-

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Delayed Tim

Paul
Brah

ORIGINAL CONTRIBUTION

Racial Differences in Survival After In-Hospital Cardiac Arrest

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differences in survival.

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(adjusted RR, 0.89 [95% CI, 0.82-0.96]; $P=.002$).

Duration of resuscitation efforts and survival after in-hospital cardiac arrest: an observational study

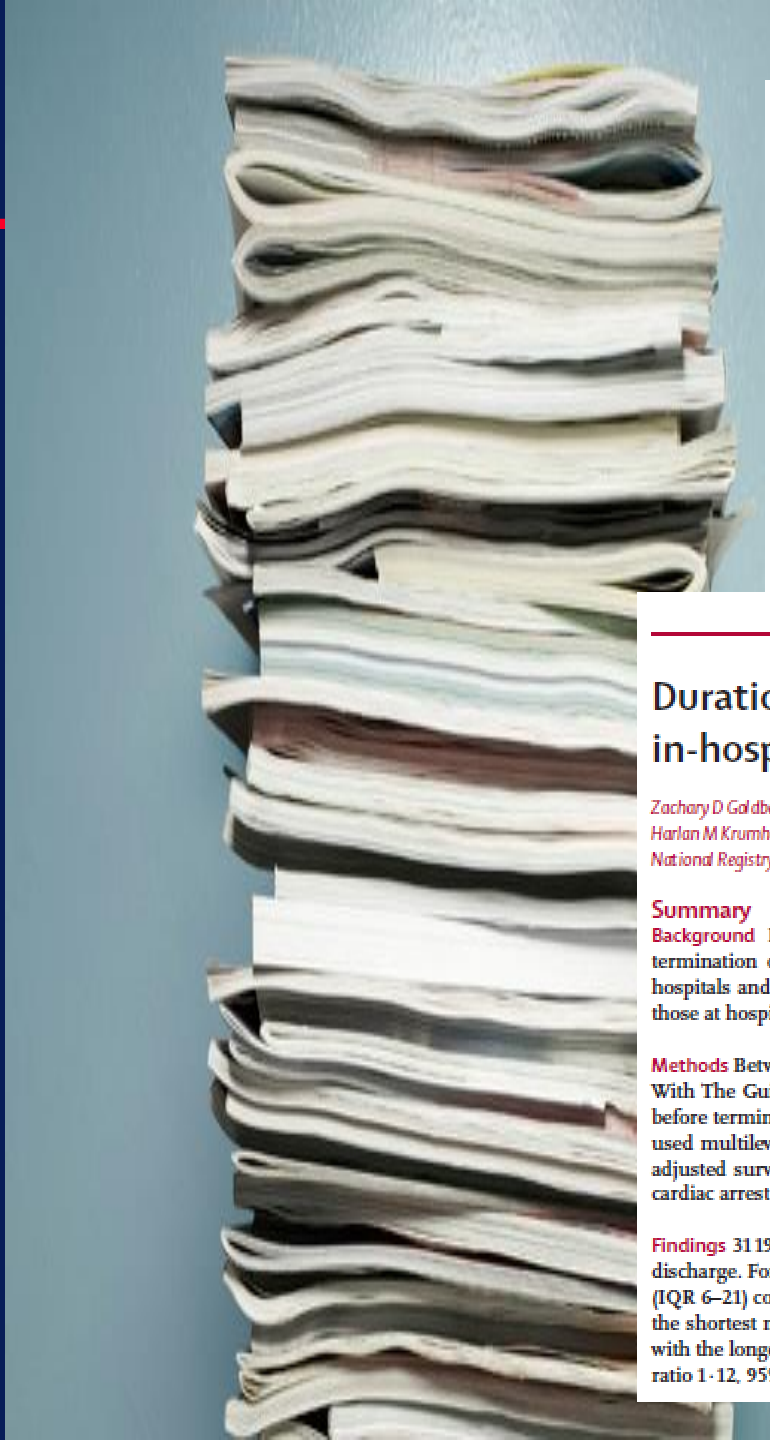
*Zachary D Goldberger, Paul S Chan, Robert A Berg, Steven L Kronick, Colin R Cooke, Mingrui Lu, Mousumi Banerjee, Rodney A Hayward, Harlan M Krumholz, Brahmajee K Nallamothu, for the American Heart Association Get With The Guidelines—Resuscitation (formerly the National Registry of Cardiopulmonary Resuscitation) Investigators**

Summary

Background During in-hospital cardiac arrests, how long resuscitation attempts should be continued before termination of efforts is unknown. We investigated whether duration of resuscitation attempts varies between hospitals and whether patients at hospitals that attempt resuscitation for longer have higher survival rates than do those at hospitals with shorter durations of resuscitation efforts.

Methods Between 2000 and 2008, we identified 64 339 patients with cardiac arrests at 435 US hospitals within the Get With The Guidelines—Resuscitation registry. For each hospital, we calculated the median duration of resuscitation before termination of efforts in non-survivors as a measure of the hospital's overall tendency for longer attempts. We used multilevel regression models to assess the association between the length of resuscitation attempts and risk-adjusted survival. Our primary endpoints were immediate survival with return of spontaneous circulation during cardiac arrest and survival to hospital discharge.

Findings 31 198 of 64 339 (48·5%) patients achieved return of spontaneous circulation and 9912 (15·4%) survived to discharge. For patients achieving return of spontaneous circulation, the median duration of resuscitation was 12 min (IQR 6–21) compared with 20 min (14–30) for non-survivors. Compared with patients at hospitals in the quartile with the shortest median resuscitation attempts in non-survivors (16 min [IQR 15–17]), those at hospitals in the quartile with the longest attempts (25 min [25–28]) had a higher likelihood of return of spontaneous circulation (adjusted risk ratio 1·12, 95% CI 1·06–1·18; p<0·0001) and survival to discharge (1·12, 1·02–1·23; 0·021).



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ESTABLISH

Delayed Tim
Paul
Brah

ORIGINAL CONTRIBUTION

Racial Differences in Survival After In-Hospital Cardiac Arrest

Duration of resuscitatio
in-hospital cardiac arres

Zachary D Goldberger, Paul S Chan, Robert A Berg, Steve
Harlan M Krumholz, Brahmajee K Nallamothu, for the A
National Registry of Cardiopulmonary Resuscitation) In

Summary
Background During in-hospital cardiac ar
termination of efforts is unknown. We in
hospitals and whether patients at hospitals
those at hospitals with shorter durations of r

Methods Between 2000 and 2008, we identifi
With The Guidelines—Resuscitation registry
before termination of efforts in non-survivor
used multilevel regression models to assess
adjusted survival. Our primary endpoints w
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(IQR 6–21) compared with 20 min (14–30) fo
the shortest median resuscitation attempts i
with the longest attempts (25 min [25–28]) ha
ratio 1·12, 95% CI 1·06–1·18; p<0·0001) and

ORIGINAL ARTICLE

Trends in Survival after In-Hospital Cardiac Arrest

Saket Girotra, M.D., Brahmajee K. Nallamothu, M.D., M.P.H.,
John A. Spertus, M.D., M.P.H., Yan Li, Ph.D., Harlan M. Krumholz, M.D.,
and Paul S. Chan, M.D., for the American Heart Association
Get with the Guidelines–Resuscitation Investigators

ABSTRACT

BACKGROUND
Despite advances in resuscitation care in recent years, it is not clear whether survival and neurologic function after in-hospital cardiac arrest have improved over time.

METHODS
We identified all adults who had an in-hospital cardiac arrest at 374 hospitals in the


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IHCA

Processes of Care and Interventions

The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 JANUARY 3, 2008 VOL. 358 NO. 1

Delayed Time to Defibrillation after In-Hospital Cardiac Arrest

Paul S. Chan, M.D., Harlan M. Krumholz, M.D., Graham Nichol, M.D., M.P.H., Brahmajee K. Nallamothu, M.D., M.P.H., and the American Heart Association National Registry of Cardiopulmonary Resuscitation Investigators*

ABSTRACT

BACKGROUND

Expert guidelines advocate defibrillation within 2 minutes after an in-hospital cardiac arrest caused by ventricular arrhythmia. However, empirical data on the prevalence of delayed defibrillation in the United States and its effect on survival are limited.

METHODS

We identified 6789 patients who had cardiac arrest due to ventricular fibrillation or pulseless ventricular tachycardia at 369 hospitals participating in the National Registry of Cardiopulmonary Resuscitation. Using multivariable logistic regression, we

From Saint Luke's Mid-America Heart Institute, Kansas City, MO (P.S.C.); the University of Michigan Division of Cardiovascular Medicine, Ann Arbor (P.S.C., B.K.N.); the Section of Cardiovascular Medicine and the Robert Wood Johnson Clinical Scholars Program, Department of Medicine, and the Section of Health Policy and Administration, Department of Epidemiology and Public Health, Yale University

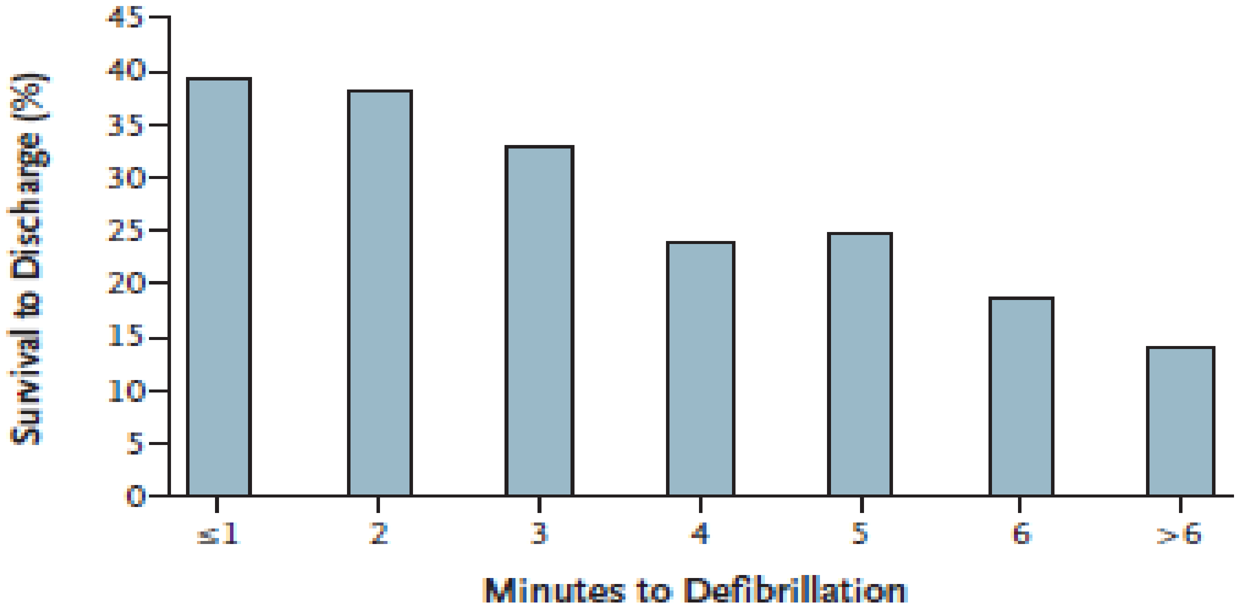
Survival

	≤ 2 minutes (n=4,744)	> 2 minutes (n=2,045)
SURVIVAL OUTCOMES		
ROSC, n (%)	3,165 (66.7%)	1,003 (49.0%)
Alive at 24 Hours, n (%)	2,607 (55.0%)	765 (37.4%)
Survival to Discharge, n (%)	1,863 (39.3%)	455 (22.2%)

	Unadjusted OR (95% CI)	Adjusted OR* (95% CI)	p-value
SURVIVAL OUTCOMES			
ROSC, n (%)	0.48 (0.43, 0.53)	0.55 (0.49, 0.62)	<.001
Alive at 24 Hours, n (%)	0.48 (0.43, 0.54)	0.52 (0.46, 0.58)	<.001
Survival to Discharge, n (%)	0.44 (0.39, 0.50)	0.48 (0.42, 0.54)	<.001
NEUROLOGICAL OUTCOMES	0.71 (0.57, 0.89)	0.74 (0.57, 0.95)	0.02
FUNCTIONAL OUTCOMES	0.67 (0.52, 0.87)	0.74 (0.56, 0.96)	0.02

Chan et al. NEJM, 2008:358, pp.9-17.

Effect of Each Incremental Minute of Delay in Defibrillation Time



Minutes to Defib-rillation	No. of Patients	Survived to Dis-charge	Unadjusted Odds Ratio (95% CI)	Adjusted Odds Ratio (95% CI)	P Value
≤1	3994	1577	Reference	Reference	—
2	750	286	0.94 (0.81–1.10)	1.02 (0.85–1.21)	0.85
3	472	160	0.78 (0.64–0.96)	0.84 (0.67–1.05)	0.12
4	291	67	0.46 (0.35–0.61)	0.50 (0.37–0.67)	<0.001
5	394	98	0.51 (0.40–0.64)	0.54 (0.42–0.70)	<0.001
6	145	27	0.35 (0.23–0.54)	0.39 (0.25–0.61)	<0.001
>6	743	103	0.25 (0.20–0.31)	0.27 (0.21–0.34)	<0.001

Figure 2. Unadjusted and Adjusted Rates of Survival to Hospital Discharge According to Time to Defibrillation.

A graded inverse association was seen between time to defibrillation and survival rate (P for trend <0.001). CI denotes confidence interval.

Automated External Defibrillators and Survival After In-Hospital Cardiac Arrest

Paul S. Chan, MD, MSc
Harlan M. Krumholz, MD, SM
John A. Spertus, MD, MPH
Philip G. Jones, MS
Peter Cram, MD
Robert A. Berg, MD
Mary Ann Peberdy, MD
Vinay Nadkarni, MD
Mary E. Mancini, RN, PhD
Brahmajee K. Nallamothu, MD, MPH
for the American Heart Association National Registry of Cardiopulmonary Resuscitation (NRCPR) Investigators

Context Automated external defibrillators (AEDs) improve survival from out-of-hospital cardiac arrests, but data on their effectiveness in hospitalized patients are limited.

Objective To evaluate the association between AED use and survival for in-hospital cardiac arrest.

Design, Setting, and Patients Cohort study of 11 695 hospitalized patients with cardiac arrests between January 1, 2000, and August 26, 2008, at 204 US hospitals following the introduction of AEDs on general hospital wards.

Main Outcome Measure Survival to hospital discharge by AED use, using multivariable hierarchical regression analyses to adjust for patient factors and hospital site.

Results Of 11 695 patients, 9616 (82.2%) had nonshockable rhythms (asystole and pulseless electrical activity) and 2079 (17.8%) had shockable rhythms (ventricular fibrillation and pulseless ventricular tachycardia). AEDs were used in 4515 patients (38.6%). Overall, 2117 patients (18.1%) survived to hospital discharge. Within the entire study population, AED use was associated with a lower rate of survival after in-hospital cardiac arrest compared with no AED use (16.3% vs 19.3%; adjusted rate ratio [RR], 0.85; 95% confidence interval [CI], 0.78-0.92; $P<.001$). Among cardiac arrests due to nonshockable rhythms, AED use was associated with lower survival (10.4% vs 15.4%; adjusted RR, 0.74; 95% CI, 0.65-0.83; $P<.001$). In contrast, for cardiac arrests due to shockable rhythms, AED use was not associated with survival (38.4% vs 39.8%; adjusted RR, 1.00; 95% CI, 0.88-1.13; $P=.99$). These patterns were consistently observed in both monitored and nonmonitored hospital units where AEDs were used, after matching patients to the individual units in each hospital where the cardiac arrest occurred, and with a propensity score analysis.

USE OF AUTOMATED EXTERNAL defibrillators (AEDs) has been proposed as a strategy to reduce times to defibrillation and improve survival from cardiac arrests that occur in the hospital setting.[1,2] However, current evidence to

Survival to Discharge

	AED Used	AED Not Used	Adjusted Rate Ratio (95% CI)	P Value
All Units, no. / total no. (%)				
All arrests	16.3%	19.3%	0.85 (0.78, 0.92)	<.001
VF and pulseless VT	38.4%	39.8%	1.00 (0.88, 1.13)	0.99
Asystole and PEA	10.4%	15.4%	0.74 (0.65, 0.83)	<.001
Monitored Units, no. / total no. (%)				
All arrests	23.2%	23.9%	0.87 (0.79-0.97)	0.01
VF and pulseless VT	48.2%	45.8%	1.03 (0.89-1.18)	0.71
Asystole and PEA	13.4%	18.6%	0.72 (0.62-0.85)	<.001
Non-Monitored Units, no. / total no. (%)				
All arrests	10.2%	12.9%	0.82 (0.70-0.98)	0.03
VF and pulseless VT	22.0%	25.0%	0.93 (0.63-1.36)	0.71
Asystole and PEA	8.2%	11.5%	0.79 (0.65, 0.96)	0.02

Survival to Discharge

	AED Used	AED Not Used	Adjusted Rate Ratio (95% CI)	P Value
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Other Outcomes

	AED Used Value	AED Not Used Value	P Value
Time to Defibrillation, min.			
Monitored Unit			
Median (IQR)	2 (0, 4)	1 (0, 4)	0.04
Delayed (>2 minutes), %	38.9%	35.2%	0.19
Non-Monitored Unit			
Median (IQR)	2 (0, 5)	2 (0, 5)	0.75
Delayed (>2 minutes), %	47.6%	42.4%	0.20
Number of Defibrillation Attempts among patients			
All Units	1 (1, 3)	1 (1, 2)	0.53
Monitored unit	1 (1, 2)	1 (1, 2)	0.30
Non-monitored unit	2 (1, 3)	2 (1, 3)	0.91
Duration of resuscitation prior to restoration of pulse in patients with ROSC, min.			
VF or Pulesless VT, median (IQR)	11 (5, 20)	10 (5, 20)	0.28
Asystole or PEA, median (IQR)	15 (9, 24)	14 (7, 22)	<.001

ORIGINAL ARTICLE

Trends in Survival after In-Hospital Cardiac Arrest

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BACKGROUND

Despite advances in resuscitation care in recent years, it is not clear whether survival and neurologic function after in-hospital cardiac arrest have improved over time.

METHODS

We identified all adults who had an in-hospital cardiac arrest at 374 hospitals in the Get with the Guidelines–Resuscitation registry between 2000 and 2009. Using multi-

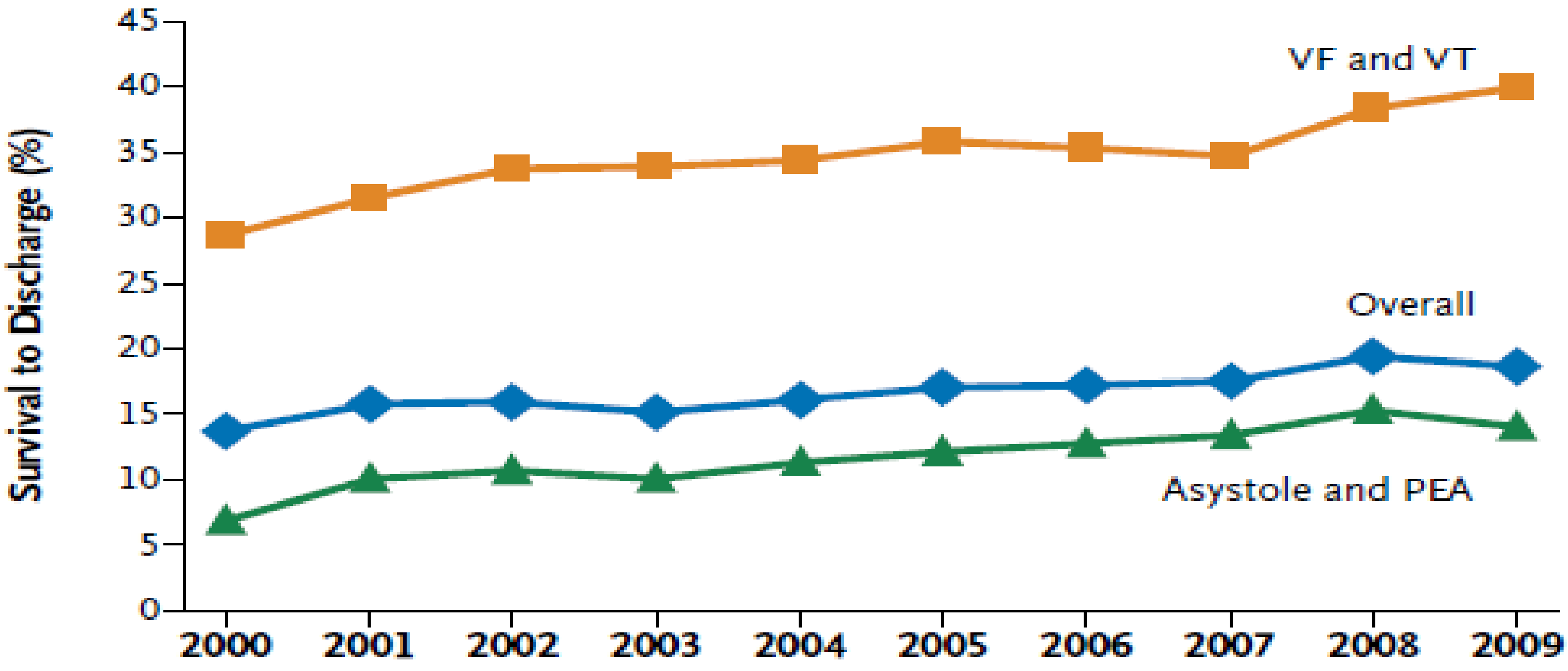
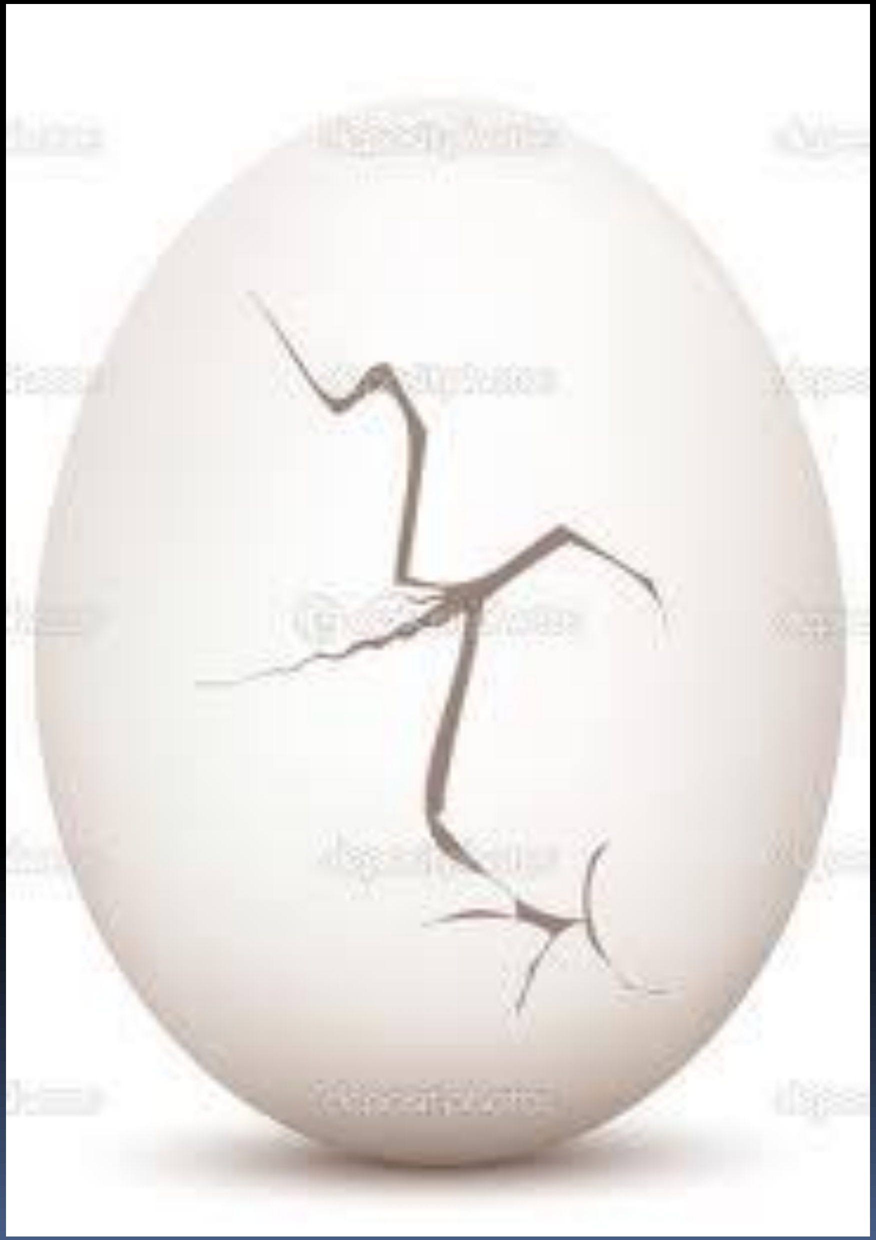


Figure 2. Unadjusted Rates of Survival to Hospital Discharge by Calendar Year.
Observed (crude) rates for survival to discharge are shown for the overall cohort and separately for shockable cardiac-arrest rhythms (ventricular fibrillation [VF] and pulseless ventricular tachycardia [VT]) and nonshockable cardiac-arrest rhythms (asystole and pulseless electrical activity [PEA]). $P<0.001$ for trend for each survival curve.

Model Results

Table 2. Trends in Survival and Neurologic Outcomes.*

Outcome	Risk-Adjusted Rates†										Adjusted Rate Ratio per Year (95% CI)‡	P Value for Trend‡
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009		
	percent											
Survival to discharge	13.7	17.1	18.2	17.8	18.9	20.0	20.5	21.2	23.3	22.3	1.04 (1.03–1.06)	<0.001
Acute resuscitation survival§	42.7	45.1	45.4	46.0	47.0	48.6	49.7	52.5	55.2	54.1	1.03 (1.02–1.04)	<0.001
Postresuscitation survival¶	32.0	38.3	40.0	39.0	40.8	42.1	42.4	41.5	43.6	42.9	1.02 (1.01–1.03)	0.001
Neurologic outcome in survivors												
Clinically significant disability‖	32.9	35.7	31.9	34.3	34.0	33.1	33.0	32.7	31.8	28.1	0.98 (0.97–1.00)	0.02
Severe disability**	10.1	10.5	9.8	10.5	11.5	11.5	9.7	12.2	11.7	10.7	1.01 (0.98–1.04)	0.37



Current Gaps in Knowledge

- We know a lot more about the epidemiology and outcomes of IHCA

Current Gaps in Knowledge

- We know a lot more about the epidemiology and outcomes of IHCA
- We know very little about HOW to do better

Current Gaps in Knowledge

- We know a lot more about the epidemiology and outcomes of IHCA
- We know very little about HOW to do better

  - Who are the high and low performers?

BEFORE: GWTG-R Survival Rates

- Previously, results were “unadjusted”

BEFORE: GWTG-R Reports on Survival

Which Hospital Has Better Outcomes?

Hospital A: 30 survivors in 100 IHCA (30%)

» 20 VT or VF

» 80 asystole or PEA

Hospital B: 40 survivors in 100 IHCA (40%)

» 80 VT or VF

» 20 asystole or PEA

BEFORE: GWTG-R Reports on Survival

Hospital A

	Alive	Total	% Survival
Overall	30	100	30.0%
VF / VT	14	20	70.0%
Asystole / PEA	16	80	20.0%

Hospital B

	Alive	Total	% Survival
Overall	40	100	40.0%
VF / VT	38	80	47.5%
Asystole / PEA	2	20	10.0%

Risk-Standardizing Survival

- Provides a fair “Apples to Apples” comparison
- Accounts for cardiac arrest rhythm, hospital location of patient’s arrest, and other important patient factors

Creating Adult Model

- Multivariable Model created

$$Y_{ij} \sim \text{Bern}\,(p_{ij}),$$
$$\text{logit}\,(p_{ij}) = \beta_{0i} + \beta_1 \mathbf{x}_{ij},$$
$$\beta_{0i} \sim N(\mu, \tau^2),$$

- Apply model coefficients to each patient

$$RASR_i = \frac{\sum_{j=1}^{n_i} E(Y_{ij} \mid \beta_{0i}; \mathbf{x}_{ij}, \beta_{1i}, \mu, \tau^2)}{\sum_{j=1}^{n_i} E(Y_{ij} \mid \mathbf{x}_{ij}, \beta_{1i}, \mu, \tau^2)} \times \overline{Y}.$$

Predictor	Beta-Weight Estimate	Odds Ratio	95% CI
Age			
<50	0	Reference	Reference
50-59	0.0031	1.00	0.91-1.11
60-69	-0.0096	0.99	0.90-1.09
70-79	-0.2560	0.77	0.70-0.85
≥ 80	-0.6562	0.52	0.47-0.57
Initial cardiac arrest rhythm			
Asystole	0	Reference	Reference
Pulseless electrical activity	0.0478	1.05	0.98-1.13
Ventricular fibrillation	1.2631	3.54	3.24-3.86
Pulseless ventricular tachycardia	1.1289	3.09	2.79-3.43
Hospital location			
Non-monitored unit	0	Reference	Reference
Intensive care unit	0.5643	1.76	1.60-1.93
Monitored unit	0.4816	1.62	1.46-1.79
Emergency room	0.5618	1.75	1.56-1.97
Procedural or surgical area	1.1550	3.17	2.80-3.60
Other	0.6210	1.86	1.54-2.25
Hypotension	-0.4749	0.62	0.57-0.67
Sepsis	-0.4879	0.61	0.56-0.68
Metastatic or hematologic malignancy	-0.7345	0.48	0.43-0.53
Hepatic insufficiency	-0.7240	0.48	0.42-0.56
Mechanical ventilation	-0.5662	0.57	0.53-0.61
IV Vasopressor	-0.7329	0.48	0.44-0.52

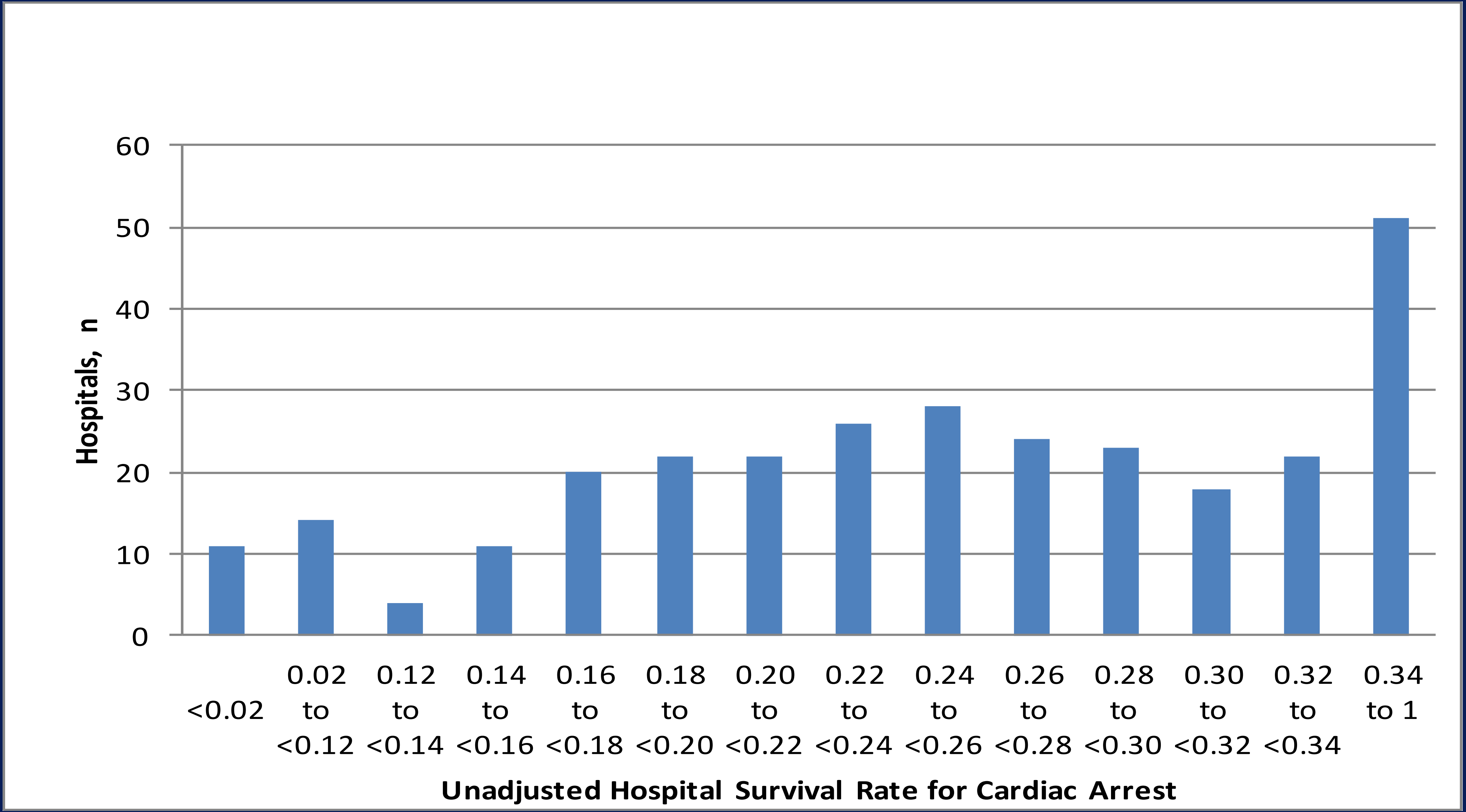
9 Key Variables (Adults)

Table 3. Model Predictors for Survival to Discharge

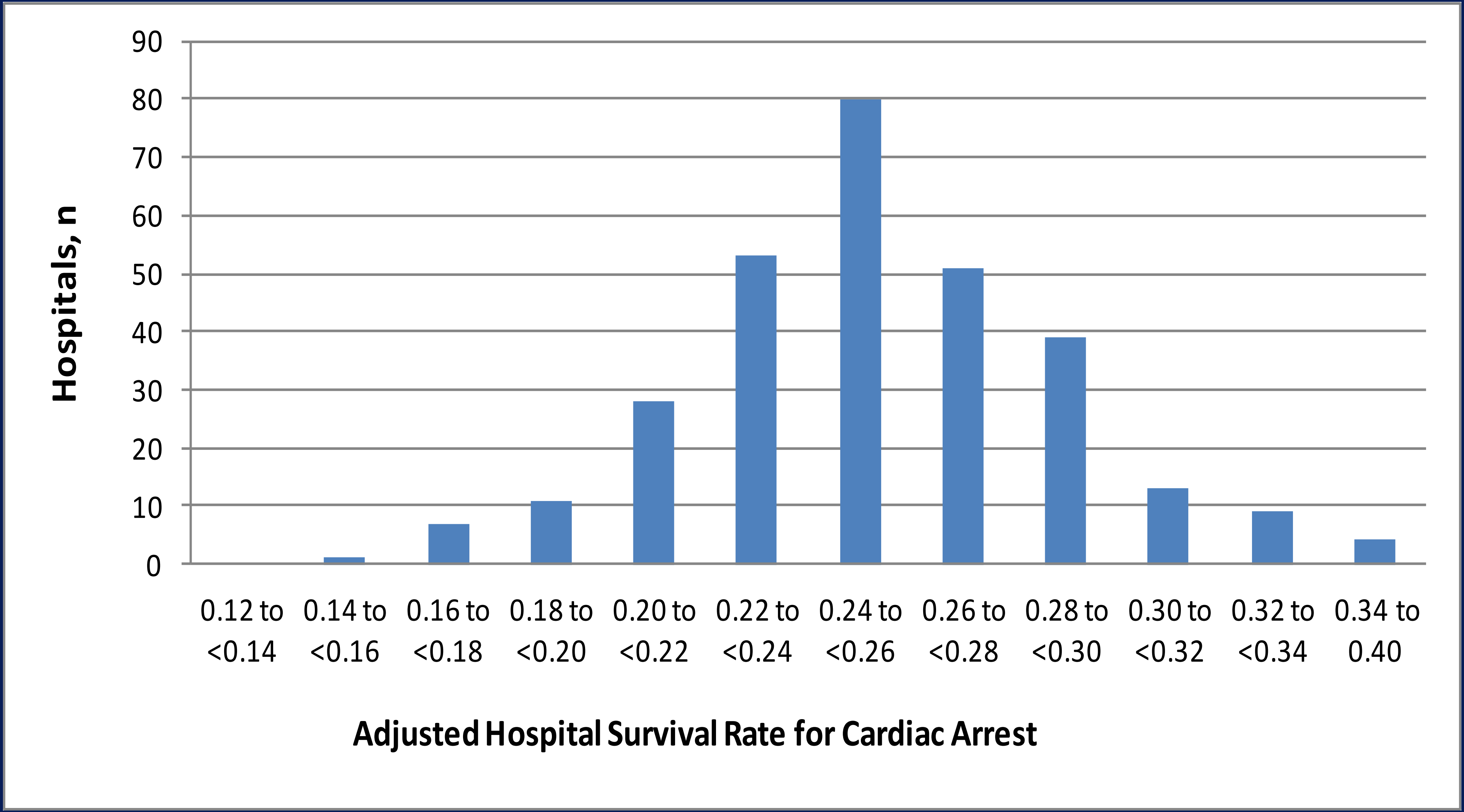
Predictor	Odds Ratio (95% CI)
Age	
Older children (8–18 y)	Reference
Neonates (0–1 mo)	0.95 (0.65, 1.39)
Infants (1 mo to <1 y)	1.67 (1.17, 2.40)
Young children (1–8 y)	1.21 (0.84, 1.73)
Male sex	0.86 (0.69, 1.08)
Illness category	
Medical-Cardiac	Reference
Medical-Noncardiac	0.88 (0.61, 1.27)
Surgical-Cardiac	1.86 (1.23, 2.81)
Surgical-Noncardiac	1.23 (0.74, 2.03)
Other	0.93 (0.57, 1.50)
Hypotension	0.85 (0.64, 1.13)
Renal insufficiency	0.50 (0.32, 0.79)
Metabolic or electrolyte abnormality	0.79 (0.57, 1.09)
Acute nonstroke CNS event	0.61 (0.37, 1.02)
Septicemia	0.65 (0.46, 0.94)
Major trauma	0.39 (0.21, 0.71)
Mechanical ventilation	0.79 (0.59, 1.06)
Intravenous vasoactive agents	0.49 (0.36, 0.65)
Location of arrest	
Unmonitored unit	Reference
ICU	1.23 (0.74, 2.06)
Procedure areas	2.10 (1.12, 3.96)
ED	0.49 (0.27, 0.86)
Monitored unit	0.42 (0.18, 0.99)
Other	1.14 (0.53, 2.47)
Cardiac arrest rhythm	
Asystole	Reference
PEA	1.18 (0.90, 1.54)
VF	1.23 (0.75, 2.00)
PVT	1.95 (1.18, 3.22)

13 Key Variables (Pediatrics)

Before Risk-Standardization - Unadjusted



After Risk-Standardization - Adjusted



GET WITH THE GUIDELINES.

Community Page

Current User: [redacted] Site: [redacted]

News | Contact Us | Logout

Get Started!

AtrialFib	N/A	N/A	N/A	
Carotid Artery Stenting	N/A	N/A	N/A	
Children's Asthma Care	N/A	N/A	N/A	
Core Measures	N/A	N/A	N/A	
Heart Failure	N/A	N/A	N/A	
Inpatient Diabetes PMT	N/A	N/A	N/A	
NCDR	N/A	N/A	N/A	
Resuscitation	N/A	N/A	N/A	
Stroke	N/A	N/A	N/A	
Total Quality	N/A	N/A	N/A	

Trainings

Advanced Reporting: Learn more about using measures interface features such as filters, display options, and exporting your reports to PDF and Excel.

Downloading: Learn how to quickly access your data in a spreadsheet format

HF: An introduction to the HF tool, including navigating the system, entering data, and running reports

Report Writer: Create customized reports on your data

Stroke: An introduction to the Stroke tool, including navigating the system, entering data, and running reports

Uploader 2.0: Step-by-step instructions on the file creation and upload processes

Resuscitation: An introduction to the Resuscitation tool, including navigating the system, entering data, and running reports

LEGEND:

- New Patient
- All Patients
- Reports
- Resources

Midas GWTG Quick Start Guide

Reminder!
Quintiles is a vendor for *ACTION Registry-GWTG.*

For more information please click the FAQ link under Resources.

If you are a CAD user please contact the Help Desk before the end of this year to transition.

My Hospital

		Start Date	AHA Baseline Date
AtrialFib	0		N/A
Heart Failure	495	03/02/2011	02/11/2011
NCDR	0		N/A
Resuscitation	523	11/13/2010	03/22/2001
Stroke	402	03/17/2009	03/04/2009
TOTAL	1420		

Snapshot

	# of Hospitals:	# of Records:
AtrialFib	28	3153
Heart Failure	958	1077407
NCDR	91	40197
Resuscitation - Patients	775	622039
Resuscitation - CPA		310115
Resuscitation - ARC		43977
Resuscitation - MET		392515
Resuscitation - PCAC		711
Stroke	[illegible]	3208044

Last updated 11/05/2014 at 04:00

Local Get With The Guidelines® Contact

SouthWest Affiliate

Vice President: Stephanie Chapman

Email: stephanie.chapman@heart.org

My Reports

- GWTG Stroke On Demand Trend Reports and Slides
- GWTG HF On Demand Trend Reports and Slides
- GWTG Resus On Demand Trend Reports and Slides
  - Heart Failure Data Quality Report
  - Stroke InSights Data Quality Report
  - Stroke Mortality Report
  - Resuscitation Data Completeness Report
  - Get With The Guidelines-Resuscitation Risk Adjusted Survival to Discharge Report

Recent Communications from Quintiles and the AHA

Get With the Guidelines...

Patient Education

Atrial Fibrillation

Finding the Report Link

My Reports

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Finding the Report Link

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Resuscitation - PCAC			711
Stroke	2446	3208044	

Last updated 11/05/2014 at 04:00

My Reports

GWTG Stroke On Demand Trend Reports and Slides

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Patient Education

Atrial Fibrillation

Get With The Guidelines-Resu McAfee

Get With The Guidelines-Resuscitation Risk Adjusted Survival to Discharge Report

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NCDR	91	40197
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Patient Education

Atrial Fibrillation

Get With The Guidelines-Resu McAfee

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Resuscitation Data Completeness Report

Get With The Guidelines-Resuscitation Risk Adjusted Survival to Discharge Report

Patient Education

Atrial Fibrillation

https://qi.outcome.com/dqr/fr McAfee

Get with the Guidelines Resuscitation
In-Hospital Cardiac Arrest Survival Report Interpretation Guide

HOW CAN THIS REPORT BE HELPFUL TO MY SITE?

To facilitate more meaningful hospital comparisons of survival for cardiac arrests occuring in hospitals, GWTG-Resuscitation has developed models to risk-standardize rates of survival to hospital discharge for patients with in-hospital cardiac arrest (IHCA). The survival rate is risk-adjusted, so that we can compare similarly ill patients across hospitals. The risk-adjustment is based on a previously validated and published model and accounts for 9 key factors:

- Age (<50, 50-59 60-69, 70-79, >80)
- Initial cardiac arrest rhythm (VF, pulseless VT, asystole, PEA)
- Hospital Location (ICU, monitored/telemetry, non-monitored, procedural, ER, other)
- Hypotension prior to cardiac arrest
- Sepsis
- Metastatic or Hematologic Malignancy
- Hepatic Insufficiency
- On Mechanical Ventilation at time of cardiac arrest
- On intravenous vasopressors at time of cardiac arrest

1 / 4

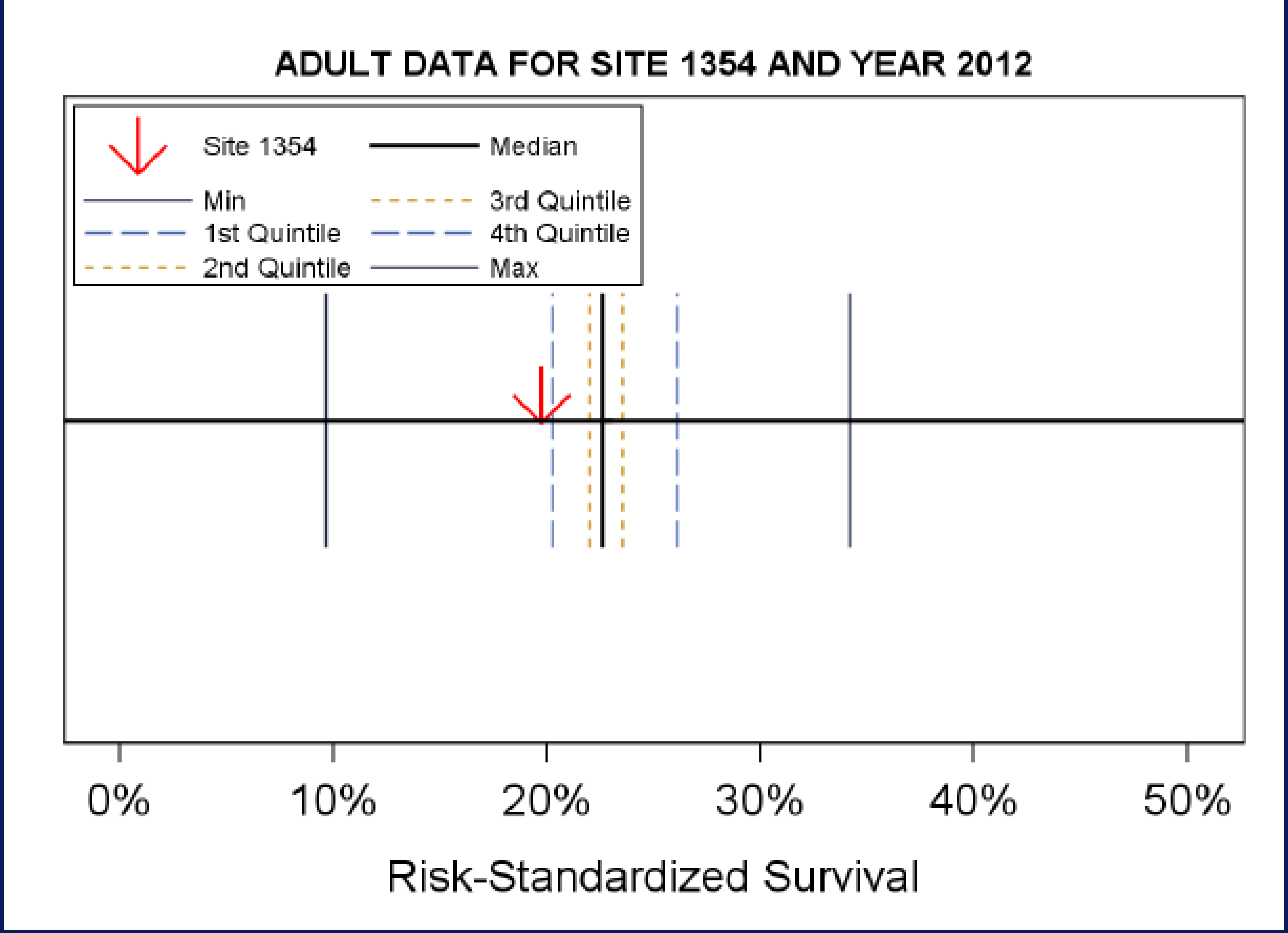
and your hospital's survival quintile. For instance, hospitals in quintile 5 have risk-standardized survival rates that are better than ≥80% of GWTG-Resuscitation hospitals, as quintile 5 includes

Hospital Report – By Number

CPA Events Occurring in Year: 2012

	SITE 1354
	Year 2012
Risk-Standardized Survival	19.7%
Risk-Standardized Survival Quintile	1

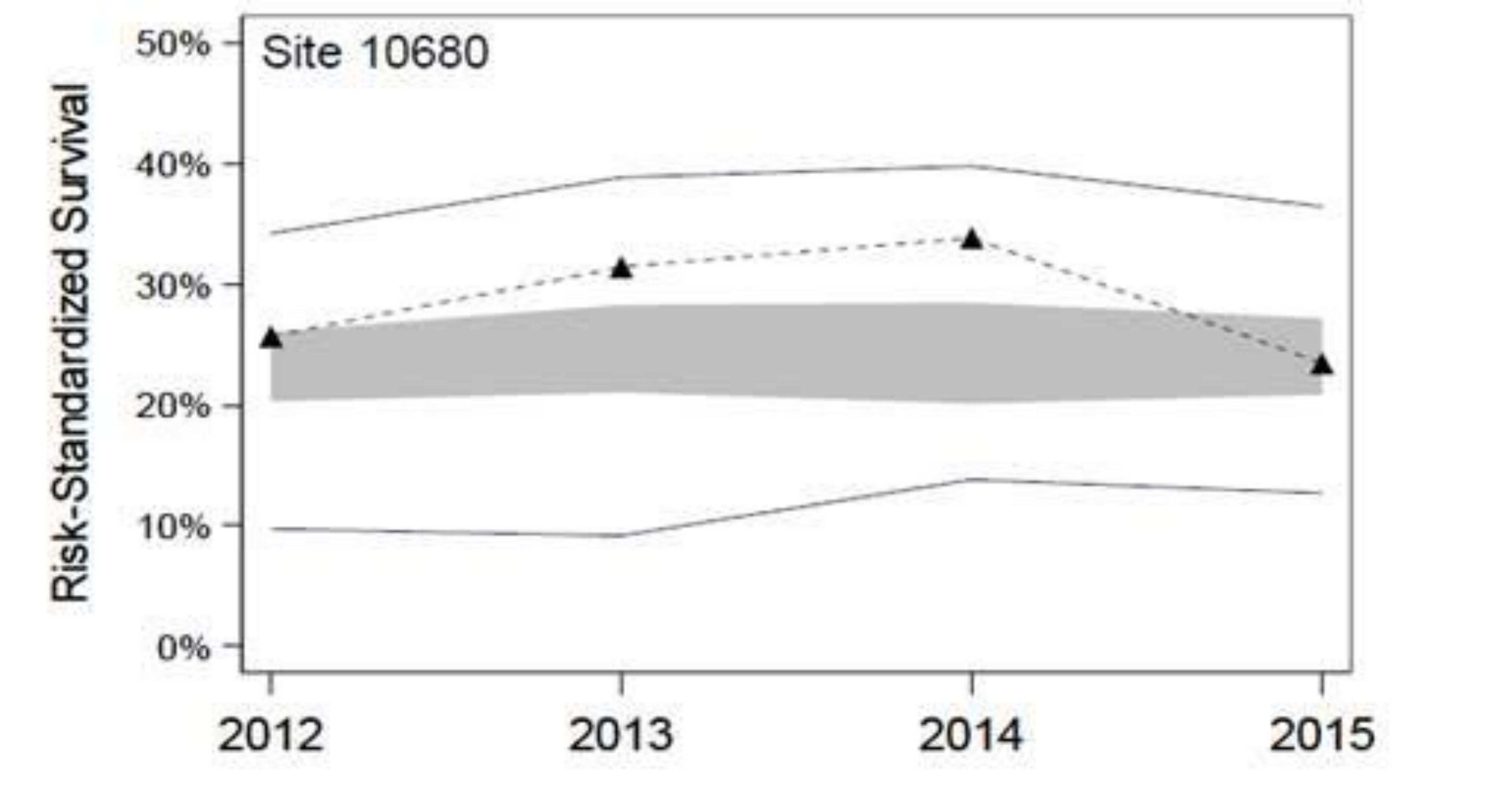
Hospital Report – By Pictorial



Meaning of Each Quintile

	Your Hospital's Survival Rate is	
Quintile	**In this Percentile Range**	**And is Better than at least**
5	81-99	80% of hospitals
4	61-80	60% of hospitals
3	41-60	40% of hospitals
2	21-40	20% of hospitals
1	1-20	N/A

Can Also Examine Annual Trends



Current Gaps in Knowledge

- We know a lot more about the epidemiology and outcomes of IHCA
- We know very little about HOW to do better

  - Who are the high and low performers?

  - What are they doing differently?

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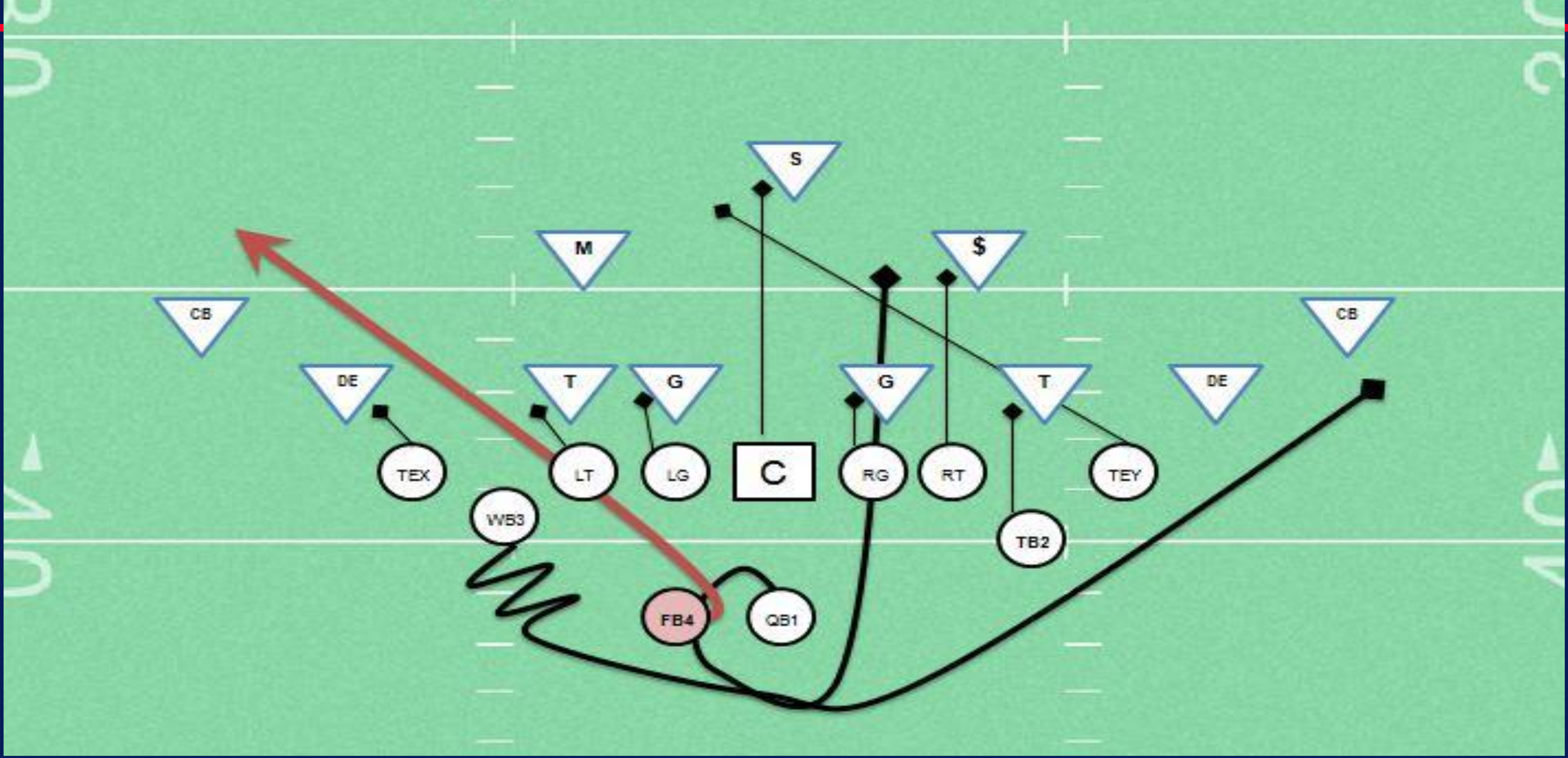
- We know a lot more about the epidemiology and outcomes of IHCA
- We know very little about HOW to do better
  - Who are the high and low performers?
  - What are they doing differently?
  - How are they doing it better?
  - Why are they able to succeed while others are not?

Spin 3MO 45 FB Dive



Information Gap in IHCA

- Need for more granular hospital information on:

Information Gap in IHCA

- Need for more granular hospital information on:
  - Preventing IHCA

Information Gap in IHCA

- Need for more granular hospital information on:
  - Preventing IHCA
  - Treating IHCA

Information Gap in IHCA

- Need for more granular hospital information on:
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  - Treating IHCA
  - Leadership and Culture

Information Gap in IHCA

- Need for more granular hospital information on:
  - Preventing IHCA
  - Treating IHCA
  - Leadership and Culture
  - Efforts and innovations for QI (mock codes, debriefing, checklists, CPR quality monitoring)

Help Us Understand Your Performance

HEROIC

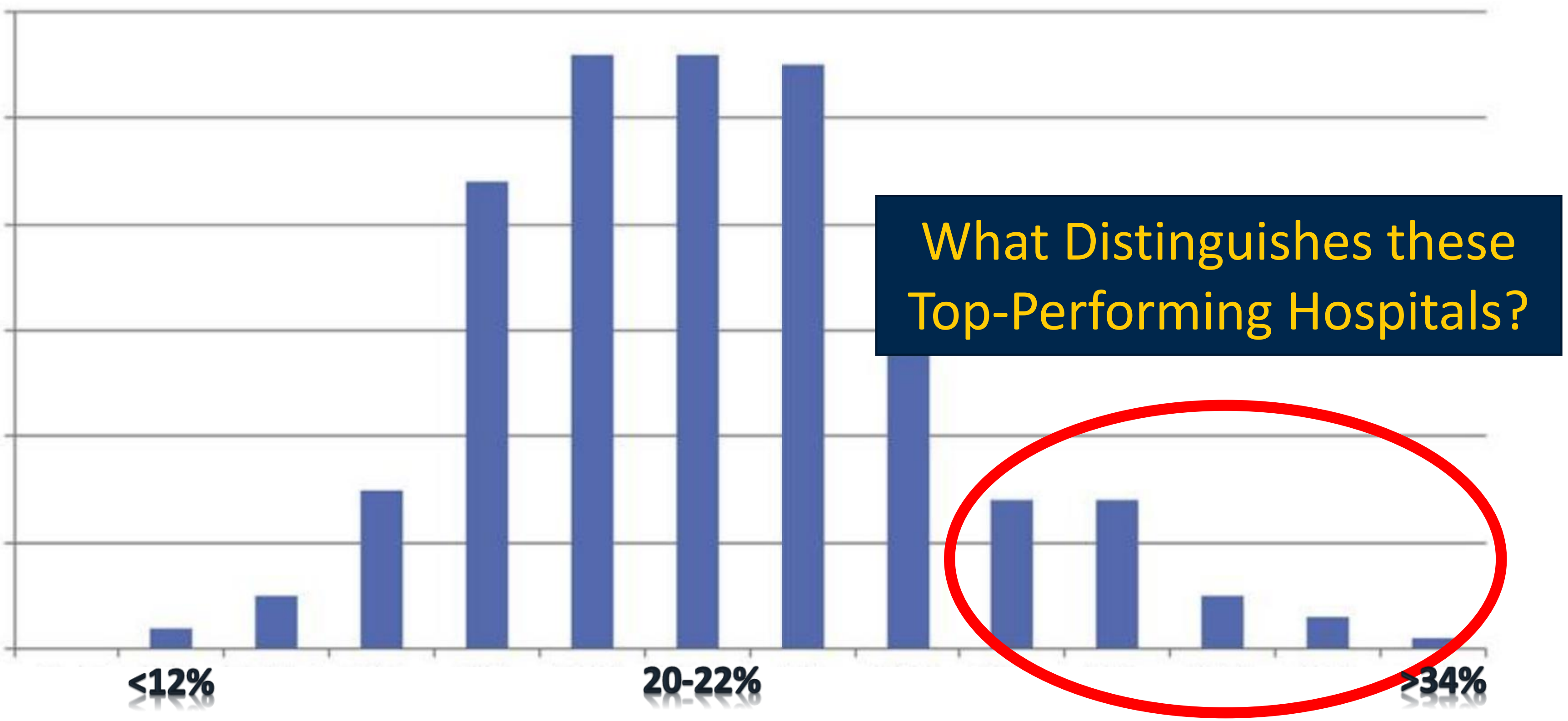
Hospital Enhancement of Resuscitation Outcomes for In-hospital Cardiac arrest

Saint Luke's

MID AMERICA HEART INSTITUTE

University of Michigan Health System

IHCA SURVIVAL
VARIES ACROSS HOSPITALS



JACC 2013

Hospitals Better Because?

- Prior studies found structural factors differ between top-performing hospitals and others
  - Size
  - Geography
  - Teaching status
- Surveys find resuscitation practices differ but these factors are not modifiable

NEJM 2008; JAMA 2009; NEJM 2012; Lancet 2012; JAMA Cardiology 2016

Sequential Mixed-Methods Study

Survey of 150 U.S. hospitals followed by a qualitative phase consisting of semi-structured, in-person interviews and site visits at 9 hospitals

Quantitative phase	*Qualitative phase*	*Quantitative phase*
Part 1 →	Part 2 →	Part 3
• Surveyed IHCA personnel at 150 hospitals	• Interviews with key informants at 9 hospitals across the U.S.	• Re-design of survey and its administration

Original Investigation

Resuscitation Practices Associated With Survival After In-Hospital Cardiac Arrest
A Nationwide Survey

Paul S. Chan, MD, MSc; Sarah L. Krein, PhD, RN; Fengming Tang, MS; Theodore J. Iwashyna, MD, PhD; Molly Harrod, MS; Mary Kennedy, BA; Jessica Lehrich, BS; Steven Kronick, MD; Brahmajee K. Nallamothu, MD, MPH; for the American Heart Association's Get With the Guidelines–Resuscitation Investigators

Supplemental content at jamacardiology.com

IMPORTANCE Although survival of patients with in-hospital cardiac arrest varies markedly among hospitals, specific resuscitation practices that distinguish sites with higher cardiac arrest survival rates remain unknown.

OBJECTIVE To identify resuscitation practices associated with higher rates of in-hospital cardiac arrest survival.

DESIGN, SETTING, AND PARTICIPANTS Nationwide survey of resuscitation practices at hospitals participating in the Get With the Guidelines–Resuscitation registry and with 20 or more adult in-hospital cardiac arrest cases from January 1, 2012, through December 31, 2013. Data analysis was performed from June 10 to December 22, 2015.

MAIN OUTCOMES AND MEASURES Risk-standardized survival rates for cardiac arrest were

Table 3. Adjusted Associations Between Hospital Factors and Risk-Standardized Survival Rates for In-Hospital Cardiac Arrest

Hospital Resuscitation Strategy or Factor	Adjusted Odds Ratio (95% CI)	*P* Value
Frequency of review of in-hospital cardiac arrest cases		
Less than once quarterly	1 [Reference]	.03
At least once monthly	8.55 (1.79-40.00)	
At least once quarterly	6.85 (1.49-31.30)	
Monitoring for interruptions of chest compressions	2.71 (1.24-5.93)	.01
Adequate resuscitation training at one's hospital (not a barrier or only mild barrier)	3.23 (1.21-8.33)	.02
Monitoring of times to defibrillation	1.89 (0.74-4.83)	.18
Frequency of immediate code debriefing		
Not at all or <10% of all resuscitations	1 [Reference]	.65
10%-49% of all resuscitations	1.19 (0.44-3.23)	
50%-100% of all resuscitations	1.56 (0.61-4.00)	
Presence of intensive care specialist in hospital ICUs at all times	1.84 (0.84-4.00)	.13
Lack of resuscitation champion is a moderate to severe barrier at one's hospital	0.56 (0.21-1.49)	.25

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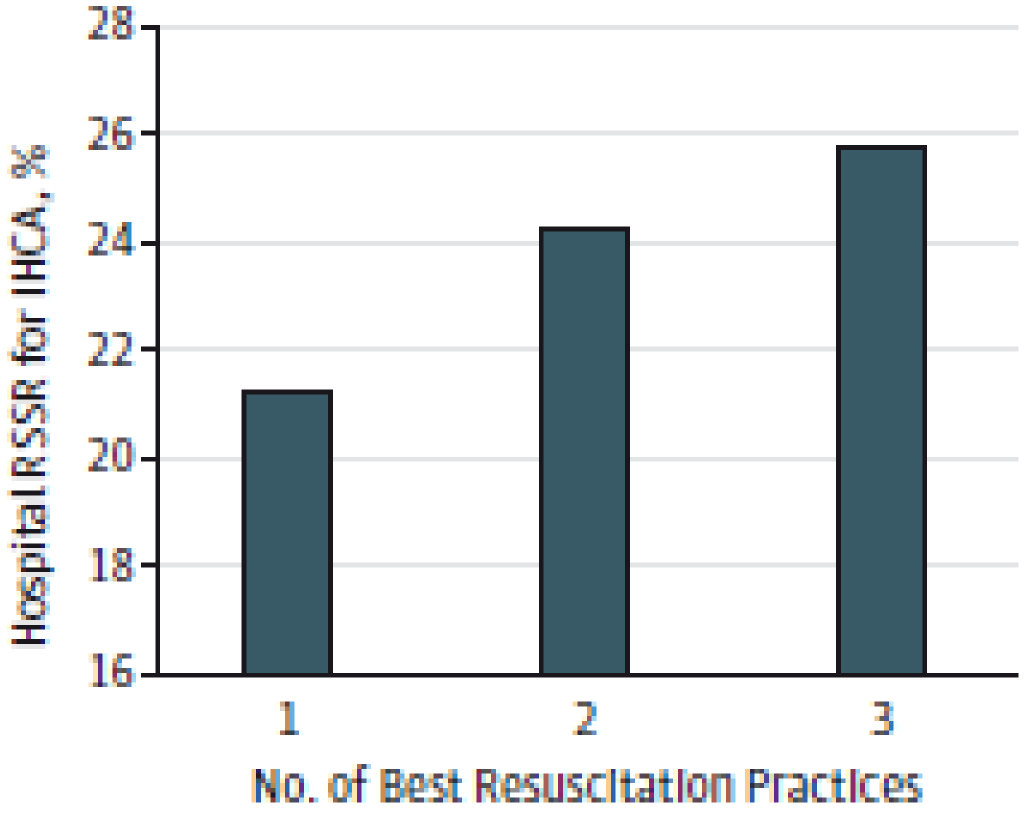
Figure 2. Risk-Standardized Survival Rates (RSSRs) for In-Hospital Cardiac Arrest (IHCA) for Hospitals Using 1, 2, or All 3 Resuscitation Practices



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Quantitative phase	*Qualitative phase*	*Quantitative phase*
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• Surveyed IHCA personnel at 150 hospitals	• Interviews with key informants at 9 hospitals across the U.S.	• Re-design of survey and its administration

Hospital Selection

- GWTG-R hospitals between 2012-2014
- At lea…
- Selec… …ance appro…
  - 5 "…
- Also …
- 12 hospitals approached; 9 accepted

Table 2. Hospital Characteristics

Hospital	Region	Staffed Beds	RSSR, percentile, 2014	Teaching Status
1	Midwest	>800	92.7	Major
2	Midwest	200 to 400	87.9	Minor
3	South	>400 to 800	97.8	Non-Teaching
4	Midwest	200 to 400	93.9	Major
5	West	200 to 400	2.5	Minor
6	South	>800	2.1	Minor
7	West	200 to 400	17.2	Non-Teaching
8	Northeast	>800	100	Major
9	Northeast	>400 to 800	10.3	Minor

RSSR = risk-standardized survival rate

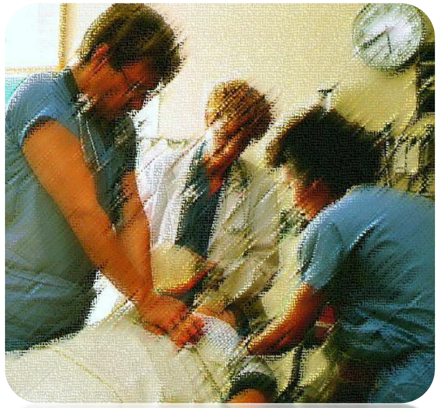
Data Collection

- 158 interviews performed between 2016-2017
  - CEOs, Chiefs of Staff, VPs, Directors, QI Staff
  - Hospitalists, Critical Care & Emergency Medicine Docs, Anesthesiologists, & Residents
  - Nurses (NPs, ICU nurses, floor nurses), RT, PAs, Pharmacy, IV Team, ACLS Staff, Security, Spiritual Services, & Biomed Engineering
- 78 hours 29 mins; 778,482 transcribed words

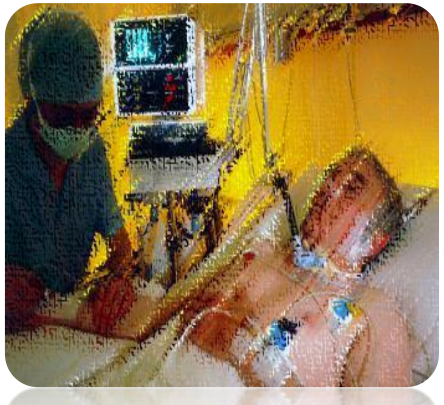
METHODS: INTERVIEWS

- Interviewees used semi-structured interview guide

Pre-IHCA



During IHCA



Post-IHCA

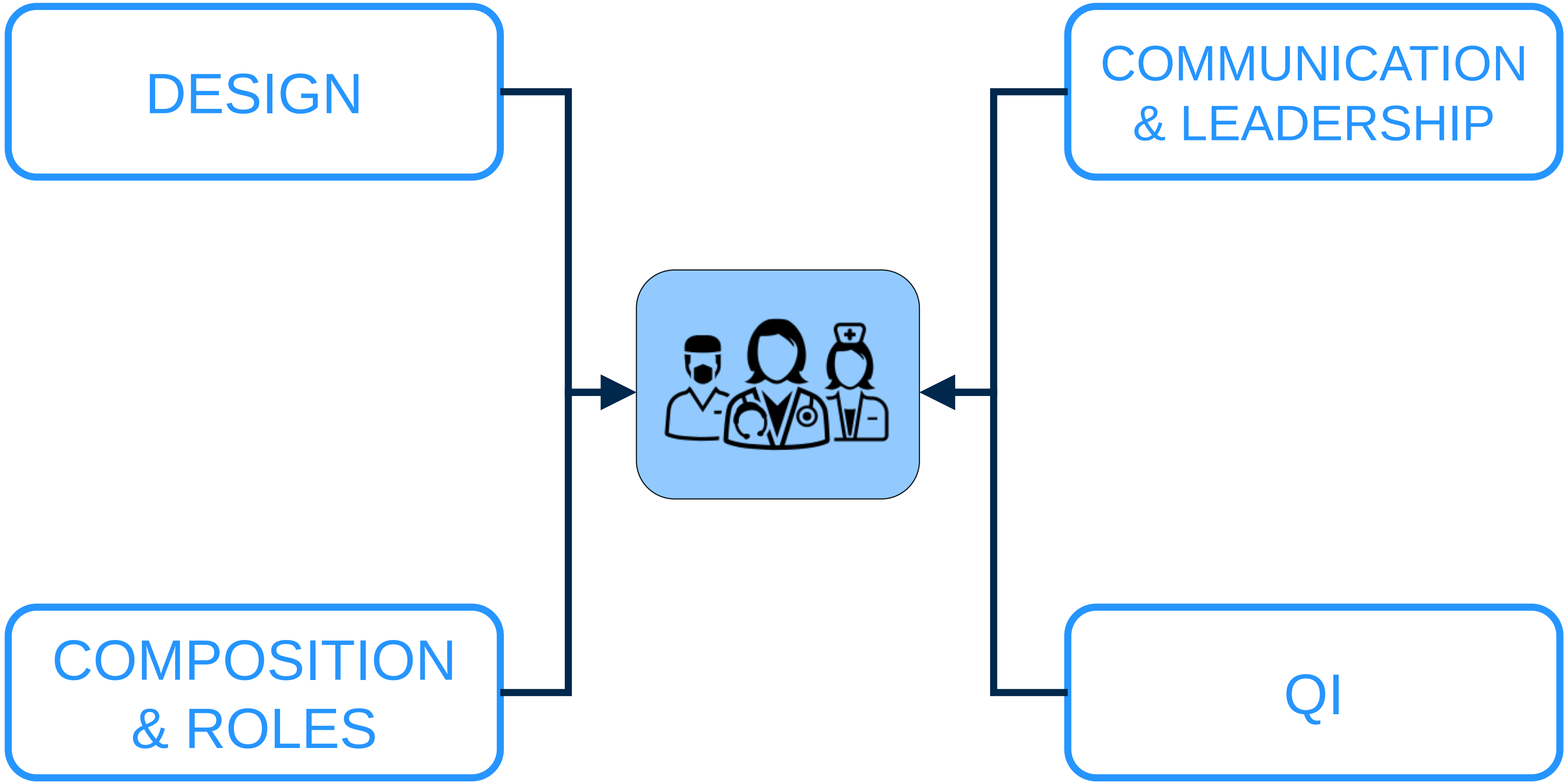
- 1 Clinician:1 Methods Expert paired in interviews; only 2 PIs “unblinded“ to hospital performance

Methods: Analysis

- Transcripts coded by 4 team members
- Analyzed using MAXQDA software
- Summary reports generated for each site and reviewed together
- Team members met regularly to question, discuss, and document interpretations and findings
- Key themes identified through rigorous analytic process and based on our conceptual framework

Results

Four Themes Distinguished Resuscitation Teams



Theme #1:
Team Design

- Two axes (for Nursing)
  - **Dedicated Teams**: Were members specifically tasked to teams?
  - **Designated Teams**: Were members assigned to teams prior to IHCA?
- Top hospitals: Dedicated or Designated teams
- Middle & bottom hospitals did <u>not</u>

Dedicated Team

- *”You have the ‘team’…a dedicated team… That’s this is all they’re doing, waiting, like having a fire service…”*
  - Critical Care Doc, Hospital A

DESIGNATED TEAM

- *“They come up with a plan beforehand, on who’s going to assume that role so they’re not doing it in the moment, during the crisis.”*
  - Nurse Supervisor, Hospital B

Different at Bottom Hospitals

- *“We’ve tried to say, ‘okay, at the beginning of the shift, you're the code nurse,’ but it never…very rarely happened…so usually, we don’t assign code nurses anymore. As soon as we hear it called, you will see if there’s people in the hallway, or a head sticking out doors”*
  - Critical Care Nurse Hospital G

Theme #2: Team Composition & Roles

- Composition did not differ across hospitals for key staff: docs, nurses, RT, anesthesia
- More variable around pharmacy, IV, EKG, spiritual services, security but this was not consistent across hospitals

Roles Did Differ…

- Top hospitals had roles & responsibilities for team members delineated prior to an IHCA
- Often trained to perform specific functions (including empowerment of frontline nursing)
- Bottom hospitals assigned roles after arrival leading to possible delays and confusion

Top Hospitals

- *“15 years ago when I started it was a free for all…. So when (Medical Director) took over and, and kind of structured everything…You just show up and you know what you’re supposed to do, and there’s no screaming and there’s no yelling.”*
  - Critical Care Nurse; Hospital B

Other Factors Related to Roles

- Universal complaint of “crowd control”
- Major differences in residents at hospitals with teaching programs
  - Top Hospitals appeared to support residents with senior staff also available
  - Bottom hospitals less support for residents

Bottom Hospitals

- *“I don't mean they [residents] suck, but look at what we give 'em. They come in as first years, they don't know anything. They come in as second years, they sort of know what's going on. By the third year, their starting their stride. They start to get good at what they do, and then they graduate and leave, and then we're back to the people that are being fed through the PEZ container…”*
  - ACLS Instructor, Hospital I

Theme #3: Communication & Leadership

- Top hospitals emphasized communication & mutual interdisciplinary respect with corrective mechanisms for dealing with problems
- Bottom hospitals struggled with communication and frequently described codes as “chaos”

Closing the Communication Loop

"Communication just needs to get better. There are some residents who are really good at giving direct orders or finding roles, closing the loop, all that stuff. But, there are some who aren't trained on that and they don't know how to do it and so, will talk softly or they won't give a complete order and things kind of get lost."

Theme #4:
QI Efforts

- Mock Codes (i.e., “practice runs”) universally praised but treated differently at top hospitals
  - Multidisciplinary
  - “Unplanned”
  - Focused with debriefs (“less than 20 mins”)

“Imagine an orchestra that never practices…”

What Didn't Distinguish Top Hospitals?

- ACLS Certification Requirements
- Technology
  - Ultrasound
  - Mechanical Chest Compression
  - Bedside Laboratory Tests

What Does This All Mean?

- Key themes do distinguish top hospitals' resuscitation teams from middle- & bottom hospitals

- Adopting approaches that address these themes may help hospitals to improve IHCA outcomes

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An American Heart Association® and Laerdal® Program

RQI 2020

Verified CPR Competence is the New Standard of Care

In-Hospital Cardiac Arrests

200,000 cardiac arrests
occur in US hospitals yearly

1/4 survive

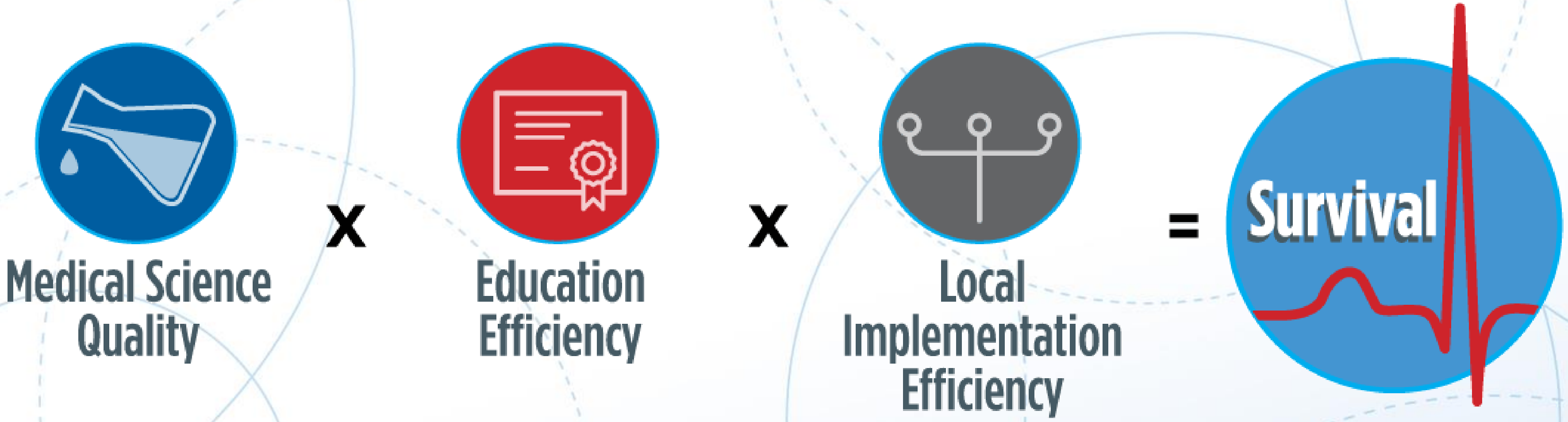
Rapid delivery of high-quality CPR is the greatest determinant of survival from cardiac arrest

There is an unacceptable disparity in the quality of resuscitation

- 42% difference in the odds of survival for patients at similar hospitals, with a similar case-mix

*Data gathered from AHA GWTG Resuscitation Hospitals across the country

There is an *UNACCEPTABLE DISPARITY* in the odds for survival



Efficient Education is a combination of three factors, *as defined in the AHA's Education Statement:*

- **High-quality CPR mastery learning** with measurement and feedback
- **Low-dose, high-frequency spaced learning**, bringing practice out of the classroom and into the workplace and clinical environment
- **Focus on continuous quality improvement and verified competence**, rather than compliance to a training schedule

RQI RESUSCITATION QUALITY IMPROVEMENT®

An American Heart Association® and Laerdal® Program

RQI 2020 Roadmap for Resuscitation Excellence

Shifting the paradigm and moving to better quality

RQI RESUSCITATION QUALITY IMPROVEMENT®

An American Heart Association® and Laerdal® Program

Foundational Components of RQI

Focus on *mastery of competence* and *confidence*, not just compliance

- **Baseline Skills Assessment**
  No card required for entry into the program

- **Low Dose-High Frequency: Online Learning Modules**
  Quarterly Cognitive and Skills sessions
  (RQI Healthcare Provider takes approximately 15 – 25 minutes every 90 days)

- **E-Simulation Patient Cases**

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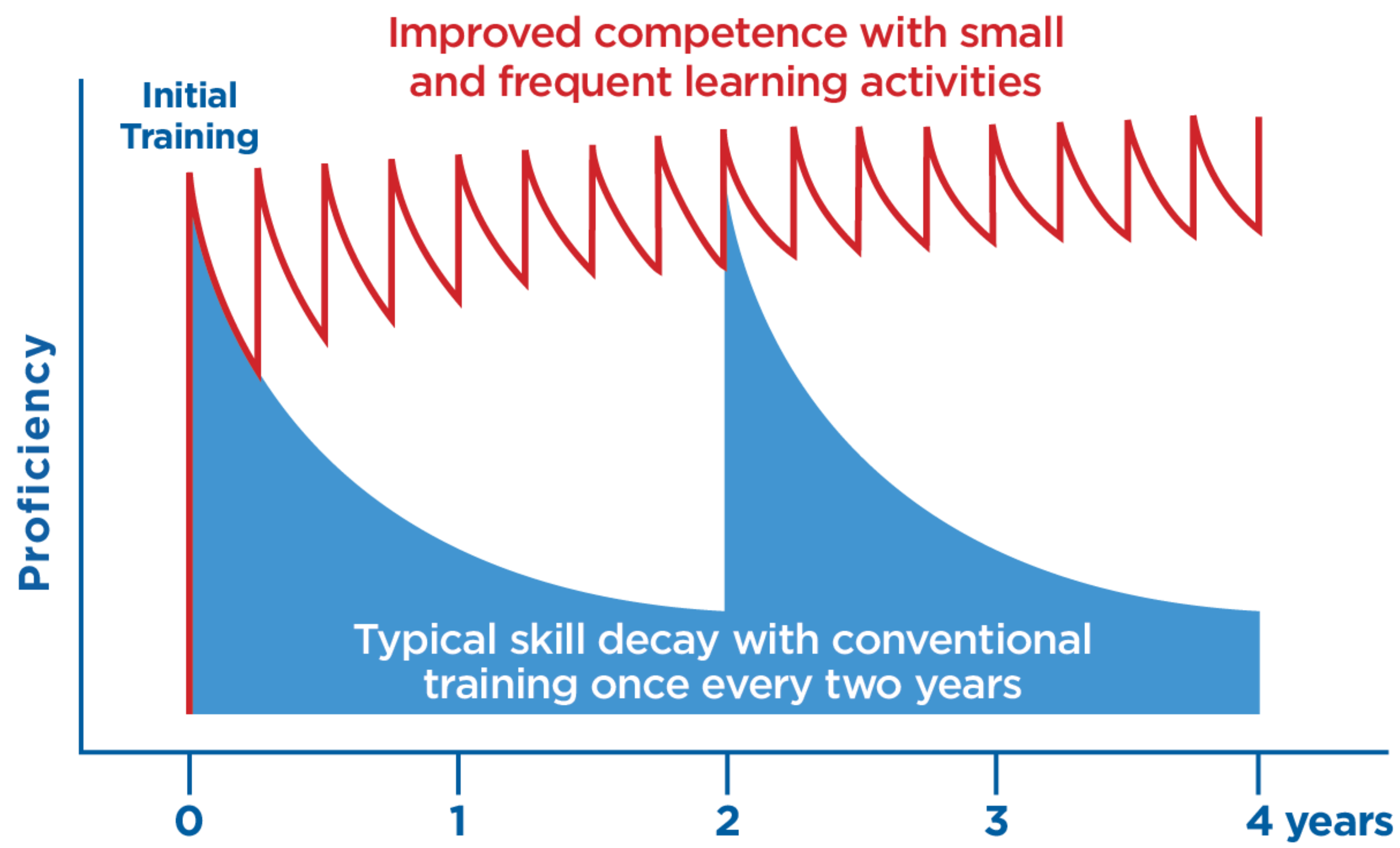
An American Heart Association® and Laerdal® Program

CPR Skills Decline



RQI 2020 eCredentials

Shifts the resuscitation paradigm toward validation of skills and knowledge rather than compliance-based course completion

- **Verification** by the AHA RQI Program that the student has demonstrated competence
- Valid through the date of compliance when skills and knowledge must again be demonstrated – **before the decay of skills occurs**

A compliant RQI Provider is *competent* in high-quality CPR skills!

RQI RESUSCITATION QUALITY IMPROVEMENT®
An American Heart Association® and Laerdal® Program

RQI: Answering the Needs of Healthcare Organizations

Delivering Innovation

Better Patient Outcomes… Saving More Lives

High Reliability

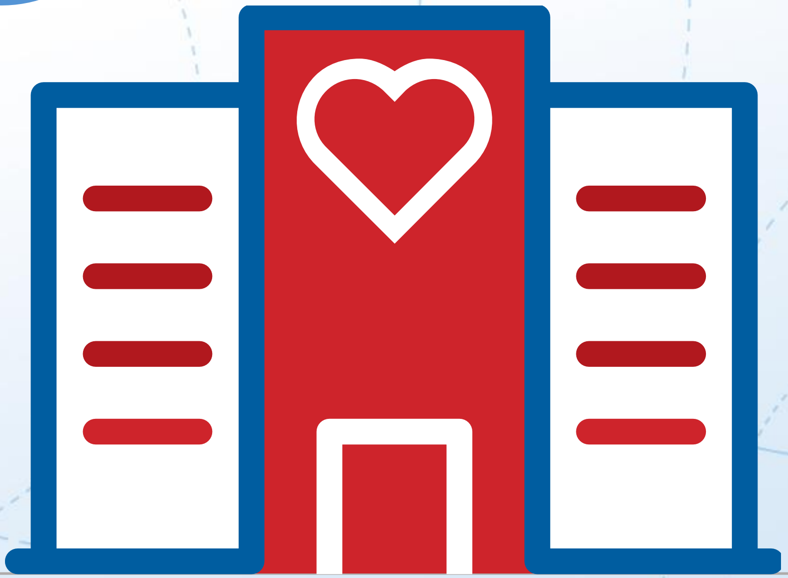
Staff Satisfaction

Quality Improvement & Quality Care

Potential Cost Savings

Scalability

Mission Achievements



Operational Efficiencies

RQI RESUSCITATION QUALITY IMPROVEMENT®

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Resuscitation Excellence is a Patient's Last Chance for Survival

Rene Ramon
RQI Development Manager
Rene.Ramon@heart.org
(832) 918-4044

Target Temperature Management & Post-Cardiac Arrest Prognostication

PRESENTER : KINJAL DESAI MD

APRIL 12TH, 2019

TIME: 1300 – 1350

STRIVE TO REVIVE

Presenter

Kinjal Desai MD,MPH
Medical Stroke Director
Neurohospitalist
Clearlake Regional Medical Center &
Mainland Medical Center

Practice Areas:
General Neurology
Vascular Neurology
Neurocritical Care
Telemedicine

Disclosures

- Kinjal Desai, MD, MPH
- I have no financial disclosures or conflicts to report
- Title: Target Temperature Management & Post Cardiac Arrest Prognostication

Aims

- History of TTM and its evolution from TH
- ILCOR 2015 Guidelines for TH/TTM post cardiac arrest
- Pathophysiology of Hypoxic Ischemic Brain Injury
- Neurocritical Care Society Guidelines for TTM
- TTM Protocols & Issues
- Post-cardiac arrest prognostication variables
- Outcome Scales
- AAN Prognostication & Multimodality Approach

In-hospital Cardiac Arrest (IHCA)

- 200,000 individuals suffer in-hospital cardiac arrest annually in US-1
- Survival to hospital discharge is approximately 26%, those with good functional status 16%
- Lots of variability observed from survival to hospital discharge -2
- Therapeutic Hypothermia (TH) for IHCA compared with usual care has been associated with lower likelihood of survival to hospital discharge and lower likelihood of favorable neurological outcomes -3
- RCTs for benefit of TH/TTM in IHCA are warranted

1 Merchant, et al. CCM 2011
2 Girotra et al. NEJM 2012
3 Chan et al. JAMA 2016

Out of Hospital Cardiac Arrest (OHCA)

ROC Data:

- 356,000 individuals (any age) suffer OHCA in US annually -1 and survival to hospital discharge is 11%, good functional status is 9%
- 60,000 individuals (age > 18 and nontraumatic etiology) suffer OHCA in US annually, survival to hospital admission 29%, survival to hospital discharge 11% and survival with good functional status 9%-2

1 Circulation. 2018;137:e67–e492. DOI: 10.1161/CIR.0000000000000558
2 Cardiac Arrest Registry to Enhance Survival website. Data reported by ROC and CARES. https://mycares.net.

Aristotle in 4th Century BC

" man's superior intelligence depends on the fact that his larger brain is capable of keeping the heart cool enough for optimal mental capacity"

Crit Care Med. 2017 February; 45(2):305-310

Before 1900s

- In ancient Egyptian treatise 5000 years ago - 1
- Hippocrates used to pack wounds with cold packs - 2
- 1650, Anne Greene was hung on a cold day, 30 min after she showed signs of life - 3
- 1700s, Dr Currie performed first systemic experiments
- 1812, Baron de Larrey, Napoleon's chief surgeon made an observation on soldiers lying close to fire died faster than those that were hypothermic - 4

1 Wang H, Olivero W, Wang D, Lanzino G. Cold as a therapeutic agent. Acta Neurochir (Wien). 2006; 148(5):565-570.
2 Polderman KH. Application of therapeutic hypothermia in the ICU: opportunities and pitfalls of a promising treatment modality. Part 1: Indications and evidence. Intensive Care Med. 2004;30(4):556-575.
3 Breathnach CS, Moynihan JB. Intensive care 1650: the revival of Anne Greene (c. 1628-59). J Med Biogr. 2009;17(1):35-38.
4 The Neurohospitalist2014, Vol. 4(3) 153-163

1900s

- TH post ROSC in Cardiac arrest started in last 1950s, later discontinued due to uncertain benefits & many difficulties 1-4
- Animal studies suggest benefit of Hypothermia post ROSC 5-8
- Majority of +ve Animal studies did not translate +ve results in Human Clinical Trials

1 Benson DW, Williams GR, Spencer FC, et al. The use of hypothermia after cardiac arrest. Anesth Analg. 1959;38:423–428.
2 Williams GR, Spencer FC. The clinical use of hypothermia following cardiac arrest. Ann Surg. 1958;148:462–468.
3 Ravitch MM, Lane RR, Safar P, et al. Lightning strike: report of a case with recovery after cardiac massage and prolonged artificial respiration. N Engl J Med. 1961;264:36–38.
4 Marion DW, Leonov Y, Ginsberg M, et al. Resuscitative hypothermia.Crit Care Med. 1996;24:81S–89S.
5 Horn M, Schlote W, Henrich HA. Global cerebral ischemia and subsequent selective hypothermia. Acta Neuropathol (Berl). 1991;81:443–449.
6 Sterz F, Safar P, Tisherman S, et al. Mild hypothermic cardiopulmonary resuscitation improves outcome after prolonged cardiac arrest in dogs. Crit Care Med. 1991;19:379–389.
7 D'Cruz BJ, Fertig KC, Filiano AJ, et al. Hypothermic reperfusion after cardiac arrest augments brain-derived neurotrophic factor activation. J Cereb Blood Flow Metab. 2002;22:848–851.
8 Hicks SD, DeFranco DB, Callaway CW. Hypothermia during reperfusion after asphyxial cardiac arrest improves functional recovery and selectively alters stress-induced protein expression. J Cereb Blood Flow Metab. 2000;20:520–530.11

2000s

2000 Guidelines for CPR & Emergency Cardiovascular care had insufficient evidence for benefit of TH - 1

TREATMENT OF COMATOSE SURVIVORS OF OUT-OF-HOSPITAL CARDIAC ARREST WITH INDUCED HYPOTHERMIA

STEPHEN A. BERNARD, M.B., B.S., TIMOTHY W. GRAY, M.B., B.S., MICHAEL D. BUIST, M.B., B.S., BRUCE M. JONES, M.B., B.S., WILLIAM SILVESTER, M.B., B.S., GEOFF GUTTERIDGE, M.B., B.S., AND KAREN SMITH, B.SC.

ABSTRACT

Background Cardiac arrest outside the hospital is common and has a poor outcome. Studies in laboratory animals suggest that hypothermia induced shortly after the restoration of spontaneous circulation may improve neurologic outcome, but there have been no conclusive studies in humans. In a randomized, controlled trial, we compared the effects of moderate hypothermia and normothermia in patients who remained unconscious after resuscitation from out-of-hospital cardiac arrest.

Methods The study subjects were 77 patients who were randomly assigned to treatment with hypothermia (with the core body temperature reduced to 33°C within 2 hours after the return of spontaneous circulation and maintained at that temperature for 12 hours) or normothermia. The primary outcome measure was survival to hospital discharge with sufficiently good neurologic function to be discharged to home or to a rehabilitation facility.

Currently, the treatment of patients with coma after resuscitation from out-of-hospital cardiac arrest is largely supportive. Because cerebral ischemia may persist for some hours after resuscitation,[5] the use of induced hypothermia to decrease cerebral oxygen demand has been proposed as a treatment option.[6] Although this suggestion has been supported by studies in animal models,[7-12] the studies in humans that have been reported to date have been uncontrolled or retrospective.[13-18]

After a pilot study that suggested the feasibility, safety, and possible efficacy of this treatment,[16] we conducted a prospective, controlled trial comparing moderate induced hypothermia with normothermia in comatose survivors of out-of-hospital cardiac arrest.

METHODS

Study Design

The study was performed in Melbourne, Australia, between

The New England Journal of Medicine

VOLUME 346 FEBRUARY 21, 2002 NUMBER 8

MILD THERAPEUTIC HYPOTHERMIA TO IMPROVE THE NEUROLOGIC OUTCOME AFTER CARDIAC ARREST

THE HYPOTHERMIA AFTER CARDIAC ARREST STUDY GROUP*

ABSTRACT

Background Cardiac arrest with widespread cerebral ischemia frequently leads to severe neurologic impairment. We studied whether mild systemic hypothermia increases the rate of neurologic recovery after resuscitation from cardiac arrest due to ventricular fibrillation.

Methods In this multicenter trial with blinded assessment of the outcome, patients who had been resuscitated after cardiac arrest due to ventricular fibrillation were randomly assigned to undergo therapeutic hypothermia (target temperature, 32°C to 34°C, measured in the bladder) over a period of 24 hours or to receive standard treatment with normothermia. The primary end point was a favorable neurologic outcome within six months after cardiac arrest; secondary end points were mortality within six months and the rate of complications within seven days.

An estimated 375,000 people in Europe undergo sudden cardiac arrest yearly.[1] Recovery without residual neurologic damage after cardiac arrest with global cerebral ischemia is rare. After cardiac arrest with no blood flow for more than five minutes, the generation of free radicals, together with other mediators, during reperfusion creates chemical cascades that result in cerebral injury.[2] Until recently, there was no therapy with documented efficacy in preventing brain damage after cardiac arrest.

Several studies have shown that moderate systemic hypothermia (30°C)[3] or mild hypothermia (34°C)[4-8] markedly mitigates brain damage after cardiac arrest in dogs. The exact mechanism for this cerebral resuscitative effect is not clear. A reduction in cerebral oxygen consumption[9,10] and other multifactorial chemical and

49% survival vs 26% in normothermia grp

Functional recovery after discharge 55% vs 39% & 6 month mortality 41% vs 55% in normothermia grp

2002 ILCOR ALS Task Force - 2

- Unconscious adult patients with spontaneous circulation after out-of-hospital cardiac arrest should be cooled to 32 to 34 degree celcius for 12-24 hours when initial rhythm was ventricular fibrillation
- Such cooling may also be beneficial for other rhythms or in-hospital cardiac arrest

1 The American Heart Association in Collaboration with the International Liaison Committee on Resuscitation (ILCOR). Guidelines 2000 for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care – An International Consensus on Science. Resuscitation. 2000;46:1–447.
2 Circulation. 2003;108:118-121

2010 Guidelines for CPR & Emergency Cardiovascular Care

- Sufficient evidence to suggest the benefit of TH in improving outcomes in adult witnessed OHCA caused by Vfib
- Benefit in OCHA due to other cardiac rhythms is unclear

Circulation. 2010;122{suppl 2};S345-S421

Landmark Trial – 2013, Nielsen et al

The NEW ENGLAND JOURNAL *of* MEDICINE

ORIGINAL ARTICLE

Targeted Temperature Management at 33°C versus 36°C after Cardiac Arrest

Niklas Nielsen, M.D., Ph.D., Jørn Wetterslev, M.D., Ph.D., Tobias Cronberg, M.D., Ph.D., David Erlinge, M.D., Ph.D., Yvan Gasche, M.D., Christian Hassager, M.D., D.M.Sci., Janneke Horn, M.D., Ph.D., Jan Hovdenes, M.D., Ph.D., Jesper Kjaergaard, M.D., D.M.Sci., Michael Kuiper, M.D., Ph.D., Tommaso Pellis, M.D., Pascal Stammet, M.D., Michael Wanscher, M.D., Ph.D., Matt P. Wise, M.D., D.Phil., Anders Åneman, M.D., Ph.D., Nawaf Al-Subaie, M.D., Søren Boesgaard, M.D., D.M.Sci., John Bro-Jeppesen, M.D., Iole Brunetti, M.D., Jan Frederik Bugge, M.D., Ph.D., Christopher D. Hingston, M.D., Nicole P. Juffermans, M.D., Ph.D., Matty Koopmans, R.N., M.Sc., Lars Køber, M.D., D.M.Sci., Jørund Langørgen, M.D., Gisela Lilja, O.T., Jacob Eifer Møller, M.D., D.M.Sci., Malin Rundgren, M.D., Ph.D., Christian Rylander, M.D., Ph.D., Ondrej Smid, M.D., Christophe Werer, M.D., Per Winkel, M.D., D.M.Sci., and Hans Friberg, M.D., Ph.D., for the TTM Trial Investigators*

ABSTRACT

BACKGROUND

Unconscious survivors of out-of-hospital cardiac arrest have a high risk of death or poor neurologic function. Therapeutic hypothermia is recommended by international guidelines, but the supporting evidence is limited, and the target temperature associated with the best outcome is unknown. Our objective was to compare two target temperatures, both intended to prevent fever.

METHODS

In an international trial, we randomly assigned 950 unconscious adults after out-of-hospital cardiac arrest of presumed cardiac cause to targeted temperature management at either 33°C or 36°C. The primary outcome was all-cause mortality through the end of the trial. Secondary outcomes included a composite of poor neurologic function or death at 180 days, as evaluated with the Cerebral Performance Category (CPC) scale and the modified Rankin scale.

RESULTS

In total, 939 patients were included in the primary analysis. At the end of the trial,

The authors' affiliations are listed in the Appendix. Address reprint requests to Dr. Nielsen at the Department of Anesthesia and Intensive Care, Intensive Care Unit, Helsingborg Hospital, S Vallgatan 5, 251 87, Helsingborg, Sweden, or at niklas.nielsen@med.lu.se.

*A complete list of investigators participating in the Target Temperature Management 33°C versus 36°C after Out-of-Hospital Cardiac Arrest (TTM) trial is provided listed in the Supplementary Appendix, available at NEJM.org.

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DOI: 10.1056/NEJMoa1310519

Outcome	33°C Group	36°C Group	Hazard Ratio or Risk Ratio (95% CI)*	P Value
	no./total no. (%)			
Primary outcome: deaths at end of trial	235/473 (50)	225/466 (48)	1.06 (0.89–1.28)	0.51
Secondary outcomes				
Neurologic function at follow-up†				
CPC of 3–5	251/469 (54)	242/464 (52)	1.02 (0.88–1.16)	0.78
Modified Rankin scale score of 4–6	245/469 (52)	239/464 (52)	1.01 (0.89–1.14)	0.87
Deaths at 180 days	226/473 (48)	220/466 (47)	1.01 (0.87–1.15)	0.92

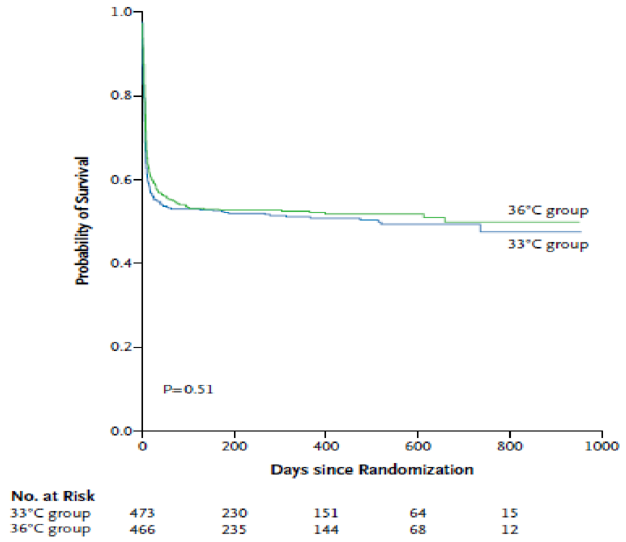

Figure 2. Probability of Survival through the End of the Trial.
Shown are Kaplan–Meier estimates of the probability of survival for patients assigned to a target temperature of either 33°C or 36°C and the number of patients at risk at each time point. The P value was calculated by means of Cox regression, with the effect of the intervention adjusted for the stratification variable of study site.

2002 vs 2013, Which one is it??

HACA & Bernard	Nielsen
Selective patients	Included all shockable and non-shockable rhythms
Normothermic group had more hyperthermia	
	ICU care improved in general from 2002 to 2013
	TH was standard of care at the time of Nielsen trial, hence selection bias while enrolling in 33 degree grp
	WLST protocol in place versus older trials were based of self-fulfilling prophecy as no proper methodology used for prognostication
	Rapid rewarming from 33 to 36 degree could have negated the beneficial effects of TH at 33 degrees

Arch Med Sci 2016; 12, 5: 1135–1141

2015 Guidelines for CPR & Emergency Cardiovascular Care

- Comatose patients with ROSC post arrest, should have TTM (VF/pVT OHCA, Non- VF/pVT and IHCA)
- Selection and maintenance of a constant temp between 32 and 36 degree celcius during TTM
- Reasonable to maintain TTM for 24 hours after achieving target temp
- Routine prehospital cooling of patients with large amounts of ice-cold fluids after ROSC is not recommended
- It may be reasonable to actively prevent fever in comatose patients after TTM

Circulation. 2015 November 3; 132(18 Suppl 2): S465–S482

32 vs 33 vs 34 degree celcius ??

Intensive Care Med (2018) 44:1807–1815
https://doi.org/10.1007/s00134-018-5256-z

ORIGINAL

A multicentre randomized pilot trial on the effectiveness of different levels of cooling in comatose survivors of out-of-hospital cardiac arrest: the FROST-I trial

Esteban Lopez-de-Sa[1*], Miriam Juarez[2], Eduardo Armada[1], José C. Sanchez-Salado[3], Pedro L. Sanchez[4], Pablo Loma-Osorio[5], Alessandro Sionis[6], Maria C. Monedero[1], Manuel Martinez-Sellés[2,7], Juán C. Martín-Benitez[8], Albert Ariza[3], Aitor Uribarri[4], José M. Garcia-Acuña[9], Patricia Villa[10], Pablo J. Perez[11], Christian Storm[12], Anne Dee[13] and Jose L. Lopez-Sendon[1]

Abstract

Purpose: To obtain initial data on the effect of different levels of targeted temperature management (TTM) in out-of-hospital cardiac arrest (OHCA).

Methods: We designed a multicentre pilot trial with 1:1:1 randomization to either 32 °C ($n=52$), 33 °C ($n=49$) or 34 °C ($n=49$), via endovascular cooling devices during a 24-h period in comatose survivors of witnessed OHCA andinitial shockable rhythm. The primary endpoint was the percentage of subjects surviving with good neurologic outcome defined by a modified Rankin Scale (mRS) score of ≤ 3, blindly assessed at 90 days.

Results: At baseline, different proportions of patients who had received defibrillation administered by a bystander were assigned to groups of 32 °C (13.5%), 33 °C (34.7%) and 34 °C (28.6%; $p=0.03$). The percentage of patients with an mRS ≤ 3 at 90 days (primary endpoint) was 65.3, 65.9 and 65.9% in patients assigned to 32, 33 and 34 °C, respectively, non-significant (NS). The multivariate Cox proportional hazards model identified two variables significantly related to the primary outcome: male gender and defibrillation by a bystander. Among the 43 patients who died before 90 days, 28 died following withdrawal of life-sustaining therapy, as follows: 7/16 (43.8%), 10/13 (76.9%) and 11/14 (78.6%) of patients assigned to 32, 33 and 34 °C, respectively (trend test $p=0.04$). All levels of cooling were well tolerated.

Conclusions: There were no statistically significant differences in neurological outcomes among the different levels of TTM. However, future research should explore the efficacy of TTM at 32 °C.

Clinical trial registration: ClinicalTrials.gov unique identifier: NCT02035839 (http://clinicaltrials.gov).

Keywords: Brain injury, Cardiac arrest, Post-cardiac arrest syndrome, Resuscitation, Sudden death, Targeted temperature management

- No difference in good neurologic outcomes at 3 months for MRS < 3
- Lower WLST for patients in 32 degree group with severe brain damage
- Animal studies suggest

Cooling to 34 degree – Improves cerebral recovery without any cardiovascular damage

Cooling to 30 degree – No additional cerebral recovery benefit, hazardous to cardiovascular system

Cooling to 28 degree and below : No benefit, more harm

Weinrauch V et al. Beneficial effect of mild hypothermia and detrimental effect of deep hypothermia after cardiac arrest in dogs. Stroke 23:1454–1462

24 vs 48 hours of TTM at 33 degree celcius

Targeted Temperature Management for 48 vs 24 Hours and Neurologic Outcome After Out-of-Hospital Cardiac Arrest
A Randomized Clinical Trial

Hans Kirkegaard, MD, PhD, DMSci, DEAA, DLS; Eldar Søreide, MD, PhD, FERC; Inge de Haas, MD; Ville Pettilä, MD, PhD, EDIC; Fabio Silvio Taccone, MD, PhD; Urmet Arus, MD; Christian Storm, MD, PhD; Christian Hassager, MD, DMSc; Jørgen Feldbæk Nielsen, MD, DMSci; Christina Ankjær Sørensen, MD; Susanne Ilkjær, MD, PhD; Anni Nørgaard Jeppesen, MD; Anders Morten Grejs, MD, PhD; Christophe Henri Valdemar Duez, MD; Jakob Hjort, MPH; Alf Inge Larsen, MD, PhD, FESC; Valdo Toome, MD; Marjaana Tiainen, MD, PhD; Johanna Hästbacka, MD, PhD; Timo Laitio, MD, PhD; Markus B. Skrifvars, MD, PhD, EDIC, FCICM

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Supplemental content

IMPORTANCE International resuscitation guidelines recommend targeted temperature management (TTM) at 33°C to 36°C in unconscious patients with out-of-hospital cardiac arrest for at least 24 hours, but the optimal duration of TTM is uncertain.

OBJECTIVE To determine whether TTM at 33°C for 48 hours results in better neurologic outcomes compared with currently recommended, standard, 24-hour TTM.

DESIGN, SETTING, AND PARTICIPANTS This was an international, investigator-initiated, blinded-outcome-assessor, parallel, pragmatic, multicenter, randomized clinical superiority trial in 10 intensive care units (ICUs) at 10 university hospitals in 6 European countries. Three hundred fifty-five adult, unconscious patients with out-of-hospital cardiac arrest were enrolled from February 16, 2013, to June 1, 2016, with final follow-up on December 27, 2016.

INTERVENTIONS Patients were randomized to TTM (33 ± 1°C) for 48 hours (n = 176) or 24 hours (n = 179), followed by gradual rewarming of 0.5°C per hour until reaching 37°C.

MAIN OUTCOMES AND MEASURES The primary outcome was 6-month neurologic outcome, with a Cerebral Performance Categories (CPC) score of 1 or 2 used to define favorable outcome. Secondary outcomes included 6-month mortality, including time to death, the occurrence of adverse events, and intensive care unit resource use.

RESULTS In 355 patients who were randomized (mean age, 60 years; 295 [83%] men), 351 (99%) completed the trial. More patients in the 48-hour group had a favorable outcome, but this was not statistically significant. Six-month mortality was not different between the groups. Adverse events were more common in the 48-hour group than in the 24-hour group. There was no significant difference in the time to mortality (hazard ratio, 0.79; 95% CI, 0.54-1.15; *P* = .22). The median length of ICU stay (151 vs 117 hours; *P* < .001), but not hospital stay (11 vs 12 days; *P* = .50), was longer in the 48-hour group than in the 24-hour group.

	No. (%) of Patients				
	48-Hour Group (n = 175)	24-Hour Group (n = 176)	Difference, % (95% CI)	RR (95% CI)	P Value
Primary outcome: CPC score of 1 or 2 at 6 mo	120 (69)	112 (64)	4.9 (−5 to 14.8)	1.08 (0.93 to 1.25)	.33
Secondary outcomes					
Mortality at 6 mo	48 (27)	60 (34)	−6.5 (−16.1 to 3.1)	0.81 (0.59 to 1.11)	.19
Any adverse event	169 (97)	161 (91)	5.6 (0.6 to 10.6)	1.06 (1.01 to 1.12)	.03

CONCLUSIONS AND RELEVANCE In unconscious survivors from out-of-hospital cardiac arrest admitted to the ICU, targeted temperature management at 33°C for 48 hours did not significantly improve 6-month neurologic outcome compared with targeted temperature management at 33°C for 24 hours. However, the study may have had limited power to detect clinically important differences, and further research may be warranted.

TRIAL REGISTRATION clinicaltrials.gov Identifier: NCT01689077

JAMA. 2017;318(4):341-350. doi:10.1001/jama.2017.8978

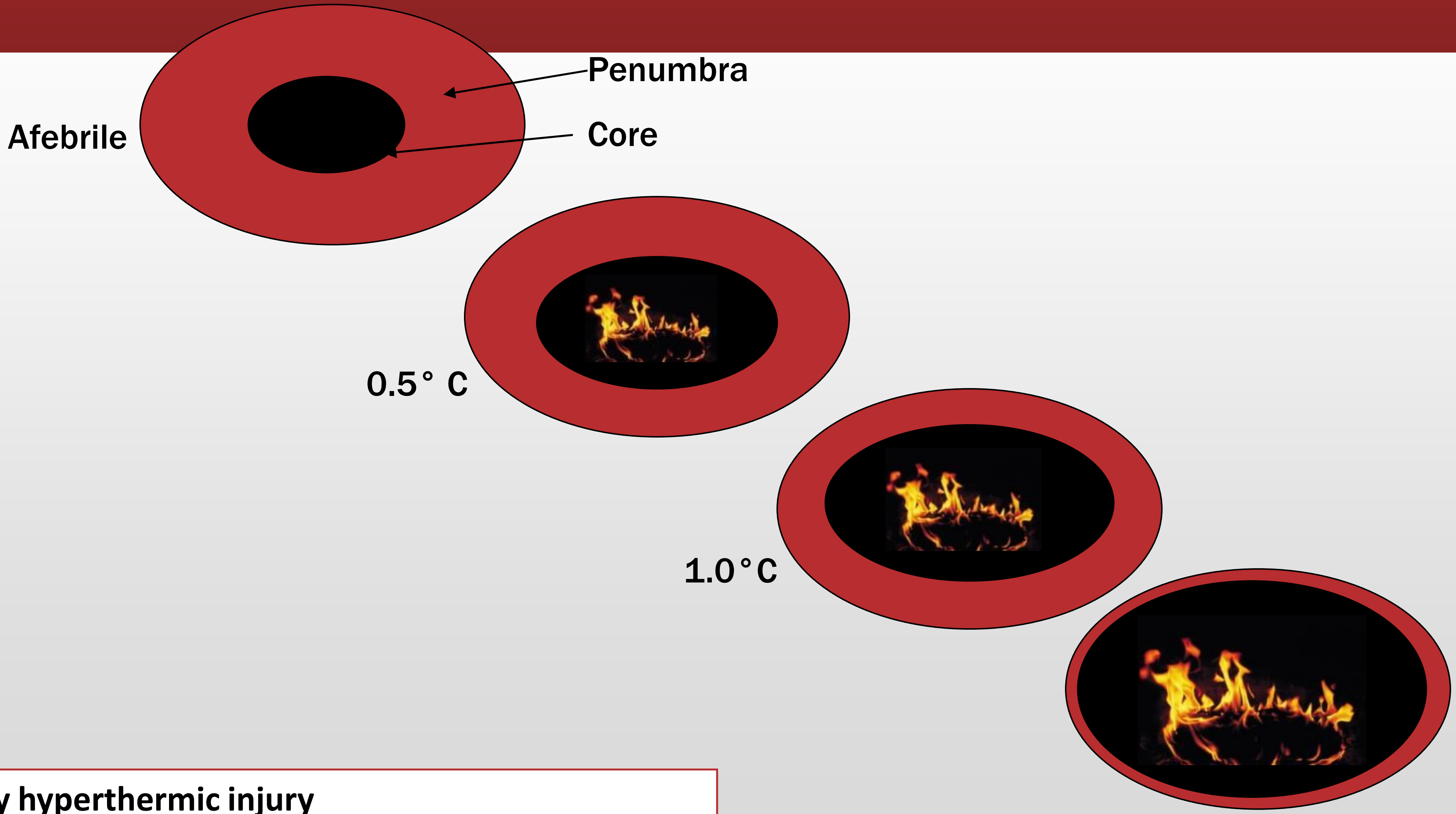
Author Affiliations: Author affiliations are listed at the end of this article.

Corresponding Author: Hans Kirkegaard, MD, PhD, DMSci, DEAA, DLS, Research Center for Emergency Medicine, Aarhus University Hospital, Noerrebrogade 44, Bldg 1B, 8000 Aarhus C, Denmark (hanskirkegaard@dadlnet.dk).

Section Editor: Derek C. Angus, MD, MPH, Associate Editor, *JAMA* (angusdc@upmc.edu).

- 48 hour TTM grp had favorable 6 month outcome (CPC 1 or 2), not statistically significant
- No different in mortality
- Longer ICU stay, not hospital stay and more infections in 48 hour grp
- Biggest drawback of this study was limited power

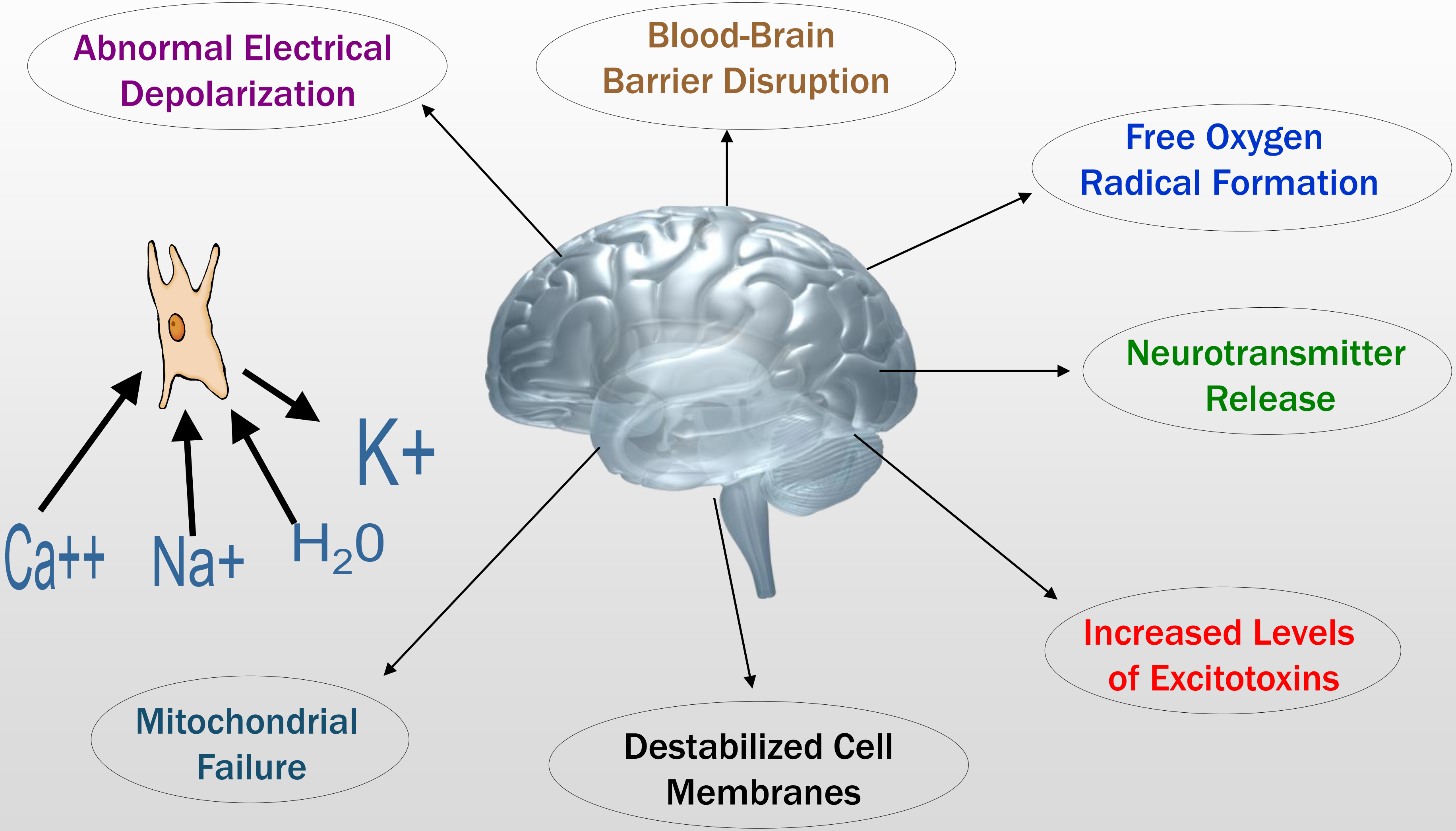
Fever & Cerebral Ischemia + Cerebral Edema



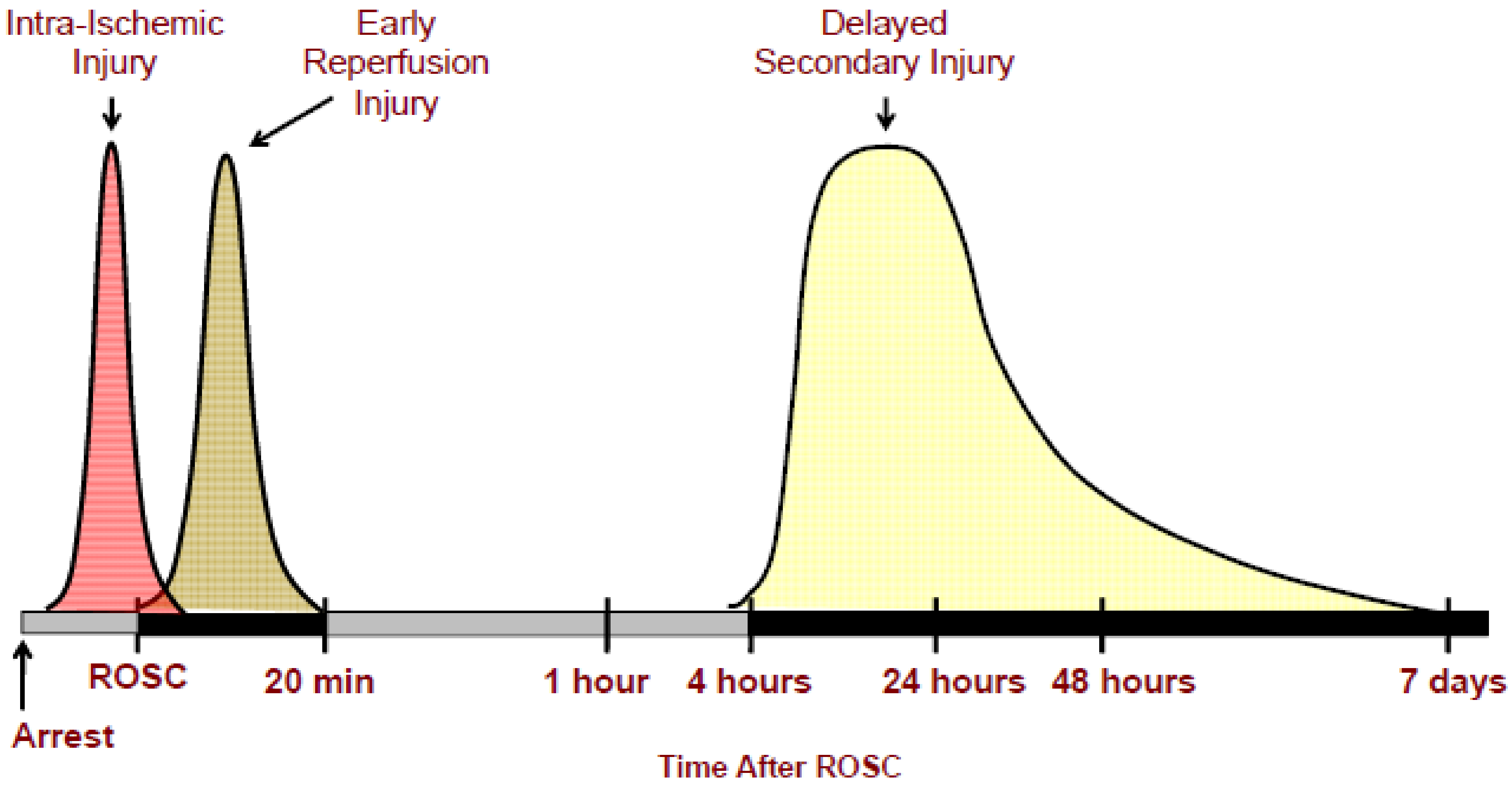
Secondary hyperthermic injury

Adapted from Ginsberg, 2002

Neuronal Damage



Time Course of Neuronal Injury Mechanisms During and After Cardiac Arrest



Courtesy of RW Neumar

Perman et al. Clinical Applications of Targeted Temperature Management. Chest 2014; 145(2):386-393.

Benefits of Hypothermia

- CMRO2 decreases by 6% with each 1 degree drop in Temp > 28 degree celcius-1
- ↓ ATP demand which slows neuronal damage
- ↓ Glutamate excitotoxicity, free radical injury and mitochondrial damage
- ↓ ICP, which is often high post Cardiac Arrest-2
- ↓ Seizure occurrence (directly via its effect on hypothalamus which is also the ictal generator)

1 Metz et al. Moderate hypothermia in patients with severe head injury: cerebral and extracerebral effects. J Neurosurg. 1996 Oct; 85(4):533-41.
2 Circulation. 2003;108:118-121.

TTM Guidelines from Neurocritical Care Society (NCS)

- 2015, 16 Questions chosen based on PICO
- Literature reviewed back-dated from March 2017
- GRADE Methodology
- Strength graded as Strong or Conditional
- Quality graded as High, Moderate, Low or Very-Low

Madden LK, Hill M, May TL et al. Neurocrit Care (2017) 27:468

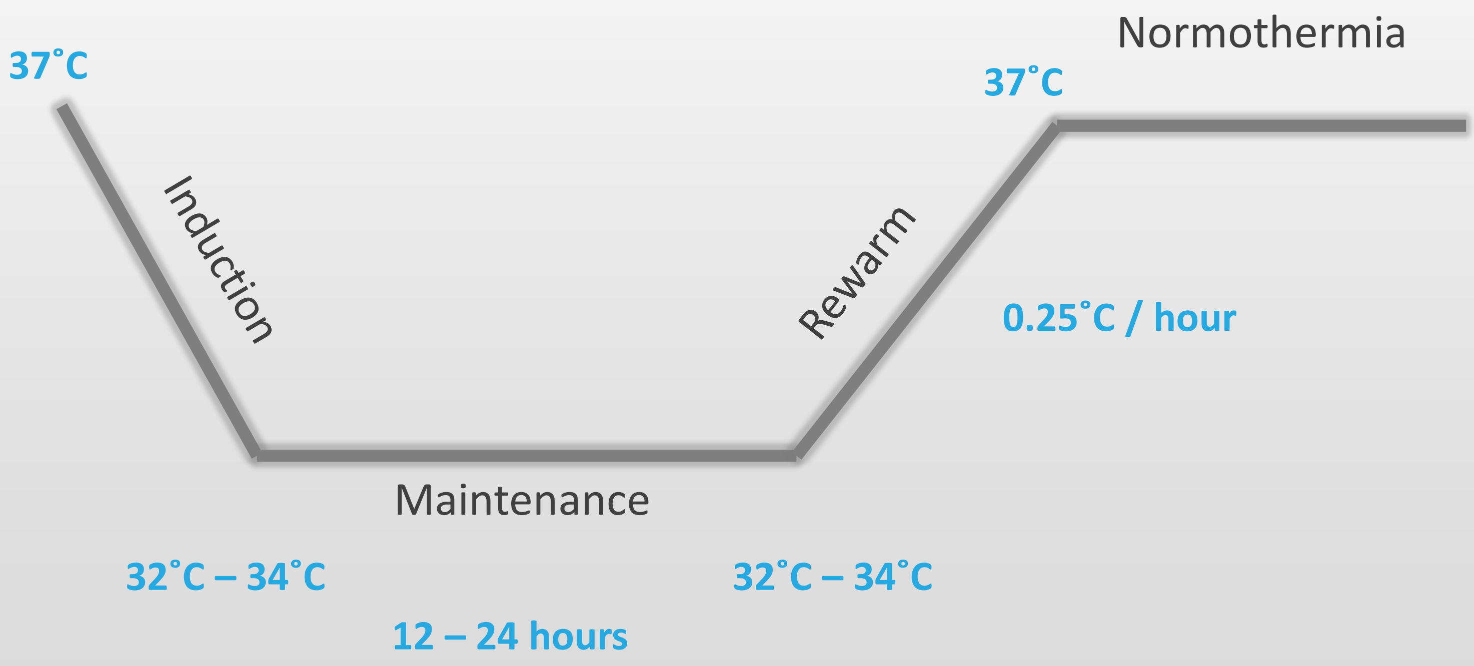
NCS Recs for TTM

- Minimum 24 hours of cooling in OHCA (Conditional, Moderate)
- No recs on specific timing of TTM initiation (Strong, Moderate)
- Controlled normothermia to reduce fever in patients refractory to conventional therapy (Strong, Moderate)
- Use of intranasal, surface or intravascular cooling devices, and/or cold infusions over air cooling blankets, cooling fans or packs to get quick times to target temp, achieve target temp and decrease likelihood of overshoot (Strong, High)
- Use of intravascular catheter or gel pads to maintain constant patient temp (Strong, High)
- Esophageal temp probe is ideal for all phases of TTM, if not available use Bladder temp probe (Conditional, Low)

NCS Recs for TTM

- Continuously monitor temp during TTM (Good Practice)
- BSAS is recommended as a tool to monitor shivering (Strong, Moderate)
- Shivering should be addressed promptly. Stepwise approach should be used if possible (Good Practice)
- Maintain K 3 to 3.5 during induction and maintenance phase to avoid rebound hyperK and arrhythmias during rewarming (Strong, High)
- ABG should be temperature corrected
- Rest of the labs should be monitored during cooling similar to managing any critically ill patient

Four Phases



Duration to follow institutional and society guidelines

Nielsen, N. et al. (2013). *N Engl J Med.* 369(23), 2197-206.

Induced Hypothermia After Cardiac Arrest

Guidelines for patient selection:

Exclusion Criteria:
- Active bleeding
- Cardiogenic shock
- Known or suspected sepsis
- Pregnancy; if not already confirmed, send urine HCG
- Continued arrhythmias
- Not to be initiated after 12 hours of return of spontaneous circulation (ROSC)
- Not to be initiated if ROSC was greater than 50 minutes
- Not a primary cardiac arrest (e.g. ventricular tachycardia/fibrillation, asystole, or PEA)
- Glasgow Coma Scale > 8
- Does not require mechanical ventilation

Inclusion Criteria:
- Start ASAP after return of spontaneous circulation (ROSC) *Not to be initiated after 12 hours of ROSC
- Primary cardiac arrest (e.g. ventricular tachycardia/fibrillation, asystole, or PEA)
- ROSC within 50 minutes
- Glasgow Coma Scale ≤ 8 (see next page for GCS calculation)
- Requires mechanical ventilation

Sedation

Midazolam 0.125 mg/kg IV x1, then continuous infusion of 50 mg in 250 mL normal saline at 0.1 mg/kg/hr.

If the patient's creatinine clearance (cr cl) is less than 30 mL/min, adjust dose to 0.0625 mg/kg IV x1, then continuous infusion of 50mg in 250mL of normal saline at 0.05 mg/kg/hr.

Paralysis (Start sedation prior to initiation.)

Cisatracurium 0.15 mg/kg IVP then start 200 mg/100 mL IV infusion at 0.5 mcg/kg/min; titrate to abolish and prevent shivering.

- If shivering or overbreathing the ventilator once infusion has started, bolus Cisatracurium 0.15 mg/kg and double infusion dose (maximum dose not to exceed 8 mcg/kg/min). May repeat bolus x1. If patient continues to over breathe the ventilator or shiver after increased rate, please notify ordering physician.
- Keep HOB at 30 degrees
- Ocular lubricant ointment to both eyes q 8 hours while receiving paralytic

Magnesium sulfate:
- ≤ 60 kg 2 grams/50 mL D5W IVPB over 15 minutes x 2
- > 60 kg 2 grams/50 mL D5W IVPB over 15 minutes x 3

Cooling device and cool patient to 36 degrees C

Stat continuous EEG, indication: rule out non-convulsive status epilepticus. (Page EEG tech at night.)

Respiratory therapy to turn heater off until patient reaches 33.0˚C. Turn heater back on once patient reaches target temperature

Monitor

- Vital signs every 15 minutes. Assess pupillary function every hour while paralyzed and document on the neurological vital sign sheet. Once patient has completed rewarming, complete neuro vital signs every 2 hours x 24 hours.
- Beseline ABG, CBC, Chem 6, glucose; magnesium post ROSC, then 1 hour after initiation of hypothermia therapy.
- Daily lactic acid level.
- Daily chest x-ray while on protocol.
- Baseline lipase amylase, LFTs, blood culture x2, UA with sensitivity and culture and sputum culture. Please send cultures before administration of first antibiotic.
- Repeat ABG after paralysis/sedation achieved.
- Chem 6, magnesium, glucose, and ABG every 4 hours and call MD with lab results.
- Assess skin integrity under pads every shift and document in nurses notes.

Adopted: Baylor College of Medicine Resident Green Book

Physiology of Therapeutic Hypothermia & Issues

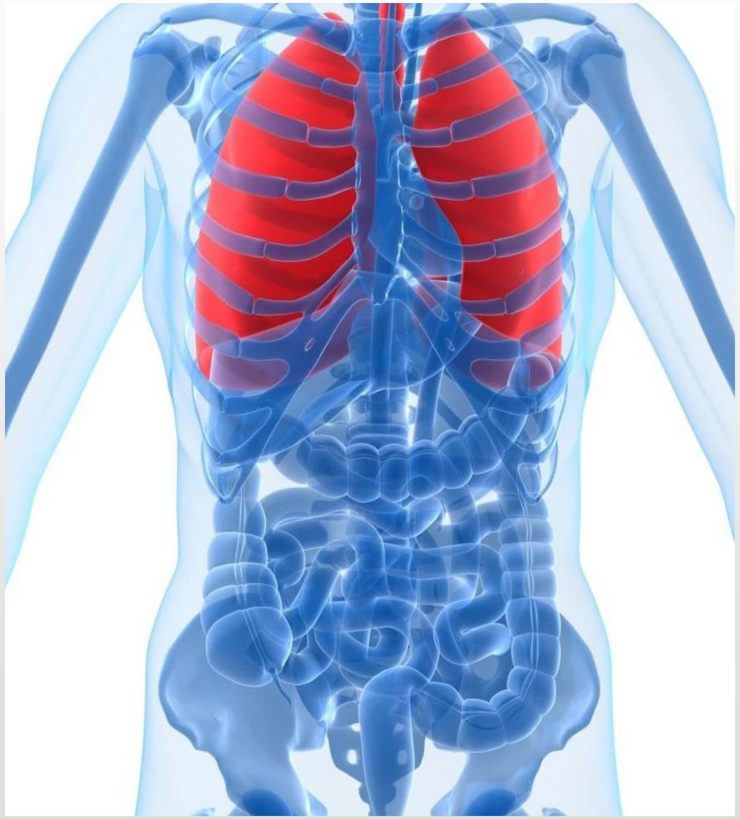
- ↓ BP, HR, CO[1-3]
- EKG Changes
  - Prolonged PR interval[1,2]
  - Widening QRS complex[1,2]
  - Increased QT wave[1,2]
  - J or Osborn wave[1]

*Representative of target temperatures 32 - 35°C

1. Mehta, S. (2010). PA: HMP Communications. pp. 603-612.
2. Nunnally, ME. (2010). Mount Prospect: SCCM. pp. 21-27.
3. Tischerman, SA. & Stertz, F. (2010). New York: Springer Science. pp. 235-246.

Physiological Effects of Therapeutic Hypothermia

- Hematological[1]
  - Impaired clotting cascade
  - Impaired platelet function: potential increase in bleeding risk
  - Decreased WBC count
- Renal
  - ↑ Diuresis[2,4]
  - Electrolyte loss[3]
- Gastrointestinal[1]
  - Impaired bowel function / motility



1. Mehta, S. (2010). PA: HMP Communications. pp. 603-612.
2. Bader MK and Littlejohn LR (2009). *AANN Core Curriculum for Neuroscience Nursing.* St. Louis, MO: Saunders. pp. 237-246.
3. Nunnally, ME. (2010). Mount Prospect: SCCM. pp. 21-27.
4. Guanci, MM. & Mathiesen, C. (2009). *Foundations of Neuroscience Nursing*. pp. 237-246.

Physiological Effects of Therapeutic Hypothermia

- Systemic
  - ↓ O_2 consumption and CO_2 production[1,3]
  - Left shift on oxyhemoglobin curve: O_2 is not readily released to the tissues[4]
  - Lactic acidosis[4]
- Endocrine[1,3]
  - ↓ Insulin secretion
- Immune suppression[1]
  - ↑ Infection: wound infections and pneumonia
- Other[1]
  - Shivering
  - Drug metabolism prolonged

1. Mehta, S. (2010). PA: HMP Communications. pp. 603-612.
2. Bader MK and Littlejohn LR (2009). *AANN Core Curriculum for Neuroscience Nursing.* St. Louis, MO: Saunders. pp. 237-246.
3. Nunnally, ME. (2010). Mount Prospect: SCCM. pp. 21-27.
4. Guanci, MM. & Mathiesen, C. (2009). *Foundations of Neuroscience Nursing*. pp. 237-246.

Physiological Changes with Rewarming

- Hemodynamic instability from Peripheral Vasodilation (Increasing Pressor requirements)
- Intracranial Pressure elevations
- Mild Coagulopathic changes
- Infections
- Electrolyte Dysfunction

Scaravilli V, Bonacina D, Citerio G. Rewarming: facts and myths from the systemic perspective. Crit Care. 2012;16(Suppl 2):A25.

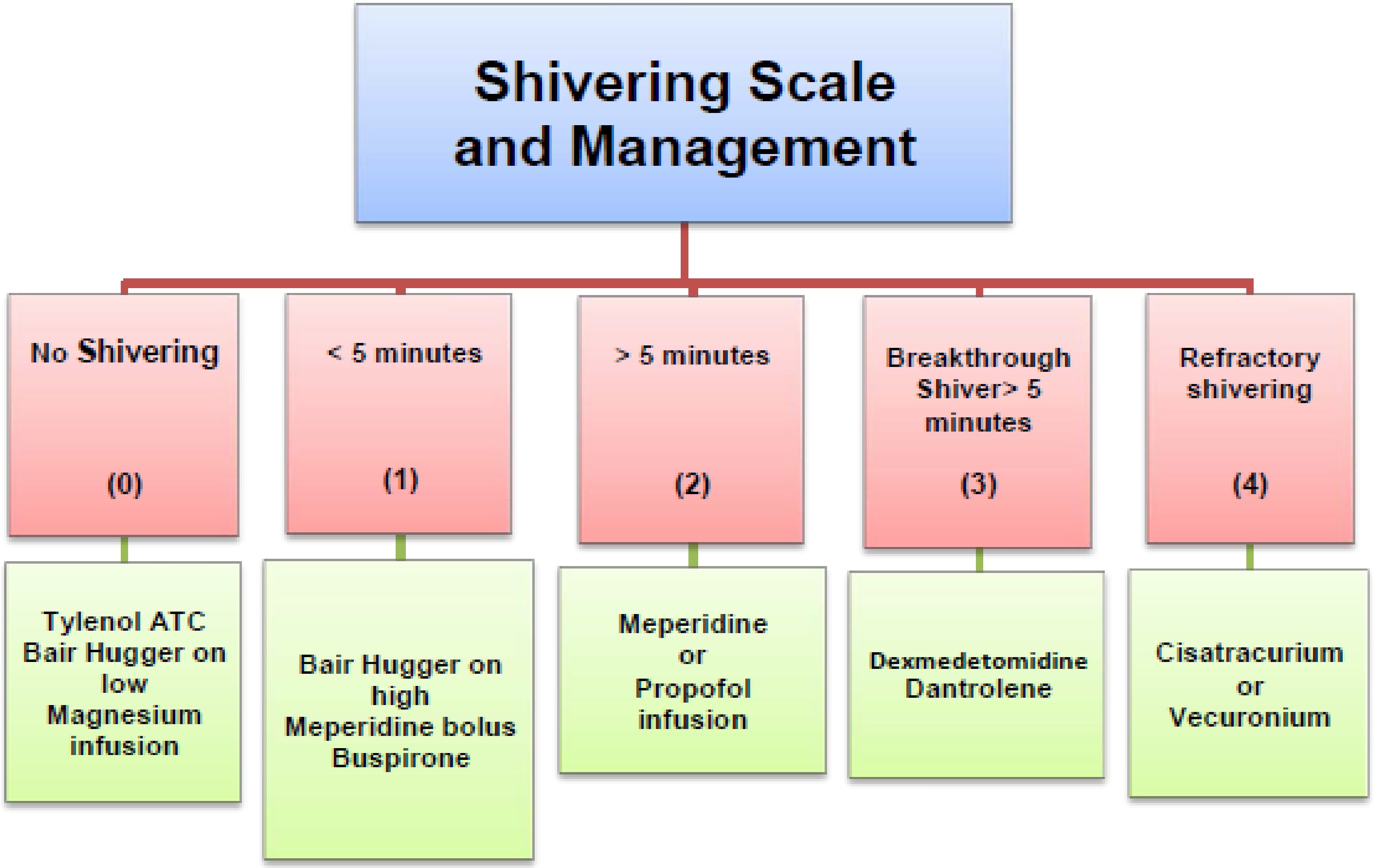
Shivering

- Physiological reflex to counteract hypothermia by Vasoconstriction to generate or maintain heat
- Posterior Hypothalamus
- Increases Metabolic demand, O2 consumption and Co2 Production
- Goal to have BSAS < 1

Bader, MK. & Littlejohn, LR. (2009). AANN Core Curriculum for Neuroscience Nursing. St. Louis, MO: Saunders. pp. 237-246.
BSAS – Bedside Shivering Assessment Scale

Bedside Shivering Assessment Scale

Adopted from TTM: Normothermia after Cardiac Arrest MGH Protocol



Younger age, Men & Lower BSA are associated with utilization of more anti-shivering measures

Step		Intervention	Dose
0	Baseline	Acetaminophen	650–1000 mg Q 4–6 h
		Buspirone	30 mg Q 8 h
		Magnesium sulfate	0.5–1 mg/h IV Goal (3–4 mg/dl)
		Skin counterwarming	43°C/MAX Temp
1	Mild sedation	Dexmedetomidine	0.2–1.5 mcg/kg/h
		or	Fentanyl starting dose 25 mcg/h
		Opioid	Meperidine 50–100 mg IM or IV
2	Moderate sedation	Dexmedetomidine and Opioid	Doses as above
3	Deep sedation	Propofol	50–75 mcg/kg/min
4	Neuromuscular blockade	Vecuronium	0.1 mg/kg IV

Choi HA, Ko SB, Presciutti M et al. Prevention of shivering during therapeutic temperature modulation: the Columbia anti-shivering protocol. Neurocrit Care. 2011 Jun;14(3):389-94

Post Cardiac Arrest Prognostication

- 80% patients in ICU after ROSC from OHCA are comatose and 2/3rd of these die from Hypoxic-Ischemic Brain Injury - 1,2
- Despite delayed neuronal death and diffuse cerebral edema, only few deaths occur from direct consequence of neuronal injury - 3
- Majority of deaths are related to Withdrawal of Life-sustaining treatment (WLST) - 4
- WLST without use of a multi-modal approach results in self-fulfiling prophecy & risks a falsely pessimistic prediction

1 Thomassen A, Wernberg M. Prevalence and prognostic significance of coma after cardiac arrest outside intensive care and coronary units. Acta Anaesthesiol Scand. 1979;23:143–8.
2. Laver S, Farrow C, Turner D, Nolan J. Mode of death after admission to an intensive care unit following cardiac arrest. Intensive Care Med. 2004;30:2126–8.
3 Fujioka M, Okuchi K, Sakaki T,et al. Specific changes in human brain following reperfusion after cardiac arrest. Stroke. 1994;25:2091–5.
4 Dragancea I, Wise MP, Al-Subaie N et al. Protocol-driven neurological prognostication and withdrawal of life-sustaining therapy after cardiac arrest and targeted temperature management. Resuscitation. 2017;117:50–7

Scales

- CPC – at discharge or after
- MRS
- GOS
- HRQOL assessment at 3 months

CPC & GOS

CPC	GOS	Disability	Conscious	Independent	Features
1	5	No, or minor	Yes	Yes	Able to work and lead a normal life. May have mild dysphasia, non-incapacitating hemiparesis, or minor cranial nerve abnormalities
2	4	Moderate	Yes	Yes	Able to travel by public transport and work in sheltered environment Independent in activities of daily life. May have hemiplegia, seizures, ataxia, dysarthria, or memory changes
3	3	Severe	Yes	No	Limited cognition, dementia, locked-in, minimally conscious. Usually in institution, but it may be looked after at home with exceptional family effort
4	2	Unconscious	No	No	Persistent vegetative state
5	1	Dead	-	-	Certified brain dead or dead by traditional criteria

CPC 1	75%
CPC 2	55%
CPC 3	44%
CPC 4	22%

Assessment of outcome after severe brain damage: a practical scale B Jennett, M Bond - The Lancet, 1975
Phelps R, Dumas F, Maynard C, Silver J, Rea T. Cerebral performance category and long-term prognosis following out-of-hospital cardiac arrest. Crit Care Med 2013;41:1252–7

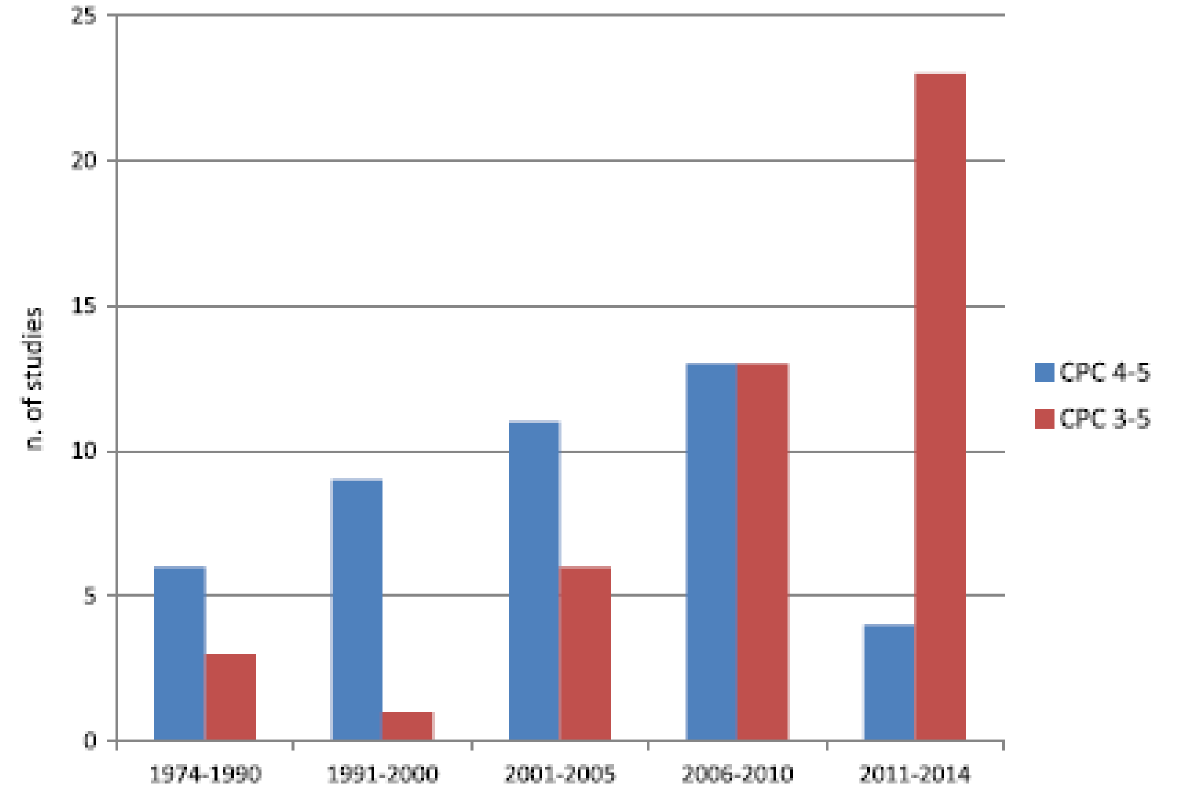


Fig. 1 Definition of poor neurological outcomes in 87 prognostication studies, 1974–2014. Reproduced from [19], with permission. CPC Cerebral Performance Category

From 2006, CPC 3 included as poor outcome due to difference in priority given to recovery of physical and neurological ability and societal participation versus recovery of consciousness only

Sandroni C, Nolan JP. Neuroprognostication after cardiac arrest in Europe: new timings and standards. Resuscitation. 2015;90:A4–5

Timing

- Earliest time for prognostication with or without TTM is at 72 hours post ROSC
- Reasonable to wait beyond 72 hours for prognosis if residual effects of sedation or paralytics

2015 Guidelines ILCOR (Circulation. 2015 November 3; 132(18 Suppl 2): S465–S482)

Prediction Variables

- Clinical Exam (Pupil Response, Brainstem reflexes, Motor Exam, Myoclonus)
- EEG
- SSEP
- Serum Biomarkers
- Neuroimaging

Neurological Exam

- Repetition is the key, given effects of TTM, sedation, NMB etc.
- Bilateral absence of pupil response at 72 hours - 0.5% FPR
- Presence of Bilateral pupil response at 72 hours does not predict good response
- Corneal reflexes have similar predictions as pupil response (they are however affected by NMBs)

Rossetti AO, Rabinstein AA, Oddo M; Neurological prognostication of outcome in patients in coma after cardiac arrest. Lancet Neurol 2016;15:597-609

Neurological Exam

- Based on ILCOR, absent motor movements or posturing should not be used to predict outcomes
- Myoclonus is not a good predictor of poor outcomes due to its high FPR 5%, 9% patients with myoclonus do survive
- Important to differentiate Lance-Adams attacks
- Myoclonic Status Epilepticus during 72 -120 hours post arrest is a reasonable predictor of poor neurological outcomes (FPR 0% - ILCOR)

1-2015 Guidelines ILCOR (Circulation. 2015 November 3; 132(18 Suppl 2): S465–S482)
2-Rossetti AO, Rabinstein AA, Oddo M; Neurological prognostication of outcome in patients in coma after cardiac arrest. Lancet Neurol 2016;15:597-609

- American Clinical Neurophysiology Society has published standardized guidelines for EEG interpretation
- EEG interpretation holds more value at 24 hours vs 48-72 hours, especially if none to mild sedation, with or without TTM

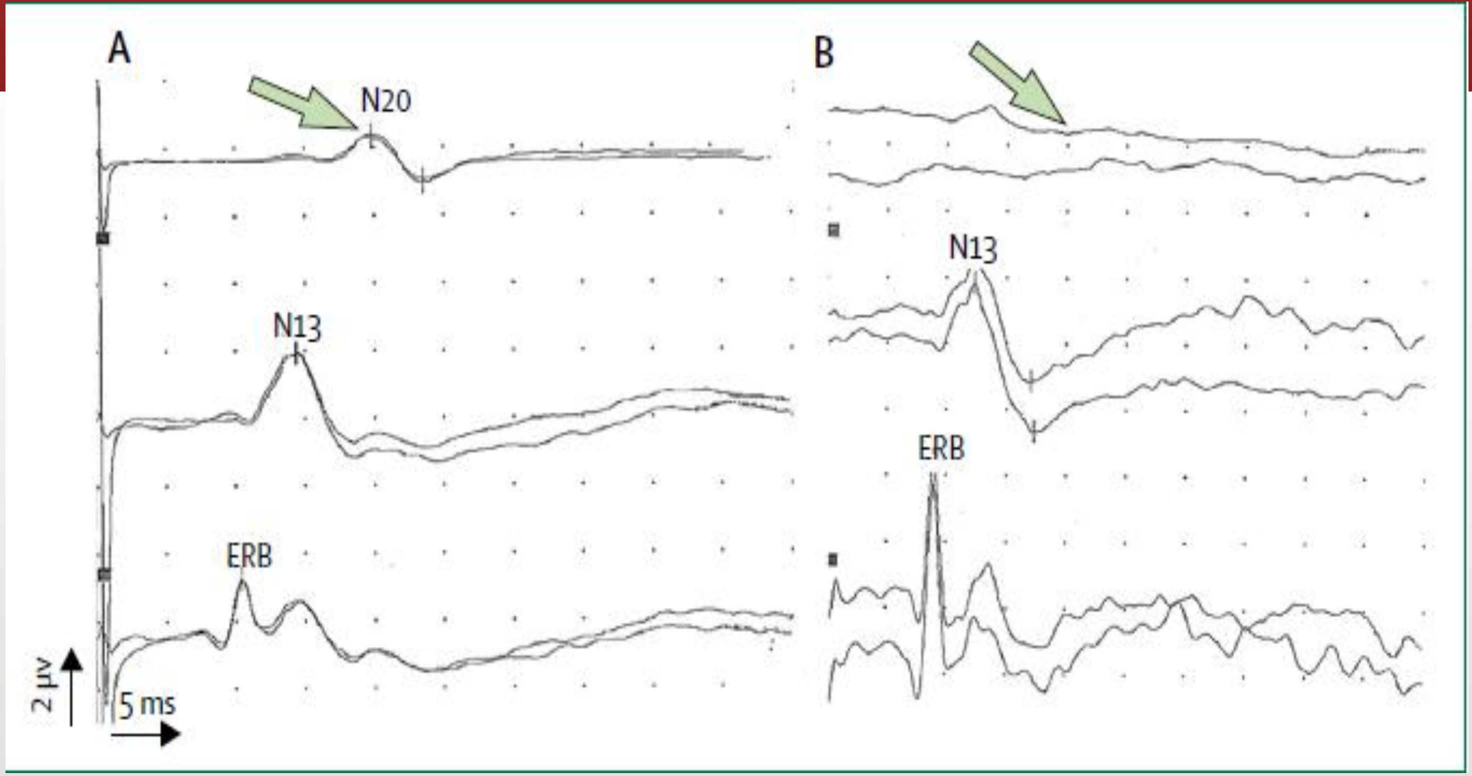
1-Hirsch LJ, LaRoche SM, Gaspard N, et al. American Clinical Neurophysiology Society's Standardized Critical Care EEG Terminology: 2012 version. J Clin Neurophysiol 2013; 30: 1–27
2-2015 Guidelines ILCOR (Circulation. 2015 November 3; 132(18 Suppl 2): S465–S482)

EEG

- Background activity, Reactivity & Epileptiform features
- With TTM, absent EEG reactivity to external stimuli (pain or auditory) at 72 hours and burst suppression pattern after rewarming predict poor outcome (ILCOR)
- Intractable and persistent Status Epilepticus at 72 hours or beyond in absence of EEG reactivity to external stimuli predicts poor outcome (ILCOR)
- For patients with Status Epilepticus at 72 hours with favorable other factors should continue to be treated upto 2 weeks

1-Hirsch LJ, LaRoche SM, Gaspard N, et al. American Clinical Neurophysiology Society's Standardized Critical Care EEG Terminology: 2012 version. J Clin Neurophysiol 2013; 30: 1–27
2-2015 Guidelines ILCOR (Circulation. 2015 November 3; 132(18 Suppl 2): S465–S482)

Somatosensory Evoked Potential (SSEP)



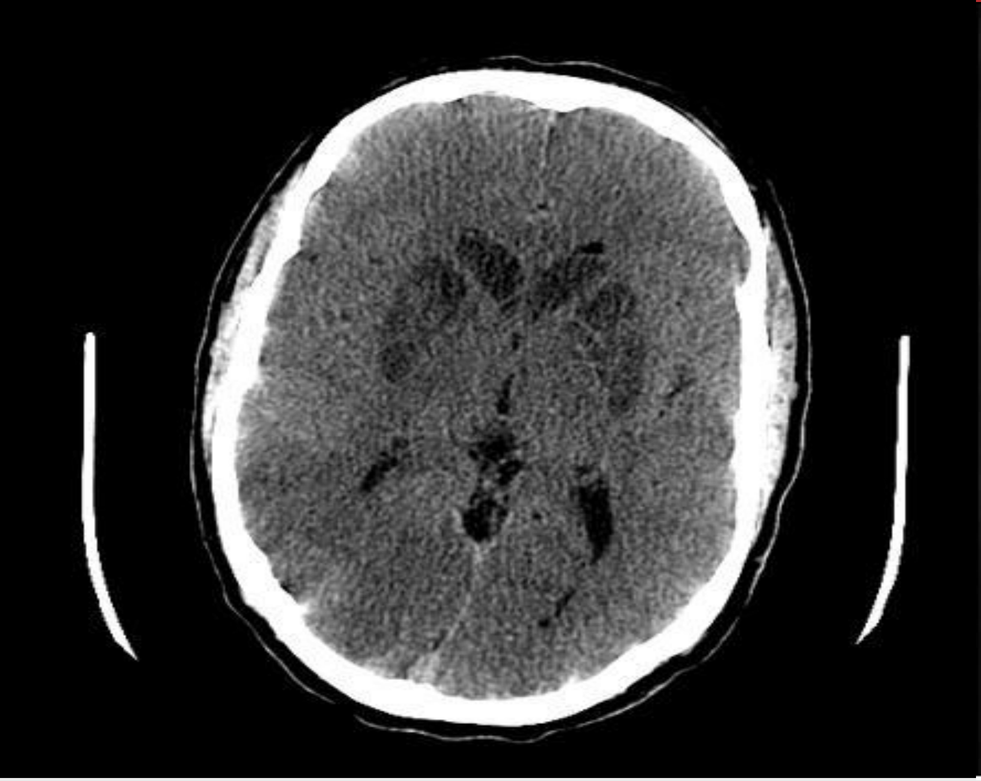
- Early latency vs Middle latency vs Long latency
- Bilateral absence of N20 potentials at 24-72 hours post cardiac arrest or after rewarming suggests poor outcome

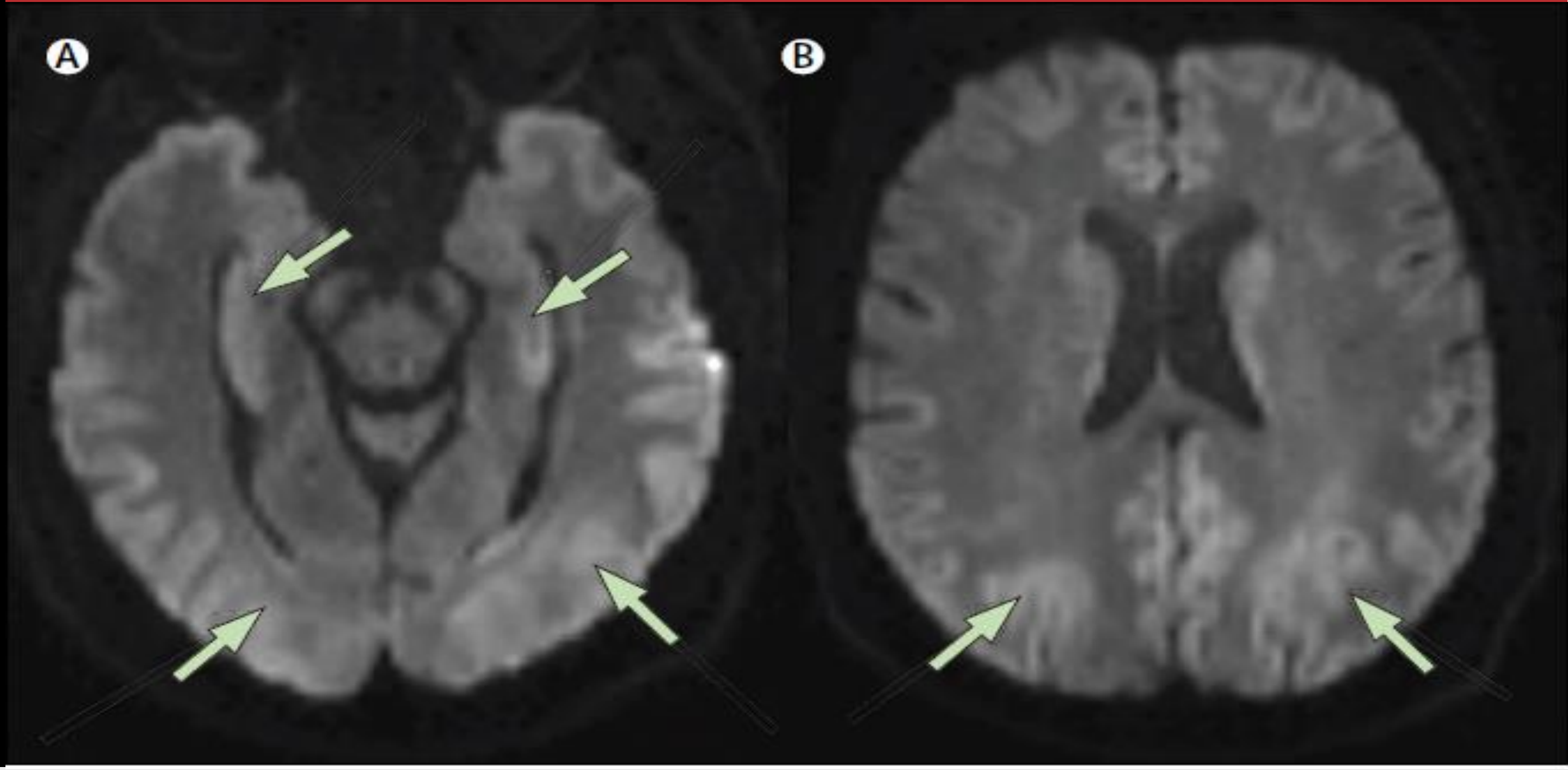
2015 Guidelines ILCOR (Circulation. 2015 November 3; 132(18 Suppl 2): S465–S482)

Serum Biomarkers

- Neuron Specific Enolase (NSE) - released by dying neurons, trends more important than individual levels, sampling issues, hemolysis, ECMO, presence also in neuroectodermal cells **(33, 88, 150 ng/ml)**
- S-100B - released by glial cells post injury, also found in other extracerebral sources
- Blood levels of NSE and S-100B should not be used alone to predict outcomes
- Higher serum values of NSE at 48-72 hours after cardiac arrest can be used to predict poor outcomes in conjunction with other tests

1-2015 Guidelines ILCOR (Circulation. 2015 November 3; 132(18 Suppl 2): S465–S482)
2-Rossetti AO, Rabinstein AA, Oddo M; Neurological prognostication of outcome in patients in coma after cardiac arrest. Lancet Neurol 2016;15:597-609





- CT is used primarily for its utility to detect ICH early as an etiology of Arrest
- For comatose patients after cardiac arrest without TTM, marked reduction in GWR on CT obtained at 2 hours post arrest predicts poor outcome
- MRI changes can be seen in Neocortex (layer 5), Deep grey nuclei (basal ganglia/Putamen) & Temporal lobe (hippocampus)
- It may be reasonable to use extensive restriction diffusion (DWI/ADC) on MRI brain at 2-6 days after arrest in combination with other factors to predict poor neurological outcome

1-2015 Guidelines ILCOR (Circulation. 2015 November 3; 132(18 Suppl 2): S465–S482)
2-Rossetti AO, Rabinstein AA, Oddo M; Neurological prognostication of outcome in patients in coma after cardiac arrest. Lancet Neurol 2016;15:597-609

Poor Outcomes

- Absent pupillary reflex at 72 hours
- Presence of Status Myoclonus during first 72 hours post arrest
- Absent N20 SSEP, 24 to 72 hours post arrest or after rewarming
- Markedly reduced gray-white ratio on CT within 2 hours of arrest
- Extensive Diffusion restriction on MRI at 2-6 days post arrest
- Persistent absence of EEG reactivity to external stimuli at 72 hours post arrest
- Persistent BURST Suppression pattern or intractable Status Epilepticus on EEG after rewarming

2015 Guidelines ILCOR (Circulation. 2015 November 3; 132(18 Suppl 2): S465–S482)

AAN Cardiac Arrest Prognostication

Special Article

AMERICAN ACADEMY OF NEUROLOGY

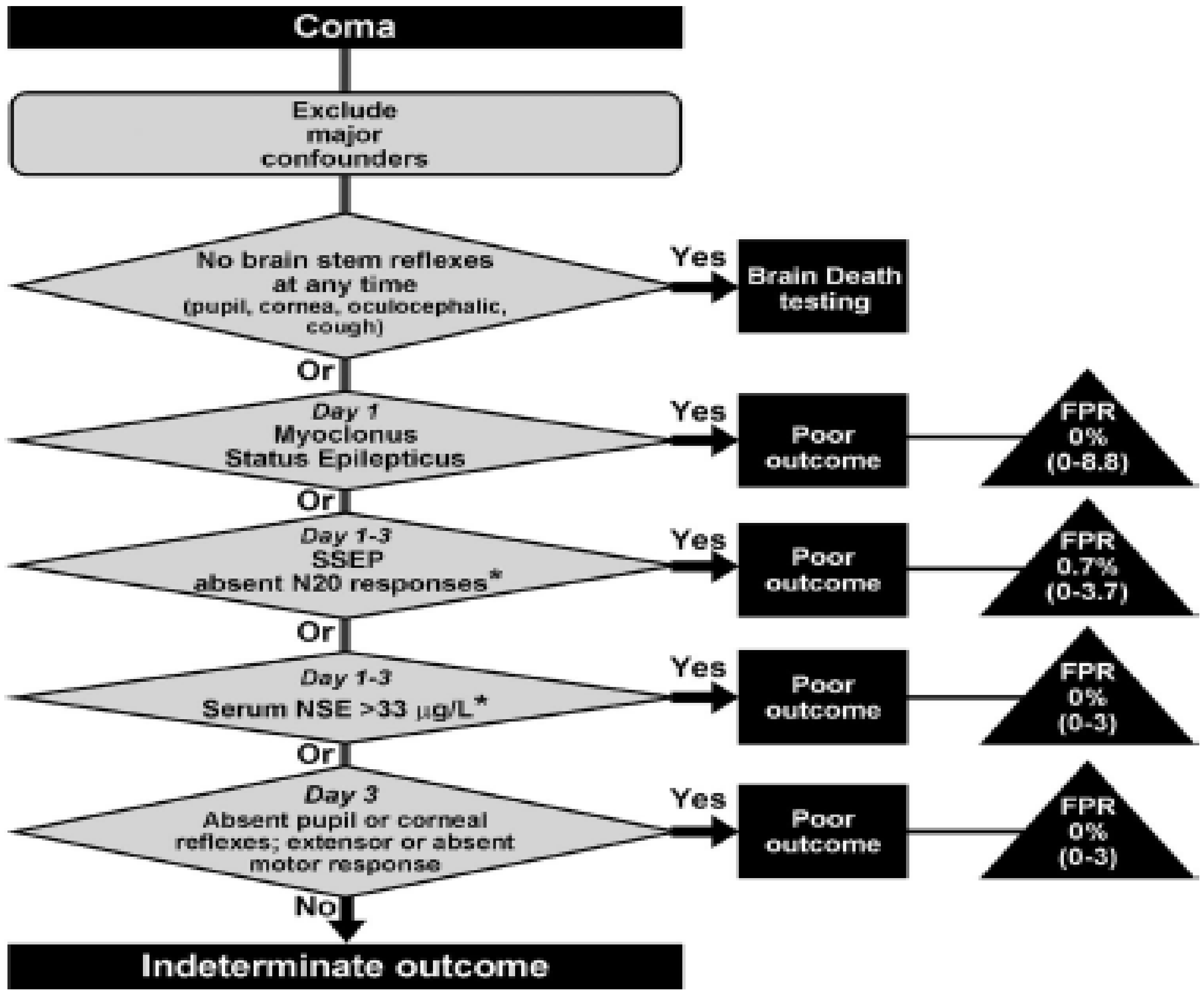
Practice Parameter: Prediction of outcome in comatose survivors after cardiopulmonary resuscitation (an evidence-based review)

Report of the Quality Standards Subcommittee of the American Academy of Neurology

E.F.M. Wijdicks, MD; A. Hijdra, MD; G.B. Young, MD; C.L. Bassetti, MD; and S. Wiebe, MD

Abstract—*Objective:* To systematically review outcomes in comatose survivors after cardiac arrest and cardiopulmonary resuscitation (CPR). *Methods:* The authors analyzed studies (1966 to 2006) that explored predictors of death or unconsciousness after 1 month or unconsciousness or severe disability after 6 months. *Results:* The authors identified four class I studies, three class II studies, and five class III studies on clinical findings and circumstances. The indicators of poor outcome after CPR are absent pupillary light response or corneal reflexes, and extensor or no motor response to pain after 3 days of observation (level A), and myoclonus status epilepticus (level B). Prognosis cannot be based on circumstances of CPR (level B) or elevated body temperature (level C). The authors identified one class I, one class II, and nine class III studies on electrophysiology. Bilateral absent cortical responses on somatosensory evoked potential studies recorded 3 days after CPR predicted poor outcome (level B). Burst suppression or generalized epileptiform discharges on EEG predicted poor outcomes but with insufficient prognostic accuracy (level C). The authors identified one class I, 11 class III, and three class IV studies on biochemical markers. Serum neuron-specific enolase higher than 33 µg/L predicted poor outcome (level B). Ten class IV studies on brain monitoring and neuroimaging did not provide data to support or refute usefulness in prognostication (level U). *Conclusion:* Pupillary light response, corneal reflexes, motor responses to pain, myoclonus status epilepticus, serum neuron-specific enolase, and somatosensory evoked potential studies can reliably assist in accurately predicting poor outcome in comatose patients after cardiopulmonary resuscitation for cardiac arrest.

NEUROLOGY 2006;67:203–210

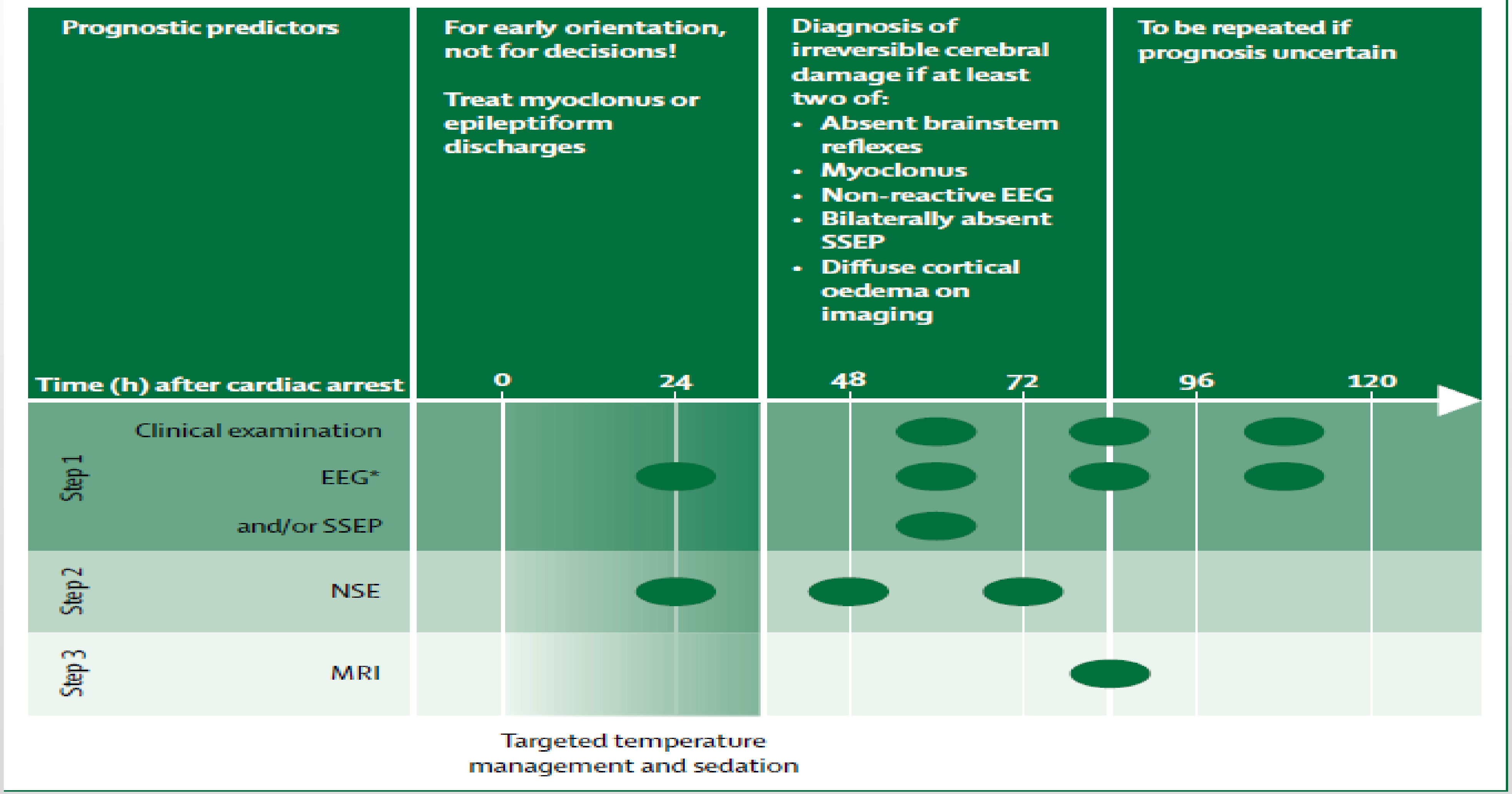


AAN vs Multimodal Approach to Prognostication

- Relying on motor exam, when neuromuscular blockade, sedatives, other comorbidities can severely affect the assessments
- Not relying on specifics in EEG, which has the highest sensitivity, specificity and lowest false positive rate
- Not utilizing Neuroimaging studies at appropriate time stamps
- Serum biomarkers with higher cut-offs for poor outcomes

Oddo M, Rossetti AO. Early Multimodal Outcome Prediction After Cardiac Arrest in Patients treated with Hypothermia. Crit Care Med 2014; 42:1340-1347

Multimodal Approach to Prognostication



Rossetti AO, Rabinstein AA, Oddo M; Neurological prognostication of outcome in patients in coma after cardiac arrest. Lancet Neurol 2016;15:597-609

Early Multimodal Outcome Prediction After Cardiac Arrest in Patients Treated With Hypothermia*

Mauro Oddo, MD[1]; Andrea O. Rossetti, MD[2]

Objectives: Therapeutic hypothermia and pharmacological sedation may influence outcome prediction after cardiac arrest. The use of a multimodal approach, including clinical examination, electroencephalography, somatosensory-evoked potentials, and serum neuron-specific enolase, is recommended; however, no study examined the comparative performance of these predictors or addressed their optimal combination.

Design: Prospective cohort study.

Setting: Adult ICU of an academic hospital.

Patients: One hundred thirty-four consecutive adults treated with therapeutic hypothermia after cardiac arrest.

Measurements and Main Results: Variables related to the cardiac arrest (cardiac rhythm, time to return of spontaneous circulation), clinical examination (brainstem reflexes and myoclonus), electroencephalography reactivity during therapeutic hypothermia, somatosensory-evoked potentials, and serum neuron-specific enolase. Models to predict clinical outcome at 3 months (assessed using the Cerebral Performance Categories: 5 = death; 3–5 = poor recovery) were evaluated using ordinal logistic regressions and receiving operator characteristic curves. Seventy-two patients (54%) had a poor outcome (of whom, 62 died), and 62 had a good outcome. Multivariable ordinal logistic regression identified absence of electroencephalography reactivity ($p < 0.001$), incomplete recovery of brainstem reflexes in normothermia ($p = 0.013$), and neuron-specific enolase higher than 33 µg/L ($p = 0.029$), but not somatosensory-evoked potentials, as independent predictors of poor outcome. The combination of clinical examination, electroencephalography reactivity, and neuron-specific enolase yielded the best predictive performance (receiving operator characteristic areas: 0.89 for mortality and 0.88 for poor outcome), with 100% positive predictive value. Addition of somatosensory-evoked potentials to this model did not improve prognostic accuracy.

Conclusions: Combination of clinical examination, electroencephalography reactivity, and serum neuron-specific enolase offers the best outcome predictive performance for prognostication of early postanoxic coma, whereas somatosensory-evoked potentials do not add any complementary information. Although prognostication of poor outcome seems excellent, future studies are needed to further improve prediction of good prognosis, which still remains inaccurate. (*Crit Care Med* 2014; 42:1340–1347)

Key Words: coma; electroencephalography; neuron-specific enolase; prognosis; somatosensory-evoked potentials

Coma after cardiac arrest (CA) is a leading cause of admission in ICUs and has a high rate of mortality and morbidity. Therapeutic hypothermia (TH) is increasingly used for neuroprotection in this context (1–3). Several recent studies have shown that TH and the related pharmacological sedation may influence some prognosticators commonly

	Mortality (CPC 5)		Poor Outcome (CPC 3–5)	
Variable	ROC Area	95% CI	ROC Area	95% CI
Clinical examination[a] + EEG	0.87	0.81–0.93	0.84	0.78–0.90
Clinical examination[a] + NSE	0.83	0.76–0.89	0.83	0.77–0.90
EEG + NSE	0.87	0.81–0.93	0.84	0.78–0.90
Clinical examination[a] + EEG + NSE	0.89	0.83–0.94	0.88	0.82–0.93
Clinical examination[a] + EEG + SSEP	0.87	0.81–0.93	0.84	0.78–0.90
Clinical examination[a] + EEG + NSE + SSEP	0.88	0.83–0.94	0.88	0.82–0.93

CPC = Clinical Performance Category, ROC = receiving operator characteristic, EEG = background reactivity on hypothermic electroencephalography, NSE = neuron-specific enolase > 33 µg/L, SSEP = somatosensory-evoked potentials.

[a]Incomplete brainstem reflexes (including pupillary, oculocephalic, corneal) and myoclonus.

On the Horizon

- GFAP
- Tau Protein
- Serum Neurofilament Light Chain
- miRNAs
- Long Latency Evoked Potential
- Pupillometer (Quantitative measurement of pupil size, PLR & constriction velocity)
- NIRS

Bright Side !!!

- Need More Studies to determine variables that actually predict good prognosis
- The Variables need to have high sensitivity, specificity with Low False Positive Rates
- The predictors should have same prognosticating ability as CPC for 3-6 month outcomes

Take Home

- Do not sugarcoat information while prognosticating
- Include families early on in discussions with identification of the MPOA
- Evidence based approach (utilizing Multimodal Outcome predictors)
- Be Firm, but empathetic
- Respect all Cultural Beliefs & Values

Questions

Email : drkinjaldesai@gmail.com

Phone : 346-347-5747


Life is why

IN-HOSPITAL RESUSCITATION: PERFORMANCE MEASURES PEDIATRIC/NEONATE-INFANT

Javier J. Lasa, MD, FAAP
Aarti C. Bavare, MD, MPH, FAAP

DISCLOSURES

Financial: none

Unlabeled/ unapproved medications or devices: none

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OUTLINE

- GET WITH THE GUIDELINES-RESUSCITATION AND ME
- ADULTS VS KIDS: DIFFERENCES BEYOND SIZE
- AHA IMPACT 2020 GOALS
- PERFORMANCE MEASURES BY AGE GROUP
- SUMMARY POINTS

ADULT VS. PEDIATRIC CPR METRICS

DIFFERENCES BEYOND SIZE

PED… ADULTS

First D… O…

Surv… …rests

Saket … MD;
Vinay M. N… …et With the

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Trends in Survival after In-Hospital Cardiac Arrest

Saket Girotra, M.D., Brahmajee K. Nallamothu, M.D., M.P.H., John A. Spertus, M.D., M.P.H., Yan Li, Ph.D., Harlan M. Krumholz, M.D., and Paul S. Chan, M.D., for the American Heart Association Get with the Guidelines–Resuscitation Investigators

Table 4. Risk-Ad…

Table 2. Trends in Survival and Neurologic Outcomes.*

Outcome	Risk-Adjusted Rates†										Adjusted Rate Ratio per Year (95% CI)‡	P Value for Trend‡
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009		
	percent											
Survival to discharge	13.7	17.1	18.2	17.8	18.9	20.0	20.5	21.2	23.3	22.3	1.04 (1.03–1.06)	<0.001
Acute resuscitation survival§	42.7	45.1	45.4	46.0	47.0	48.6	49.7	52.5	55.2	54.1	1.03 (1.02–1.04)	<0.001
Postresuscitation survival¶	32.0	38.3	40.0	39.0	40.8	42.1	42.4	41.5	[illegible]	[illegible]	1.02 (1.01–1.03)	0.001
Neurologic outcome in survivors												
Clinically significant disability‖	32.9	35.7	31.9	34.3	34.0	33.1	33.0	32.7	31.8	28.1	0.98 (0.97–1.00)	0.02
Severe disability**	10.1	10.5	9.8	10.5	11.5	11.5	9.7	12.2	11.7	10.7	1.01 (0.98–1.04)	0.37

40% of adult CPR occurs on ward (Brady, WJ. Resuscitation 2011)

1. Berg, R. et al. *CCM* 2012
2. Anderson, L. et al. *BMJ* 2016
3. Anderson, L. et al. *JAMA* 2015
4. Nadkarni, V. et al. JAMA 2006
5. Girotra, S. et al. *NEJM* 2012
6. Girotra, S. et al. *Circ CV Qual Outcomes* 2012

American Heart Association.

HOW CAN WE HELP???

Increase Survival
from Cardiac Arrest:

***In Hospital*:**

Adults: From 19% → 38%

Children: From 35% → 50%

AHA'S EMERGENCY CARDIOVASCULAR CARE

IMPACT 2020 GOALS

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LET'S IMPROVE CPR PERFORMANCE!

GWTG-R PROGRAM GOAL:

- *INCREASE SURVIVAL TO DISCHARGE*

HOW?

- *DEFINE **ELEMENTS** OF A COMPREHENSIVE RESUSCITATION SYSTEM OF CARE*
- *ENCOURAGE IMPLEMENTATION AND PERFORMANCE EXCELLENCE THROUGH A **RECOGNITION** PROGRAM*

LET'S IMPROVE CPR PERFORMANCE!

GWTG-R PROGRAM GOAL:

- *INCREASE SURVIVAL TO DISCHARGE*

PERFORMANCE MEASURES—OVERVIEW:

- *DECREASE UNMONITORED/UNWITNESSED ARRESTS*
- *DECREASE TIME TO CHEST COMPRESSIONS*
- *DECREASE TIME TO DEFIBRILLATION*
- *CONFIRMATION OF ENDOTRACHEAL TUBE PLACEMENT*

POP QUIZ

DESCRIBE THE ELEMENTS OF HIGH- QUALITY CPR DEMONSTRATED IN THIS PHOTOGRAPH?

CASE

A 4 yo boy had a fall onto monkey bars.

→ Brought by EMS to a pediatric ER.

→ ER: CXR showed bilateral lung contusions and R sided pneumothorax which was evacuated with a chest tube.

→ Admitted to ward with 3L NC

→ Next day increased respiratory distress despite increased respiratory support and functional chest tube

→ RRT/MET was activated

A 4 yo boy falls onto monkey bars.

RRT assessment: HR 160, RR 70s, BP 100/82, significant respiratory distress, tired appearing and sleepy

→ Decision made to intubate

→ ETT placed and confirmed with CO_2 colorimetric detector, 20ml/kg NS bolus given

→ Transport to Pediatric ICU

A 4 yo boy falls onto monkey bars.

On arrival to ICU→ HR 170s, RR 24 on ventilator, BP 90/50

→ 5 minutes later: pulses thready, Capnometry tracing lost, BP not recordable → **PEA**

→ Resuscitation per PALS guidelines: High quality CPR, Epinephrine, ??H's/T's??: 2 more fluid boluses (hypovolemia), pull back of ETT (hypoxemia and acidosis)

→ Return of spontaneous circulation in 4 minutes

→ Extubated after 5 days

→ Discharged home day 12 with no respiratory support

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A 4 yo boy falls onto monkey bars.

→ Review: Potential cause of arrest: Worsened lung contusions, ETT R main stem

CARDIOPULMONARY ARREST

?PREVENT IN FUTURE?

RETURN OF SPONTANEOUS CIRCULATION

SURVIVAL TO DISCHARGE

NO LONG TERM DISABILITY

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American Heart Association® Get With The Guidelines® Resuscitation

AHA collaborative QI program

Improve adherence to evidence based care:

- In-hospital cardiopulmonary arrest
- Post cardiac arrest care after out of hospital cardiac arrest

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IN-HOSPITAL CARDIAC ARRESTS (IHCA)

- Per year >200 000 adults and ~6000 children experience IHCA[1]
- IHCAs are secondary to respiratory compromise, shock, predictable progressive deterioration[2]
- Outcomes (survival to discharge and neurologic functionality) for IHCAs have improved
- Risk adjusted outcomes vary between hospitals

[1]*AHA 2015 report*

[2]*Nadkarni JAMA 2006*

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Resuscitation

Goal of GWTG-R→ Save more lives

- Prevent in-hospital cardiac arrest
- Optimize outcomes

- Benchmarking
- QI
- Knowledge translation
- Research

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American Heart Association

Get With The Guidelines.

Resuscitation

PERFORMANCE MEASURES

PEADIATRIC
Age < 18 years and
>= 1year

NEONATE/INFANT
Age < 1 year and
>= 24 hours old

ADULT
Age >=18 years

NEWLY BORN
Event occurred at
delivery
(< 24 hours old)

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Resuscitation

PERFORMANCE MEASURES

PEADIATRIC
Age < 18 years and
>= 1year

NEONATE/INFANT
Age < 1 year and
>= 24 hours old

ADULT
Age >=18 years

NEWLY BORN
Event occurred at delivery
(< 24 hours old)

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PEDIATRIC AND NEONATE/INFANT [24 HOURS OLD- 18 YEARS]

1. Confirmation of airway device placement in trachea
2. Time to first chest compressions <= 1 min
3. Time to IV/IO epinephrine <= 5mins of asystole or PEA
4. Percent pulseless cardiac events occurring in ICU

MEASURE 1

PERCENT OF EVENTS WITH CONFIRMATION OF AIRWAY DEVICE PLACEMENT IN TRACHEA

MEASURE 1 PERCENT OF EVENTS WITH CONFIRMATION OF AIRWAY DEVICE PLACEMENT IN TRACHEA

RATIONALE

Risk for ETT misplacement/ displacement with movement

RECOMMENDATION

Clinical assessment + confirmatory devices to verify ETT placement after intubation, securement and any transport *(Class I, LOE B)*

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MEASURE 1 PERCENT OF EVENTS WITH CONFIRMATION OF AIRWAY DEVICE PLACEMENT IN TRACHEA

RECOMMENDATION: Exhaled or End-Tidal CO2 monitoring

When available ETCO2 capnography recommended in all settings and during transport for children with **perfusing cardiac rhythm** *(Class IIb, LOE C)*

During cardiac arrest: if ETCO2 not detected→ confirm ETT by direct laryngoscopy *(Class IIa, LOE C)*

MEASURE 2

PERCENT OF EVENTS WHERE TIME TO FIRST CHEST COMPRESSIONS IS <= 1 MINUTE

MEASURE 2 PERCENT OF EVENTS WHERE TIME TO FIRST CHEST COMPRESSIONS IS <= 1 MINUTE

RATIONALE

- Chest compressions generate blood flow to vital organs and increase likelihood of ROSC
- Early CPR → improved survival and neurologic outcomes for out of hospital cardiac arrest

RECOMMENDATION

When a child/infant is unresponsive or not breathing:

BLS- Start CPR within 10 seconds if no pulse or unsure of pulse *(Class IIa, LOE C)*

PALS- Start chest compressions immediately while 2nd rescuer prepares for ventilation *(Class I, LOE C)*

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MEASURE 2 PERCENT OF EVENTS WHERE TIME TO FIRST CHEST COMPRESSIONS IS <= 1 MINUTE

RECOMMENDATION

- C-A-B sequence (1 rescuer: 30:2, 2 rescuers 15:2) *(Class IIb, LOE C)*
- Infant: 1 rescuer- 2 finger chest compressions

  2 rescuer- 2 thumb encircling hands technique
- CPR: chest compressions with rescue breaths
- Ventilation with minimal interruption of compressions *(Class IIa, LOE C)*

MEASURE 2 PERCENT OF EVENTS WHERE TIME TO FIRST CHEST COMPRESSIONS IS <= 1 MINUTE

RECOMMENDATION: High Quality CPR

1. Rate: 100-120/min *(Class IIa, LOE C)*
2. Depth: depress chest 1/3rd of AP diameter- 1.5" infants, 2" children, not more than 2.5" for adolescents *(Class IIa, LOE C)*
3. Full recoil *(Class IIb, LOE B)*
4. Minimize interruptions
5. Avoid excessive ventilation

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MEASURE 3

PERCENT OF EVENTS WHERE TIME TO EPINEPHRINE <=5 MINUTES OF ASYSTOLE OR PULSELESS ELECTRICAL ACTIVITY

MEASURE 3

PERCENT OF EVENTS WHERE TIME TO EPINEPHRINE <=5 MINUTES OF ASYSTOLE OR PULSELESS ELECTRICAL ACTIVITY

RATIONALE

Epinephrine is strong inotrope and vasoconstrictor→ augments heart function and coronary perfusion

RECOMMENDATION

While continuing CPR, obtain vascular access→ Epinephrine 0.01mg/kg (0.1 ml/kg of 1:10,000 solution) iv/io

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MEASURE 3

PERCENT OF EVENTS WHERE TIME TO EPINEPHRINE <=5 MINUTES OF ASYSTOLE OR PULSELESS ELECTRICAL ACTIVITY

RECOMMENDATION

- Same dose of Epinephrine repeated every 3-5 minutes *(Class I, LOE B)*
- High dose Epinephrine has no survival benefit and can be harmful particularly in asphyxia *(Class III, LOE B)*

MEASURE 4

PERCENT OF PULSELESS CARDIAC EVENTS OCCURRING IN AN ICU SETTING VERSUS GENERAL INPATIENT AREA

MEASURE 4 PERCENT OF PULSELESS CARDIAC EVENTS OCCURRING IN AN ICU SETTING VERSUS GENERAL INPATIENT AREA

RATIONALE

- Rates of return of spontaneous circulation are higher for arrests within ICU than for cardiac arrests outside ICU *(Class IIa, LOE B)*
- More resources: personnel, technology → improved monitoring

RECOMMENDATION

Establishment of RRT/MET systems *(Class IIb, LOE C)*

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MEASURE 4 PERCENT OF PULSELESS CARDIAC EVENTS OCCURRING IN AN ICU SETTING VERSUS GENERAL INPATIENT AREA

RECOMMENDATION

- Use of Early Warning Sign Systems (EWSS) to recognize deterioration early *(Class IIb, LOE C)*
- High-risk patients to be transferred to ICU settings

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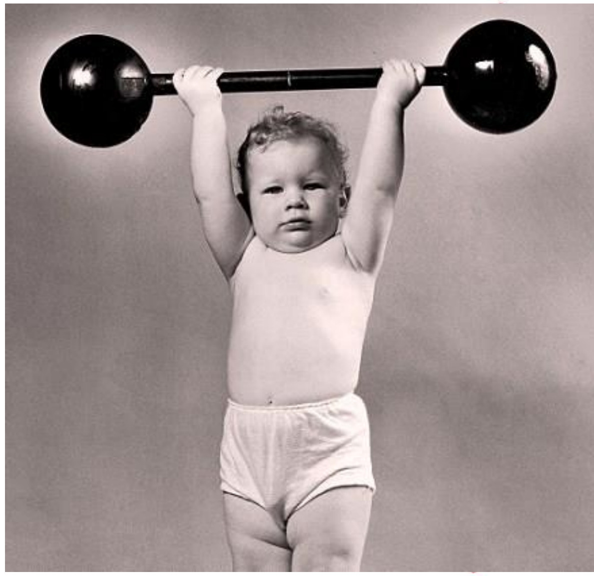
Resuscitation



Prevent CPR

Optimize CPR outcomes

Awareness

Availability

Ability

- Multidisciplinary education
- Information dissemination

- Code cart stocking:
- Medications
- Equipment

- Training
- Crisis resource management
- Debriefing

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PREVENTION IS BETTER THAN CURE: RRT/METS

Institute for Healthcare Improvement

100k lives Campaign

Circulation

Peberdy et al Circulation 2007

ILCOR CONSENSUS STATEMENTS

Recommended Guidelines for Monitoring, Reporting, and Conducting Research on Medical Emergency Team, Outreach, and Rapid Response Systems: An Utstein-Style Scientific Statement

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IMPACT OF RRTS/METS

Maharaj et al. Critical Care 2015; 19:254

CRITICAL CARE

Rapid response systems: a systematic review and meta-analysis

Post RRT Risk Ratio:
Cardiac Arrests- 0.65 [0.61-0.7]
Mortality- 0.8 [0.76-0.89]

Effectiveness of rapid response teams on rates of in-hospital cardiopulmonary arrest and mortality: A systematic review and meta-analysis

Solomon et al J. Hosp. Med. 2016 June;11(6):438-445

Post RRT Relative Risk :
Cardiac Arrests- 0.62 [0.55-0.69]
Mortality- 0.88 [0.83-0.93]

A 4 yo boy falls onto monkey bars.

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Resuscitation

RRT/MET

ETT:
- Assessment post placement
- Transport: movement

- Cardiac arrest in ICU
- Immediate high quality CPR
- Epinephrine within a minute of arrest

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SUMMARY

Encourage – Educate - Empower:

- Prevention is better than cure
- But when arrest ensues: prompt recognition and intervention saves lives
- Start compressions early
- Assess ETT position at placement and with any movement
- Epinephrine ASAP

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American Heart Association®

life is why™

Resources link: www.heart.org

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THE ROLE OF CPR QUALITY IN IMPROVED CARDIAC ARREST SURVIVAL

LynAnne Walden, MA, BSRC, RRT-NPS

Regional Program Manager – Life Support Training

Ascension Healthcare

Presenter Disclosure Information

LynAnne Walden, MA, BSRC, RRT-NPS

The Role of CPR Quality in improved cardiac survival

FINANCIAL DISCLOSURE: N/A

UNLABELED/UNAPPROVED USES DISCLOSURE: N/A

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475,000

People who die from cardiac arrest in one year in the United States

American Heart Association.

Focus All You Do

Focus All We Do

Saving Every Single One

- Create Systems
- Mobilize army of trained responders
- Ensure public access to AEDs
- TRY standards
- Eliminate preventable cardiac death in hospitals
- HIGH-Quality CPR

American Heart Association.

ZERO

You do great work

We do great work

BELIEVE in the vision

Arrive gloriously at ZERO

Because of you

No one dies from cardiac arrest

Excerpts from *A World Where No One Dies From Cardiac Arrest*, American Heart Association, Jan, 5 2018, https://www.youtube.com/watch?v=EC7HW7S2EzI

LET'S GET STARTED

High Quality CPR

"High-quality CPR should be recognized as the foundation on which all resuscitative efforts are built"

Cardiopulmonary Resuscitation Quality: Improving Cardiac Resuscitation Outcomes Both Inside and Outside the Hospital – A Consensus Statement From the American Heart Association, July 23, 2013

American Heart Association.

What Makes It High Quality?

American Heart Association.

Components of High Quality CPR

Early Recognition

Activating Emergency Response System

Chest Compression Fraction

- Compression – Ventilation Ratio
- Compression Rate
- Minimizing Time Off Chest

Compression Depth

Hand Placement

Chest Recoil

Avoid Hyperventilation

American Heart Association.

Chest Compression Fraction

- Compression – Ventilation Ratio
- Compression Rate
- Minimizing Time Off Chest

Fundamentals

- Adult 30:2 - Child/Infant 15:2
- Compression Rate 100-120
- CCF >60%

Findings:

- Compression ***Rates of 100-119*** have "***the greatest likelihood for survival***"
- Higher chest compression rates (100-120) were "significantly correlated ***with initial return of spontaneous circulation***"
- Compressions <100 ***reduced ROSC to 42%***

Chest compression rates and survival following out-of-hospital cardiac arrest.

Idris AH[1], Guffey D, Pepe PE, Brown SP, Brooks SC, Callaway CW, Christenson J, Davis DP, Daya MR, Gray R, Kudenchuk PJ, Larsen J, Lin S, Menegazzi JJ, Sheehan K, Sopko G, Stiell I, Nichol G, Aufderheide TP; Resuscitation Outcomes Consortium Investigators.

Chest compression rates during cardiopulmonary resuscitation are suboptimal: a prospective study during in-hospital cardiac arrest.

Abella BS[1], Sandbo N, Vassilatos P, Alvarado JP, O'Hearn N, Wigder HN, Hoffman P, Tynus K, Vanden Hoek TL, Becker LB.

American Heart Association.

Compression Depth

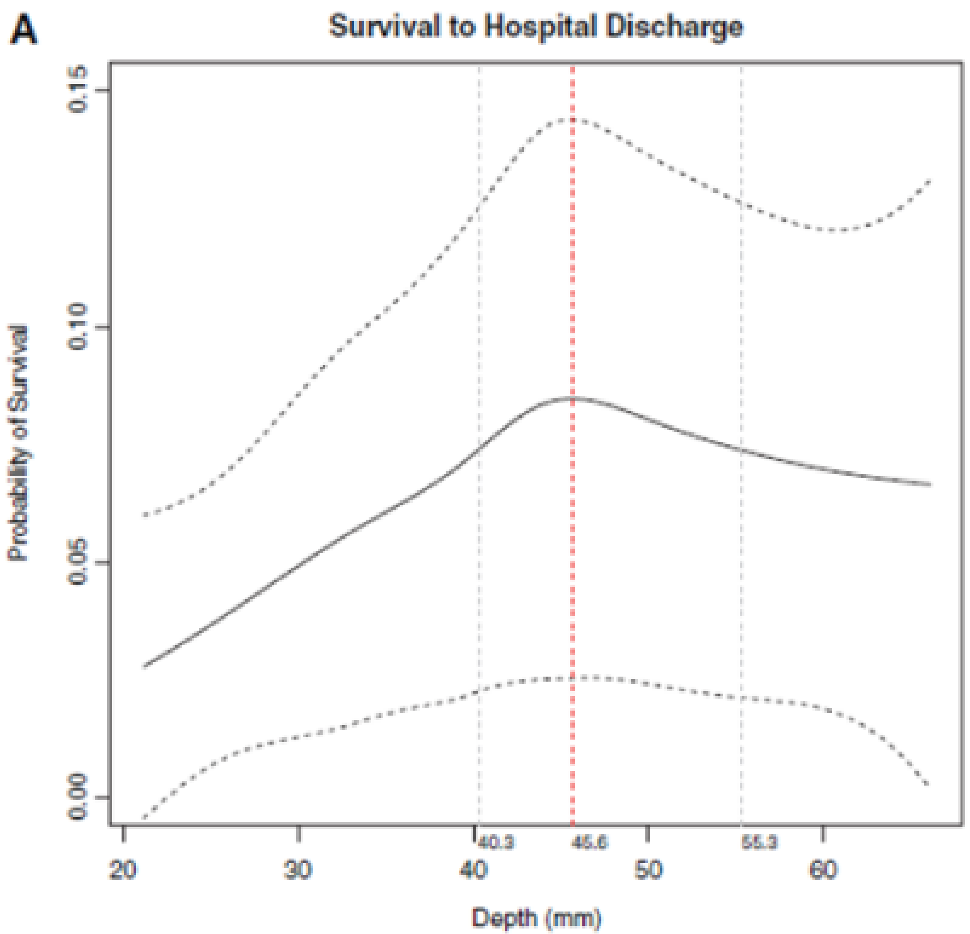
Components

- ***≥50 mm*** in adults with no residual leaning
- At least one third the anterior-posterior dimension of the chest in infants and children
- **2014 Study:** Stiell et al

Resuscitation Science

What Is the Optimal Chest Compression Depth During Out-of-Hospital Cardiac Arrest Resuscitation of Adult Patients?

Ian G. Stiell, MD; Siobhan P. Brown, PhD; Graham Nichol, MD; Sheldon Cheskes, MD; Christian Vaillancourt, MD; Clifton W. Callaway, MD; Laurie J. Morrison, MD; James Christenson, MD; Tom P. Aufderheide, MD; Daniel P. Davis, MD; Cliff Free, EMT-P; Dave Hostler, PhD; John A. Stouffer, EMT-P; Ahamed H. Idris, MD; and the Resuscitation Outcomes Consortium Investigators



Avoid Hyperventilation

Findings

- Cardiac arrest patient is more at risk for hyperventilation due to reduced blood flow from the pulmonary vascular bed
- Give one breath every 6 seconds (approx. 10 breaths/minute). Avoid giving breaths too fast or too forceful
- In 2004 study, survival decreased to only 15% when ventilation rates above 12 were used vs 85% with rate of 12

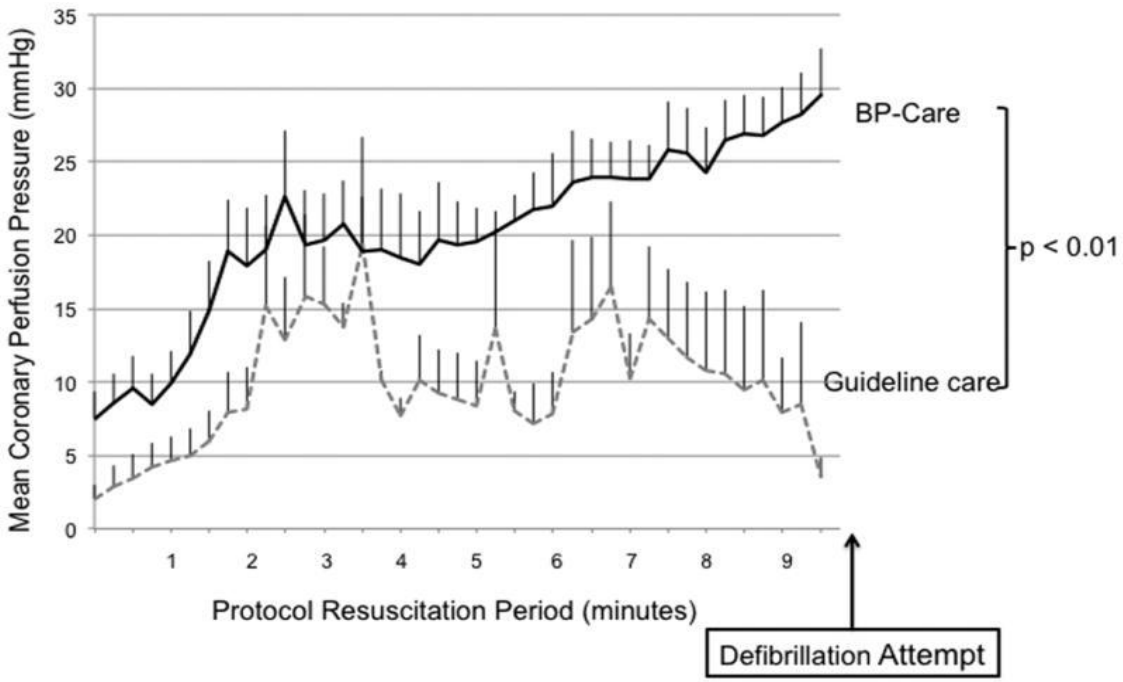
Death by hyperventilation: A common and life-threatening problem during cardiopulmonary resuscitation

Tom Aufderheide;Keith Lurie;

Ventilation strategies during out-of-hospital cardiac arrest: a problem that should not be neglected

Wei Gu[1,2], Chun-Sheng Li[1,2]

Role of Coronary Perfusion Pressure & Blood Pressure Monitoring



- Growing volume of research evaluating benefits of using intra-arterial blood pressure monitoring during CPR
- As yet inconclusive research regarding CPP as a predictor of outcomes
- 2016 study: 24-hour survival was more likely with BP care versus Guideline care

Blood Pressure and Coronary Perfusion Pressure Targeted Cardiopulmonary Resuscitation Improves 24-Hour Survival from Ventricular Fibrillation Cardiac Arrest

Y. Maryam, Naim MD,[1] Robert M. Sutton, MD MSCE,[1] Stuart H. Friess, MD,[2] George Bratinov, MD,[1] Utpal Bhalala, MD,[3] Todd J. Kilbaugh, MD,[1] Joshua Lampe, PhD,[4] Vinay M. Nadkarni, MD MS,[1] Lance B. Becker, MD,[4] and Robert A. Berg, MD[1]

American Heart Association.

How Do We Achieve High Quality?

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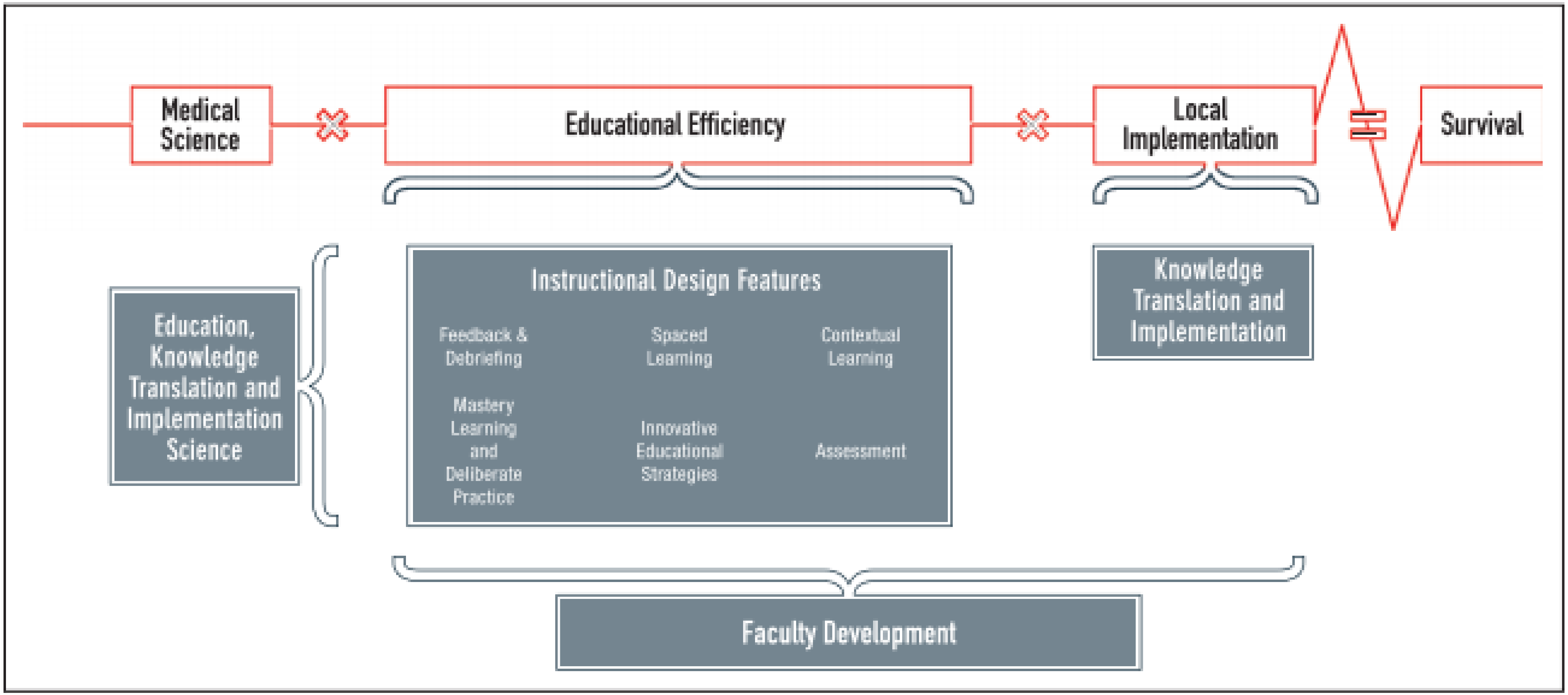
American Heart Association.

Educational Efficiency
&
Local Implementation

Modified Formula for Survival



Resuscitation Education Science: Educational Strategies to Improve Outcomes From Cardiac Arrest, 2018, Cheng et al

Mastery Learning & Deliberate Practice

Mastery

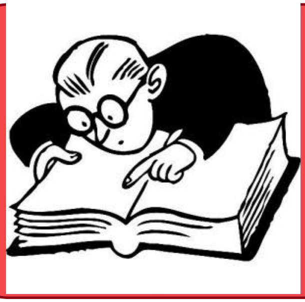
Implies that a learner can consistently demonstrate a predefined level of competence for a specific skill or task

Deliberate Practice

- "Includes activities that have been specially designed to improve the current level of performance"
- Identifies weaknesses, addresses them, moves on to next level
- Repetition AND feedback

Resuscitation Education Science: Educational Strategies to Improve Outcomes From Cardiac Arrest, 2018, Cheng et al

Spaced Practice



The separation of training into several discrete sessions over a prolonged period with measurable intervals between training sessions.

Summary of Evidence

- Nurses and residents who completed 120-second booster training in 1,3, 6 month intervals improved their skills
- Nurses practicing CPR for as little as 2 minutes at repeated intervals improved retention
- Fewer errors made by participants of neonatal resuscitation booster training every 3 months as compared to standard training group

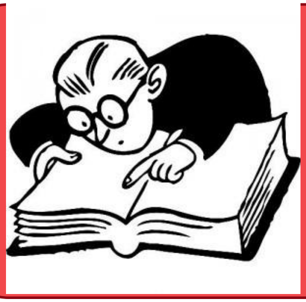
Sullivan NJ, Duval-Arnould J, Twilley M, Smith SP, Aksamit D, Boone-Guercio P, Jeffries PR, Hunt EA. Simulation exercise to improve retention of cardiopulmonary resuscitation priorities for in-hospital cardiac arrests: a randomized controlled trial. *Resuscitation*. 2015;86:6–13. doi: 10.1016/j.resuscitation.2014.10.021.

Sutton RM, Niles D, Meaney PA, Aplenc R, French B, Abella BS, Lengetti EL, Berg RA, Helfaer MA, Nadkarni V. Low-dose, high-frequency CPR training improves skill retention of in-hospital pediatric providers. *Pediatrics*. 2011;128:e145–e151. doi: 10.1542/peds.2010-2105.

Kaczorowski J, Levitt C, Hammond M, Outerbridge E, Grad R, Rothman A, Graves L. Retention of neonatal resuscitation skills and knowledge: a randomized controlled trial. *Fam Med*. 1998;30:705–711.

Resuscitation Education Science: Educational Strategies to Improve Outcomes From Cardiac Arrest, 2018, Cheng et al

Contextual Learning



Aligning the needs of specific learners with learning objectives and content delivery when possible.

Learner Context

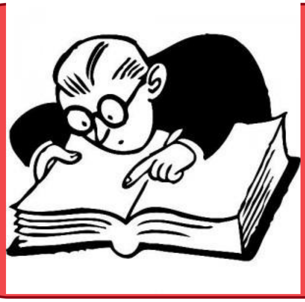
- Team Training
- Stress & Cognitive Load

Environmental Context

- Manikin Fidelity
  - Align features with relevant learning objectives
- Limited-Resource Settings

Resuscitation Education Science: Educational Strategies to Improve Outcomes From Cardiac Arrest, 2018, Cheng et al

Feedback & Debriefing



Fundamental element of resuscitation education. Performance data (feedback) and conversations about performance (debriefing) drive performance improvement

Opportunities

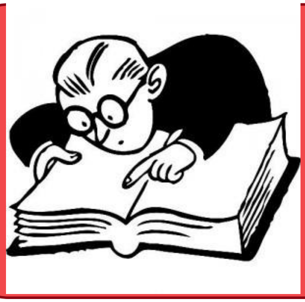
- Supportive learning environments
- Adapt for simulation and clinical contexts
- Integrate key performance data
- Align with important elements of instructional design

Resuscitation Education Science: Educational Strategies to Improve Outcomes From Cardiac Arrest, 2018, Cheng et al

Innovative Educational Strategies

Resuscitation Education Science: Educational Strategies to Improve Outcomes From Cardiac Arrest, 2018, Cheng et al

Assessment



Assessment should focus on domains of clinical knowledge, technical skills, and teamwork

Validity of Data

Assessment Tool Creation vs Modification

Resuscitation Education Science: Educational Strategies to Improve Outcomes From Cardiac Arrest, 2018, Cheng et al

Knowledge Translation & Implementation

Knowledge Translation:

Requires the integration of not only practitioners but also policy makers, educators, healthcare administrators, and healthcare organizations as knowledge users.

Effective implementation:

- Focuses on individuals, organizations, systems, and communities
- Requires dedicated effort and a commitment to pursue these activities with the goal of improving patient care and outcomes

Resuscitation Education Science: Educational Strategies to Improve Outcomes From Cardiac Arrest, 2018, Cheng et al

Putting It All Together

High Quality CPR Components

\+

Evidence-Based Educational Best Practices

=

Getting To ZERO


Imagine a
world where
no one dies
from cardiac arrest...


Getting to
Zero

American Heart Association.

American Heart Association.

AFTERNOON BREAK
15 MINUTES

EMERGENCY MEDICAL SERVICES

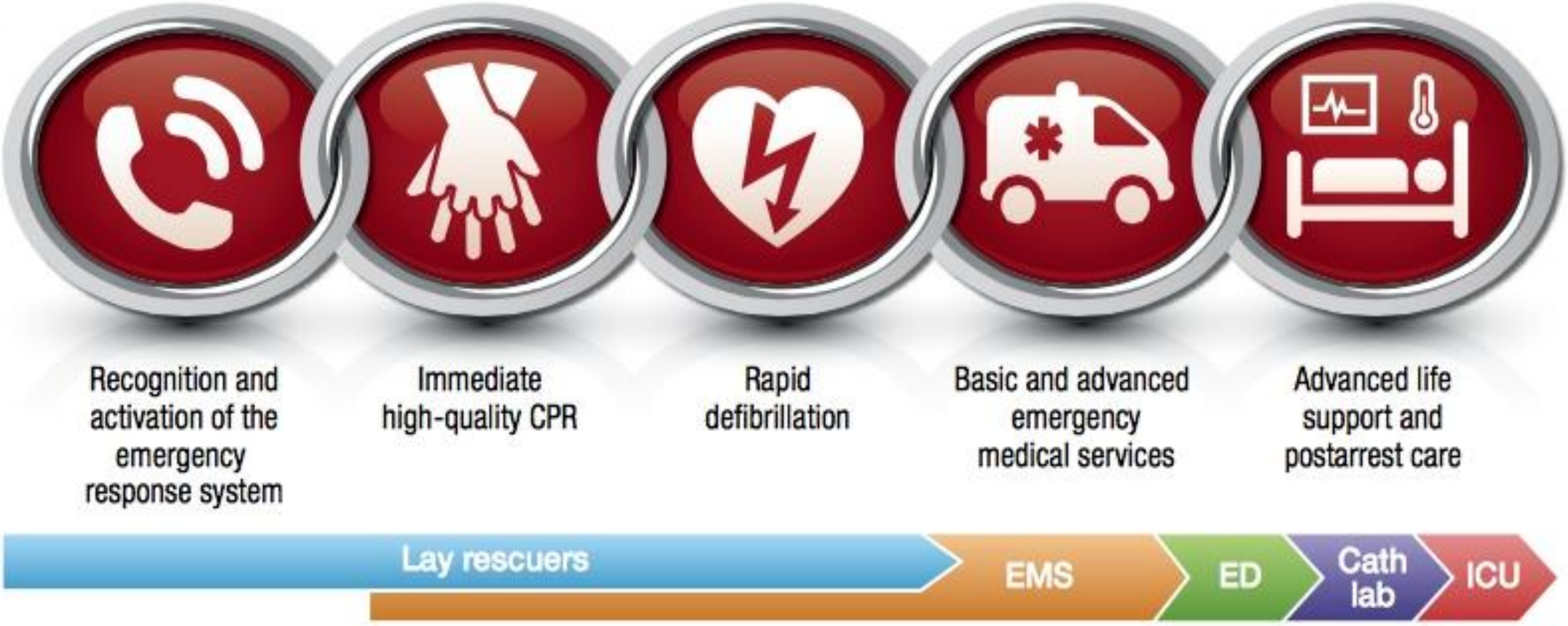
RESUSCITATION CHALLENGES IN A RURAL SETTING

JIM SWISHER, LP

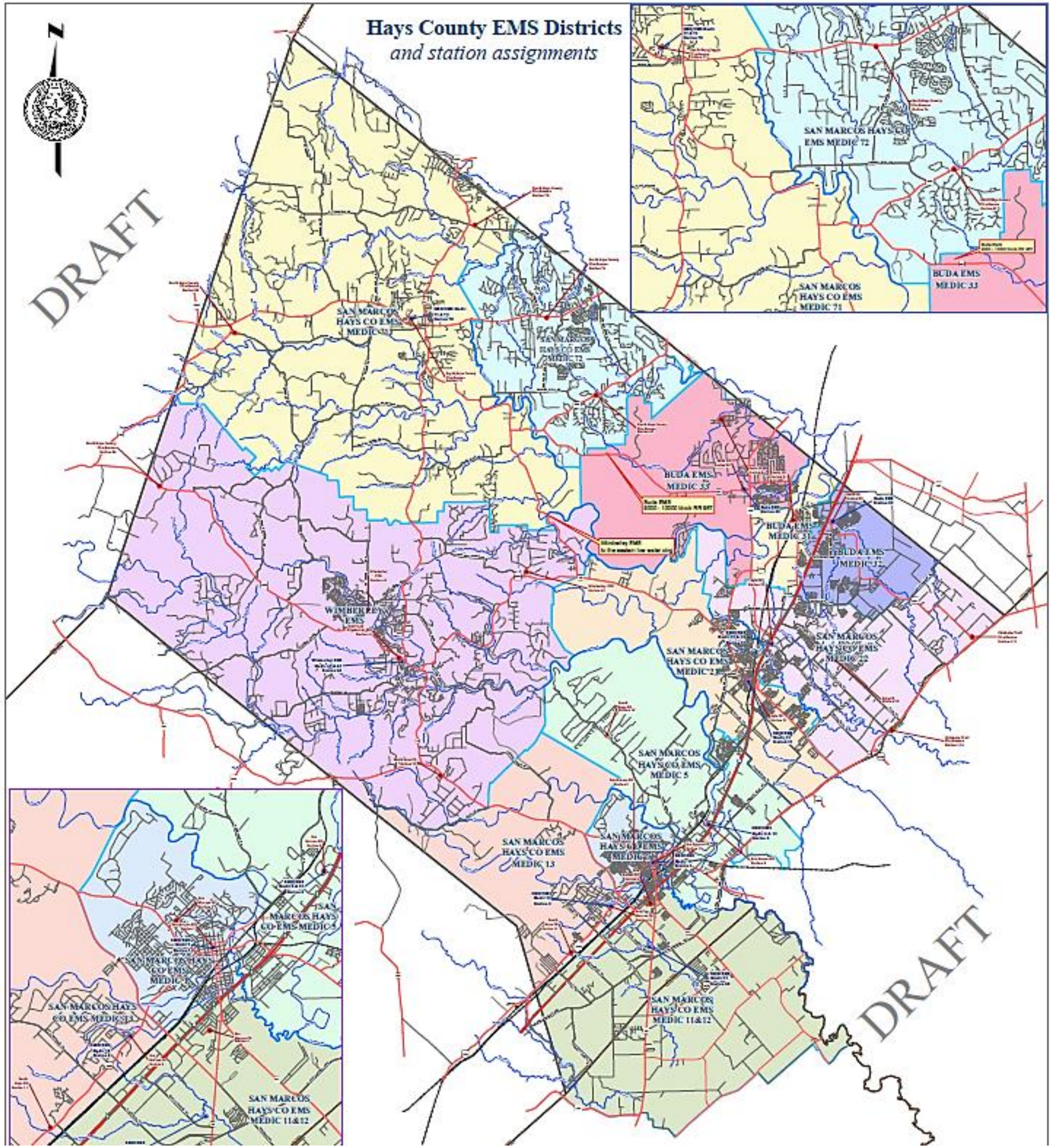
JIM SWISHER
DEPUTY CHIEF
SAN MARCOS HAYS COUNTY EMS
JSWISHER@SMHCEMS.ORG

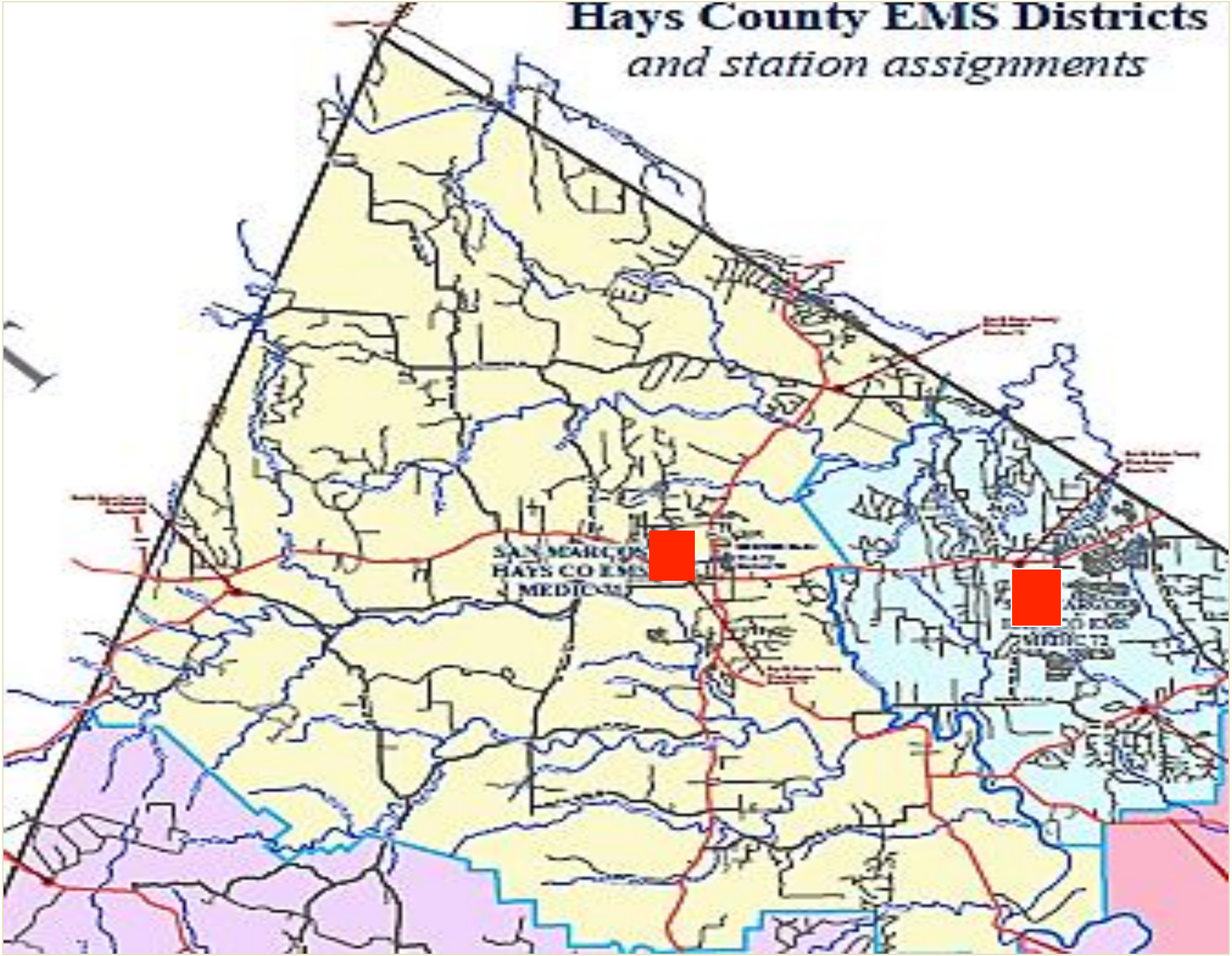
NO FINANCIAL DISCLOSURES
NO UNLABELED OR UNAPPROVED DISCLOSURES
ALL PICTURES ARE APPROVED FOR USE

American Heart Association.


Recognition and activation of the emergency response system
Immediate high-quality CPR
Rapid defibrillation
Basic and advanced emergency medical services
Advanced life support and postarrest care
Lay rescuers
EMS
ED
Cath lab
ICU

A FEW THINGS TO THINK ABOUT


Hays County EMS Districts
and station assignments
DRAFT
SAN MARCOS HAYS CO EMS MEDIC 71
SAN MARCOS HAYS CO EMS MEDIC 72
BUDA EMS MEDIC 33
BUDA EMS MEDIC 31
BUDA EMS MEDIC 32
WIMBERLEY EMS
SAN MARCOS HAYS CO EMS MEDIC 22
SAN MARCOS HAYS CO EMS MEDIC 21
SAN MARCOS HAYS CO EMS MEDIC 5
SAN MARCOS HAYS CO EMS MEDIC 13
SAN MARCOS HAYS CO EMS MEDIC 11&12
DRAFT


Hays County EMS Districts
and station assignments

American Heart Association.

American Heart Association.

American Heart Association.

HIGH QUALITY CPR

- Rural training can be hit and miss?
- Once trained always trained?
- AED's are few and far between and may not be useable
- How long can you do high quality CPR…… by your self
- When do you stop?
- Can you do High Quality CPR safely in the back of an ambulance?
- Do your 911 dispatchers give self help instructions?

WHAT ARE THE CHALLENGES

AGE OLD ISSUES

DISTANCE WILL ALWAYS BE AN ISSUE

VOLUNTEERISM IS DECREASING

LACK OF FUNDING FOR RESPONSE READINESS

MEDICS GET TRAINING AND HEAD TO TOWN FOR $$

LACK OF CONTINUE AND UPDATED TRAINING

MEDICS REQUIRED TO TRANSPORT OBVIOUS DECEASED

HOSPITALS ARE FEW, FAR BETWEEN

MENTAL STRESS OF PROVIDERS TAKING CARE OF FAMILY AND FRIENDS

American Heart Association.

GOOD NEWS IS

- CELL PHONE COVERAGE MAPS ARE GETTING BETTER
- CPR VOLUNTEER APPS ARE AVAILABLE AND ATTACHED TO SOME DISPATCH CENTERS
- AHA IS ALIVE AND WELL WITH A LOT OF TRAINING AVAILABLE
- THE STATE HAS SOME GRANTS FOR DISTANCE EDUCATION FOR EMT AND PARAMEDICS
- PEDIATRIC HOSPITALS ARE DOING CPR TRAINING FOR PARENTS OF HIGH RISK KIDS
- COMMUNITIES ARE FINDING NEW RESPONSE READY FUNDING SOURCES
- SAFER EQUIPMENT FOR TRANSPORTING OF CPR PATIENTS
- ACCEPTANCE OF "WORK ON SCENE" PROTOCOLS BY ADVANCED EMS AGENCIES
- SMALL COMMUNITIES STILL BAND TOGETHER AND TAKE CARE OF EACH OTHER
- THE STATES SCHOOL AGE CPR MANDATE WAS HUGE BUT COULD BE EXPANDED

State of Texas requires CPR for High School Graduation

by Paul - last updated on December 18, 2014

In what is another win, Texas has signed into law a requirement for all students to learn CPR. The bill amends the Texas Education Code to require school districts and open-enrollment charter schools to provide cardiopulmonary resuscitation (CPR) instruction to students in grades 7 through 12 at least once before graduation.

However, the bill also removes the use of an automated external defibrillator as part of the essential knowledge and skills of the health curriculum. The bill was renamed the Edmund Kuempel Act, named after a state representative that had died two days after being re-elected to the Texas House of Representatives.

The law was made effective immediately upon signing.

American Heart Association.

WHAT WE ARE WORKING ON AT SMHC EMS

TEACH COMMUNITIES HOW TO RECOGNIZE THE PRE CPR SIGNS/SYMPTOMS

SHARED TRAINING AND MEDICAL DIRECTION WITH ALL FIRST RESPONDERS

PIT CREW CPR MODEL IF ENOUGH PEOPLE ARE AVAILABLE

WORK PEDIATRIC PATIENTS ON SCENE, NOT PLAY FOOTBALL

LET ROSC STABILIZE BEFORE MOVING

C-1 TRANSPORT OF CPR AND ROSC PATIENTS

STOP TRANSPORT AND STABILIZE IF A ROSC PT GO'S BACK INTO ARREST

STRAIGHT TO CATH LAB WITH CPR OR STEMI

KEY TAKEAWAYS FROM STRIVE TO REVIVE

ALLISON CAPETILLO

THANK YOU FOR ATTENDING STRIVE TO REVIVE: HOUSTON!

Information for claiming your CE Credits
will be emailed to you directly.