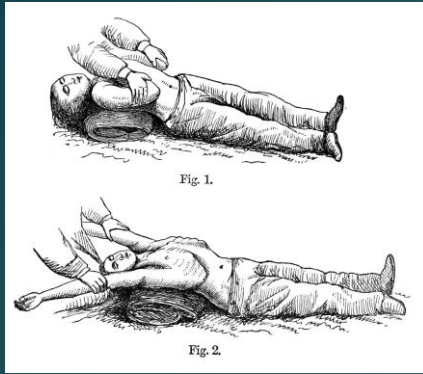




History of CPR: From When to Then



JON R KROHMER, MD, FACEP, FAEMS
UP EMS SYMPOSIUM
9-13-25



Activities: NO Disclosures

- ▶ President, Holland HeartStart
- ▶ Principal, EMSMD, PLLC
- ▶ Former Director, Office of EMS, National Highway Traffic Safety Administration (NHTSA) Office of EMS
- ▶ Former Principal Deputy Assistant Secretary and Deputy Chief Medical Officer, DHS Office of Health Affairs
- ▶ EMS SME, Cambridge Consulting Group
- ▶ EMS SME and BOD (non-executive) Velico Medical, Inc
- ▶ Adjunct Associate Professor, Department of Emergency Medicine, Michigan State University
- ▶ Adjunct Clinical Associate Professor, Department of Emergency Medicine, Western Michigan University Homer Stryker MD School of Medicine



Discussion

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- ▶ Distinguish between cardiac arrest and heart attack (MI)
- ▶ Types of CPR attempts over the ages
- ▶ Current CPR practices
 - ▶ Certification
 - ▶ Bystander
- ▶ Chain of Survival
- ▶ Adjuncts to CPR – pit crew / mechanical / ITD / Heads up
- ▶ Hands only CPR
- ▶ Telecommunicator CPR
- ▶ HeartSafe Community
- ▶ Six Minutes to Live



Cardiac Arrest vs Heart Attack (MI)

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- ▶ Cardiac Arrest (heart has stopped)
 - ▶ Usually occurs suddenly with little warning
 - ▶ Can result from a heart attack
 - ▶ Patient is unconscious / no pulse (heartbeat) / abnormal or no breathing
 - ▶ Fatal if not treated immediately
 - ▶ Requires CPR **and** defibrillation (shock)
- ▶ Heart attack (MI - myocardial infarction)
 - ▶ Patient will have symptoms (chest pain, shortness of breath, nausea, arm discomfort)
 - ▶ Men vs Women
 - ▶ Patient is conscious, has pulse and is breathing
 - ▶ Requires medical care soon – recognize and call 9-1-1



Cardiopulmonary Resuscitation (CPR) 5

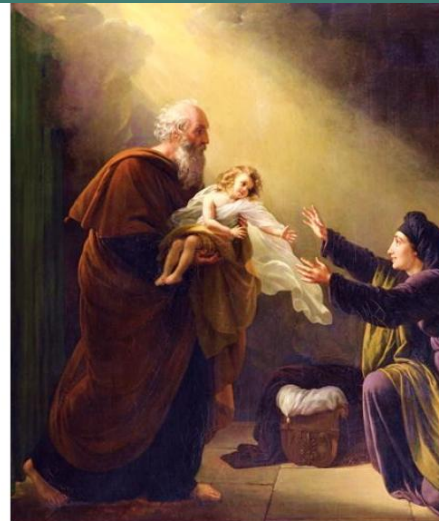
- ▶ Artificial respiration (breathing)
- ▶ Artificial circulation (cardiac compressions)
- ▶ Defibrillation (electrical shock)



Ancient attempts

6

- ▶ Ancient Egypt – goddess Isis revived Osiris via the “breath of life”
- ▶ Elijah revived a boy with mouth – mouth x 2
 - ▶ Kings 1 and Kings 2



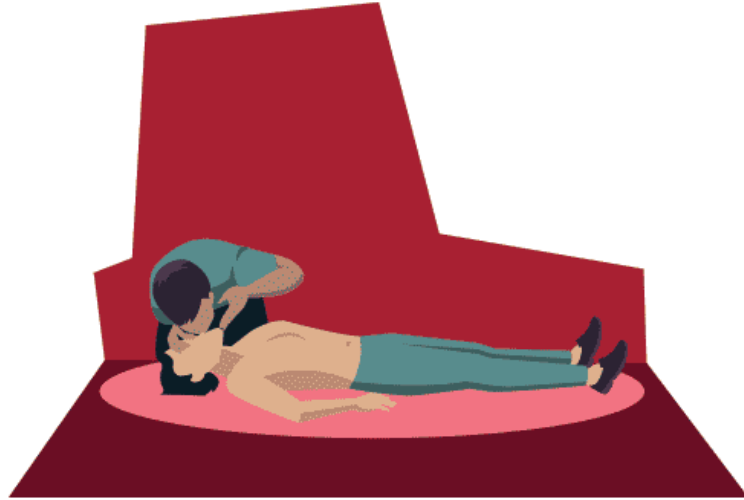
Elijah Resuscitating the Son of the Widow of Sarepta, 1819 painting by Louis Hersent

Early Methods Before 1700's

7

- ▶ Inflation
 - ▶ Bellows to lungs
- ▶ Stimulation
 - ▶ Flagellation
 - ▶ Applying heat and cold
 - ▶ Vigorously shaking or rolling the body
- ▶ Inversion and Rolling
 - ▶ Hanging
 - ▶ Rolling over barrels
- ▶ Fumigation
 - ▶ Tobacco smoke via tube or bellows





18th century

10

- ▶ Humane Societies

- ▶ 1740: Paris Academy of Sciences

- ▶ Recommended mouth to mouth for drowning victims

- ▶ 1767: Society for the Recovery of Humans and the Apparently Drowned (Amsterdam)

- ▶ Guidelines for reversing death w ventilation and circulation

- ▶ Royal Humane Society (London)

- ▶ Mouth to Mouth

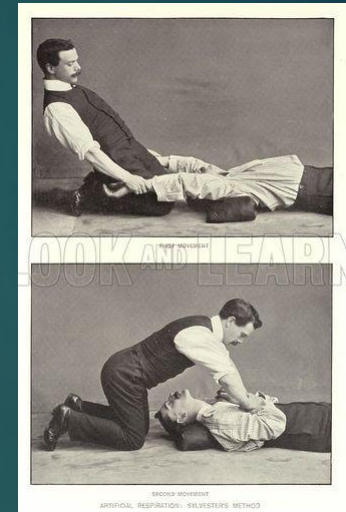
- ▶ 1740 - Paris Academy of Science

- ▶ Mouth to mouth for drowning victims

- ▶ Manual methods

- ▶ Silvester technique – arm lift / chest pressure

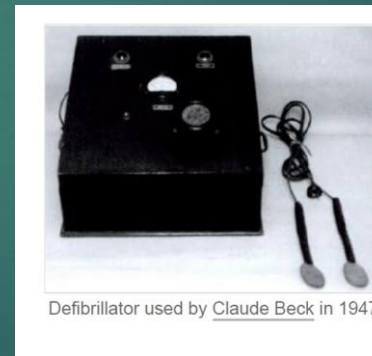
- ▶ Holger Nielsen technique – arm lift / back pressure



20th Century – start of real CPR

11

- ▶ Chest compression and rescue breathing combined
- ▶ 1900's Dr. George Crile – external chest compression on dogs and humans (internal cardiac compression still preferred)
- ▶ 1933: Johns Hopkins Univ – effectiveness of external chest compressions in dogs
- ▶ 1947: Dr. Claude Beck – first successful human internal cardiac defibrillation



Defibrillator used by Claude Beck in 1947

Birth of Modern CPR

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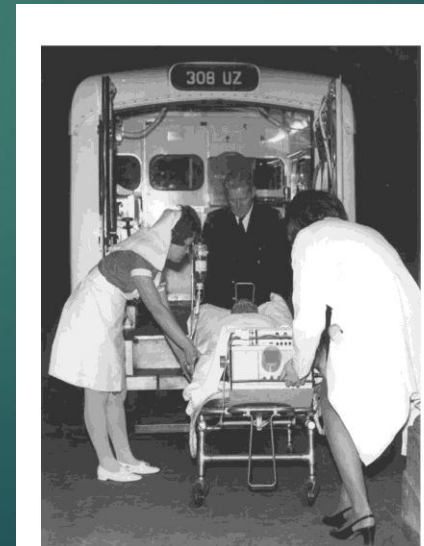
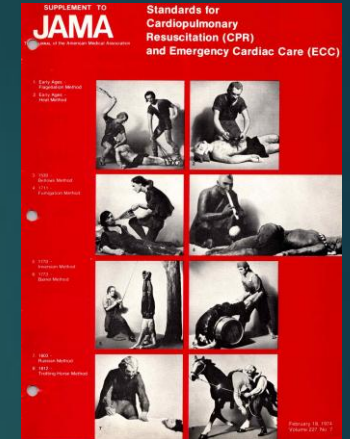
- ▶ Rediscovered breathing
 - ▶ Dr. James Elam and Dr. Peter Safar
 - ▶ Proved that expired air contained enough oxygen to keep blood oxygenated – enough for non-breathing patient
 - ▶ Safar: opened the airway with head-tilt / chin-lift maneuver
 - ▶ “airway / breathing / circulation”
- ▶ Circulation
 - ▶ Kouwenhoven / Knickerbocker / Jude – Johns Hopkins Univ
 - ▶ Working on external defibrillators
 - ▶ Firm pressure with paddles on dogs compressed the heart enough
 - ▶ Confirmed external cardiac compression in humans
 - ▶ 1960 JAMA landmark article



Modern CPR

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- ▶ 1960 – combined mouth – mouth and external chest compressions
- ▶ American Heart Association – started training physicians in CPR
- ▶ 1966 – first National Conference on Cardiopulmonary Resuscitation and Emergency Cardiac Care
 - ▶ AHA and ARC started training civilians
- ▶ 1965 – Dr. Frank Pantridge at Royal Victoria Hospital in Belfast
 - ▶ Portable defibrillator - Heartmobile

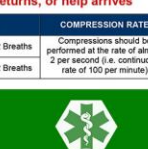


CPR standards (certification)

14

- ▶ Compression to Ventilation Ratios
 - ▶ 5:1 / 15:2 multiple rescuers
 - ▶ 30:2 single rescuer
- ▶ Compression Rate
 - ▶ 100 – 120 compressions per minute
- ▶ Compression Depth
 - ▶ 2 – 2 ½ inches
- ▶ Quality Compressions
 - ▶ Full chest recoil
 - ▶ Minimizing interruptions
 - ▶ Chest compression fraction

RESUSCITATION (CPR)

D DANGER Check for hazards & ensure safety	R RESPONSE Check to see if Unresponsive/Unconscious	S SEND FOR HELP Call the ambulance on 000																			
Adults & Children 	A casualty who is unresponsive and not breathing normally needs urgent resuscitation	Infants Under 12 months 																			
	A AIRWAY Open airway, Head tilt/Chin Lift																				
	B BREATHING Check breathing, if not breathing / abnormal breathing commence CPR																				
	C CPR 30 compressions : 2 breaths (if unwilling or unable to do breaths, consider doing chest compressions only)																				
	D DEFIBRILLATOR (AED) Attach AED as soon as available and follow its prompts																				
Continue sequence until responsiveness or normal breathing returns, or help arrives																					
	<table border="1"><thead><tr><th>HEAD TILT</th><th>PRESSURE</th><th>DEPTH</th><th>BREATHS</th><th>RATIO</th><th>COMPRESSION RATE</th></tr></thead><tbody><tr><td>ADULTS & CHILDREN</td><td>Yes</td><td>2 Hands</td><td>1/2 chest depth (Approx 5 cm)</td><td>Full breaths</td><td>30 Compressions: 2 Breaths</td><td rowspan="2">Compressions should be performed at the rate of almost 2 per second (i.e. continuous rate of 100 per minute)</td></tr><tr><td>INFANT (Birth - 1)</td><td>No</td><td>2 Fingers</td><td>1/3 chest depth (Approx 4 cm)</td><td>Puffs</td><td>30 Compressions: 2 Breaths</td></tr></tbody></table>	HEAD TILT	PRESSURE	DEPTH	BREATHS	RATIO	COMPRESSION RATE	ADULTS & CHILDREN	Yes	2 Hands	1/2 chest depth (Approx 5 cm)	Full breaths	30 Compressions: 2 Breaths	Compressions should be performed at the rate of almost 2 per second (i.e. continuous rate of 100 per minute)	INFANT (Birth - 1)	No	2 Fingers	1/3 chest depth (Approx 4 cm)	Puffs	30 Compressions: 2 Breaths	
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www.clarencevalleyfirstaid.com.au
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Evolution of defibrillation

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- ▶ Manual Defibrillation – manual shock
 - ▶ Internal defibrillation
 - ▶ External defibrillation
- ▶ Automated Defibrillation
 - ▶ Heart-Aid - late 1970's
 - ▶ Increased sophistication since then
 - ▶ Automated rhythm analysis / +/- manual shock
- ▶ Public Access Defibrillation (PAD)
 - ▶ Citizen training and public placement of AEDs
 - ▶ Early CPR and AED
 - ▶ Chain of survival





Mechanical CPR Devices

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Heads up CPR

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Impedance Threshold Device

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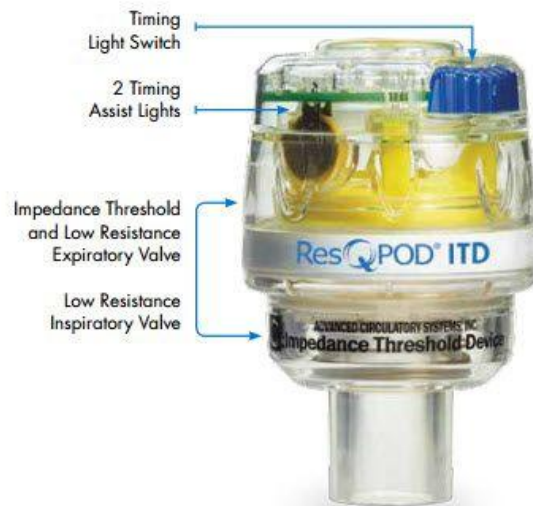
A Simple Solution for More Effective Resuscitation



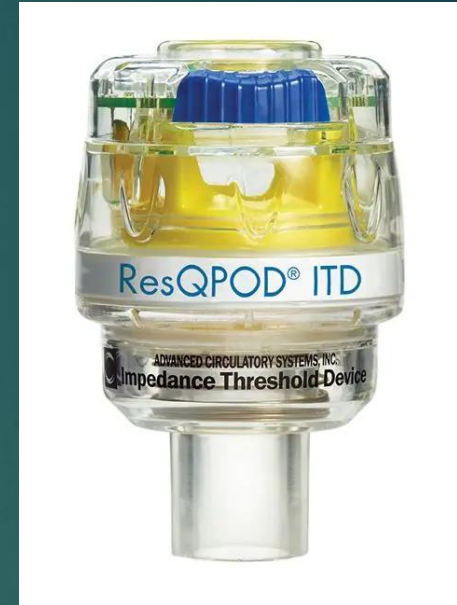
ResQPOD Features and Benefits

- Easy to integrate into resuscitation protocols
- Can be used during BLS and ALS care
- Compatible with all airway adjuncts and ventilation sources
- Timing lights guide ventilations at 10/minute
- Compatible with automated CPR devices
- Cost effective

Attached to a facemask or other airway adjunct, the ResQPOD ITD contains airway pressure-sensing valves to selectively prevent air from entering the chest during chest wall recoil. This enhances the vacuum that pulls blood back to the heart, increasing preload. Patient ventilation and exhalation are not restricted. Timing lights flash at 10 per minute and guide ventilations at the AHA-recommended rate to discourage hyperventilation.



ResQPOD ITD 10



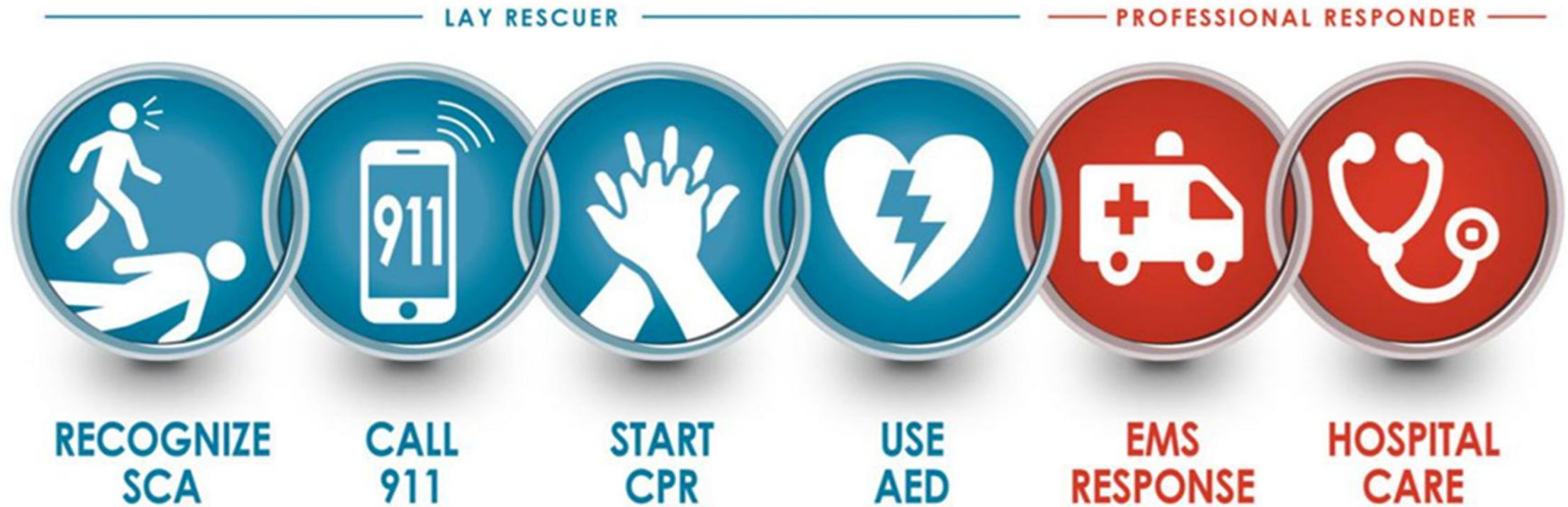


AED AED



Chain of Survival

21



Hands-Only CPR

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- ▶ Chest compressions alone are effective for first few minutes to circulate oxygenated blood
- ▶ Overcomes resistance to mouth to mouth ventilations
- ▶ Recognize that patient is not responsive and not breathing normally
 - ▶ Don't assess for pulse
 - ▶ Ignore agonal respirations
- ▶ Call 9-1-1 / push hard and fast in center of chest

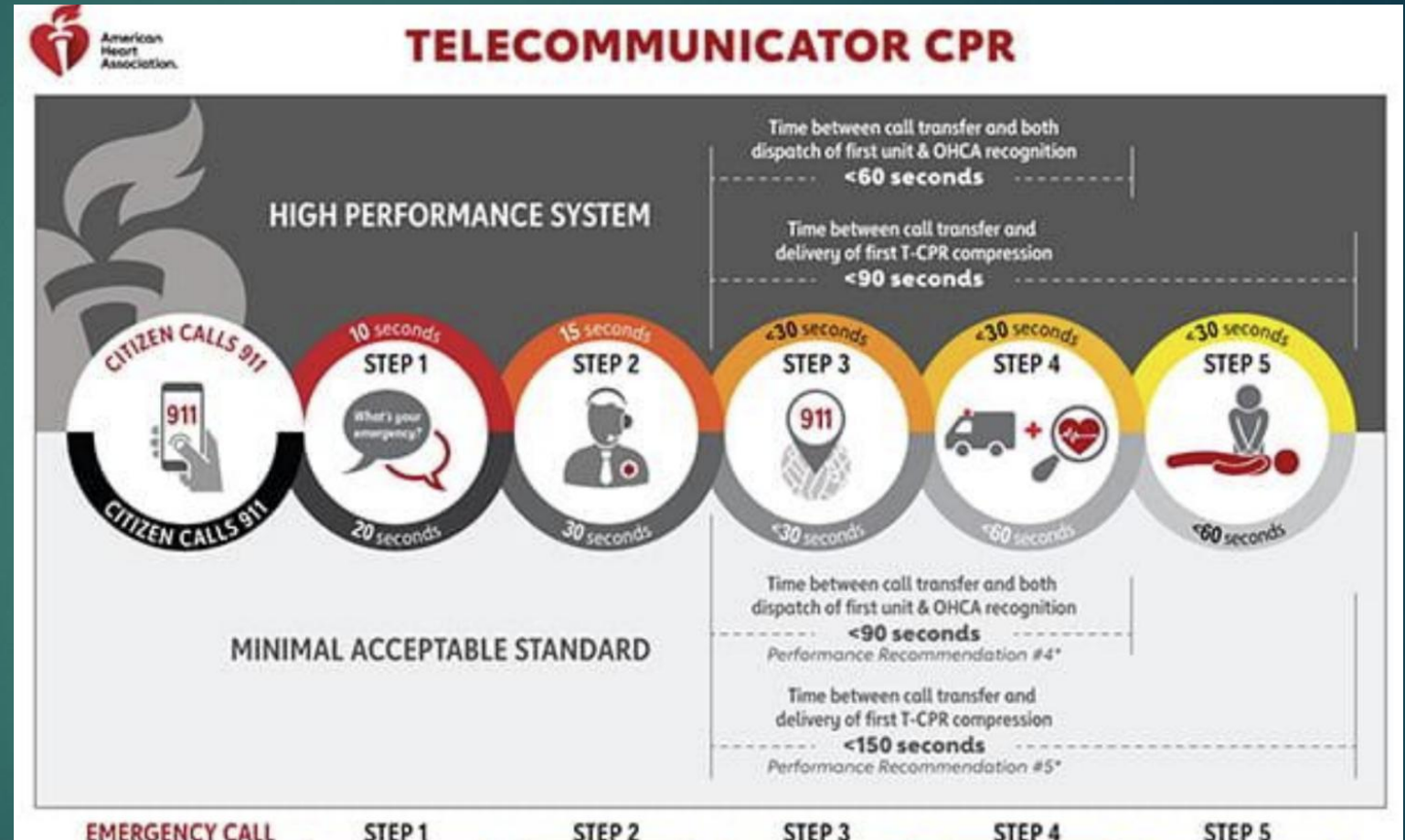
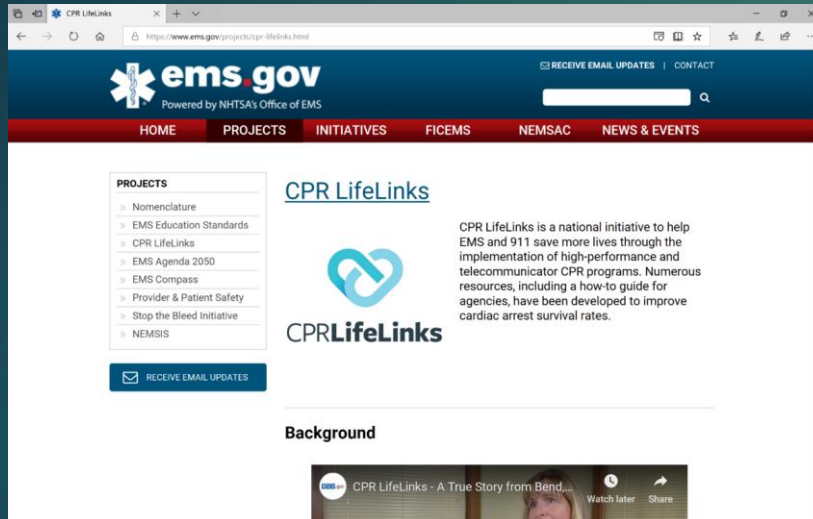
Two steps to save a life:





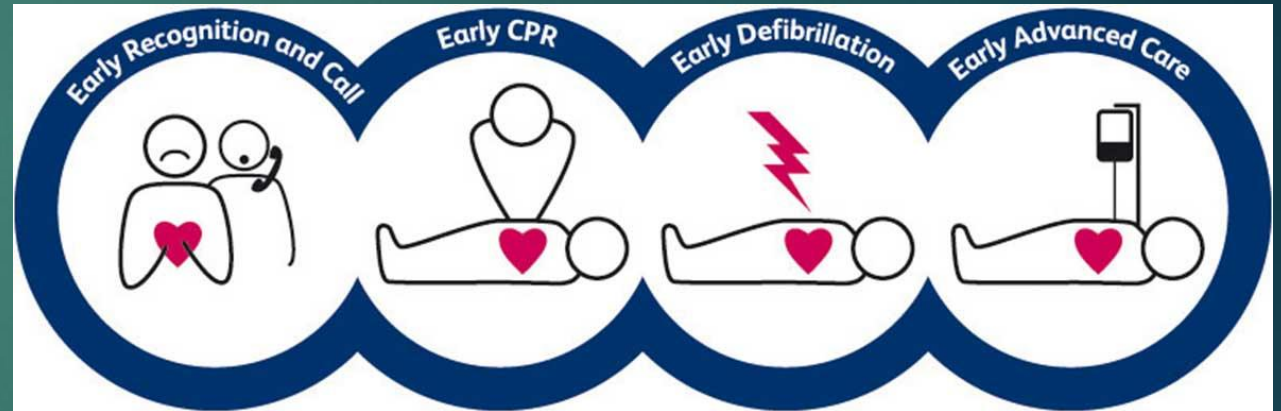
Telecommunicator CPR – 9-1-1

24



Life Saving Process

- ▶ Confirm unconscious / unresponsive
- ▶ Confirm not breathing NORMALLY
- ▶ Activate 911 response
- ▶ Start CPR
- ▶ Determine if AED is available
- ▶ Continue CPR
- ▶ Apply AED when available
- ▶ Continue CPR until EMS arrives



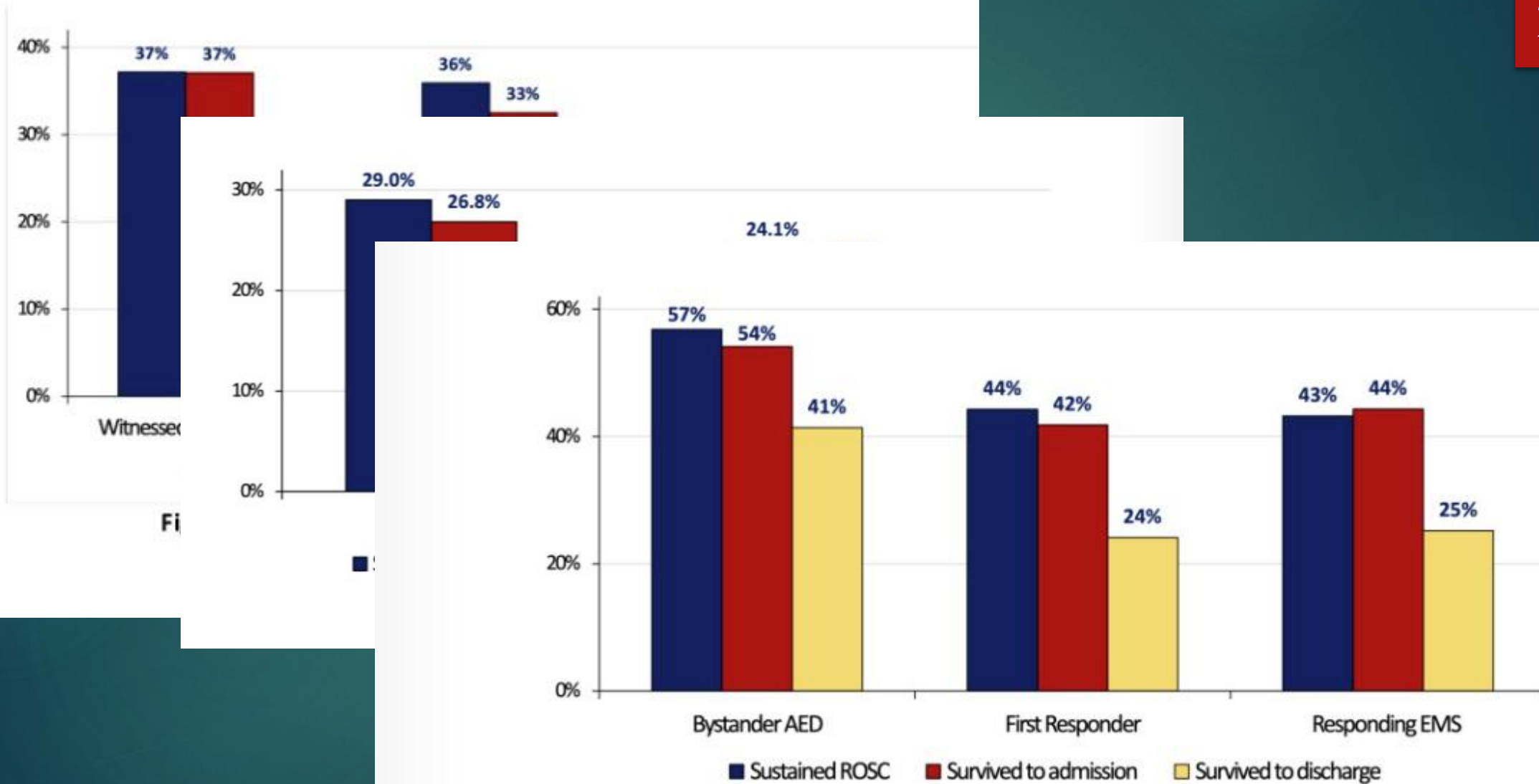


Figure 15. Unadjusted survival outcomes by who performed first defibrillation in the population with a shockable presenting rhythm.

HeartSafe Community

27

- ▶ Recognition by the Citizen CPR Foundation
- ▶ Lead organization
- ▶ Plan for collection and analysis of cardiac arrest data
 - ▶ CARES participation encouraged
- ▶ 15% of population trained in CPR
- ▶ Recognition of citizen CPR
- ▶ Strategies for increasing citizen recognition of sudden cardiac arrest – encouraging bystander CPR
- ▶ T-CPR program
 - ▶ Engage, encourage and support state legislation re T-CPR
- ▶ Schools and public buildings develop emergency response plans
- ▶ AED placement around community
- ▶ AED registry
- ▶ First Responder AEDs
- ▶ High performance CPR
- ▶ Cardiac arrest QI program
 - ▶ Patient outcome data
- ▶ Secondary public health education programs



PulsePoint connection



SCA victim in need.



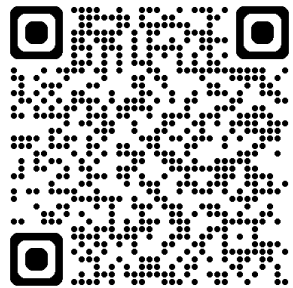
911 system sends
PulsePoint alert.



Signal received by nearby
PulsePoint users.



Users rush to help
the victim before
professional help arrives.



PulsePoint

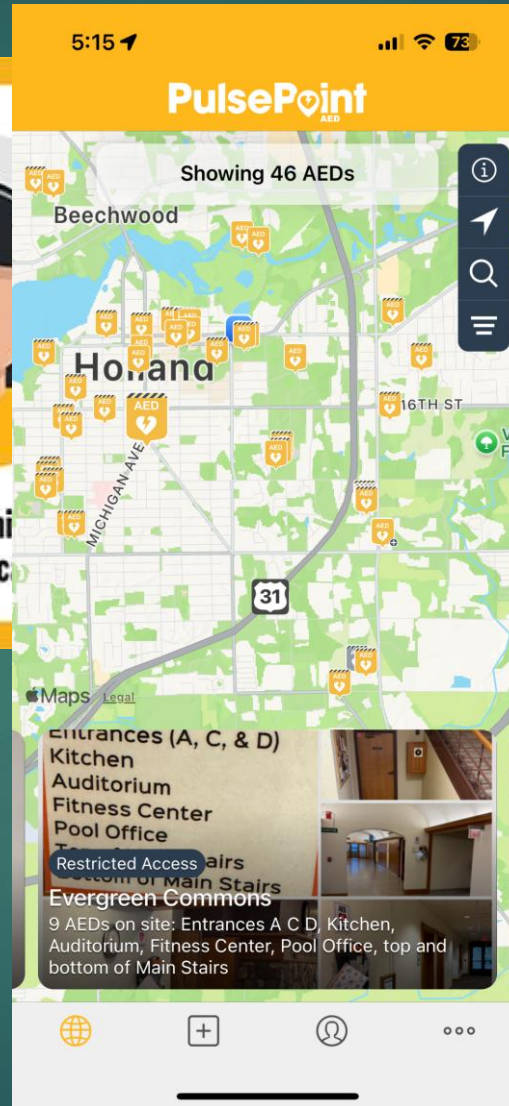
PulsePoint AED registry



911 is called to report
a person in need.



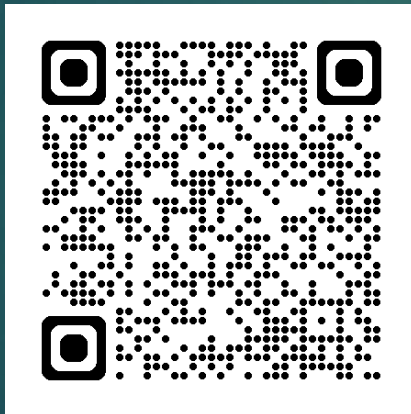
Emergency communi
confirms possible c



to nearby AEDs alerted
with emergency responders.



AED is delivered
to the incident location.



Six Minutes to Live

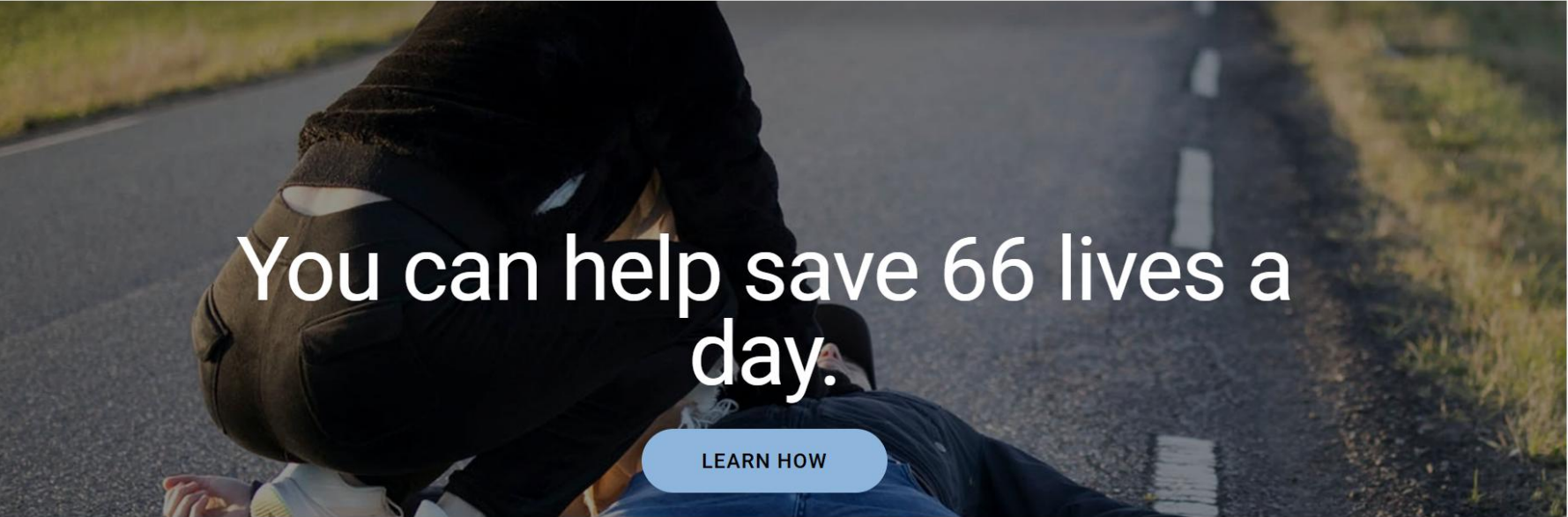
30

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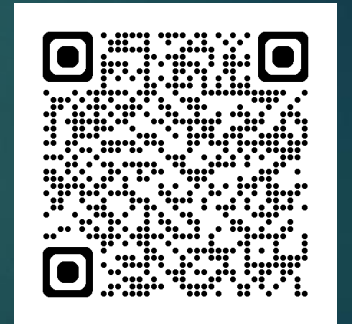
Six Minutes to Live

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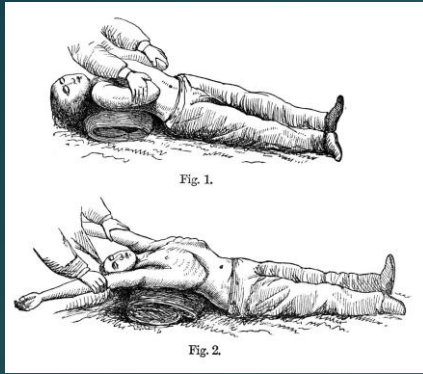
[Six Minutes to Live](#)



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History of CPR: From When to Then



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9-13-25

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LAY RESCUER

PROFESSIONAL RESPONDER



RECOGNIZE
SCA



CALL
911



START
CPR



USE
AED



EMS
RESPONSE



HOSPITAL
CARE

CPR – someone's life may be in your hands!

- ▶ HeartSafe Holland
 - ▶ heartsafeholland.org

