



# PEDIATRIC TERMINATION OF RESUSCITATION

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# DISCLOSURE

- Drs. Adelgais and Brumme have no financial disclosures

## GOALS OF THIS PRESENTATION:

- To discuss implications of termination of resuscitation (TOR) guidelines for pediatric out of hospital cardiac arrest (OHCA)
- To review the evidence for one example of a termination of resuscitation guideline
- To consider the ethical implications for out of hospital pediatric termination of resuscitation for EMS providers and families

# BACKGROUND

- Pediatric out-of-hospital cardiac arrest is a low-frequency high-acuity event for EMS
- Incidence is low: 7.3 per 1,000 pediatric patient encounters
  - Compared to 73-90 per 1,000 adult patient encounters
- Survival varies based on cause
  - Survival for medical causes is 2-26%
  - Survival for traumatic causes 0-20%
- Most survivors with poor neurologic outcome

# TERMINATION OF RESUSCITATION (TOR) GUIDELINES

## TOR guidelines aim to reduce:

- Futile transports
- Provide psychosocial support on scene
- Preserve EMS resources
- Improve provider safety

**Predictive ability for those who would not survive:**

**Specificity: > 99%**

**Positive Predictive Value: >99%**

## Common elements include:

- Unwitnessed cardiac arrest
- No Shockable Rhythm
- No ROSC prior to transport after 20-30 minutes of high-quality CPR
- **Additional elements** may include:
  - Presence or absence of bystander CPR
  - Establishment of a definitive airway
  - Use of ALS interventions

# PEDIATRIC TOR GUIDELINES: FEW AND FAR BETWEEN...

## Joint policy statement for traumatic pediatric TOR:

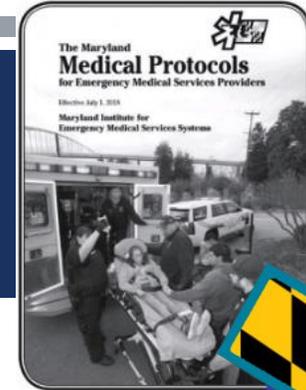
*“The decision to withhold resuscitative efforts in a child under specific circumstances (decapitation or dependent lividity, rigor mortis, etc) is reasonable.”*

*“A more formal study evaluating out-of-hospital traumatic cardiopulmonary arrest that includes long-term neurologic and functional outcome should be performed to clarify expectations for intact survival in children and legitimize the inclusion of children in termination-of-resuscitation protocols.”*

*“Termination-of-resuscitation protocols for children based on the evidence should be developed and implemented under the guidance of the EMS system or state EMS medical director.”*



# THE MARYLAND EXPERIENCE...



- Maryland Institute for Emergency Medical Services Systems (MIEMSS) writes EMS protocols for state use
- Decision made to develop a TOR guideline for use in pediatric cardiac arrest
- Utilized family members, EMS providers, EMS medical directors, and EMS researchers and did a road trip taking public comment
- Developed 2 set of criteria → **Medical and Trauma**

# MIEMSS PTOR CRITERIA

## Medical TOR:

- Can consider a patient for prehospital TOR if **<18 years** of age, AND
- Two **15-minute cycles** of CPR, AND
- At least **3 doses of epinephrine**, AND
- In asystole, AND
- End-tidal CO<sub>2</sub> of <15 mmHg

## Trauma TOR:

- Can consider a patient for prehospital TOR **<15 years** of age, AND
- Two **5-minute** cycles of CPR, AND
- In asystole, AND
- End-tidal CO<sub>2</sub> <15 mmHg

**There is adequate social/emotional support and safety for civilians and professionals on**

## RESEARCH QUESTION

How well will the termination of resuscitation criteria perform when applied to a large diverse population of children with out of hospital cardiac arrest???

# Applying a set of termination of resuscitation criteria to paediatric out-of-hospital cardiac arrest

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## Resuscitation

journal homepage: [www.elsevier.com/locate/resuscitation](http://www.elsevier.com/locate/resuscitation)

# STUDY AIMS AND HYPOTHESES

- **Aim:**

To evaluate the predictive ability of the MIEMSS Pediatric TOR (pTOR) guideline for identifying pediatric patients **who are unlikely to survive** after out-of-hospital cardiac arrests from medical and traumatic causes

- **Hypothesis:**

The pTOR guideline will perform comparably to previous adult guidelines in predictive ability

# PEDIATRIC TERMINATION OF RESUSCITATION

## Methods:

- Retrospective observational study of pediatric patients (0-17 years) with 911 EMS encounters for out of hospital cardiac arrest in 2019
- ESO Data Collaborative: January 1, 2019-December 31, 2019
- Excluded: interfacility transports, unknown ROSC status

# METHODS: ESO VARIABLES

## Medical TOR:

- Can consider a patient for prehospital TOR if <18 years of age, AND
- 30-minute of scene time, AND
- At least 3 doses of epinephrine, AND
- Initial non-shockable rhythm

## Trauma TOR:

- Can consider a patient for prehospital TOR <15 years of age, AND
- 10-minute scene time, AND
- Initial non-shockable rhythm

\*Exclusion of end-tidal CO<sub>2</sub> given too many missing variables

# METHODS: ANALYSIS AND OUTCOMES

## Primary Outcome:

- Frequency of prehospital ROSC in children who meet the pediatric TOR criteria
- Descriptive statistics:
  - Patient demographics
  - Clinical information
  - Agency level descriptors
  - Cardiac arrest characteristics

## Analysis:

- **Sensitivity** = Detecting the percent of patients with the condition
- **Specificity** = Detecting the percent of patients without the condition
- **Positive Predictive Value** = percent of patients with the condition who test positive
- **Negative Predictive Value** = percent of patients without the condition that test negative

# STUDY POPULATION

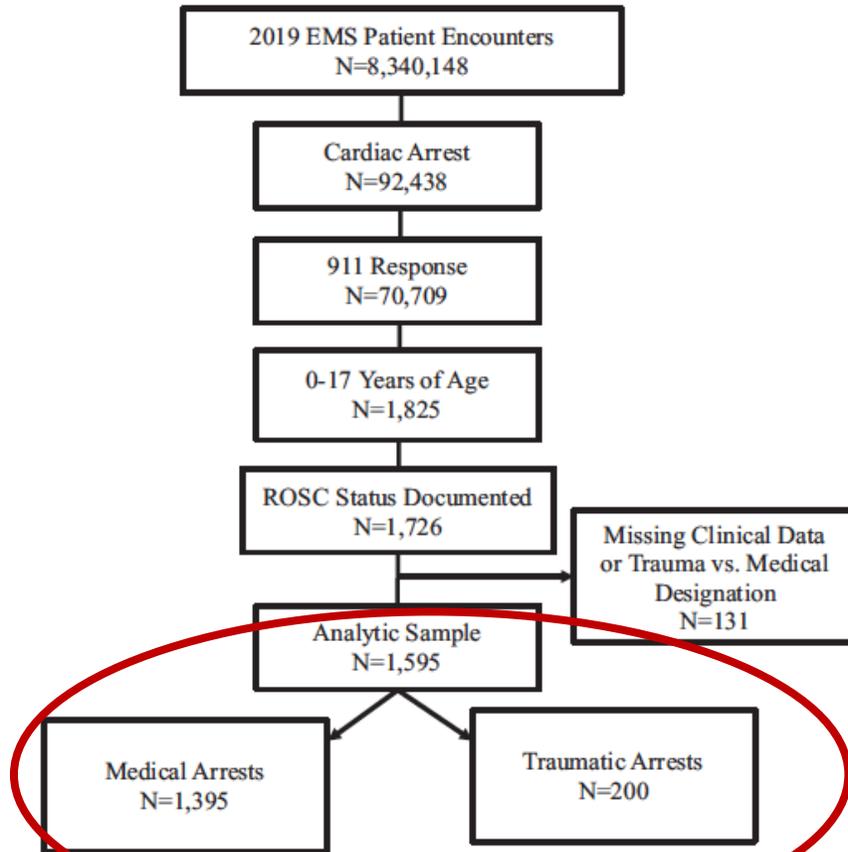


Fig. 1 - Inclusion of POHCA cases for analysis, Legend: ROSC - Return of Spontaneous Circulation, POHCA - Paediatric Out-of-Hospital Cardiac Arrest.

| Characterstics           | Medical<br>N=1395 | Trauma<br>N=200 |
|--------------------------|-------------------|-----------------|
| Witnessed arrest         | 36.9%             | 58%             |
| Bystander CPR            | 36.3%             | 23%             |
| Initial shockable rhythm | 5.9%              | 7.0%            |
| Asystole                 | 70.3%             | 38%             |
| PEA                      | 11.1%             | 19.5%           |
| Resuscitation attempted  | 95.3%             | 94.5%           |
| Prehospital ROSC         | 23.2%             | 27%             |

# STUDY POPULATION

**Table 1: Characteristics of Pediatric Cardiac Arrests Ages 0-17**

|                                   | Medical<br>(N=1395) | Trauma<br>(N=200) | Overall<br>(N=1726) |
|-----------------------------------|---------------------|-------------------|---------------------|
| <i>Patient Demographics</i>       |                     |                   |                     |
| Age in years (Median (IQR))       | 1 (0-6)             | 10 (3-15)         | 1 (0-9)             |
| Male                              | 58.9% (821)         | 65% (130)         | 60% (1032)          |
| Non-white*                        | 48.5% (677)         | 43% (86)          | 48.4% (836)         |
| <i>EMS Agency Characteristics</i> |                     |                   |                     |
| ALS Unit or Higher                | 97.6% (1360)        | 97% (194)         | 94.5% (1642)        |
| Urbanicity                        |                     |                   |                     |
| Urban                             | 79.1% (1103)        | 74% (148)         | 79% (1363)          |
| Suburban                          | 29.4% (41)          | 4.5% (9)          | 3% (51)             |
| Rural                             | 17.9% (250)         | 21.5% (43)        | 17.7% (305)         |
| Unknown                           | <1% (1)             | 0% (0)            | <1% (7)             |

## FINDINGS: MEDICAL CAUSES OF ARREST

- Among 1072 patients without ROSC-the rule applied to 44: **One ultimately had ROSC**

|                           | <i>No ROSC</i> | <i>ROSC</i> | <i>Total N</i> |
|---------------------------|----------------|-------------|----------------|
| <i>TOR Applies</i>        | 44             | 1           | 45             |
| <i>TOR Does not apply</i> | 1028           | 322         | 1350           |
| <i>Total N</i>            | 1072           | 323         | 1395           |

Sensitivity = 4.1%, Specificity = 99.7%, PPV = 97.8%, NPV = 23.9%

**99.7% patients with a medical arrest that met the TOR criteria would not have ROSC**

# FINDINGS: TRAUMATIC CAUSES OF ARREST

Application of MIEMSS Trauma Pediatric TOR Protocol ages 0-14 years

*Scene Time = 10 minutes*

|                    | No ROSC | ROSC | Total N |
|--------------------|---------|------|---------|
| TOR Applies        | 27      | 4    | 31      |
| TOR Does not apply | 71      | 36   | 107     |
| Total N            | 98      | 40   | 138     |

Sensitivity = 27.6%, Specificity = 90.0%, PPV = 87.1%, NPV = 31.5%

**90% patients with a trauma arrest would not have ROSC**

Application of MIEMSS Trauma Pediatric TOR Protocol ages 0-14 years

*Scene Time = 20 minutes*

|                    | No ROSC | ROSC | Total N |
|--------------------|---------|------|---------|
| TOR Applies        | 13      | 1    | 14      |
| TOR Does not apply | 85      | 39   | 124     |
| Total N            | 98      | 40   | 138     |

Sensitivity = 13.3%, Specificity = 97.5%, PPV = 92.9%, NPV = 31.5%

**97.5% patients with a trauma arrest would not have ROSC**

## IMPLICATIONS OF RESULTS

- The Maryland pTOR criteria only applied to 4%
  - 76% of all medical arrests did not achieve ROSC
- Medical pediatric TOR criteria performs well, similarly to existing TOR guidelines in use for adults
- Trauma pediatric TOR criteria did not perform as well when used for patients with shorter scene times → improved with increased scene time
- Two of four trauma patients who had ROSC and met the pediatric TOR criteria were victims of drowning

## CONCLUSIONS BY AUTHORS

- Criteria for this statewide protocol for pediatric TOR works as well as adult TOR criteria in identifying POCHA patients who did not have prehospital ROSC
- Opportunities still exist to optimize the criteria for pediatric TOR, while still minimizing the number of misclassified patients
- This data provides EMS Medical Directors and key stakeholders important information to identify clinical and social factors key for deployment of TOR guidelines

# WHAT ABOUT COLORADO?

## DENVER METRO EMS PROTOCOLS

### ADVANCED LIFE SUPPORT

- No ROSC despite 30 minutes adequate CPR with ventilation
- No shockable rhythm (must have AED on patient)
- No reversible cause identified

### BASIC LIVE SUPPORT

- No AED shock advised
- No ROSC despite CPR
- Arrest unwitnessed by either EMS or bystanders
- No bystander CPR before EMS arrival

### Transport all the following:

**Hypothermic arrest**

**Drowning w/ hypothermia and submersion < 60 min**

**Lightning strike and electrocution**

**Avalanche victim**

**Pregnant patient with estimated gestational age  $\geq 20$  weeks**

# TRANSLATING TO EMS: DURING A RESUSCITATION

At least 1 member of the team should be with the parent to talk about everything and answer questions

***“Your child is in cardiac arrest, and we are doing everything we can to get him/her back to life before we start moving toward the hospital”***

***“...we are doing exactly what the doctors would do at the hospital”***

***“...we just need a few minutes to try to get your child’s heart beating again so we can give him/her the best chance at survival”***

Issue: January 2020  
Peter Antevy, MD

## When a Child Dies: The Parents' Perspective

12/29/2019

Issue: January 2020

Peter Antevy, MD



EMS World  
The Death of a Child: Supporting the Family

38:26

Cookie policy

A 6-year-old boy was playing in the street in front of his house when his father hurriedly put the car in reverse and accidentally ran him over. The scene was awful in every sense, mostly because the child suffered a head injury incompatible with life. The rescue and engine arrived and immediately focused on treating the child, yet quickly recognized the severity of the skull injury and that further care



**BEREAVED PARENTS' RECOMMENDATIONS FOR END-OF-LIFE AND BEREAVEMENT CARE**  
DURING HOSPITALIZATION | DURING THE DYING PHASE | DURING BEREAVEMENT

<https://www.emsworld.com/article/1223673/when-child-dies-parents-perspective>

# WHAT PARENTS NEED...GRIEVING

- Clear information and honesty
- Resources
- Space to grieve

Reference: JEMS August 2016

|              |                       |  |
|--------------|-----------------------|--|
| <b>G</b>     | <b>Gather</b>         | Gather the family; ensure all members are present.   |
| <b>R</b>     | <b>Resources</b>      | Call for support resources available to assist the family with their grief, e.g., chaplain services, ministers, family and friends.            |
| <b>I</b>     | <b>Identify</b>       | Identify yourself, identify the deceased patient by name, and identify the state of knowledge of the family relative to the events of the day. |
| <b>E</b>     | <b>Educate</b>        | Briefly educate the family as to the events that have occurred, educate them about the current state of their loved one.                       |
| <b>V</b>     | <b>Verify</b>         | Verify their family member has died. Be clear! Use the words "dead" or "died."   |
| <b>[ _ ]</b> | <b>Space</b>          | Give the family personal space and time for an emotional moment; allow the family time to absorb the information.                              |
| <b>I</b>     | <b>Inquire</b>        | Ask if there are any questions, and answer as many as you can.   |
| <b>N</b>     | <b>Nuts and bolts</b> | Inquire about organ donation and personal belongings. Offer the family the opportunity to view the body.                                       |
| <b>G</b>     | <b>Give</b>           | Give them contact information for resources that can assist them.  |



# ETHICS OF TERMINATION OF RESUSCITATION



# WHY DO ETHICS MATTER?



- EMS providers make difficult decisions all the time with limited context and resources
- Patient deaths, especially pediatric deaths have been shown to be an important contributors to burn-out, decision fatigue, and impaired provider confidence

HOW CAN  
TERMINATION  
OF  
RESUSCITATION  
BE ETHICAL?

Ethics in medicine – what framework do we use?

Best known - Principles of Biomedical Ethics by Tom L  
Beauchamp and James Childress (first published in 1979)

Respect for  
autonomy

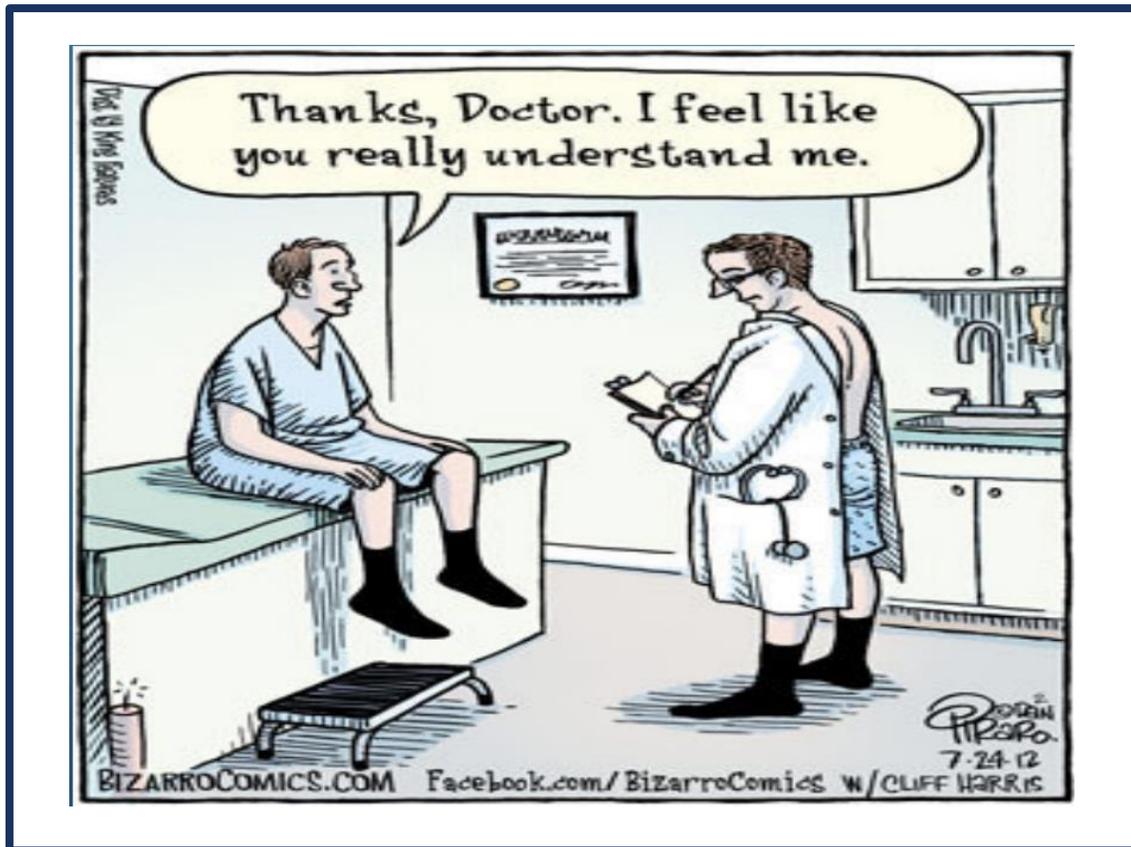
Beneficence

Non-  
maleficence

Justice

**All counterbalanced by duty to treat**

# RESPECT FOR AUTONOMY



- Acknowledgement that patients with decision-making capacity have the right to make decisions related to their medical care
- **In pediatrics: parents or guardians are surrogate decision-makers for children <18 years old**
- The concept of informed consent falls under this principle

# NON-MALEFICENCE

- Do no harm
- How do people think about harm? Is it universal? Are things you consider harm the same as your patients?
- Is it different when it's a child versus an adult?



*"First, do no harm. After that, go nuts."*

SCHWARTZ

# BENEFICENCE

- Beneficence: best interest principle/standard
- Difficult issue as often considerations are due to quality-of-life judgements
- Speculating on the future capacity of the child to appreciate the benefit of a "successful resuscitation"

# JUSTICE

- Futility
- Resource allocation (what is going on the environment to change resources?)
- Inequality in resuscitative efforts due to socioeconomic, race, location



# PRINCIPALISM

- The ethical framework from Beauchamp and Childress is referred to as principlism
- Loosely grounded in utilitarianism: how to maximize the greatest good for the greatest number of people
- What is a possible downfall to utilitarianism?

# PEDIATRIC OUT OF HOSPITAL DEATHS

- Roughly 1/3 of pediatric deaths, but out of hospital cardiac arrest remains low
- Outcomes for survival from pediatric out of hospital cardiac arrest (OHCA) are low
  - 0-1 year old: 3.3%
  - 1-11 years old: 10.5%
  - 12-19 years old: 15.8%

## TERMINATION OF RESUSCITATION

- 18-month-old child, found limp, grey, unresponsive, unknown down-time, last normal approximately 30 minutes, vomited on couch while napping, no significant history, limited English proficiency family, no pulses, hypotensive.
- 25 minutes to intubate, intermittently achieve ROSC to lose pulses repeatedly
- Requiring Epi, to maintain thready pulses, 30+ minutes to closest hospital
- What next?





# TERMINATION OF RESUSCITATION

THE PATIENT IS IN FRONT OF YOU: WHY DO WE STRUGGLE TO STOP?



01

Length of field  
resuscitation

02

Mechanism of arrest

03

Age of the child

04

Initial Vital Signs

# TERMINATION OF RESUSCITATION

# HOW GOOD ARE WE AT RECOGNIZING NON- BENEFICIAL RESUSCITATIVE EFFORTS?

- Last resuscitation and CPR
  - 78% thought it was appropriate (survival to discharge 15.3%)
  - 13% uncertain if appropriate (survival 1.3%)
  - 8% perceived as inappropriate (survival 2.7%)

# APPROPRIATENESS OF CPR



- Perception of inappropriate CPR influenced by:
  - Non-shockable initial rhythm
  - Unwitnessed arrest
  - Older patients
  - “Poor” initial impression of the patient

# PEDIATRIC DEATH IN THE HOSPITAL: PARENTS PERSPECTIVE

## 3 Phases:

- 1. Hospitalization:** clear explanations for likelihood of survival, managing pain
- 2. Dying phase:** Quiet space, time to be with family and the child, remove medical interventions
- 3. Bereavement:** Instructions for what happens next, connection with other families, ongoing follow-up with providers who cared for the child

# DEATH OF A PEDIATRIC PATIENT OR TOR IN THE FIELD

- Often EMS is entering care relationship in the **DYING PHASE**
- **Have to consider scene safety**
- Recognize limitations of communication, showing resuscitative efforts to families has been shown to improve grief and bereavement, decrease PTSD and decrease litigation

# TERMINATION OF RESUSCITATION

- What do parents need when their child is dying?
  - Want **honesty, clarity and directness**
  - When there is CPR use **clear explanations**: your child's heart is not beating on its own, we are trying to get it to start again. They are not breathing; we are breathing for them with the bag and mask.
  - **Allow opportunity for touch** (if possible)
  - **Please use the words “your child has died”**

# FALSE HOPE IN TRANSPORT



- Emphasis on “scoop and run”
- Easier to remove of a child from scene
- Depending on the state, family might be detained on scene by law enforcement
- Patient and family-centered protocols could offer ethically-grounded support

## PEDIATRIC TOR TO IMPROVE EMS RESILIENCE

**Death of a child is difficult**

**Foundation for resilience:**

- Improved knowledge of epidemiology of pediatric death
- Application of an ethical framework for TOR protocol

# PARTING THOUGHTS

Food for thought:

- NEJM 2018 “Will you forgive me for saving you?”
- Compassionate Options for Pediatric EMS (COPE project) out of Kentucky with great resources regarding communication



# QUESTIONS?

IF YOU HAVE SPECIFIC CASES OR WOULD  
LIKE ONGOING DISCUSSION:

PLEASE EMAIL:

**[KRISTINA.BRUMME@GMAIL.COM](mailto:KRISTINA.BRUMME@GMAIL.COM)**

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