Enhancing Hospital Response to Cardiac Arrest

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Special Resuscitation Circumstances
Approx 6 million babies of babies require basic resuscitation (bag-and-mask ventilation)

Approx 3-6% of babies require advanced resuscitation

<1% need advanced resuscitation
0.1% require chest compressions
0.05% require drugs

136 million babies born

All babies require immediate assessment at birth and simple newborn care
(assess breathing, dry, and put the baby skin-to-skin with mother)

Birth to help them breathe (drying and rubbing)

Figure 1: Estimate of annual number of all newborns who require assistance to breathe at birth and varying levels of neonatal resuscitation.
Legend: Adapted from [1] using data from [2,3,5,6,20].

Most pediatric emergencies are seen in **community** hospitals

- **120m** ED visits to 5,000 hospitals in 2013
- **30m** Pediatric visits, 3.8 million infant visits
- **24m** Pediatric visits to community EDs

80% Pediatric emergency visits are seen in community EDs
Rapid Recognition
• METs/RRS
• A,B,C’s
• Treat Resp Failure and Shock
• Consider ECMO??

Post-Arrest stabilization

CPR

No Flow
• PROTECTION
• Prompt CPR;
• Defibrillate, if shockable rhythm
• Consider ECMO?

Low Flow
• PRESERVATION
• Push hard, 100-120/min
• Minimize interruption
• Full recoil
• Ventilation
• Vasopressors?
• Rx Reversible Causes
• Consider E- CPR??

Low, Normal or High Flow
• RESUSCITATION
• Targeted Temperature Management
• Blood pressure
• Oxygenation
• Ventilation
• Seizures
  • Consider PCI / Thrombolysis?
  • Consider ECMO?

RESUSCITATION /REGENERATION

Pre-Arrest

Cardiac Arrest
• PRESERVATION
### High-Quality Resuscitation Program

#### Pre-arrest

**Identification**
- **High Risk Clinical Indicators**
  - Parshuram 2009
  - Bonafide 2011

**“Low Dose, High Frequency”**
- Hands-on practice with defibrillator, chest compressions and ventilations
  - Niles 2009, Sutton 2011a, Sutton 2011b

#### Intra-arrest

**Real-time CPR Feedback**
- Commercially available Audio + visual feedback
- ETCO2
- Arterial BP

#### Post-Resuscitation Care

**Post-Resuscitation "Dress Rehearsals"**
- Anticipate Challenges; Rehearse Interventions; Review Protocols; Clarify Communication; Document Competence
  - Scholtz 2011

**Post-Resuscitation Care**

- **Temperature control, Blood pressure/Hemodynamics, Oxygen, CO2, PCA, ECMO, Glucose, pH, electrolytes, Fluid management**

<table>
<thead>
<tr>
<th>Day 0</th>
<th>Day 1</th>
<th>Day 2-3</th>
<th>Day 4</th>
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</table>

**Review and Debriefings**
- **Immediate and Scheduled:**
  - Provide feedback for multidisciplinary provider and resuscitation teams

**Immediate**
- Brief Team Reflection
  - Quick discussion: Latent and obvious errors, clinical issues, barriers to process and examples of excellence
  - Edelson 2008; Dine 2008

**Weekly/Monthly**
- Educational Debriefings
  - (Audio/Video) Extended team discussion of selected events:
    - Resuscitation process, provider skills, system process, etc.
  - Edelson 2008; Dine 2008; Wolfe 2014

#### Primary Outcome:
- Return of Spontaneous Circulation

#### Secondary Outcome:
- Survival to discharge

#### Primary Outcome: Survival to One Year
Things we can **DO** and **MEASURE**

- **Environment**
  - **Team Performance**
  - **System Performance** (Debriefing)

- **Team**
  - **Individual**

**Low Intensity**
**High Frequency**
Cardiac arrest performance

- Compression rate
- Ventilation Rate
- Compressions resumed
- Ventilation Rate
- Defib correct dose
- Backboard
- Alternating providers
- No interruptions
- CPR fraction
- Pulse Check done
- Defib correct dose
- Recognized fibrillation
- No preshock pause
- Recognized PEA
- 1st dose epi
- 2nd dose epi
- 1st dose epi
- Recognized PEA
Breakdown of score

A total of 16 points is possible and is broken into 4 categories with 16 total components (1pt each):

**BLS components (8 possible points)**
1. Appropriate compression rate (100-120/min)
2. Appropriate ventilation rate (8-10/min)
3. Use of a backboard under the patient
4. Provider administering compressions alternated ≤ every 120 seconds
5. No interruptions in compressions >10 sec (ex: during intubation, procedures, rhythm check, excluding pre-shock pause)
6. CPR fraction ≥ 80%
7. Correct endotracheal tube placement (size and confirmation)
8. Continuous end tidal monitoring initiated for CPR quality (capnography)

**Pulseless Electrical Activity components (4 possible points)**
1. Pulse check done <= 120 seconds
2. Recognition/verbalization of pulseless electrical activity
3. First dose of epinephrine administered in correct dose and <= 5 minutes into case
4. Second dose of epinephrine administered in correct dose and in 3-5 minutes’ after first

**Vfib components (4 possible points)**
1. No pre-shock pause (time from stopping CPR to administering shock <= 10 seconds)
2. Recognition/verbalization of fibrillation <= 120 seconds of rhythm change from PEA
3. Defibrillation at correct dose (2-4 J/kg) and administered <= 180 seconds after recognition of PEA
4. Compressions resumed immediately after defibrillation and continued for > =120 seconds prior to pulse check
<table>
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<tr>
<th>ADULT QUALITY MEASURES</th>
<th>PEDIATRIC QUALITY MEASURES</th>
<th>NEWBORN/NEONATE QUALITY MEASURES</th>
<th>QUALIFY FOR RECOGNITION</th>
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<tr>
<td>1. Time to first shock ≤ 2 min for VF/pulseless VT first documented rhythm:</td>
<td>1. Time to first chest compressions ≤ 1 min:</td>
<td>1. Time to first chest compressions ≤ 1 min (in newborn/neonates ≥ 10 min old):</td>
<td>85% COMPLIANCE</td>
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<tr>
<td>% of events with VF/pulseless VT first documented rhythm in whom time to first shock ≤ 2 min of event recognition.</td>
<td>% of events where time to chest compressions ≤ 1 min of event recognition.</td>
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<td>Time to epinephrine ≤ 5 min for asystole or pulseless electrical activity:</td>
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<td>3. Percent pulseless cardiac events occurring in an ICU setting:</td>
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<td>% of events who were monitored tracheal tube placement or witnessed at the time of arrest.</td>
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<td>4. Device confirmation of events with tracheal tube placement confirmed by ETCO2.</td>
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Options to consider:

1. Time from ROSC to PCI for Cardiac Arrest with STEMI
2. Achievement of stated target temperature goal (in all cases <37.5°C) for 6 to 24 hours post-ROSC
3. No duration of hypotension (age-appropriate) <5%ile during hours 2-24 post-ROSC
4. Seizure evaluation (with EEG) for hours 6-24 post-ROSC
5. Neurologic evaluation and CPC/modified Rankin-score recorded on hospital discharge
6. Referral for rehabilitation and neuropsychiatric evaluation within 6 months following hospital discharge
Challenges toward 2020

Knowledge Discovery → Knowledge Processing → Knowledge Transfer

Data

Teach
Learn
Remember
Act
Act well

Level of Evidence
Continuous review

Quality of evidence

Can it work?
Is it feasible and safe?
Does it work?

Quality of Life
Intact Neurologic Survival
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<td>2. Time to epinephrine ≤ 5 minutes for asystole or pulseless electrical activity:</td>
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<td>2. Time to bag mask ventilation &lt; 1 min from CPA recognition:</td>
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<td>% of events in newborn/ neonates &lt; 10 minutes old with time to bag mask ventilation ≤ 1 minute of event recognition.</td>
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<td>3. Percent pulseless cardiac events monitored or witnessed:</td>
<td>3. Percent pulseless cardiac events occurring in an ICU setting:</td>
<td>3. Time to invasive airway ≤ 2 min from CPA recognition:</td>
<td>85% COMPLIANCE</td>
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<td>% of events who were monitored or witnessed at the time of arrest.</td>
<td>% of pulseless events occurring in an ICU setting versus a ward setting (General ward, Step-down)</td>
<td>% of events with time to invasive airway placement ≤ 2 minutes from event recognition.</td>
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<td>% of events with tracheal tube placement which was confirmed by ETCO2.</td>
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