Best Practice Standards for Providing Care in the ED in 2018

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DISCLOSURE

I do not have any relevant financial relationship with commercial interest to disclose.
Objectives

- Define Pediatric emergency medicine challenges
- Describe minimum standards for Pediatric Emergency Department
- List Quality Improvement principles and framework
- Understand use of Bundles in Pediatric Emergency
- Understand use of LEAN in ED
Outline

- Introduction
- Challenges facing PEM
- Standards of Pediatric Emergency Department
- Quality improvement in ED
- Bundles
- LEAN
Best Practice Standards

- Best Approaches, Lessons Learned, and Evidence-Based
- No universally accepted definition of a “best practice”
- Techniques or methodology that, through experience and research, has proven to reliably lead to a desired result
- Management practices and work processes that lead to optimal results in reducing the risk of compliance violations or other unwanted events that could give rise to potential liability
Benefits of Adopting Best Practices

- Improving program effectiveness
- Development of mutual trust
- Creation of a shared vision
- Establishing objectives
Benefits of Adopting Best Practices

- Reduce Costs*
- Avoid Mistakes**
- Improve Performance
- Reduces the Risk/Liability of Non-Compliance
Pediatric Emergency Medicine

staff with Emergency Medicine skills

staff with Pediatric skills
Pediatric Emergency Medicine

- Regardless of a hospital’s characteristics, critically ill children are often brought to EDs because of geographic proximity.

- All EDs should have at least the minimum resources and staffing available to stabilize critically ill or injured children.

- Unwanted variation in health care can contribute to waste, inefficiency and ineffectiveness in providing diagnostic accuracy and therapeutic reliability.
Emergency Medical Services for Children continuum of care
Challenges Facing PEM

- Overcrowding of emergency care areas in hospitals
- Poor facilities for children and mothers
- Long waiting times for a hospital bed
- Poor staff training for pediatric emergency conditions
Challenges Facing PEM

- Insufficient equipment and supplies of the right size
- Policies & guidelines more suited for adult than pediatric patients
- Difficulties in getting senior or specialist advice for the pediatric age group
Challenges Facing PEM

- In resource poor countries, emergency presentations being due to chronic disease, poor health or neglect

- In resource rich countries, EDs may be used for relatively minor illnesses and injuries
Pediatric preparedness of US emergency departments: a 2003 survey

- Only 6% of emergency departments had all recommended equipment and supplies.
- Emergency departments frequently lacked laryngeal mask airways and neonatal or infant equipment.
- The median pediatric-preparedness score for all emergency departments = 55/100*

Pediatrics : 2007 Dec;120(6):1229-37
These concerns have led countries to publish standards of care for children in emergency departments.

- Improve the emergency care of children
- Assists both managers and clinical staff to deliver improvements
Joint Policy Statement—Guidelines for Care of Children in the Emergency Department
Administration and Coordination of the ED for the Care of Children

- **Physician Coordinator for Pediatric Emergency Care.** The pediatric physician coordinator is a specialist in emergency medicine or pediatric emergency medicine; or if these specialties are not available then pediatrics or family medicine, appointed by the ED medical director, who through training, clinical experience, or focused continuing medical education demonstrates competence in the care of children in emergency settings, including resuscitation.

- **Nursing Coordinator for Pediatric Emergency Care.** The pediatric nurse coordinator is a registered nurse (RN), appointed by the ED nursing director, who possesses special interest, knowledge, and skill in the emergency care of children.

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Physicians, Nurses and Other Healthcare Providers Who Staff the ED

- Physicians who staff the ED have the necessary skill, knowledge, and training in the emergency evaluation and treatment of children of all ages who may be brought to the ED, consistent with the services provided by the hospital.

- Nurses and other ED health care providers have the necessary skill, knowledge, and training in providing emergency care to children of all ages who may be brought to the ED, consistent with the services offered by the hospital.

- Baseline and periodic competency evaluations completed for all ED clinical staff, including physicians, are age specific and include evaluation of skills related to neonates, infants, children, adolescents, and children with special health care needs. (Competencies are determined by each institution’s medical and nursing staff privileges policy.)
Guidelines for ED Policies, Procedures, and Protocols

Policies, procedures, and protocols for the emergency care of children should be developed and implemented in the areas listed below. These policies may be integrated into overall ED policies as long as pediatric specific issues are addressed.

- Illness and injury triage.
- Pediatric patient assessment and reassessment.

Guidelines for Improving Pediatric Patient Safety

The delivery of pediatric care should reflect an awareness of unique pediatric patient safety concerns and are included in the following policies or practices:

- Children are weighed in kilograms.
- Weights are recorded in a prominent place on the medical record.
- For children who are not weighed, a standard method for estimating weight in kilograms is used (e.g., a length-based system).
**Guidelines for Equipment, Supplies, and Medications for the Care of Pediatric Patients in the ED**

- Pediatric equipment, supplies, and medications are appropriate for children of all ages and sizes (see list below), and are easily accessible, clearly labeled, and logically organized.
- ED staff is educated on the location of all items.
- Daily method in place to verify the proper location and function of equipment and supplies.
- Medication chart, length-based tape, medical software, or other systems is readily available to ensure proper sizing of resuscitation equipment and proper dosing of medications.

**Guidelines for ED Support Services**

Radiology capability must meet the needs of the children in the community served. Specifically:

- A process for referring children to appropriate facilities for radiological procedures that exceed the capability of the hospital is established.
- A process for timely review, interpretation, and reporting of medical imaging by a qualified radiologist is established.

**Guidelines for QI/PI in the ED**

- The QI/PI plan shall include pediatric specific indicators.
- The pediatric patient care-review process is integrated into the ED QI/PI plan. Components of the process interface with out-of-hospital, ED, trauma, inpatient pediatric, pediatric critical care, and hospital-wide QI or PI activities.
National Assessment of ED Pediatric Readiness

- Measure adherence to the 2009 national guidelines for care of children in Eds
- Identify gaps and barriers to adherence
- Evaluate the effect of nurse or physician pediatric emergency care coordinators (PECCs)
- Included data on 88.9% of all annual pediatric ED visits in the United States at 24-hour access emergency departments

JAMA Pediatr - June 1, 2015; 169 (6); 527-34
National Assessment of ED Pediatric Readiness

- The mean WPRS was 68.9.
- Low volume EDs mean WPRS was 61.4
- High volume EDs mean WPRS was 89.8 ($p=0.001$).
- PECCs, either nurse or physician, raised the WPRS, irrespective of the ED pediatric volume
- EDs were 4 times more likely to have quality improvement plans for children if one PECC was present

JAMA Pediatr - June 1, 2015; 169 (6); 527-34
National Assessment of ED Pediatric Readiness

- The median percentage of recommended pediatric equipment available was 91%

- The most frequent barriers to guideline adherence and implementation noted by respondents were cost of training (54.4%) and lack of educational resources (49.0%)

JAMA Pediatr - June 1, 2015; 169 (6); 527-34
Pediatric readiness assessment

Average Pediatric Readiness Scores

<table>
<thead>
<tr>
<th>Patient Volume</th>
<th>Low Volume (&lt;1800 patients)</th>
<th>Medium Volume (1800-4999 patients)</th>
<th>Medium to High Volume (5000-9999)</th>
<th>High Volume (&gt;=10000)</th>
<th>All Participating Hospitals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score</td>
<td>62</td>
<td>70</td>
<td>74</td>
<td>84</td>
<td>69</td>
</tr>
<tr>
<td>n</td>
<td>1629</td>
<td>1248</td>
<td>708</td>
<td>561</td>
<td>4146</td>
</tr>
</tbody>
</table>

How are we improving? 2003 vs 2013
Overall Median Pediatric Readiness Score

- Median Score: 68.9
- 2003 Median Score: 55.0

Median Pediatric Readiness Score for Emergency Departments by Patient Volume

- Low Volume (<1800 patients)
  - Median Score: 61.3
- Medium Volume (1800-4999 patients)
  - Median Score: 47.8
- Medium to High Volume (5000-9999)
  - Median Score: 54.2
- High Volume (>=10000)
  - Median Score: 58.3

www.pedsready.org
How about your ED Readiness?
Quality Improvement in ED
Aims of Quality

- Effective
- Safe
- Efficient
- Timely
- Equitable
- Patient-centered
Quality Framework

- **Structure**: the setting of care, including physical layout of the ED and available resources

- **Process**: the patient experience in the ED, such as pathway-guided care

- **Outcomes**: includes morbidity and mortality but also includes many other measures, such as frequency of antibiotic use or time metrics
Acute Care Model

- Segmentation (Triage)
- Therapeutic reliability
- Diagnostic accuracy
- Disposition
QUALITY MEASUREMENT IN PEM

- Short-term measure within-ED outcome for quality of care

- True outcomes of care demand that our health care systems generate information regarding how ill and injured children return to health after an ED visit
BUNDLES
Implementation of Sepsis Protocol

- Shorter time to first intravenous fluid
- Shorter time to antibiotics administration
- Reduced time to vasoactive infusion
- Decreased mortality
- Reduced length of hospital and PICU stay
- Reduced number of children with organ dysfunction
Implementation of Sepsis Protocol

- Early use of practice consistent with 2002 guidelines improved outcome in newborn and children (mortality rates 8% vs 38%)

- Every hour delay without restoration of normal BP for age and CRT less than 3 sec – associated with a two fold increase in adjusted mortality odd ratio

Han et al., pediatrics 2003; 112: 793 – 799
Improving Adherence to PALS Septic Shock Guidelines

- **Objective**: improve adherence to national guidelines for children with septic shock in a pediatric emergency department with poor guideline adherence
- **Methods**: Prospective cohort study of children presenting to a tertiary care pediatric emergency department with septic shock
- Quality improvement (QI) interventions, were used to improve adherence to a 5-component sepsis bundle, including timely (1) recognition of septic shock, (2) vascular access, (3) administration of intravenous (IV) fluid, (4) antibiotics, and (5) vasoactive agents

Paul et al, Pediatrics 2014;133:e1–e9
Improving Adherence to PALS Septic Shock Guidelines

**Results:**
- 242 patients were included: 126 patients before the intervention and 116 patients during the QI intervention
- Achieved 100% adherence for all metrics
- Reduction in hospital mortality from 4.0% to 1.7%.

Paul et al, Pediatrics 2014;133:e1–e9
Improving Adherence to PALS Septic Shock Guidelines

<table>
<thead>
<tr>
<th>Care Element</th>
<th>Preintervention Adherence, n (%)</th>
<th>Postintervention Adherence, n (%)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recognition within 5 min</td>
<td>180 (79)</td>
<td>113 (97)</td>
<td>.011</td>
</tr>
<tr>
<td>Vascular access within 5 min</td>
<td>84 (67)</td>
<td>104 (90)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>60 mL/kg IV fluid within 60 min</td>
<td>47 (37)</td>
<td>85 (73)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Antibiotics within 60 min</td>
<td>88 (70)</td>
<td>99 (86)</td>
<td>.02</td>
</tr>
<tr>
<td>Vasoactive agents started at 60 min</td>
<td>44 (35)</td>
<td>79 (68)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Overall bundle adherence</td>
<td>24 (19)</td>
<td>90 (78)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Median time to IV fluids</td>
<td>83 (IQR, 43–145)</td>
<td>33 (IQR, 0–68)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Median time to vasoactive agents</td>
<td>90 (IQR, 51–164)</td>
<td>35 (IQR, 14–86)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Appropriate fluid mechanism used</td>
<td>62 (49)</td>
<td>110 (95)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>(pressure bag, rapid-infuser, manual push)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coagulation profile obtained</td>
<td>35 (28)</td>
<td>44 (38)</td>
<td>.092</td>
</tr>
<tr>
<td>Liver function tests obtained</td>
<td>63 (50)</td>
<td>77 (66)</td>
<td>.014</td>
</tr>
<tr>
<td>Lactic acid obtained</td>
<td>83 (66)</td>
<td>96 (83)</td>
<td>.003</td>
</tr>
</tbody>
</table>

Paul et al, Pediatrics 2014;133:e1–e9
Improving Adherence to PALS Septic Shock Guidelines

- Process focused QI methodology
- Reduced mortality 4.8% to 1.7%
- Care bundles simplify & streamline the process thus speeding it up

Paul et al, Pediatrics 2014;133:e1–e9
Recognition Bundle (see AAP Trigger tool example Figure 2)
- Screen patient for septic shock using an institution trigger tool.
- Clinician assessment within 15 minutes for any patient who screens positive in the trigger tool.
- Initiate Resuscitation Bundle within 15 minutes for patient identified by the trigger tool whom the assessing clinician confirms suspicion of septic shock.

Resuscitation Bundle (see Algorithm Figure 3 and 4)
- Attain IV/IO access within 5 minutes.
- Appropriate fluid resuscitation begun within 30 minutes.
- Initiation of broad-spectrum empiric antibiotics within 60 minutes.
- Begin peripheral or central inotrope infusion therapy for fluid-refractory shock within 60 minutes.

Stabilization Bundle (see Algorithm Figure 3 and 4)
- Use multimodal monitoring to optimize fluid, hormonal, and cardiovascular therapies to attain hemodynamic goals.
- Confirm administration of appropriate antimicrobial therapy and source control.

Performance Bundle
- Measure adherence to Trigger, Resuscitation, and Stabilization Bundles.
- Perform root cause analysis to identify barriers to adherence.
- Provide an action plan to address identified barriers.

2017 by the Society of Critical Care Medicine.
Recognition Bundle (see AAP Trigger tool example Figure 2)

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Performance Bundle

- Measure adherence to Trigger, Resuscitation, and Stabilization Bundles.
- Perform root cause analysis to identify barriers to adherence.
- Provide an action plan to address identified barriers.
Recognition bundle

- Screen patient for septic shock using an institution trigger tool (High risk patients, Vital signs and physical examination)
- Clinician assessment within 15 minutes for any patient who screens positive in the trigger tool
- Initiate resuscitation bundle within 15 minutes for any patients identified by the trigger tool whom the assessing clinician confirm suspicion of septic shock
High Risk Population

- Malignancy
- Asplenia (Including SCD)
- Bone Marrow Transplant
- Central or Indwelling line/catheter
- Solid organ transplant
- Immunodeficiency / Immunosuppression / Immunocompromise
<table>
<thead>
<tr>
<th></th>
<th>Cold shock</th>
<th>Warm shock</th>
<th>Non-specific</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulses</td>
<td>Decreased or weak</td>
<td>Bounding</td>
<td></td>
</tr>
<tr>
<td>Capillary Refill</td>
<td>≥ 3 sec</td>
<td>&lt; 1 sec</td>
<td></td>
</tr>
<tr>
<td>Skin</td>
<td>Mottled, cool</td>
<td>Flushed</td>
<td>Petechiae /purpura</td>
</tr>
<tr>
<td>Mental status</td>
<td></td>
<td></td>
<td>Decreased/ Lethargy /confusion/ inappropriate cry, poor interactivness with parents, obtunded</td>
</tr>
</tbody>
</table>
## Triage Trigger Tool

### Table 1. High Risk Conditions
- Malignancy
- Aspiration (including DCS)
- Bone marrow transplant
- Central or indwelling intracatheter
- Cold organ transplant
- Severe MYCOP
- Immunodeficiency, immunosuppression or immunosuppression

### Table 2. Vital Signs (PALS)

<table>
<thead>
<tr>
<th>Age</th>
<th>Heart Rate</th>
<th>Resp Rate</th>
<th>Sys tole BP</th>
<th>Temp (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 d - 1 m</td>
<td>&gt; 206</td>
<td>&gt; 60</td>
<td>&lt; 60</td>
<td>&lt;36 or &gt;36</td>
</tr>
<tr>
<td>≥ 1 m - 3 m</td>
<td>&gt; 206</td>
<td>&gt; 60</td>
<td>&lt; 70</td>
<td>&lt;36 or &gt;36</td>
</tr>
<tr>
<td>≥ 3 m - 11 i</td>
<td>&gt; 190</td>
<td>&gt; 60</td>
<td>&lt; 70</td>
<td>&lt;36 or &gt;36</td>
</tr>
<tr>
<td>1 y - 2 y</td>
<td>&gt; 100</td>
<td>&gt; 60</td>
<td>&lt; 70 × (age in y ÷ 2)</td>
<td>&lt;36 or &gt;36</td>
</tr>
<tr>
<td>2 y - 4 y</td>
<td>&gt; 100</td>
<td>&gt; 60</td>
<td>&lt; 70 × (age in y ÷ 2)</td>
<td>&lt;36 or &gt;36</td>
</tr>
<tr>
<td>4 y - 6 y</td>
<td>&gt; 100</td>
<td>&gt; 60</td>
<td>&lt; 70 × (age in y ÷ 2)</td>
<td>&lt;36 or &gt;36</td>
</tr>
<tr>
<td>6 y - 10 y</td>
<td>&gt; 100</td>
<td>&gt; 60</td>
<td>&lt; 70 × (age in y ÷ 2)</td>
<td>&lt;36 or &gt;36</td>
</tr>
<tr>
<td>≥ 10 y - 15 y</td>
<td>&gt; 100</td>
<td>&gt; 60</td>
<td>&lt; 70 × (age in y ÷ 2)</td>
<td>&lt;36 or &gt;36</td>
</tr>
<tr>
<td>&gt; 15 y</td>
<td>&gt; 100</td>
<td>&gt; 60</td>
<td>&lt; 60</td>
<td>&lt;36 or &gt;36</td>
</tr>
</tbody>
</table>

### Table 3. Exam Abnormalities

<table>
<thead>
<tr>
<th></th>
<th>Cold Shock</th>
<th>Warm Shock</th>
<th>Non-specific</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pores (central vs. peripheral)</td>
<td>Decreased or weak</td>
<td>Bounding</td>
<td></td>
</tr>
<tr>
<td>Capillary refill (central vs. peripheral)</td>
<td>≥ 3 sec</td>
<td>Flash (&lt; 1 sec)</td>
<td></td>
</tr>
<tr>
<td>Skin</td>
<td>Mottled, cool</td>
<td>flushed, reddish, exanthema (other than face)</td>
<td>Petechiae below the nape, any purpura</td>
</tr>
<tr>
<td>Mental Status</td>
<td>Decreased, irritability, confusion, inappropriately rhyming or clownish, poor interaction with parents, lethargy, diminished arousability, obtundation</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Septic Shock Checklist
- Temperature abnormality (Table 1)
- Hypotension (Table 2) <90 mm Hg
- Tachypnea (Table 2) >20 bpm
- Tachycardia (Table 2) >100 bpm
- Capillary refill abnormality (Table 2)
- Mental status abnormality (Table 2)
- Skin abnormality (Table 2)

Identify as at risk for sepsis if:
1. Hypotension or
2. Meets 3/8 criteria or
3. Meets 2/8 criteria if high-risk
Patients present to ED with concern for infection and / or temperature abnormality

Exclude from shock triage tool, continue routine triage process

No

Yes

Continue assessment at triage

- Obtain full set of vital signs
- Focused history and PE
- Is the pt. high risk?
  - Temp -----------
  - Hypotension ----------
  - Tachycardia ---------
  - Tachypnea -----------
  - CRT -------------
  - Mental status ------------
  - Pulse quality ------------
  - Skin -----------------

Identify as meeting sepsis / septic shock if:
1- Hypotension or
2- Meet 3/8 criteria or
3- Meet 2/8 criteria in high risk

Continue assessment at triage
Electronic Medical Record

Fig. 4. ED patient tracking board with the lightning bolt in the Patient Care column, indicating the need for timely evaluation for possible septic shock (patient in bed 7).
Recognition Bundle (see AAP Trigger tool example Figure 2)

- Screen patient for septic shock using an institution trigger tool.
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Resuscitation Bundle (see Algorithm Figure 3 and 4)

- Attain IV/IO access within 5 minutes.
- Appropriate fluid resuscitation begun within 30 minutes.
- Initiation of broad-spectrum empiric antibiotics within 60 minutes.
- Begin peripheral or central inotrope infusion therapy for fluid-refractory shock within 60 minutes.

- Cardiovascular therapies to attain hemodynamic goals.
- Confirm administration of appropriate antimicrobial therapy and source control.

Performance Bundle

- Measure adherence to Trigger, Resuscitation, and Stabilization Bundles.
- Perform root cause analysis to identify barriers to adherence.
- Provide an action plan to address identified barriers.
<table>
<thead>
<tr>
<th>Time</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 min</td>
<td>Recognize decreased mental status and perfusion. Begin high flow O₂ and establish IO/IV access according to PALS.</td>
</tr>
<tr>
<td>5 min</td>
<td>If no hepatomegaly or rales / crackles then push 20 mL/kg isotonic saline boluses and reassess after each bolus up to 60 mL/kg until improved perfusion. Stop for rales, crackles or hepatomegaly. Correct hypoglycemia and hypocalcemia. Begin antibiotics.</td>
</tr>
<tr>
<td>15 min</td>
<td>Fluid refractory shock? Begin peripheral IV/IO Inotrope infusion, preferably Epinephrine 0.05 – 0.3 µg/kg/min Use Atropine / Ketamine IV/IO/IM if needed for Central Vein or Airway Access Titrate Epinephrine 0.05 – 0.3 µg/kg/min for Cold Shock. (Titrate central Dopamine 5 – 9 µg/kg/min if Epinephrine not available) Titrate central Norepinephrine from 0.05 µg/kg/min and upward to reverse Warm Shock. (Titrate central Dopamine ≥ 10 µg/kg/min if Norepinephrine not available)</td>
</tr>
<tr>
<td>60 min</td>
<td>Catecholamine-resistant shock? If at risk for Absolute Adrenal Insufficiency consider Hydrocortisone. Use Doppler US, PICCO, FATD or PAC to Direct Fluid, Inotrope, Vasopressor, Vasodilators Goal is normal MAP-CVP, ScvO₂ &gt; 70%* and CI 3.3 – 6.0 L/min/m² Normal Blood Pressure Cold Shock ScvO₂ &lt; 70%* / Hgb &gt; 10g/dL on Epinephrine? Begin Milrinone infusion. Add Nitroso-vasodilator if CI &lt; 3.3L/min/m² with High SVRI and/or poor skin perfusion. Consider Levosimendan if unsuccessful. Low Blood Pressure Cold Shock ScvO₂ &lt; 70%* / Hgb &gt; 10g/dL on Epinephrine? Add Norepinephrine to Epinephrine to attain normal diastolic blood pressure. If CI &lt; 3.3 L/min/m² add Dobutamine, Enoximone, Levosimendan, or Milrinone. Low Blood Pressure Warm Shock ScvO₂ &gt; 70%* on Norepinephrine? If euvoletic, add Vasopressin, Terlipressin, or Angiotensin. But, if CI decreases below 3.3 L/min/m² add Epinephrine, Dobutamine, Enoximone, Levosimendan.</td>
</tr>
</tbody>
</table>

**Persistent Catecholamine-resistant shock?** Evaluate Pericardial Effusion or Pneumothorax. Maintain IAP < 12mmHg

**Refractory Shock?** ECMO
Resuscitation Bundle

- Attain IV/IO access within 5 minutes
- Appropriate fluid resuscitation begun within 30 minutes
- Initiation of broad spectrum empiric antibiotics within 60 minutes
- Begin peripheral or central inotrope infusion therapy for fluid – refractory shock within 60 minutes.
15 min

Fluid refractory shock?

Begin peripheral IV/IO inotrope infusion, preferably Epinephrine 0.05 – 0.3 µg/kg/min
Use Atropine / Ketamine IV/IO/IM if needed for Central Vein or Airway Access

Titrate Epinephrine 0.05 – 0.3 µg/kg/min for Cold Shock.
(Titrate central Dopamine 5 – 9 µg/kg/min if Epinephrine not available)
Titrate central Norepinephrine from 0.05 µg/kg/min and upward to reverse Warm Shock.
(Titrate Central Dopamine ≥ 10 µg/kg/min if Norepinephrine not available)

60 min

Catecholamine-resistant shock?

If at risk for Absolute Adrenal Insufficiency consider Hydrocortisone.
Use Doppler US, PICCO, FATD or PAC to Direct Fluid, Inotrope, Vasopressor, Vasodilators
Goal is normal MAP-CVP, ScvO₂ > 70%* and CI 3.3 – 6.0 L/min/m²

Normal Blood Pressure
Cold Shock
ScvO₂ < 70%* / Hgb > 10g/dL on Epinephrine?
Begin Milrinone infusion.
Add Nitroso-vasodilator if CI < 3.3L/min/m² with High SVRI
and/or poor skin perfusion.
Consider Levosimendan if

Low Blood Pressure
Cold Shock
ScvO₂ < 70%* / Hgb > 10g/dL on Epinephrine?
Add Norepinephrine to Epinephrine to attain normal diastolic blood pressure. If CI < 3.3 L/min/m² add Dobutamine,
Enoximone, Levosimendan, or

Low Blood Pressure
Warm Shock
ScvO₂ > 70%*
on Norepinephrine?
If euvoletic, add Vasopressin,
Terlipressin, or Angiotensin. But, if CI decreases below 3.3 L/min/m²
add Epinephrine, Dobutamine,
Enoximone, Levosimendan.
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• Screen patient for septic shock using an institution trigger tool.
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Stabilization Bundle (see Algorithm Figure 3 and 4)

• Use multimodal monitoring to optimize fluid, hormonal, and cardiovascular therapies to attain hemodynamic goals.
• Confirm administration of appropriate antimicrobial therapy and source control.

Performance Bundle

• Measure adherence to Trigger, Resuscitation, and Stabilization Bundles.
• Perform root cause analysis to identify barriers to adherence.
• Provide an action plan to address identified barriers.

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Stabilization Bundle

- Multimodal monitoring to guide fluid, hormonal, and cardiovascular therapies (ICU)

- Administration of appropriate antibiotic therapy and source control.
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- Attain IV/IO access within 5 minutes.
- Appropriate fluid resuscitation begun within 30 minutes.
- Initiation of broad-spectrum empiric antibiotics within 60 minutes.
- Begin peripheral or central inotrope infusion therapy for fluid-refractory shock within 60 minutes.

Performance Bundle

- Measure adherence to Trigger, Resuscitation, and Stabilization Bundles.
- Perform root cause analysis to identify barriers to adherence.
- Provide an action plan to address identified barriers.

2017 by the Society of Critical Care Medicine.
Performance bundle

- Measurement of adherence as well as achievement of goals and individual components
- Assessment of barriers as well as unintended consequences such as inappropriate antibiotic duration or fluid over resuscitation

Outcome measures:
- Mortality
- Rapid transfers from floor to ICU (within 12 hours of admission)
Performance measures

Process measures:
- Compliance with initial clinical assessment (i.e., full set of vitals within 30 minutes of arrival at the ED)
- First bolus within 20 minutes of recognition of septic shock risk
- Antibiotics within 60 minutes of recognition of septic shock risk

Balance measure:
- False-positives
Best Practices for Improving Flow and Care of Pediatric Patients in the Emergency Department
ED crowding

- Patient safety
- Increases medical errors
- Increasing overall length of stay, time to triage, time until seen by physician
- Delay in initiation Rx *
- Decreases patient satisfaction
- Increase number of patient leaving without being seen by a physician
STRATEGIES FOR IMPROVING ED PATIENT FLOW

- Address efficiencies

- combination of triage, efficiency of evaluation, resource utilization, patient length of stay in the ED, and inpatient bed availability
Suggestion to Improve Patient Flow

- Pediatric-specific triage pathways
- Emergency care pathways (Triage)
- Nurse practitioners or physician assistants in lower-acuity patients during peak hours
- Fast tract or urgent care (seasonal variation)
- Physician-led team triage
Suggestion to Improve Patient Flow

- Clinical Practice Guidelines
- Clinical Practice Pathways
- LEAN methodology
- ED to Observation Units or Short stay
- Earlier inpatient discharges
- Waiting rooms for inpatients discharges
LEAN methodology

- Business operating principles developed by Japanese auto manufacturers
- Provide value-added steps in every level of process design and modification, or a “bottom up” management
Goals of Applying Lean in Healthcare

- Focus on Providing Excellent Patient Experience
- Continually Monitor and Improve in All Areas
- Minimize Waste in Delivering Treatment and Services
Identify patient population & value

Pursue perfection

Map value stream

Respond to what patient see as value

Get rid of waste
LEAN principles

- **Elimination/reduce** of unnecessary waste
- Minimizing delays (Improved workflow)
- Worker empowerment
- Continuous improvement
- **Maximizing** value-added processes
WASTE

- LEAN strives to remove waste from a process
- Waste is defined as any step which does not provide value to the patient and family (NVA)
- Value added (VA) steps include any step that directly contributes to improvement of the patient’s medical condition or experience
- NVA steps are sometimes necessary because of regulation or safety considerations
## Examples of health care waste

<table>
<thead>
<tr>
<th>Potential Health Care Waste</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processing</td>
<td>Asking patient the same question multiple times</td>
</tr>
<tr>
<td>correction</td>
<td>Medical error</td>
</tr>
<tr>
<td>Searching</td>
<td>Equipment, material, information not readily available</td>
</tr>
<tr>
<td>Transportation</td>
<td>Any unnecessary movement of staff, patents</td>
</tr>
<tr>
<td>Underutilized staff</td>
<td></td>
</tr>
<tr>
<td>Waiting</td>
<td></td>
</tr>
<tr>
<td>Inventory</td>
<td>Excess items expired</td>
</tr>
</tbody>
</table>
95% Non-Value Added

Keep/Improve

Value Added

Eliminate

Necessary Work

Unnecessary Work

Reduce
LEAN tools

- Value Stream Mapping (VSM)
- Rapid cycle improvement sessions (kaizen)
- 5S (a method for organizing and standardizing workspaces)
VSM

- Patient’s interaction with the system (multiple transitions)
- Map each step in the process of a patient who presents for medical care—from arrival until their care is completed—all from the patient’s perspective
- VSM it becomes a visual tool for identifying the non-value-added (NVA) or wasteful steps
- These NVA steps are identified as opportunities for improvement
Simple Laceration Repair Process—Steps Include Waiting Time

Value-Added (VA)

- Attending Evaluation
- Topical Med Admin
- Sedation Administration
- Wound Cleaning and Repair
- Discharge Teaching

Non-Value-Added (NVA)

- Quick Reparation
- Triage
- Primary RN Assessment
- Resident Assessment
- Resident Teaching
- Topical Medication Ordering
- Waiting
- Recovery Time
- Discharge Instruction Prep

Total time = 212 minutes  VA time = 25 minutes  # of Process steps = 13  VA steps = 5  % of NVA time = 88%
LEAN and ED

- Redesign processes
- Improve patient access and flow
- Reduce wait times
- ED overcrowding and errors
Applying Lean: Implementation of a Rapid Triage and Treatment System

- Objective was to evaluate how applying Lean principles to develop a Rapid Triage and Treatment (RTT) system affected ED metrics.
- Patients undergo a rapid triage with low-acuity patients seen and treated by a physician in the triage area.
- No changes in staffing, physical space or hospital resources occurred during the study period.

RTT Implementation

PATIENT ARRIVES IN ED

TRIAGE RN & Registration
- Seen simultaneously by both Triage RN and Registration. Entered into computer, armband applied, consent signed. RN enters chief complaint, ESI level, vitals taken.
- C/T = 5 min-15 min
- C/O = 2 min
- 3 shifts - 2 RN’s from 3-11 pm

Patient to RTT

MD/RN/Tech RTT Team
- See patient in Triage area simultaneously and discharge patient home
- C/T = 5 min-62 min
- C/O = 3 min
- 2 shifts - 8 am-2 am
Applying Lean: Implementation of a Rapid Triage and Treatment System

- Compare hospital electronic medical record data six months before and six months after implementation of the RTT system.
- Mean ED length of stay was longer in the period before RTT (4.2 hours) than after (3.6 hours)
- Mean ED arrival to physician start time was 62.2 minutes prior to RTT and 41.9 minutes after
- LWBS rate for the six months prior to RTT was 4.5% and 1.5% after RTT initiation

Lean-focused simulation resuscitation room redesign

- Goal to efficiently identify and address systems and quality issues
- Multidisciplinary team
- Two in situ simulations (cardiogenic shock and multiple trauma)
- 42 types of waste were identified in areas of inventory, transportation, and motion (medication duplication, nurse leave room to get medication.. )

Lean-focused simulation resuscitation room redesign

- Simulations the end of the event
- Overall improvement of resuscitative care
- Before: IV access took over 3 min and not able to deliver the first shock for pulseless VTach in the desired 1 min
- After: IV access was obtained in the <90 s and the first shock for pulseless VTach was delivered in <1 min
- The resuscitation room was less cluttered allowing for the easier identification of necessary equipment and that the provision of resuscitative care was overall more efficient

Take Home Messages:

- All EDs should have at least the minimum resources and staffing available to stabilize critically ill or injured children
- Best practice Care bundles simplify & streamline the process
- Different strategies available to improve flow of patients in EDs
- Using LEAN methodology help Improve patient access and flow, Reduce wait times and ED overcrowding and errors
References

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- Pediatrics 2014;133:e1–e9
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