Right care, right place, every time:
Optimizing pediatric emergency care

Marc Auerbach, MD MSci FAAP
Professor, Pediatrics and Emergency Medicine
Yale University School of Medicine

March, 23 2024
Disclosures

• I have no relevant financial relationships with any commercial interests nor conflicts of interest to declare

• I will discuss projects with grant funding from:
Objectives

By end of this presentation the attendee will be able to

1. Define Pediatric Readiness
2. Describe disparities in pediatric emergency care in the US
3. Locate three resources to improve Pediatric Readiness
4. Plan to engage in Pediatric Readiness improvement in the next three months
Monday at 10 pm - text from your cousin

Friday, March 22 10:00pm

Emily our 6 month old is coughing, is breathing fast and has a fever.

What should we do?
Tuesday 4 am- another text…

Saturday, March 23 4:00am

Emily woke up does not look right

Texting you a video now…
suprasternal retractions
Emily Lives in Portland
Emily Lives in Portland

Community → EMS → Pediatric ED/Children’s Hospital → Home
Emily Lives in Rockland
Emily Lives in Rockland

Community → EMS → Community ED → Inter-facility transport → Pediatric ED/Children's Hospital → Home
Continuum of Emergency Care in Maine

1. Community: 1.4 million
   • 252,000 pediatric (18%)

2. Emergency Medical Services: 300,000 calls/year
   • 15,000 Pediatric (5%)
   • 272 agencies + 5,500 EMS providers
     • 167 Transporting ground services
     • 101 Non-transporting services
     • 4 Air services (3 are restricted response services)
Continuum of Emergency Care in MN

3. Emergency Departments: 8.5 million ED visits
   • 1.5 million pediatrics (18%) 

4. Hospitals: 35 hospitals (16 CAH)
   • 1 Children’s
   • 124 Pediatric Beds, 8 PICU
Where do children receive emergency care?

82.7% in community EDs (<15 pediatric patients/day)

17.3% in Children’s Hospital EDs (100-250 pediatric patients/day)

https://www.cdc.gov/nchs/fastats/emergency-department.htm
History of Emergency Medicine

- 1965: Vietnam War - NHTSA
- 1966: 1st 24/7 ED Alexandria, VA
- 1973: EMS Systems Act
- 1979: EM- 23rd specialty
Pediatric emergency care is **UNEVEN**

- Variation in pediatric equipment
- Variation in pediatric standards/protocols
- Variation in pediatric training/subspecialists

Health Disparities

• Preventable differences in the burden of illness/injury based on:
  • Age
  • Geographic factor
  • Gender/Sexual identity
  • Disability
  • Socioeconomic status
  • Race/ethnicity
Disparities in process

- Pediatric ED: ↑ adherence to guidelines
  - Bronchiolitis, AOM, imaging, asthma

- General ED: ↑ over treatment
  - Admission, medications, testing (labs/imaging)

Auerbach. Comparing Practice Patterns. Pediatric Emergency Care 2015.
Disparities in outcomes

• General vs Pediatric ED
  • Pediatric Cardiac Arrest: OR mortality 2.2 (1.7-2.8)
  • Pediatric Trauma: OR mortality 1.57 (1.15-2.14)

Michelson. Pediatrics. February 2018
Sathya. JAMA Surg. September 2015
Community -> EMS -> Community ED

Inter-facility transport

Pediatric ED/Children's Hospital

Home
Reducing Disparities

Aim: to ensure all US EDs + EMS have essential guidelines and resources to provide effective and appropriate pediatric care
Pediatric Readiness Score = compliance with Joint Policy Statement

Joint Policy Statement—Guidelines for Care of Children in the Emergency Department

abstract

Children who require emergency care have unique needs, especially when emergencies are serious or life-threatening. The majority of ill and injured children are brought to community hospital emergency departments (EDs) by virtue of their geography within communities. Similarly, emergency medical services (EMS) agencies provide the bulk of out-of-hospital emergency care to children. It is imperative, therefore, that all hospital EDs
Pediatric Readiness Score

- 55 question online survey provides a weighted score from 0-100%

1. Administration + coordination  
   19/100

2. Physician + RN staffing/training  
   10/100

3. Pediatric quality improvement  
   7/100

4. Pediatric patient safety  
   14/100

5. Policies, procedures and protocols  
   17/100

6. Equipment, supplies, medications  
   33/100
Pediatric Readiness Survey

Pediatric Patient Safety in the ED

27. Are all* children seen in the ED weighed in kilograms (without conversion from pounds)?

*Note: This includes critical situations when a child might bypass triage and have his/her weight estimated in kilograms.

☐ Yes ☐ No Go to 29

28. Is the weight recorded in the ED medical record in kilograms only?

☐ Yes ☐ No Go to 30

29. If no, how are children in the ED weighed, and how is the weight recorded in the medical record?
(Choose one)

a. ☐ Weighed in pounds and converted to kilograms for recording in the medical record

b. ☐ Weighed in either pounds or kilograms with an option to record in either pounds or kilograms in the medical record

30. Are temperature, heart rate, and respiratory rate recorded on all children? ☐ Yes ☐ No

49. Is each of the following monitoring equipment items available for immediate use in the ED?
(Check Yes or No for each)

a. Neonatal blood pressure cuff

b. Infant blood pressure cuff

d. Defibrillator with pediatric and adult capabilities including paddles/paddles

e. Pulse oximeter with pediatric and adult probes

f. Continuous end-tidal CO2 monitoring device

50. Is each of the following fluid resuscitation equipment items available for immediate use in the ED?
(Check Yes or No for each)

a. 22 gauge catheter-over-the-needle

b. 24 gauge catheter-over-the-needle

c. Pediatric intra-osseus needles

d. IV administration sets with calibrated chambers and extension tubing and/or infusion devices with ability to regulate rate and volume of infusate

e. Umbilical vein catheters (3.5F or 5.0F)

f. Central venous catheters (any two sizes in range, 4F-7F)
Pediatric Readiness Score (2021)

Improved from 55% in 2003, stable from 2013

- **All**: 3557/5150 hospitals
  - Low: <1,800 children/yr
    - 71% (50%)
  - Medium: 1,800 – 4,999
    - 66% (31%)
  - Medium to high: 5,000-9,999
    - 73% (11%)
  - High: ≥10,000
    - 81% (8%)
  - 30% rural/remote

Remick et al JAMA Open 2023
Maine Pediatric Readiness Score

- **All**: 15/35 hospitals
- **Low**: <1,800 patients
  - 9 hospitals
- **Medium**: 1,800 – 4,999 patients
  - 5 hospitals
- **Medium to high**: 5,000-9,999 patients
  - 1 hospitals
- **High**: ≥10,000 patients
  - 1 hospitals
2021 Distribution of Scores by Volume

Low: <1,800 pediatric patients (average of 5 or fewer a day)

Medium: 1,800 – 4,999 pediatric patients (average of 6-13 a day)

Medium to High: 5,000 – 9,999 pediatric patients (average of 14-26 a day)
Disparities in access

• Families seek care in ED closest to home
  • 94% live < 30 minutes from any ED
  • 90% live closest to NOT PEDIATRIC READY

Rural child = Low Pediatric Readiness ED

4X higher mortality

## Disparities in Outcomes - Medical

<table>
<thead>
<tr>
<th>Pediatric Readiness Scores by Quartile</th>
<th>30-59</th>
<th>60-74</th>
<th>75-87</th>
<th>88-100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adjusted Relationship PRS and in-hospital mortality</td>
<td><strong>Ref</strong></td>
<td>0.52 (0.3-0.90)</td>
<td>0.36 (0.22-0.58)</td>
<td>0.25 (0.18-0.37)</td>
</tr>
<tr>
<td>p = 0.018</td>
<td>p&lt;0.001</td>
<td>p&lt;0.001</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unadjusted Mortality</td>
<td><strong>11.1%</strong></td>
<td>5.4%</td>
<td>4.9%</td>
<td><strong>3.4%</strong></td>
</tr>
</tbody>
</table>
Figure 1. Adjusted Odds Ratios (aORs) for In-Hospital Mortality Among Children With Injuries and Medical Conditions Across Quartiles of Emergency Department (ED) Pediatric Readiness, Including Subgroups

Jenkins PC, et al. Emergency Department Pediatric Readiness and Disparities in Mortality Based on Race and Ethnicity. JAMA Netw Open. Sept 2023
Readiness factors associated with survival

1. Presence of Pediatric Emergency Care Coordinators

2. Pediatric resuscitation equipment/supplies

3. Pediatrics specific QI, triage tools, and disaster plans

Remick, JTACS 2022
PECC: Pediatric Emergency Care Coordinator

• Nurse +/- Physician

• Responsible for overseeing pediatric specific activities
  1. Provides pediatric perspective to ALL work
  2. Pediatric specific quality improvement
  3. Ensures pediatric skills of staff
  4. Ensures availability of pediatric equipment, supplies, meds
  5. Develops/periodically reviews pediatric policies/procedures

*** ROLE FOR PEDIATRICIANS/PEDIATRIC DEPARTMENTS***
PECCs Post-pandemic

• PECCs in MN
  • Physician 25% (52% in 2014)
  • Nurse 33% (64%)

• Barriers to PECC
  • Lack of support/time
  • Pediatrics relatively lower priority
  • Less access to pediatric resources + expertise
Aim: improve pediatric readiness over 6 months

Baseline - PRS1
- Simulation measurement

Report Out - Benchmarking of PRS and sim
- Action planning

Improvement - Resources
- Meetings at 2 and 4 months

Final - PRS2

0 months → 2 weeks → 2, 4 months → 6 months
# Why pediatric simulation?

<table>
<thead>
<tr>
<th></th>
<th>Clinical</th>
<th>Simulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experiences</td>
<td>Few Unstructured Uncontrolled</td>
<td>Many Structured Controlled</td>
</tr>
<tr>
<td>Feedback</td>
<td>Rare</td>
<td>Frequent</td>
</tr>
<tr>
<td>Errors</td>
<td>Patient harm, unethical</td>
<td>Valuable to learning</td>
</tr>
</tbody>
</table>
Step 1: Simulation-based Measurement

• Simulated pediatric patients with parent present to community EDs
  1. Infants Foreign Body
  2. Infant sepsis
  3. Infant seizure
  4. Child cardiac arrest

• Participating providers
  • Two real world teams of 1-2 physicians, 3-5 nurses, 1-2 technicians
  • In-situ in ED resuscitation bay using real equipment/resources and simulated medications

• Facilitated by Children’s Hospital physician/nurse/sim team
  • Identical patient physiology and response to treatment
  • Scripted parent actor
  • Train-the-trainer for all Children’s Hospitals

• Customized needs assessment for each ED
Step 2: Report Out to ED Leadership

- EMSC readiness score: 82%
  - GED: 64%
  - PED: 90%

- Teamwork score: 59%
  - GED: 74%
  - PED: 86%

- Seizure case score: 36%
  - GED: 68%
  - PED: 78%

- Cardiac arrest case score: 50%
  - GED: 52%
  - PED: 67%

- Foreign body case score: 36%
  - GED: 80%
  - PED: 80%

- Sepsis case score: 43%
  - GED: 73%
  - PED: 100%
**Step 2: Report Out to ED Leadership**

**ED Pediatric Performance Snapshot: INFANT SEPSIS**

**Case details**

10-month old female, presents with parent with vomiting/fever/lethargy

1. Mottled, cap refill 4 sec, tachycardia, normotensive, crying, CXR with pneumonia

2. Stops crying, more tachycardic, hypotensive, fluids improve HR

3. Fluids/pressors improve HR/BP

**Breakdown**

1. Begin high flow O₂
2. Establish 1<sup>st</sup> IV/IO
3. 60 mL/kg given over 15 minutes
4. Give appropriate antibiotics
5. Establish 2<sup>nd</sup> IV/IO
6. Push-Pull technique used
7. Start vasopressor after 3<sup>rd</sup> bolus:

**Team 1/Team 2**

- ✓ ✓
- ✓ ✓
- × ×
- × ×
- ✓ ✓
- × ×
- × ×

**Safety threats**

1. Staff members using different applications for medication dosing

**Action items**

1. To increase percentage of teams that demonstrate delivery of 60 cc/kg in less than 10 minutes by 25% within 6 months
Understanding gaps in sepsis care
Step 3: Collaborative Improvement Phase

Supported by Super PECC in collaboration with

- Interprofessional pediatric content experts/specialists
- State EMSC program
- Other PECCs in region

1. Conducting staff training/education
2. Implementing quality improvement and safety
3. Updating policies, procedures and protocol templates
4. Guidance on equipment, supplies, medications
Akron Children’s Hospital, Alaska Native Medical Center, Alberta Children’s Hospital, Boston Medical Center, Boston Children’s Hospital, Brown University, C.S. Mott Children’s Hospital, Children’s Hospital Colorado, Children’s Hospital of Montefiore, Children’s Hospital of Alabama, Children’s Hospital of Philadelphia, Children’s Hospital of Pittsburgh, Children’s Hospital of Los Angeles, Children’s Medical Center Dallas, Children’s Minnesota Minneapolis Hospital, Children’s National Medical Center, Cohen Children’s Medical Center, Connecticut Children’s Medical Center, Dartmouth-Hitchcock Medical Center, Harbor UCLA Medical Center, Johns Hopkins All Children’s Hospital, Lucille Packard Children’s Hospital, Mayo Clinic, UCSF Benioff Children’s Hospital, McMaster Children’s Hospital, Nationwide Children’s Hospital, Morgan Stanley Children’s Hospital, Seattle Children’s Hospital, The Johns Hopkins Hospital, UC Davis Children’s Hospital, NYU Langone Children’s, Mount Sinai Children’s Hospital
Step 4: Repeat PRS Measurement

<table>
<thead>
<tr>
<th></th>
<th>Pre-PRS</th>
<th>Post-PRS</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connecticut (n=12 EDs)</td>
<td>64+/-4</td>
<td>77+/-4</td>
<td>0.022</td>
</tr>
<tr>
<td>Indiana (n=10 EDs)</td>
<td>58 +/-5</td>
<td>75+/-3</td>
<td>0.009</td>
</tr>
<tr>
<td>National (n=34 EDs)</td>
<td>62+/-2</td>
<td>79+/-2</td>
<td>&lt; 0.001</td>
</tr>
</tbody>
</table>

Effective Program
BUT only 250 of 5500 EDs
Costly to sustain

Abulebda, J Peds 2020
Auerbach. Pediatric Emergency Care 2017
Abulebda, Auerbach. Academic Emergency Medicine 2017
Auerbach. Pediatrics 2022
Mentor PECCs

• Often affiliated with Children’s Hospital (any specialty)

• Goal: make it easy for community ED PECCs to do job well!
Collaborative Pediatric Education

- Lectures
- Case reviews
- Simulation
Simulation definitions

- **Simulation**
  - Technique: *NOT the simulator technology/equipment*
  - Replaces/amplifies real experiences with guided experiences, interactive

- **Simulator**
  - Object, imitates reality for the purpose of experiment or training

- **Fidelity**
  - Degree to which sim replicates real events and/or work
  - High technology ≠ High fidelity
Barriers to High-Fidelity Pediatric Simulations

Lack of access to:

1. Simulators $$$$$
2. Equipment/consumables $
3. Actors/SPs $$
4. Maintenance of simulators $
5. Trained sim staff/technicians $$
6. Trained sim faculty $$
7. Subject matter experts (pediatrics) $
8. Time for participants
9. Space/sim-center/travel $$
10. Cases/curriculum $$

Al-Ghareeb. Barriers and enablers to the use of high-fidelity patient simulation manikins. Nursing Ed. 2016
SimBox + Tele SimBox
Free online simulation for everyone.

Step by step guide on how to facilitate a simulation.
Use to augment in-person, hybrid or distance simulation.
Low to no technology required.
What is SimBox?

- Booklet
- Low or high technology mannequin
- Monitor or computer
- Your own equipment
Scenario script:

"You will hear a brief EMS dispatch and then see a two minute countdown clock as you prepare for the arrival of the patient."

**Link to ED Pediatric Burn Video**

Facilitator states: "ED, this is an ALS unit, coming in with a 16 month old boy with significant burns that he got after pulling hot water off the stove cover himself. We will arrive in 3 minutes."

**SimBox**

### Case progression: Burn

**2 minute warning**

- Team assembles + confirms earliest arrival time
- Allows for equipment, broom, medications
- Dons PPE
- Calls for help

**SAMPLE history**

"The patient has arrived. Yes, gloves. The patient is crying and you can see large blisters."

**Time 0 (min 7)**

- Team places patient monitors
- Estimates weight
- Assess ABCDEs
- Begins to carefully remove clothes

**"Away is patient. Breath sound is clear. ABG 2+ and CORT 2 sec. He is able to remove all his clothes, but burns on his chest, abdomen, legs. His weight is 10 kg."**

2

**3 (min 12)**

- Removes patient
- Risks for access and venous access
- Checks BP and temperature
- "He is still screaming in pain, IV unsuccessful. Is there anything else?"

**3 (min 12)**

- Team notes improvement in tachycardia and normal BP with appropriate pain management
- Asks for POC glucose
- Calculates the total body surface area (TBSA) burned
- "1 mEq/kg IN fentanyl given. Patient seems much more comfortable now. His BP is 100/60, and his HR is now 150. We were able to get an IV Secondary survey with no new significant findings."

**3 (min 12)**

- Team dresses burns in dry, clean, sterile dressings
- Reassesses ABCDE
- Informs the social work team
- Discusses what is the most appropriate destination for transfer (eg. pediatric burn center) & contacts burn team

**"We have covered the burns with dry, sterile dressings. He is calm and comfortable. Accepting team is ready for handoff."

**Wrap up (min 16)**

- Team handoffs to the receiving Transfer/ Pediatric Burn/ ICU team
- Formulates pain & fluid management plan for transport
- Updates family and answers their questions
- Prepares for transfer

Medical history: None, born full term, up to date on immunizations.

Last meal: Pancakes for breakfast approximately 4 hours prior to the incident.

**EmergencySimBox.com**
SimBox+ +TeleSimBox
Brief patient update and 2-minute countdown clock.
**MANAGEMENT OF POST-PARTUM HEMORRHAGE**

**BLOOD LOSS > 500ML by VAGINAL DELIVERY**

- **PERFORM FUNDAL MASSAGE**
- **ADMINISTER 1ST LINE UTEROTONIC AGENT**
  - Oxytocin (Pitocin) 10-40 IU intravenously
- ** ADMINISTER 2ND or 3RD LINE UTEROTONIC AGENT**
- "UNSTABLE VS or EBL > 1000ML; transfuse 2 U pRBC"
- **INITIATE MTP**

**IDENTIFY & ADDRESS CAUSE OF BLEEDING:**

- **TONE BLOOD UTERUS 70-90% of FPI**
- **TRANSPORT UTERUS & Maternal M/F**
- **ADMINISTER OXYTOCIN**
- **ADMINISTER 2nd line uterotonic agents**

**Resources: Infographic**

**CAUSES OF POSTPARTUM HEMORRHAGE**

**PRIMARY**
- Uterine Atony
- Lacerations
- Retained Placenta
- Placenta Accreta
- Placental Abruption
- Uterine Inversion
- Known Coagulopathy Defects

**SECONDARY**
- Subinvolution Of Placental Site
- Retained Products Of Conception
- Infection
- Coagulation Defects: DIC/Amyloid Fluid Embolism

**ESTIMATED BLOOD LOSS (EBL) IN OBSTETRIC HEMORRHAGE**

- **Acute Massive:**
  - 100 ml
  - 160 ml
  - 250 ml
  - 500 ml

**WARNING:**
- EBL > 1000-1500 is linked with high maternal mortality.
- HYPOTENSION IS A LATE FINDING

**MASSIVE TRANSFUSION IN OBSTETRICS REQUIRES A COORDINATED APPROACH:** SEE YOUR INSTITUTION OR LOCAL GUIDELINES.
**EMSC Mission:** to reduce child and youth mortality and morbidity resulting from severe illness or trauma

**EMSC Vision:** no matter where a child lives—the health systems in their area will provide quality emergency care services
Maine EMSC State Partnership Program
What is Always Ready for Children?

A collaborative Northeastern program for state and regional recognition of emergency departments that are “pediatric ready”
Hospital Pediatric Readiness Recognition Program

The Maine Always Ready for Children Recognition Program

The care and management of a pediatric patient in the Emergency Department can be one of the most stressful events clinicians can face. One way to help prepare to provide excellent care is to participate and evaluate your Emergency Department with the National Pediatric Readiness Assessment. The Assessment is a key component of the National Pediatric Readiness Project, a nationwide collaborative effort to help provide resources and guidelines for hospital EDs to utilize with their unique needs, challenges, and resources for pediatric care.

The National Pediatric Readiness Project is a multi-phase quality improvement initiative to ensure that all U.S. emergency departments have the essential guidelines and resources in place to provide effective emergency care to children.

The NPRP assessment helps ED personnel to be better prepared to provide quality care for all patients of all ages.

MAINE ALWAYS READY FOR CHILDREN program for Hospital Emergency Departments & Trauma Centers

About Pediatric Readiness ▼

What is assessed? ▼

The assessment includes questions for hospital EDs around:

- Infrastructure
- Administration and coordination of care for children
- Personnel
- Pediatric-specific policies
1. Complete National Pediatric Readiness Assessment (NPRA) or National Pediatric Readiness Project (NPRP)
2. Readiness Score from NPRA or NPRP (any score)
3. Identify an ED PECC
1. Complete National Pediatric Readiness Assessment (NPRA) or National Pediatric Readiness Project (NPRP)
2. Readiness Score from NPRA or NPRP (70 or above)
3. Identify an ED PECC
1. Complete National Pediatric Readiness Assessment (NPRA) or National Pediatric Readiness Project (NPRP)
2. Readiness Score from NPRA or NPRP (80 or above)
3. Identify an ED PECC
4. Willing to share ARC best practices & resources
Maine Always Ready for Children Recognized Hospitals

Recognition Level:
- Pediatric Innovator

- Pen Bay Medical Center
- Maine Medical Center
Maine Medical Center
ARC Pediatric Innovator Recognized

Physician PECC:  
Dr. Rachel Williams

Nurse PECC:  
Heidi Cote

Pen Bay Medical Center
ARC Pediatric Innovator Recognized

Physician PECC:  
Dr. Tyler Giberson

Nurse PECC:  
Diane Hynes
How to participate:

• Ensure your facility has an ED PECC
• Have completed the National Pediatric Readiness Assessment (NPRA) or self assess with the National Pediatric Readiness Project (NPRP) Tool
• Submit application with commitment letter to NYS EMSC Program [https://www.maine.gov/ems/hospitalpecc](https://www.maine.gov/ems/hospitalpecc)
• Start improving patient care!
• Maine EMSC Program Manager Marc.A.Minkler@maine.gov
Objectives

By end of this presentation the attendee will be able to

1. Define pediatric readiness
2. Describe disparities in pediatric emergency care in the US
3. Locate three resources to improve ED pediatric readiness
4. Plan to engage in pediatric readiness improvement in the next three months
Three options to engage NOW

1. Conduct a pediatric simulation (office, ED, EMS)
2. Become/Recruit/Mentor a PECC
3. Engage with EMSC at state level (ARC program)
Questions?

National work: marc.auerbach@yale.edu

NY specific- amy.eisenhauer@health.ny.gov
Pediatric Readiness Saves Lives

You can help save children’s lives.
www.pediatricreadiness.org