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Pediatric Airway Management: Building Blocks of Success

Maria J. Mandt, MD
Asso. Professor of Pediatrics & EM
Medical Director of EMS & CCT

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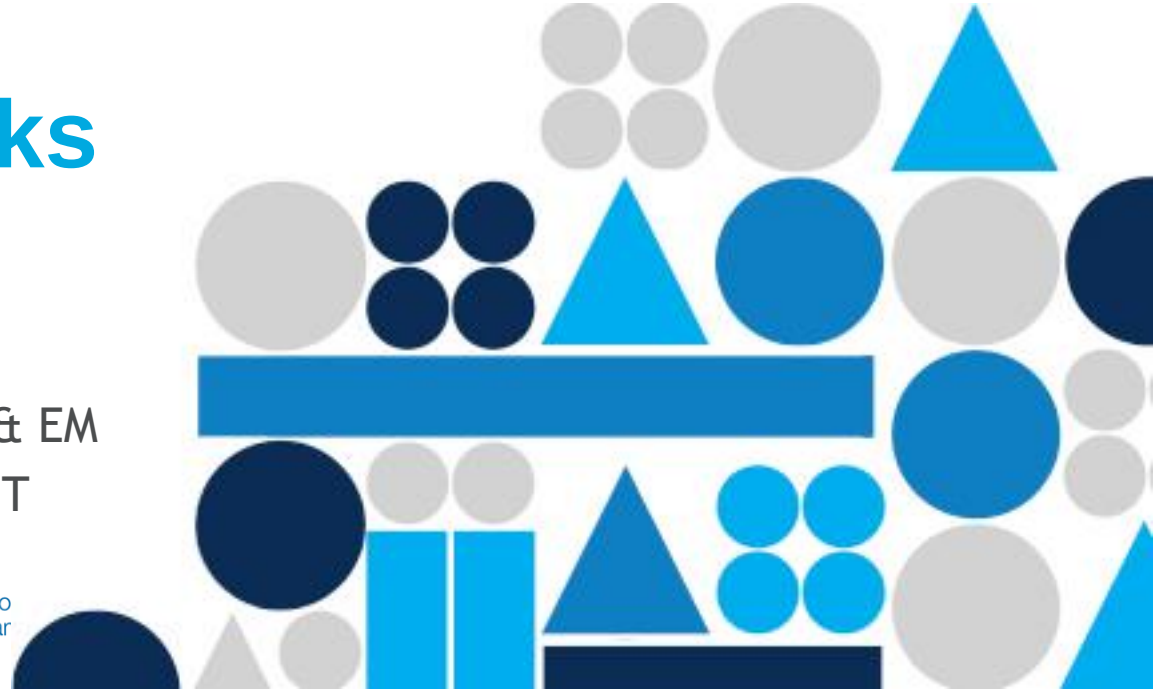

Financial Disclosure: I have no relevant financial disclosures with any commercial interest

Disclosure of Aspiration: Quality is not an act. It is a habit.

- Aristotle

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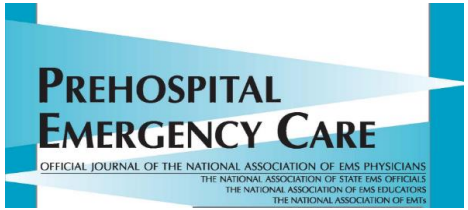
Pediatric Airway Management: Building Blocks of Success

1. Education
2. Knowing Your Toolbox
3. Effective Quality Management

New Year, New Answers?



Prehospital Pediatric Respiratory Distress and Airway Management Training and Education: An NAEMSP Position Statement and Resource Document

John Lyng, Matthew Harris, Maria Mandt, Brian Moore, Toni Gross, Marianne Gausche-Hill, and J. Joelle Donofrio-Odmann

Prehospital Pediatric Respiratory Distress and Airway Management Interventions: An NAEMSP Position Statement and Resource Document

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911. . . What Is Your Emergency?

- Called to the home of a 7-year-old male seizing for 15 minutes
- Child continues to seize upon your arrival
- IN Versed given
- Access obtained
- Given IV Ativan
- Seizure stops
- Responds to painful stim
- Snoring, pO_2 87%

Video credit: https://www.youtube.com/watch?v=j1H4BRBBbpg

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First Step?

Should happen before you get on-scene!

PREHOSPITAL PEDIATRIC RESPIRATORY DISTRESS AND AIRWAY MANAGEMENT TRAINING AND EDUCATION: AN NAEMSP POSITION STATEMENT AND RESOURCE DOCUMENT

John Lyng, Matthew Harris, Maria Mandt, Brian Moore, Toni Gross, Marianne Gausche-Hill, and J. Joelle Donofrio-Odmann

Setting Up the Issue

Why would Training and Education require special attention?

Photo credit: unsplash.com

- Low-frequency, high-risk events
- Limited exposure in clinical practice + stress of event = 👎
- Rapid decay of skills

Lyng, J et al. *Prehosp Emerg Care* 2022

Pediatric Airway and Respiratory Characteristics and Assessment

Pediatric airway education should include discussion of the factors that make pediatric airway management challenging.

- Unique anatomy and physiology
- The importance of pediatric assessment: consistent, reproducible

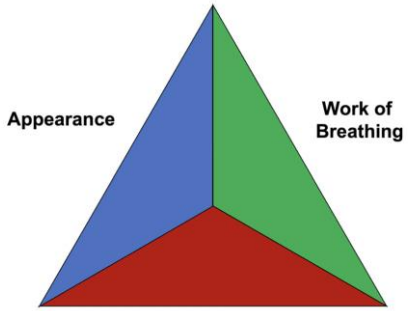

FIGURE 1. Pediatric Assessment Triangle. (Redrawn from: Ronald A, Brownstein D, Gausche-Hill M. The Pediatric Assessment Triangle: A Novel Approach fo rhte Rapid Evaluation of Children. *Pediatric Emergency Care*. April 2010 26(4):312–315. doi: 10.1097/PEC.0b013e3181d6db37.

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Lyng, J et al. *Prehosp Emerg Care* 2022

Education Beyond the Triangle

We've got the "What" → Now need to work on the "How to Fix It"

Paramedics could correctly identify respiratory distress in 92% of cases, but:

- Identifying the disease process? Coin flip. (50%)
- Knowing the appropriate intervention to fix it? 38%

Recognition of early signs of respiratory distress and pathophysiology translates to less invasive, easier, and less risk-prone interventions

But how?

Lyng, J et al. *Prehosp Emerg Care* 2022; Schroter S et al. *Prehosp Emerg Care* 2021

Categories of Pediatric Respiratory Disturbances

EMS agencies should provide pediatric-specific education that addresses recognition and treatment of pediatric respiratory distress based upon pathophysiology affecting upper airways, lower airways, cardiovascular systems, or extrinsic causes of disordered breathing.

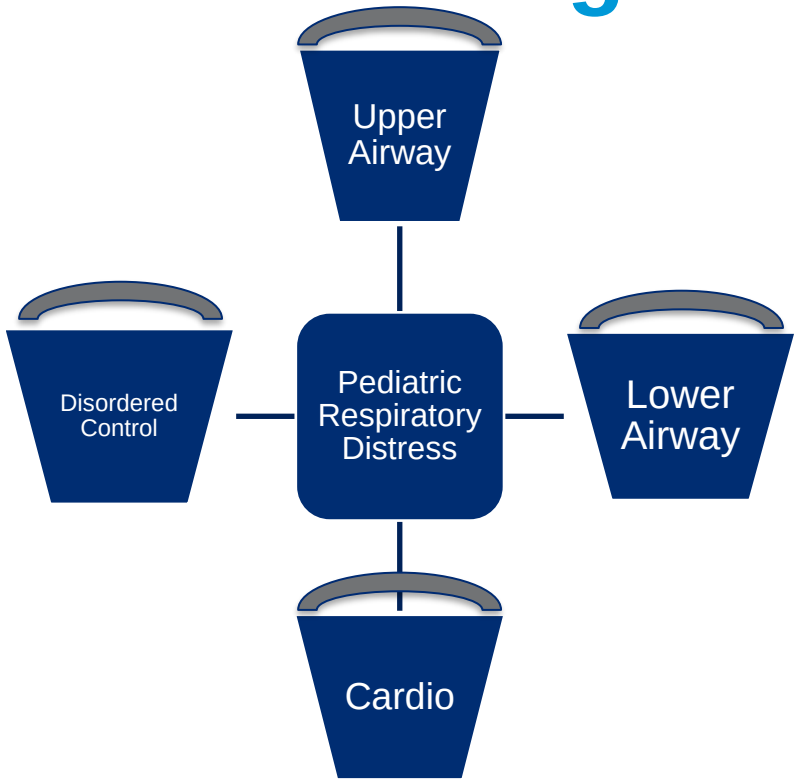
Lyng, J et al. *Prehosp Emerg Care* 2022

Education Beyond the Triangle

Training to the buckets

Education should emphasize these causes. Shown to:

- Allow for earlier recognition
- Results in more appropriate and less invasive management
- Directly impacts patient outcomes



Lyng, J et al. *Prehosp Emerg Care* 2022

Beware: Disordered Control of Breathing

Areas of Concentration:

Respiratory Alkalosis-related tachypnea

- Emphasize: Low EtCO2 values need to be matched when initiating assisted ventilations

Hypo-ventilatory respiratory failure (big one)

- TBI, status epilepticus, post-ictal states, toxic ingestions, etc
- Emphasize: benefits of capnography

Lyng, J et al. *Prehosp Emerg Care* 2022

Education Beyond the Triangle

Photo credit: twitter.com

Cognitive/Psychomotor Skills geared towards:

- Equipment
- Anatomy
- Physiology
- Special considerations

Approach to Pediatric Airway and Respiratory Interventions

EMS clinicians should receive initial and ongoing education and training in pediatric airway and respiratory conditions that emphasizes the principle of using the least invasive most effective strategies to achieve oxygenation and ventilation.

Lyng, J et al. *Prehosp Emerg Care* 2022

Be Goal Oriented. Not Procedure Oriented.

Goals: 1. Adequate oxygenation and ventilation
2. Do no harm

What we have learned:

Adequate oxygenation and ventilation can be achieved by multiple methods

Photo credit: unsplash.com

Lyng, J et al. *Prehosp Emerg Care* 2022

Be Goal Oriented. Not Procedure Oriented.

"As an alternative to committing substantial resources to help their clinicians maintain mastery of more invasive but equally efficacious skills, EMS agencies should instead consider focusing training efforts on simpler, less invasive but equally efficacious interventions."

Photo credit: unsplash.com

Lyng, J et al. *Prehosp Emerg Care* 2022

Longitudinal Education and Competency Assessment

Initial and continuing pediatric-focused education should be structured to maintain EMS clinician competency in the assessment and management of pediatric airway and respiratory emergencies and should be provided on a recurring basis in order to mitigate the decay of EMS clinicians' knowledge and skills that occurs due to infrequent field-based clinical exposure.

Lyng, J et al. *Prehosp Emerg Care* 2022

Prehospital Pediatric Education

Where we are:

- Minimal training
- Wide variability in training modalities, but little change
- Lack of set standards: Minimal procedural exposure or duration of training
- Skill retention and decay

What we know:

- Our current go-to methods of education are not effective
- We don't know what DOES work
- Clinicians are largely unaware of their skill decay

Lyng, J et al. *Prehosp Emerg Care* 2022

Prehospital Pediatric Education

Where does that leave us as an agency?

1. Recognize that duration of skill retention is inversely linked to complexity of the procedure

6 months after training: 42% skill retention for ETI

66% skill retention for BVM

2. Make conscious, honest decisions about agency bandwidth to commit to pediatric cognitive and psychomotor skill retention

Lyng, J et al. *Prehosp Emerg Care* 2022

Prehospital Pediatric Education

What we must decide:

"agencies must consider whether providing additional education is the answer to issues of decay of invasive skills,

OR

Whether the agency should simplify care to include only those interventions that the agency can meaningfully devote resources toward assessing and maintaining clinician competency"

Lyng, J et al. *Prehosp Emerg Care* 2022

Education Should Be Tied To Quality

Photo credit: quotemaster.org

Integration of Clinician Education and Quality Management Programs

Integration of clinician education programs with quality management programs is essential for the development and delivery of initial and continuing education intended to help EMS clinicians attain and maintain proficiency in pediatric airway and respiratory management.

Lyng, J et al. *Prehosp Emerg Care* 2022

Circle Back . . What Is Your Emergency?

- Called to the home of a 7-year-old male seizing for 15 minutes
- Given Versed and Ativan
- Responds to painful stim
- Snoring, pO_2 87%

What strategies do you employ and how do you monitor effectivity for further decline?

Prehospital Pediatric Respiratory Distress and Airway Management Interventions: An NAEMSP Position Statement and Resource Document

Matthew Harris, John W. Lyng, Maria Mandt, Brian Moore, Toni Gross, Marianne Gausche-Hill, and J. Joelle Donofrio-Odmann

EMS agencies should train and equip their clinicians with age-appropriate pulse oximetry and capnography equipment to aid in the assessment and management of pediatric respiratory distress and airway emergencies.

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Harris M et al. *Prehosp Emerg Care* 2022; Remick K et al. *Prehosp Emerg Care* 2017

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Capnography is:

useful to help EMS clinicians identify patients with impending respiratory failure, as correlation has been shown between exhaled $EtCO_2$ and venous PCO_2 in children with moderate-to-severe respiratory distress (8). When used in conjunction with pulse oximetry, capnography identifies hypercapneic respiratory failure and apnea, as well as the improvement or worsening of hypercapnia on a breath-to-breath basis (9).

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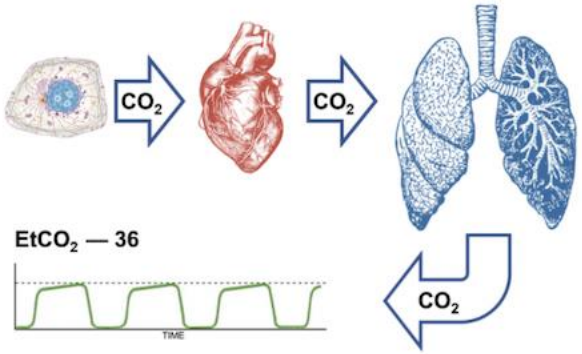
Harris M et al. *Prehosp Emerg Care* 2022

Capnography Pearls



Whether BMV, ETI or SGA, $EtCO_2$ tells you about more than just the lungs

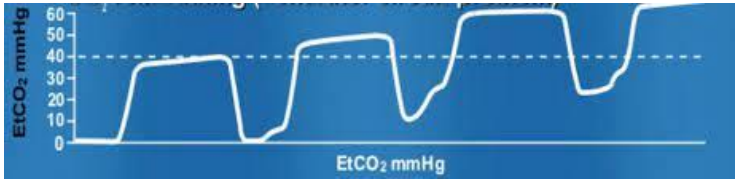


Photo credit: emdocs.net

Rising capno = respiratory depression (and soon-to-be apnea)

△ of 10mmHg

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Freeman J et al. *Acad Emerg Med* 2016

What to Do? Noninvasive is Always First

- Naked is better: visualize chest rise
- Optimize positioning
- Suction
- Relieve obstructions
  - NPA/OPA
  - Jaw thrust/chin lift

Photo credit: 9Gag.com

Never Underestimate the Value of Jaw Thrust

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Video credit: Kalra A, Tufts Medical Ctr Anesthesia Dept

Case Continuation

The child's respiratory rate slows to 6 breaths per minute and his oxygen saturation drops to 78%

Now what?

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Noninvasive Interventions

EMS agencies should emphasize noninvasive positive pressure ventilation and effective bag-valve-mask ventilation strategies in children.

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Harris M et al. *Prehosp Emerg Care* 2022

The Most Important Skill: BMV

- Rapid and effective means of oxygenation and ventilation
- Skill available to all provider levels
- Linked to improved survival over other means in many studies
- When something else isn't working. . . What do you return to?

Most under-rated skill in its importance. And difficulty.
Knowing how to troubleshoot is critical!

Harless, J et al. *Int J Crit Illn Inj Sci* 2014

Case Continuation

- Your partner is providing bag mask ventilation, but the oxygen saturation is not improving

Now What?

Stop. Check Common BMV Pitfalls

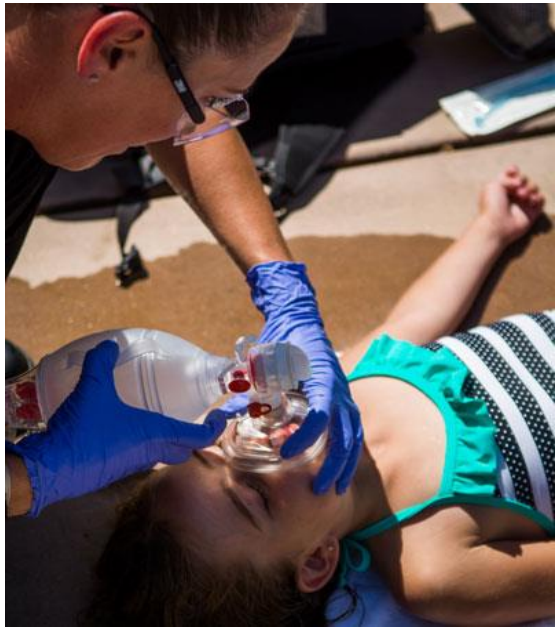


Photo credit: JEMS.com

Photo credit: Kalra A, Tufts Medical Ctr Anesthesia Dept

Remember: Basics Aren't Always Basic

1. Improve positioning
   - Ramp and roll
   - Nook and Notch

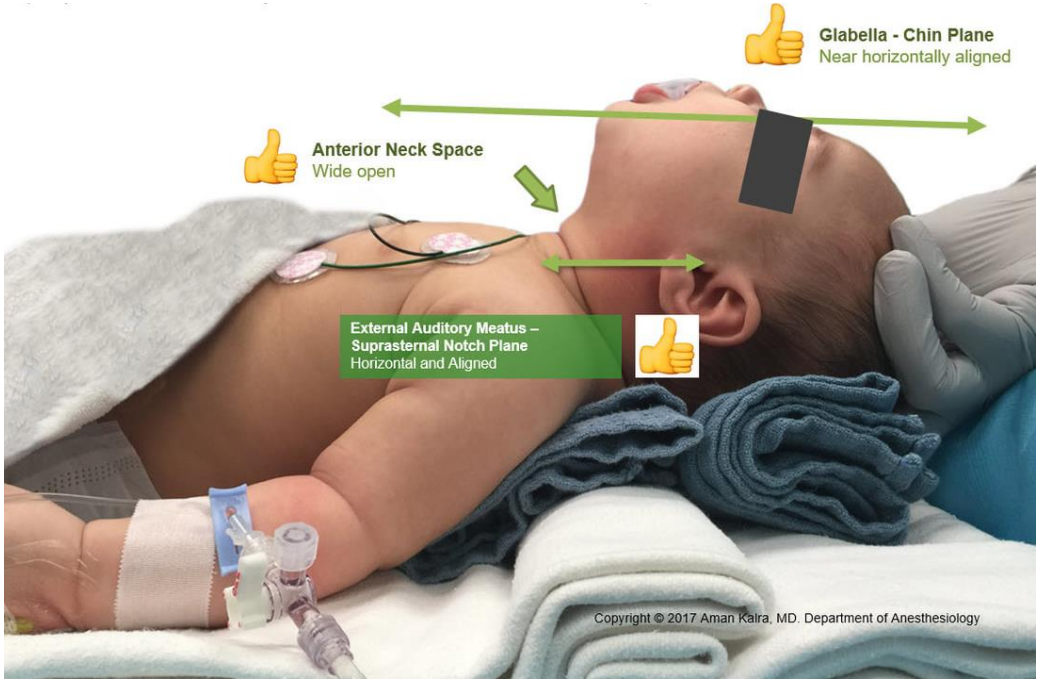


Photo credit: Kalra A, Tufts Medical Ctr Anesthesia Dept

The Basics Aren't Always Basic

2. Verify equipment
- Appropriately sized
- Appropriately placed
- Cuff inflated

Photo credit: Kalra A, Tufts Medical Ctr Anesthesia Dept

The Basics Aren't Always Basic

3. Improve your technique
- Focus on the jaw thrust/chin lift
- Achieve a tight seal
- Classic C-E (one-person)
- Transition to 2-person and a "V-clamp" technique

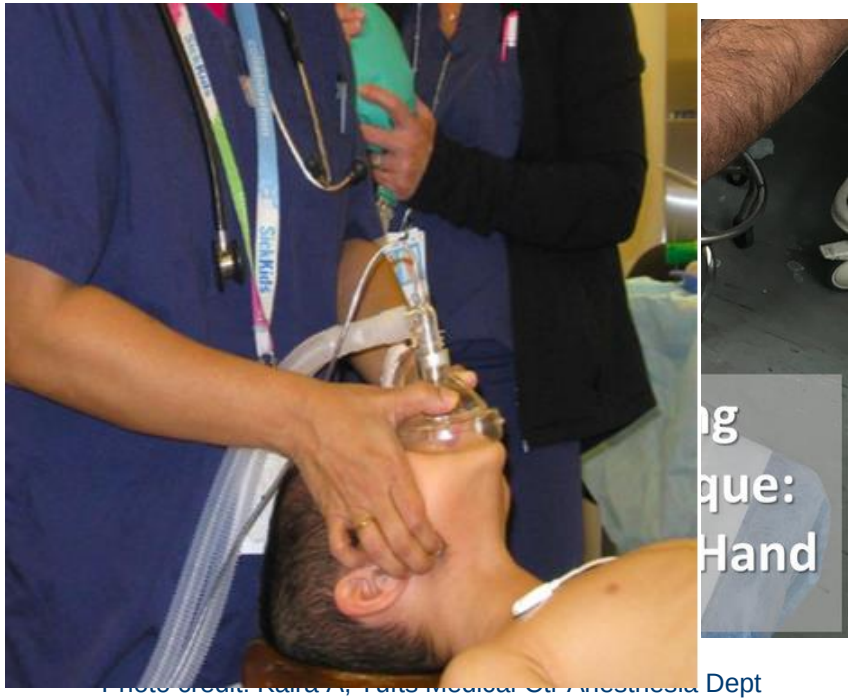


Photo credit: Karsli C. *Can J Anesth* 2015

The Basics Aren't Always Basic

4. Relieve obstructions

Late recognition of upper airway obstruction is very common

- Tracheal tug, stridor, snoring
- Paradoxical chest wall movement
- Capnography changes

Video credit: Kalra A, Tufts Medical Ctr Anesthesia Dept

Karsli C. *Can J Anesth* 2015

Case Continuation

- You achieve effective oxygenation and ventilation with the V-clamp and 2-person technique. Your transport time to the most appropriate facility is 10 minutes.

VS

- Your transport time to the nearest appropriate facility is 1 hour.

Does transport time change intervention? Should it?

Should other factors matter more?

Invasive Interventions

Supraglottic airways can be used as primary or secondary airway management interventions for pediatric respiratory failure and cardiac arrest in the EMS setting.

The current available evidence does not show benefit for pediatric prehospital ETI in the management of pediatric OHCA, trauma or seizures. Prehospital ETI may in fact, increase mortality in select populations.

Harris, M et al. *Prehosp Emerg Care* 2022

Choose Your Weapons Carefully

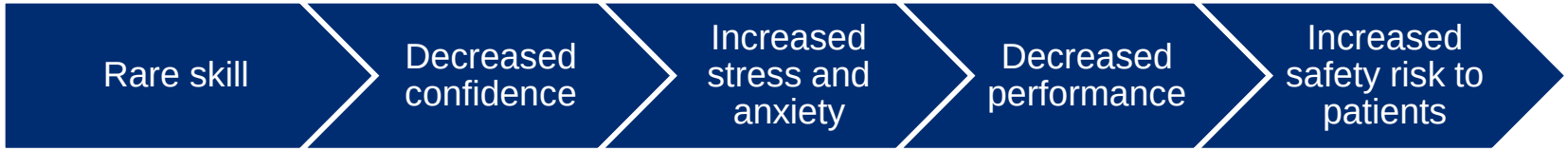
No strong evidence to support ETI over BVM or SGA for most situations!

Mounting evidence of detrimental effects in pediatrics

- Increased risk of hypoxia/hypotension
- Detrimental effect of ventilatory techniques following intubation
- Prolongs scene times
- Repeated attempts and/or prolonged interruption of chest compressions

Pepe PE et al. *Crit Care* 2015; Aufderheide TP, et al. *Circulation* 2004; Niebauer et al. *Pediatrics* 2011

Comes Down to This:



Ask Two Questions:

1. Are we doing the right thing for ALL patients?
2. What is the safest, most reliable way to achieve the goal?

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Cottrell EK et al. *Prehosp Emerg Care* 2014;
Cushman JT, et al. *Prehosp Emerg Care* 2010

Time and Place for Everything. . .

Intubation may be of benefit in certain scenarios:

- Longer-term airway protection
- Ability to place on ventilator
- Tracheal suctioning

Need to consider:

1. Reason ETI is the answer
2. Timing in resuscitation
3. Maintenance of a robust CQI/QM program

Photo credit: redbubble.com

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QM is about Pulling in the Same Direction

Photo credit: unsplash.com

5 Critical Components of Pediatric Airway Quality Management: Oversight

Physician Medical Director Oversight

Medical Director Oversight Must Include a Focus on Pediatric Airway and Respiratory Management and Integrate Pediatric-Specific Elements in Guideline Development, Competency Assessment, and Skills Maintenance Efforts.

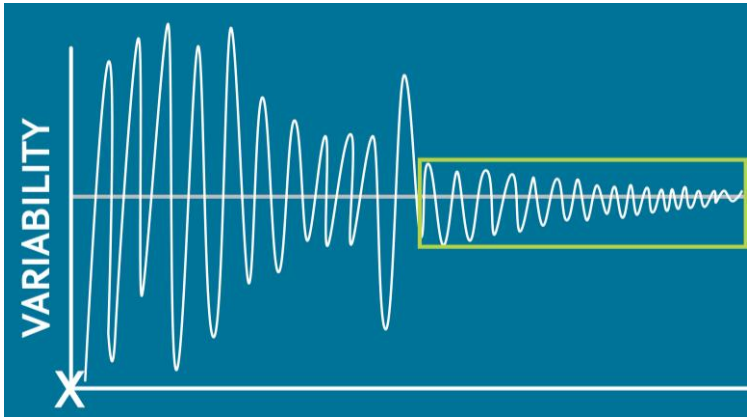


Photo credit: Edelstein, P (2016) Thought Leadership: Addressing the Greatest Threat to Healthcare

Don’t have a medical director who can provide pediatric expertise?

Mandt, M et al. *Prehosp Emerg Care* 2022

5 Critical Components of Pediatric Airway Quality Management: Collaborate

Photo credit: unsplash.com

Collaboration In Pediatric Systems Of Care

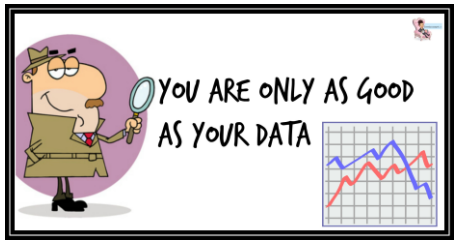
EMS Agencies Are Encouraged to Collaborate with Medical Professionals Who Have Expertise in Pediatric Emergency Care to Provide Support for Quality Management Initiatives in Pediatric Respiratory Distress and Airway Management.

Mandt, M et al. *Prehosp Emerg Care* 2022

5 Critical Components of Pediatric Airway Quality Management: Benchmark

PEDIATRIC QUALITY INDICATORS

EMS Agencies Should Define Quality Indicators for Pediatric-Specific Elements in Respiratory Distress and Airway Management and Benchmark Performance Based on Regional and National Standards.



Benchmarking Pearls:

- Separate data by age
- Utilize what's out there
- There's not much out there

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Mandt, M et al. *Prehosp Emerg Care* 2022
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5 Critical Components of Pediatric Airway Quality Management: Measure

PEDIATRIC MEASURES OF PERFORMANCE

EMS Agencies Should Implement Both Quantitative (Objective) and Qualitative (Subjective) Measures of Performance to Assess Competency in Pediatric Respiratory Distress and Airway Management.

Critical Question: What was your thought process?

Photo credit: pinterest.com

Mandt, M et al. *Prehosp Emerg Care* 2022

5 Critical Components of Pediatric Airway Quality Management: Focus

Pediatric Advanced Airway Management

EMS Agencies Choosing to Incorporate Pediatric Endotracheal Intubation or Supraglottic Airway Insertion Must Use Pediatric-Specific Quality Management Benchmarks and Perform Focused Review of Advanced Airway Management.

Mandt, M et al. *Prehosp Emerg Care* 2022

Example Advanced Airway Focused Review:

Universal airway QM:

- Rolling reviews
- System and individual elements of care assessed
- Number of attempts & patient response
- Patient's clinical outcome and relevant hospital-based data

Additional QM for pETI:

- Quarterly psychomotor practice
- Quarterly topic-focused education
- Quarterly decision-making testing

Examples of High-Performing Agencies

Factors associated with successful prehospital ETI programs:

1. Quality, orientation and prehospital-centered experience of initial training
2. Tiered response: increasing frequency of skill performance
3. On-scene supervision of ETI performance
4. Breadth/frequency of on-going training and critical review

Pepe PE et al. *Crit Care* 2015; Wang HE et al. *Prehosp Emerg Care* 2005; Youngquist ST et al. *Acad Emerg Med* 2008

Summary: The Secrets to Success

- Longitudinal pediatric airway and respiratory education should focus on assessment, early recognition, and stage-matched management
- Education should be tied to quality management efforts
- Spectrum of care begins (and often ends) with non-invasive measures first
- Can’t manage quality without standardization and benchmarking

Central Thesis: Least invasive means to achieve adequate oxygenation and ventilation

Thank You!