SEPTEMBER 2ND & SEPTEMBER 3RD, 2025

Respiratory Illness in the Pediatric Patient

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Pediatric Emergency Medicine Fellow

Children's Hospital Colorado
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Department of Pediatrics
SCHOOL OF MEDICINE
UNIVERSITY OF COLORADO ANSCHUTZ MEDICAL CAMPUS

Objectives

- Present the impact of pediatric respiratory illness on hospital systems
- Review pediatric upper and lower airway anatomy
- Identify common respiratory devices that can be used to support pediatric patients
- Describe clinical features of various pediatric respiratory illnesses and appropriate management for each
- Introduce pediatric readiness score and how it might impact pediatric care

80% of pediatric patients are seen at general EDs for emergency care

Respiratory illness is the most common cause of pediatric hospitalization in the US with influenza and RSV accounting for 2.1 and 2.7 deaths per 100,000 infants under 1 year of age, respectively

Acute asthma exacerbations are the primary cause of morbidity and mortality for children with asthma, accounting for ~ 750,000 emergency department (ED) visits and 225,000 hospitalizations each year.

Pediatric pneumonia accounts for over 500,000 ED visits each year. Accounts of about 7% of pediatric admissions.

In US, croup affects about 3% of children each year

In the US, bronchiolitis accounts for 2.1 million annual outpatient visits, 18% of all pediatric hospitalizations, and 10% of pediatric intensive care unit (ICU) admissions.

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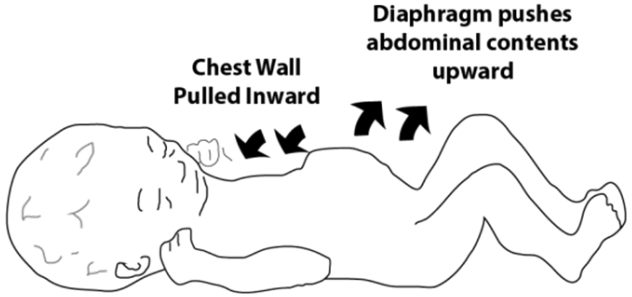
How are kids different?

Chest Wall More Compliant
decreased elastic recoil
exhalation requires work

Abdominal Breather
abdomen rises as diaphragm descends
stomach distention limits tidal volume

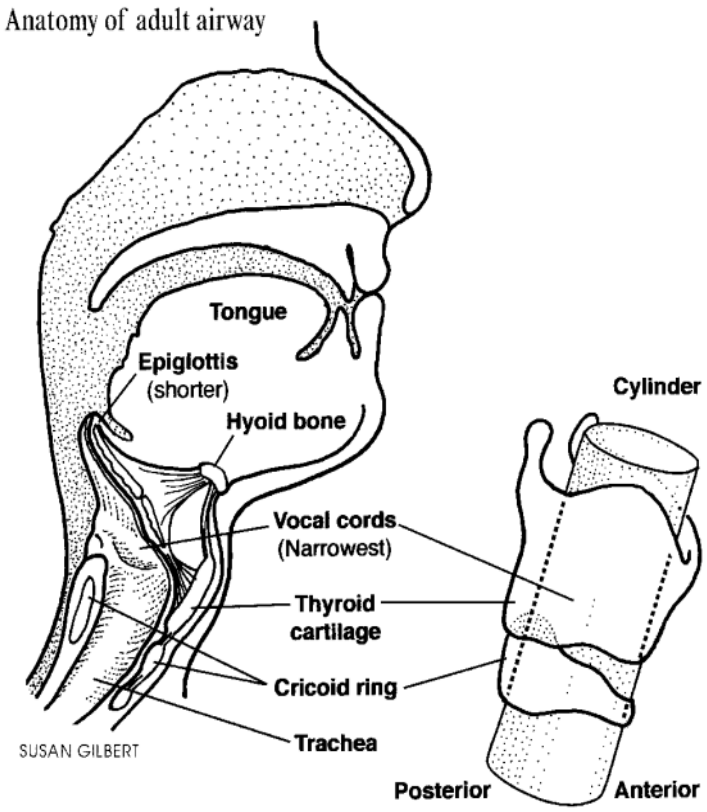


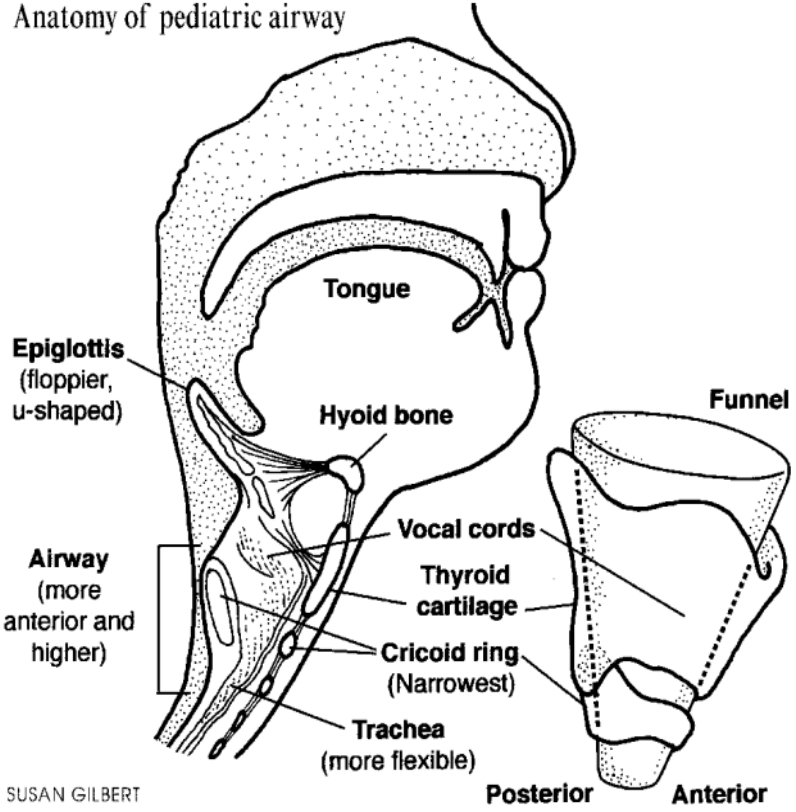
Rocking Chest Wall Motion
Common With Stress And Even Partial Obtruction

Chest collapse on inhalation limits lungs expansion
Increased work of breathing
Harder infant tries to breathe, the less efficiently he breathes

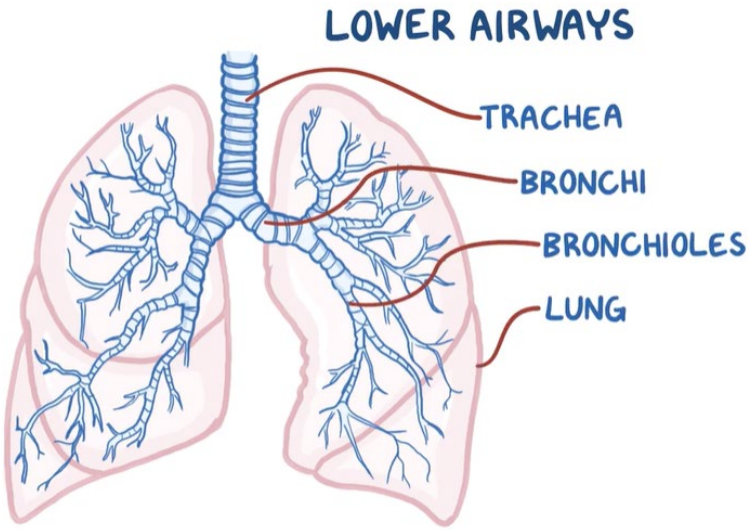
Chest Wall More Box-Like
rib angles mechanically inefficient
limited lung expansion
limited tidal volume increases
↑ alveolar ventilation is respiratory rate dependent

Muscles of Ventilation Tire Easily
Fatigue leads to respiratory failure


Anatomy of adult airway
Tongue
Epiglottis
(shorter)
Hyoid bone
Vocal cords
(Narrowest)
Thyroid
cartilage
Cricoid ring
Trachea
Cylinder
Posterior
Anterior
SUSAN GILBERT


Anatomy of pediatric airway
Tongue
Epiglottis
(floppier,
u-shaped)
Hyoid bone
Airway
(more
anterior and
higher)
Vocal cords
Thyroid
cartilage
Cricoid ring
(Narrowest)
Trachea
(more flexible)
Funnel
Posterior
Anterior
SUSAN GILBERT

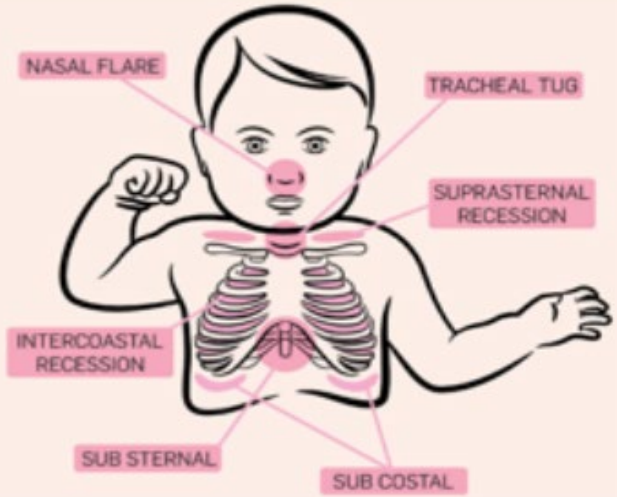
Pediatric Lower Airway



Decreased functional residual capacity

Fewer alveoli for gas exchange

Must breathe faster to achieve minute ventilation



Other signs of respiratory distress

- Head bobbing (infants)
- Tripod positioning
- Paradoxical abdominal breathing
- Flat affect
- Absence of crying
- Grunting

Pediatric Respiratory Rates

Age	**Rate** (breaths/ minute)
Infant (to 1 yr)	30-60
Toddler (1-3 yrs)	24-40
Preschool (3-6 yrs)	22-34
School Age (6-12 yrs)	18-30
Adolescent (12-18 yrs)	12-16

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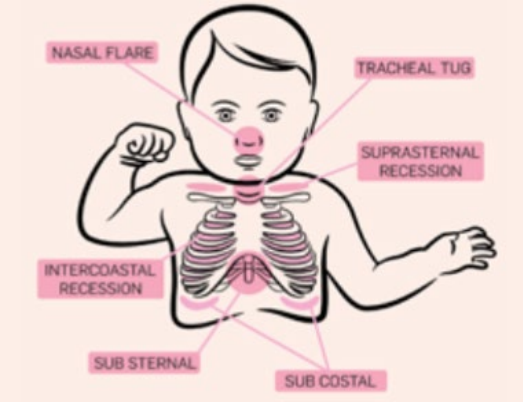
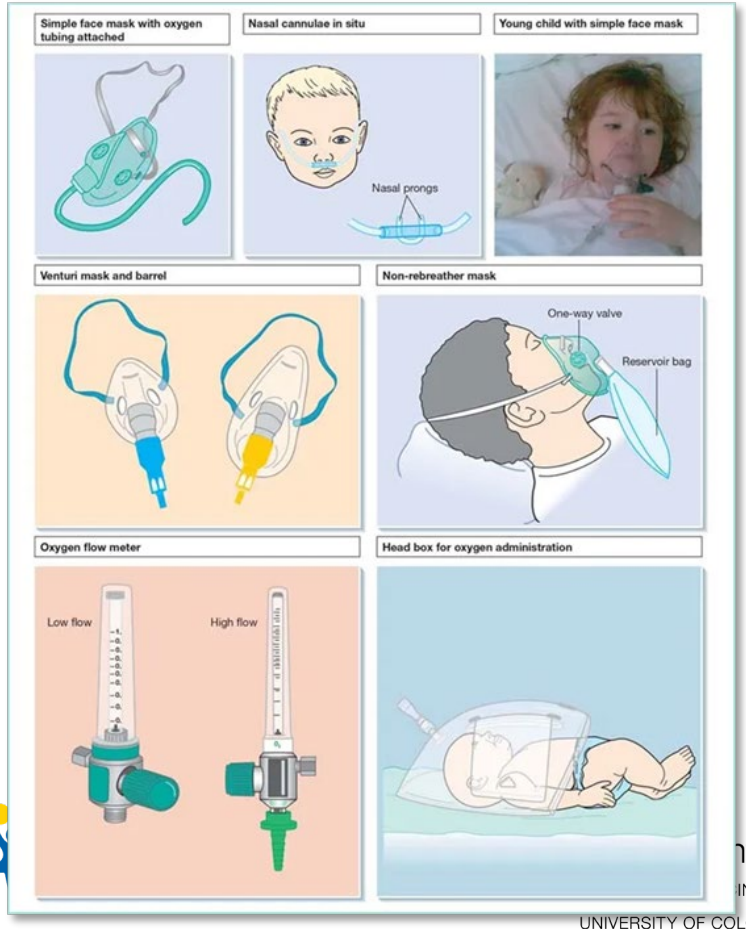
Pediatric Respiratory Exam

Mental Status/Activity Level	Work of breathing + Oxygen Saturation	Auscultation
Awake? Crying? Vs. Somnolent? Listless?		Stridor? Rales? Rhonchi? Wheeze? Diminished breath sounds?

Oxygen Delivery Methods



Nasal cannula (generally good for infants): 24% to 45% oxygen, flow: 0.5 to 2 L/minute

Simple face mask: 35% to 50% oxygen, flow 6 to 10 L/minute

Nonrebreathing mask: 90% oxygen, flow: 10 to 15 L/minute

Heated high flow nasal cannula

- 1.5-2L/kg
- Heated, humidified
- Often need the flow and not the fraction of inhaled oxygen (FIO_2)

CHCO Standard Heated High Flow by Age

Acute Care Flow Guidelines

Age	Acute Care Flow Rate Limit L/min
30 days up to 12 months	8
13 months up to 24 months	10
25 months up to five (5) years	12
Greater than five (5) years	16

Non-invasive positive pressure ventilation

- BiPAP and AVAPS are most used
- Start around PIP 10-12 PEEP 5-6
- Tidal volume 10cc/kg

How do you know if your respiratory support is working?

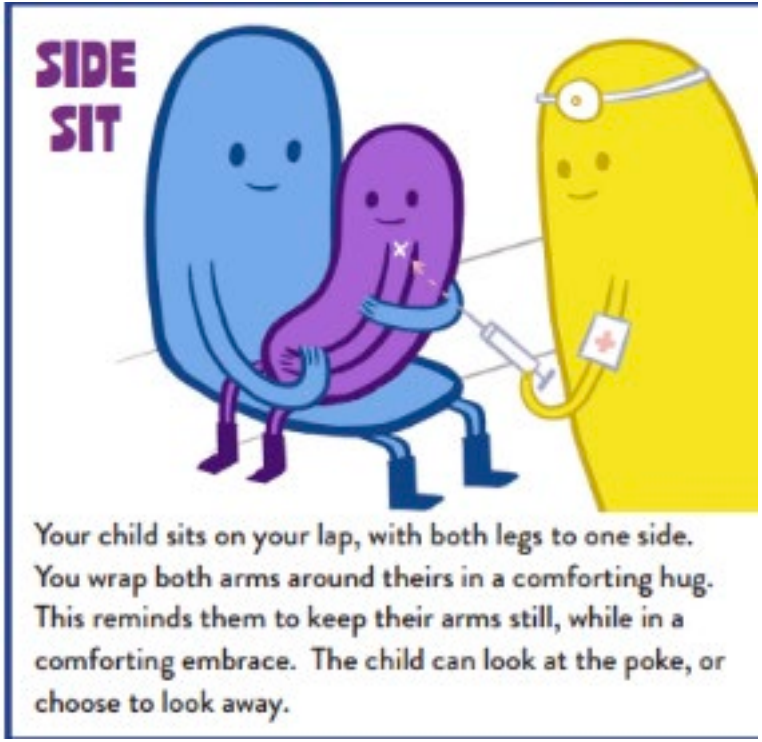
- Decreased respiratory rate and work of breathing
- Improved gas exchange:
  - Decrease in oxygen delivery and maintain pulse oximetry saturations
  - CO_2 retention improving relative to their tachypnea

Medication Delivery: Nebulizers

Nebulizers should be delivered via face mask, and the mask should be positioned at the child's face

Blow-by nebulizers are NOT as effective, and patients are not getting all the medication

Estimated they are get ½ the dose compared to appropriately fitting face mask


SIDE SIT
Your child sits on your lap, with both legs to one side. You wrap both arms around theirs in a comforting hug. This reminds them to keep their arms still, while in a comforting embrace. The child can look at the poke, or choose to look away.

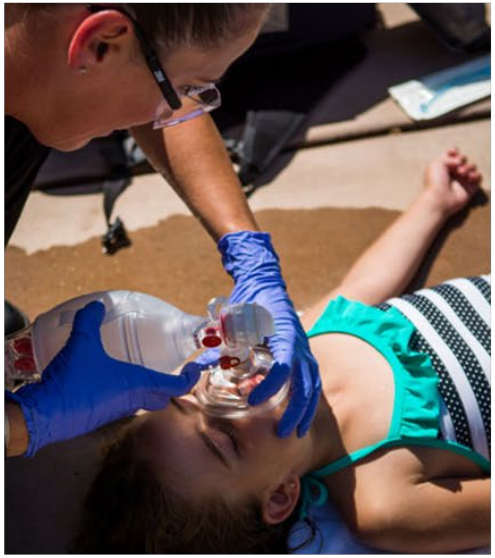

BACK TO TUMMY SIT
Your child sits on your lap, facing away from you. You wrap both arms around theirs in a comforting hug. You can also wrap your legs around theirs for a full embrace. For bigger kids, you can have them sit on a chair or bed, and straddle them from behind.


TUMMY TO TUMMY SIT
Your child sits on your lap, facing you. Their legs straddle and wrap around your waist. You wrap both arms around theirs, for a full embrace, using your underarms and forearms to keep their arms safely contained. This works even for older children.


BACK TO TUMMY TABLE SIT
Your child sits on a table, with you hugging them from behind. You wrap your arms around theirs for a big hug. Use your hugging arms to keep their hands safely contained. For smaller children, you can also use your arms to remind their legs to stay still.

Bag-valve mask pitfalls in pediatric patients

Soft Tissue Compression



Occluding Nostrils

Pushing Down on Face

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

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

3. Improve your technique
   - Focus on chin lift
   - Achieve a tight seal
   - Classic C-E hold

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2yo female two days of low-grade fever, runny nose. Developed harsh cough and noisy breathing

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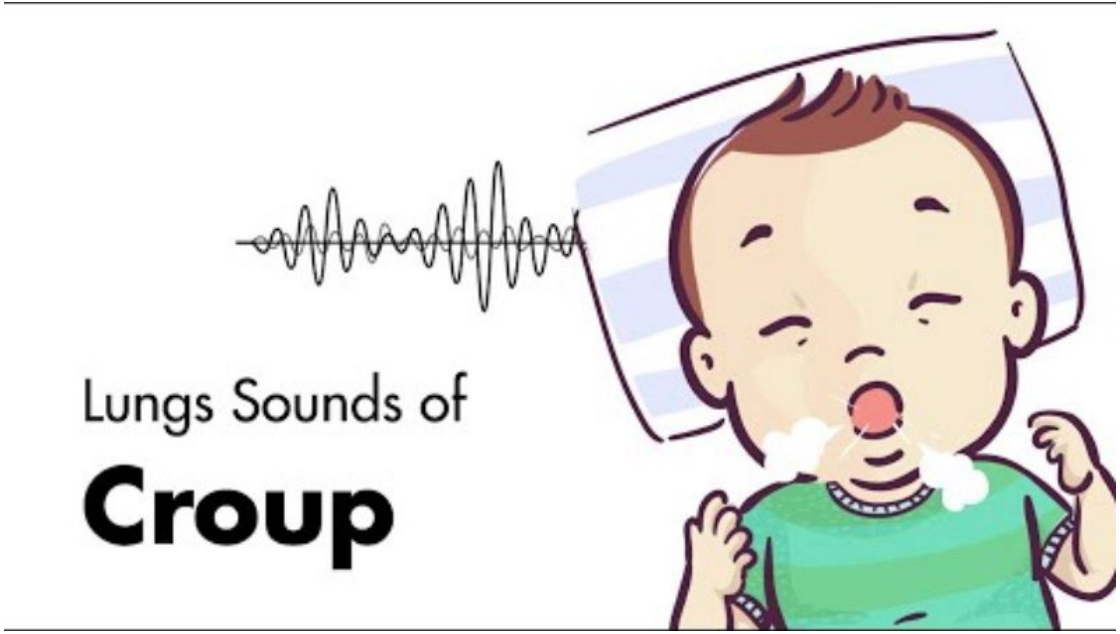
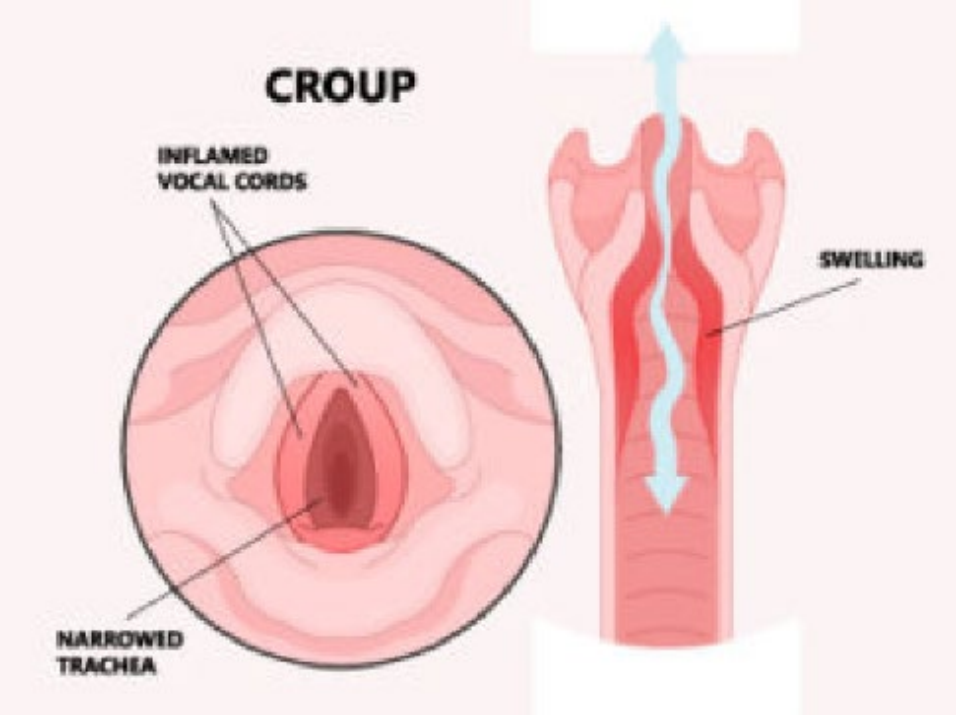
CROUP


Lungs Sounds of
Croup



Age: 6months- 6 years

Most common causes: parainfluenza, influenza A/B, COVID, etc

“Noisy breathing” and barky cough with preceding few days of URI sx +/- fevers

Defining Croup Severity

Mild Severity

- Stridor with activity
- Mild or no retractions
- Normoxia, no tachypnea, no tachycardia
- Normal mental status
- Able to talk or feed

Moderate

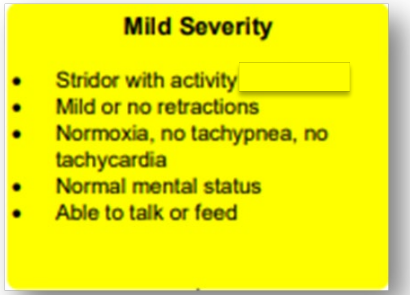
Biphasic stridor with agitation
-OR-
Inspiratory stridor at rest with moderate retractions AND 1 of the following:

- Mild tachypnea, mild tachycardia
- Agitated, tired, or low tone
- Difficulty talking or feeding

Severe/Life-Threatening

- Biphasic stridor or no stridor due to poor respiratory effort or near complete airway obstruction
- Severe retractions
- Hypoxemia or cyanosis, marked tachycardia or bradycardia
- Abnormal mental status, confused, drowsy
- Unable to talk or feed

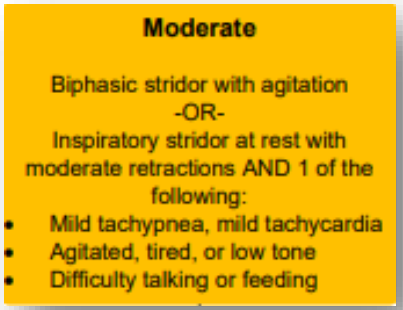
Management



Decadron 0.6mg/kg PO
(max 16mg)
Peak effect in 2 hours
Lasts 24-36 hours

Discharge home with close PCP follow-up

Management



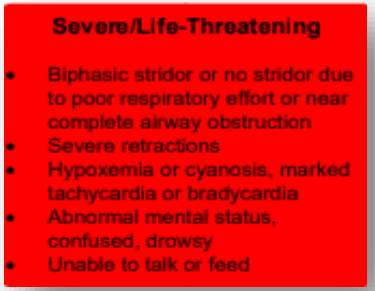
- Decadron 0.6mg/kg PO (max 16mg)

+

- Racemic epinephrine nebulized solution

- Observe for 2-3 hours after racemic epinephrine
- If no further racemic needed, discharge home
- If multiple doses needed, can consider admission for observation

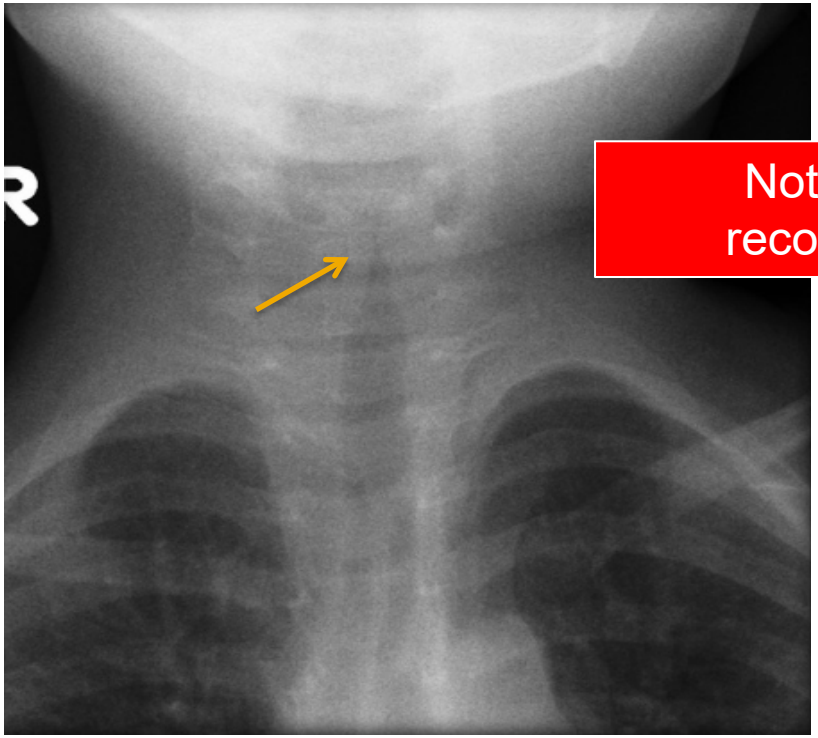
Management



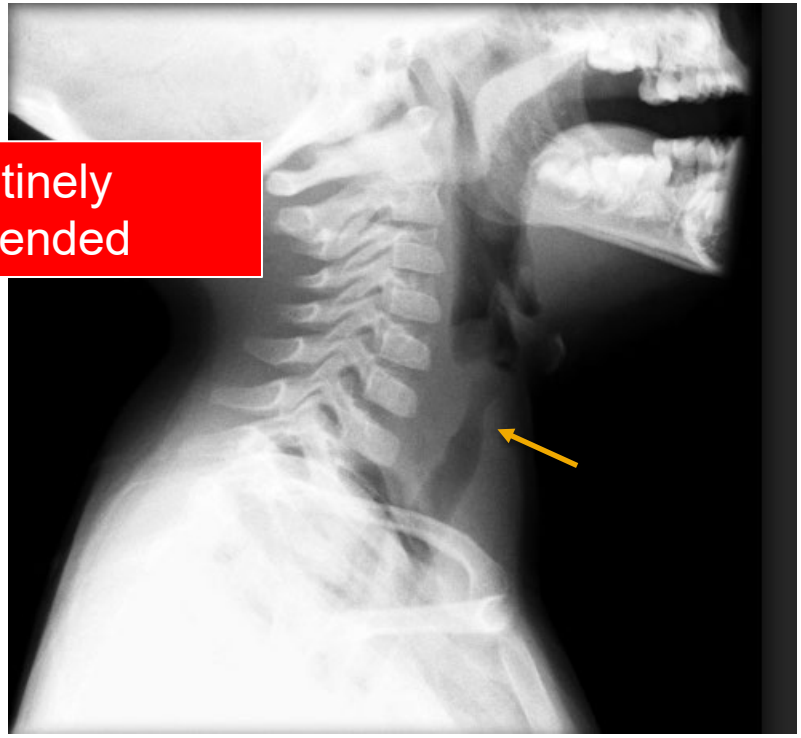
- Decadron 0.6mg/kg PO or IV methylprednisone if concerned about aspiration risk if mental status is poor
- Continuous racemic epinephrine
- Heliox

Call critical care transport
Address airway if needed but will be a difficult airway

What about Neck XR?



Not routinely recommended



Age >6years

Drooling/intolerance of secretions

Toxic/ill-appearing

Poor response to racemic epinephrine

Hypoxemia

What if it isn't croup?

Differential Diagnosis Table

Infectious:
- Retro-/ para-pharyngeal abscess
- Bacterial tracheitis
- Lower respiratory tract infection
- Epiglottitis

Anatomic:
- Foreign body aspiration/ingestion
- Tracheomalacia
- Other airway anomaly

Allergic/Atopic
- Spasmodic croup
- Allergies/Anaphylaxis
- Asthma

Reflux
- GERD

**If concerns for abscess, bacterial tracheitis, epiglottitis, foreign body aspiration, or spasmodic croup, consult ENT.

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6-month-old two days copious amounts of rhinorrhea and cough

Today, developed fast breathing and increased work of breathing

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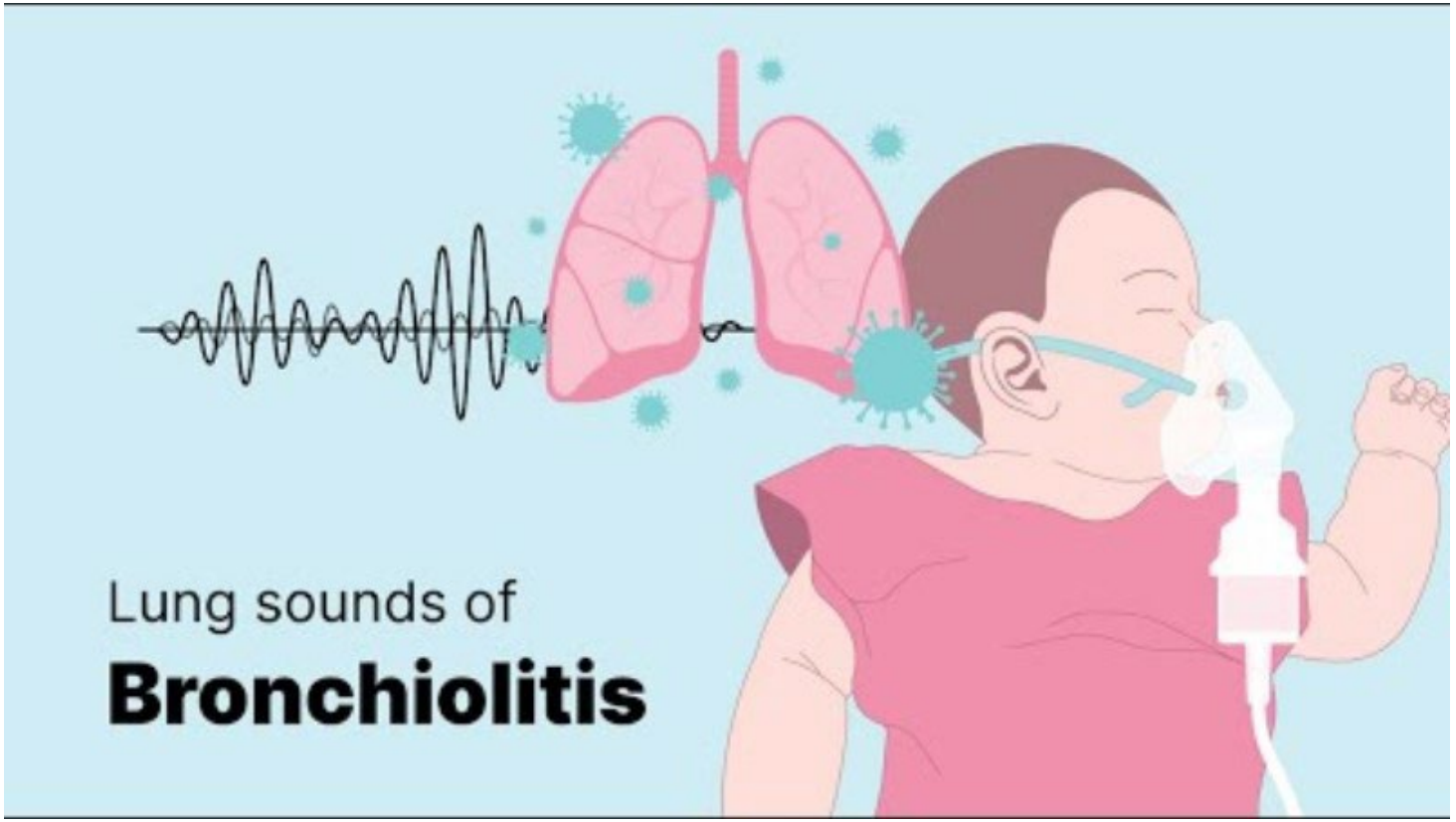
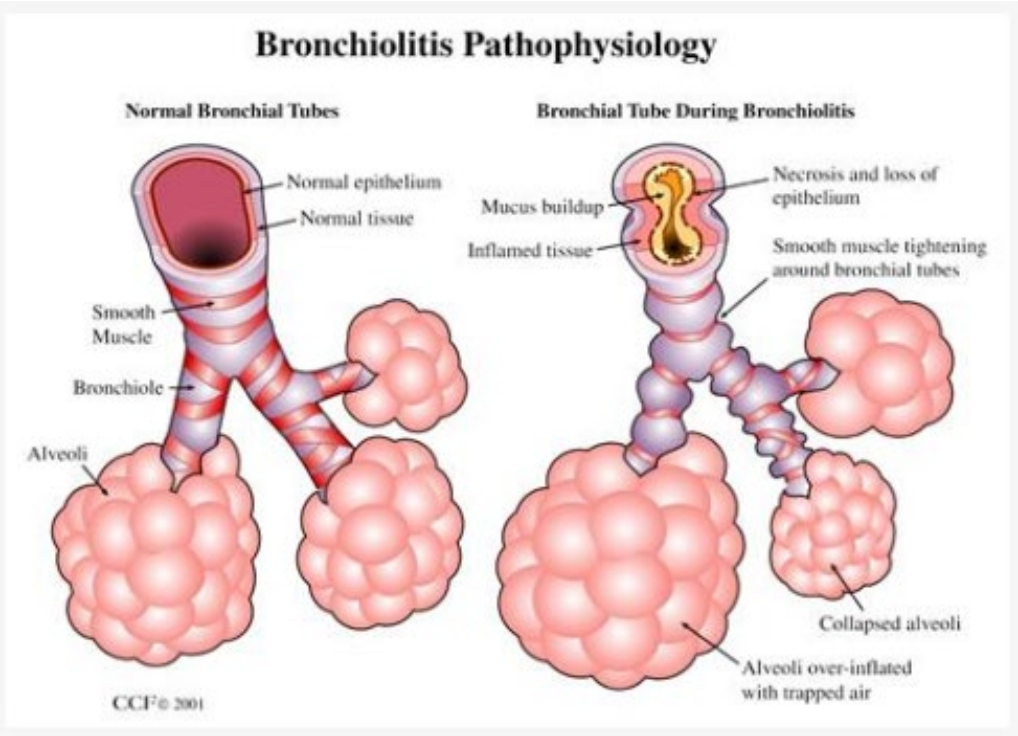
BRONCHIOLITIS


Lung sounds of
Bronchiolitis



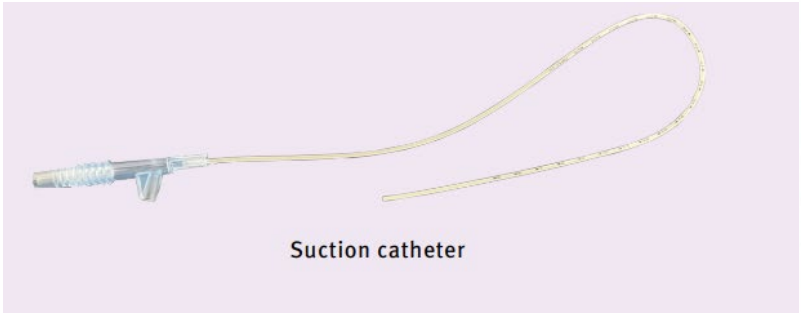
Age: <2 years old

Clinical Symptoms: rhinorrhea, congestion, tachypnea, retractions, rhonchi, hypoxemia, +/- fevers

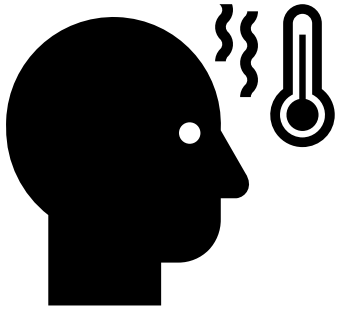
RSV, influenza, COVID, HMPV, rhinovirus/enterovirus

Suction!

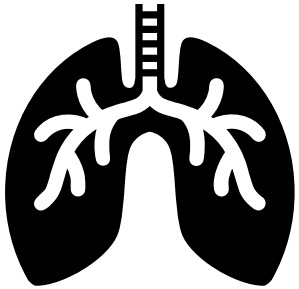

frida baby
NoseFrida
The OG SnotSucker
PEDIATRICIAN #1 RECOMMENDED BRAND
1 Nasal Aspirator
4 Hygiene Filters


Suction catheter

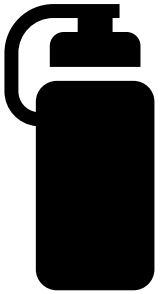

100 pack



Address fever



Low-flow nasal cannula
Heated-high flow
BiPAP
AVAPS
Mechanical Ventilation



PO hydration preferred

Chest x-ray, labs, albuterol, steroids are generally not recommended

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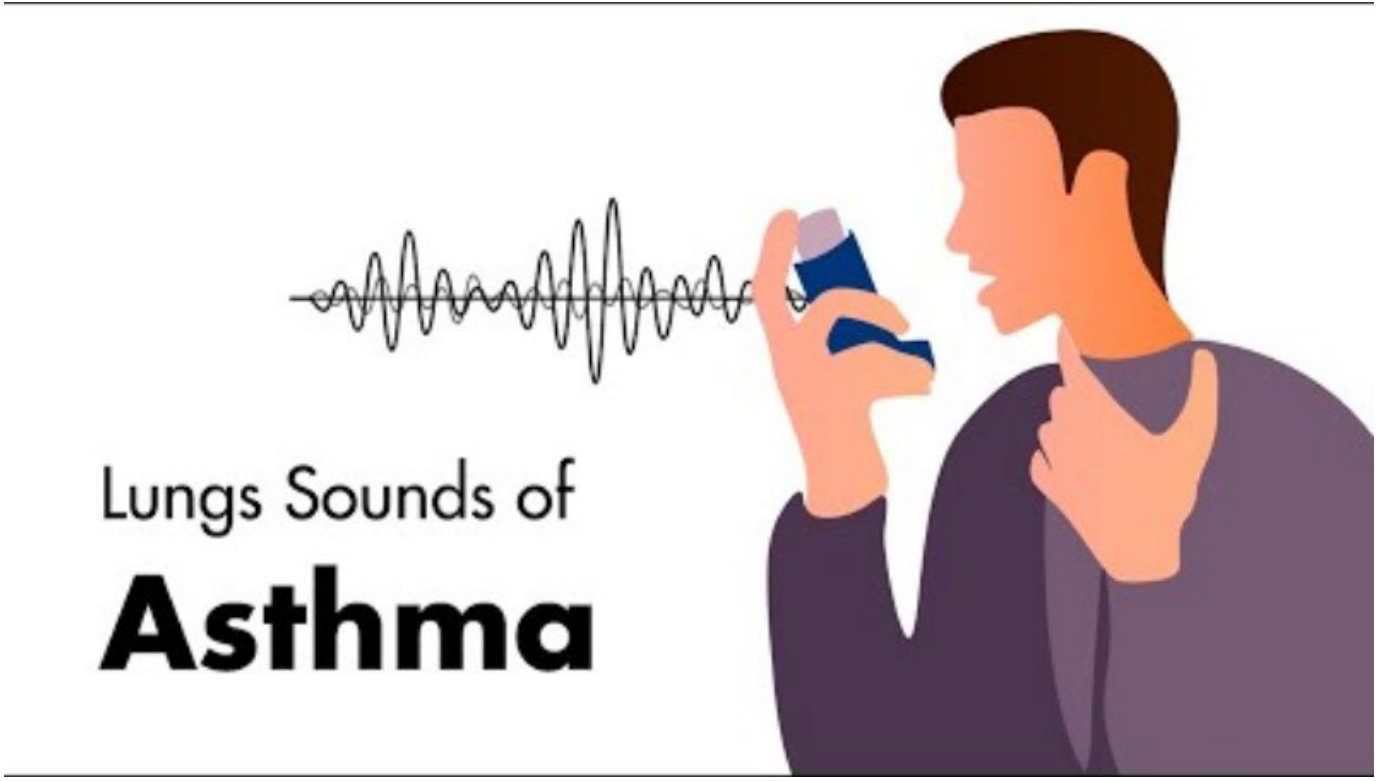
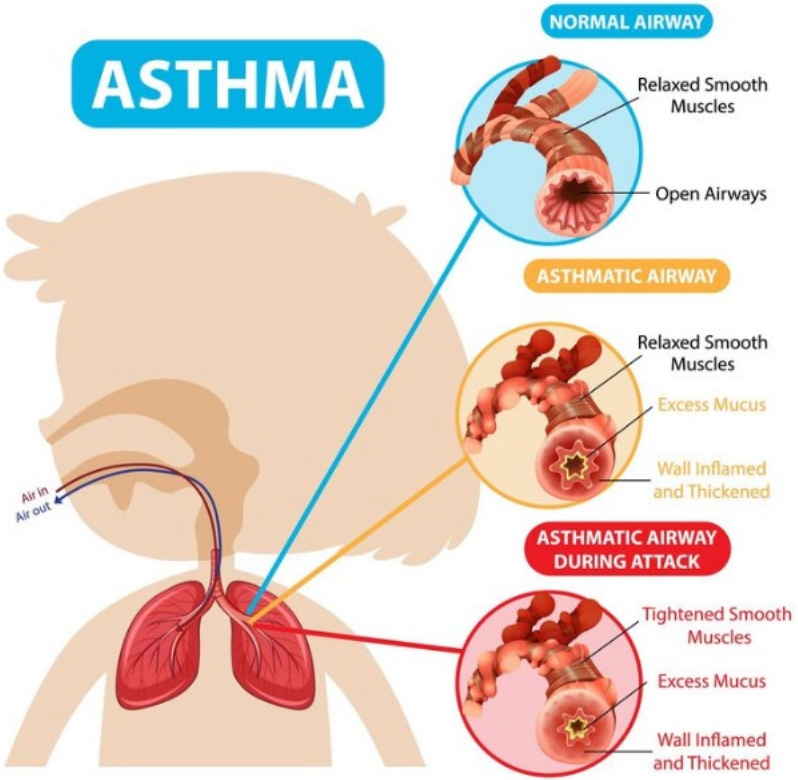
8yo one day of cough and shortness of breath.
Having trouble keeping up in PE class.
Older brother has asthma. There is smoke exposure at home.


Lungs Sounds of
Asthma



Risk Factors for Life Threatening asthma

- Prior history of life-threatening exacerbation
- Previous ICU admission
- Previous endotracheal intubation
- Older age
- Inability to recognize airflow obstruction
- Poor asthma control

Pediatric Asthma Severity Score

Pediatric Asthma Score

SCORE	1	2	3
Respiratory Rate			
2-3 years	≤34	35-39	≥40
4-5 years	≤30	31-35	≥36
6-12 years	≤26	27-30	≥31
>12 years	≤23	24-27	≥28
Oxygen Requirement	>95% on room air	90-95% on room air	<90% on room air or on any oxygen
Auscultation	Normal breath sounds to end-expiratory wheeze only	Expiratory wheezing	Inspiratory and expiratory wheezing to diminished breath sounds
Retractions	None or intercostal	Intercostal & substernal	Intercostal, substernal, & supraclavicular
Dyspnea	Speaks in sentences, coos, & babbles	Speaks in partial sentences, short cry	Speaks in single words/short phrases/grunting

5-7
MILD

8-11
MODERATE

>12
SEVERE

5-7
MILD

Management

Albuterol MDI (3 doses as needed)

<20kg: 4 puffs

>20kg: 8 puffs

Decadron 0.6mg/kg (max 16mg)

Observe 1 hour and discharge home

8-11 MODERATE

Management

1. Albuterol-ipratropium nebs (3 doses)
2. Decadron 0.6mg/kg

Improved to mild category? Observe and discharge home

No improvement? Start continuous albuterol Consider IV magnesium

>12
SEVERE

Management

1. Albuterol-ipratropium nebs (3 doses)
2. Decadron 0.6mg/kg
3. Continuous albuterol
4. Consider asthma therapy adjuncts

CRITICAL ASTHMA

No air movements, severe respiratory distress, altered mental status, poor respiratory effort

Albuterol-ipratropium (3 doses)
IV methylprednisone (2mg/kg, max 60mg)
Continuous albuterol
IV magnesium
BiPAP
Asthma adjuncts

Asthma Adjuncts

1. IV Magnesium
2. IM epinephrine
3. SubQ or IV Terbutaline
4. Positive pressure

Chest x-rays, antibiotics, labs are generally not recommended for acute asthma exacerbations

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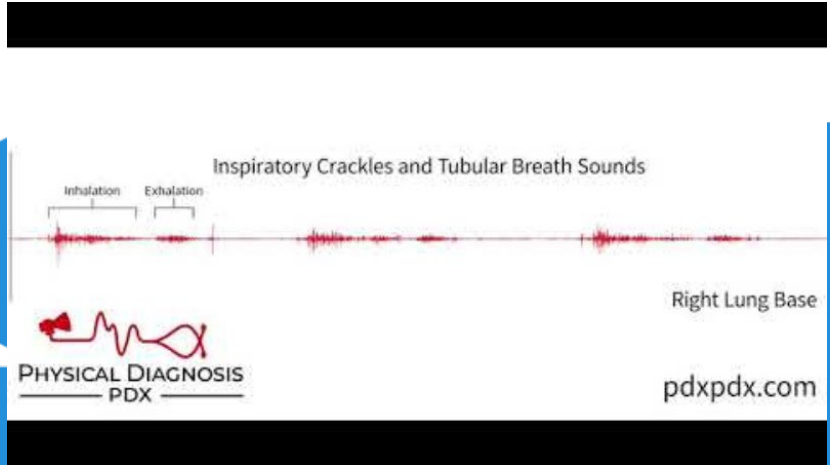
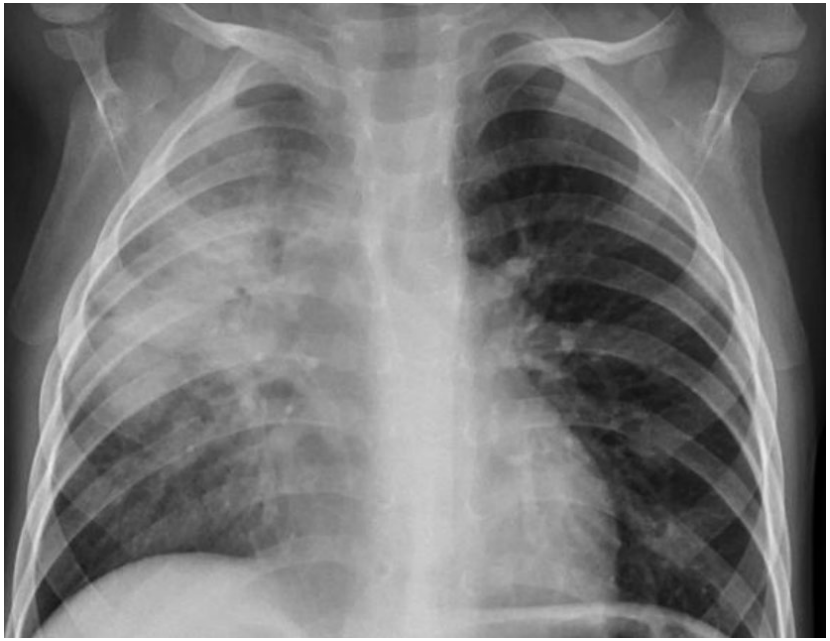
5yo male 5 days cough and congestion now with high fevers, tachypnea



Pneumonia

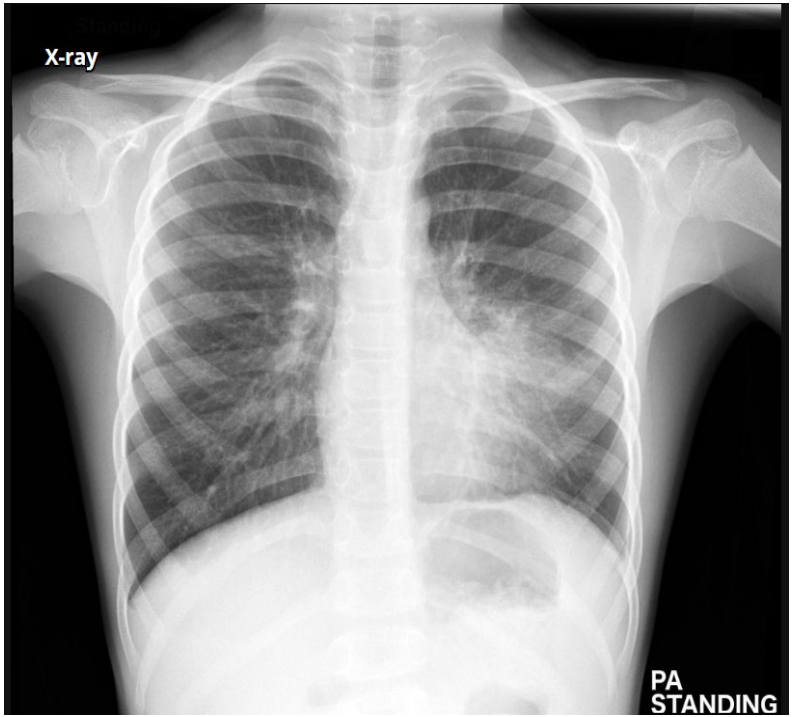


Most commonly is Uncomplicated Community Acquired Pneumonia

Many are triggered by viral illness, but they do not seem to get better as expected.

Most sensitive signs for pediatric pneumonia are tachypnea and fever

Pneumonia



Amoxicillin 30mg/kg
PO TID

IV ampicillin 50mg/kg every 6 hours for kids with severe disease, inability to tolerate PO

Azithromycin is not standard pediatric pneumonia treatment without known mycoplasma infection

EMS for Children Colorado

Log In

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Pediatric Respiratory Resouces

Pediatric Respiratory Education

- Common Pediatric Respiratory Infections >
- Bronchiolitis and Croup Brief Presentation >
- Evaluation and Management of the Febrile Infant >
- Education Calendar >
- Pediatric Respiratory Distress >
- High Flow Nasal Cannual in the ED >

Clinical Pathways

Croup >

Fever In Infants less than 60 days >

Bronchiolitis >

Nose Frida Resources (English) >

Nose Frida Resources (Spanish) >

Includes pathways for:
- Home Oxygen
- Hydration
- Heated High Flow Oxygen
- ED, Inpatient, and Primary Care

Handout for caregivers for the use of Nasal Frida

Pediatric RSV Surge Resources

EMS Pediatric RSV Surge Resources >

Facility Pediatric RSV Surge Resources >

Pediatric Readiness

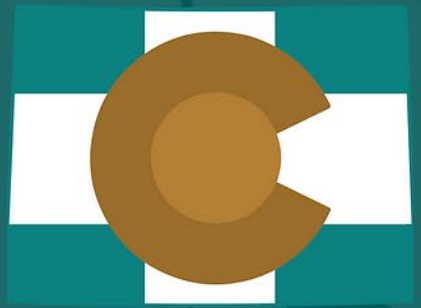
Pediatric Readiness for EMS >

Pediatric Readiness for the ED >

OneCall

720-777-3999

National Pediatric Readiness Project



High pediatric readiness in EDs is associated with:

76% lower mortality rate in ill children[1,2]

60% lower mortality rate in injured children[2]

AT LEAST 1,400 children's lives saved across the US each year[2]

1. "Emergency Department Pediatric Readiness and Mortality in Critically Ill Children" *Pediatrics*, 2019, Ames et al.

2. "Emergency Department Pediatric Readiness and Short-term and Long-term Mortality Among Children Receiving Emergency Care" *JAMA Network Open*, 2023, Newgard et al.

Having a pediatric emergency care coordinator has been shown to have the most impact on pediatric readiness!

- Here, it's different.

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EMS for Children (EMSC) Colorado

is charged with integrating, expanding, and improving pediatric emergency care by promoting the value and importance of integrating pediatric emergency care into the state emergency medical system.

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Clinical Pathways

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Respiratory Season Resources

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Continuing Education Platform