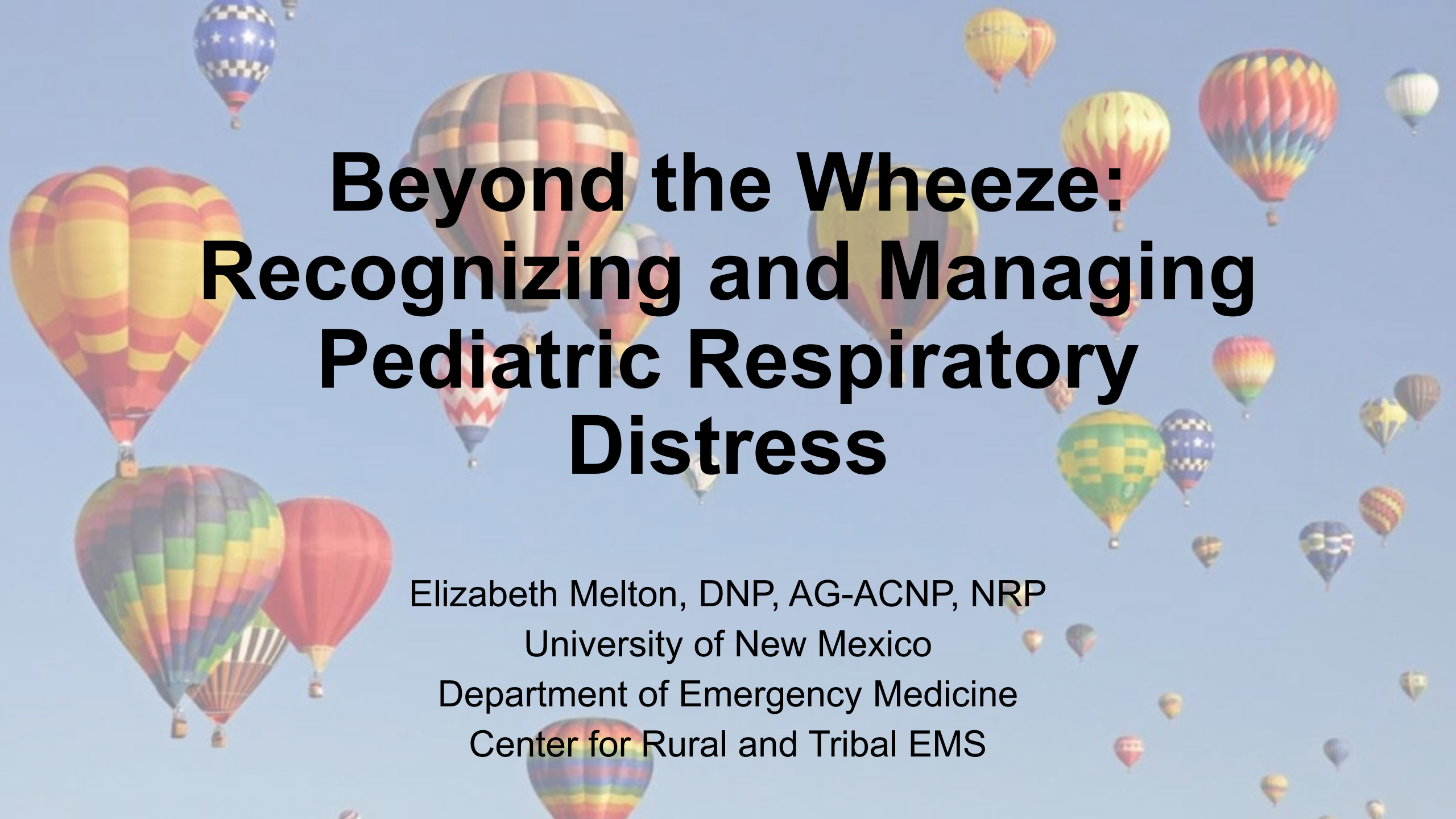

Beyond the Wheeze: Recognizing and Managing Pediatric Respiratory Distress

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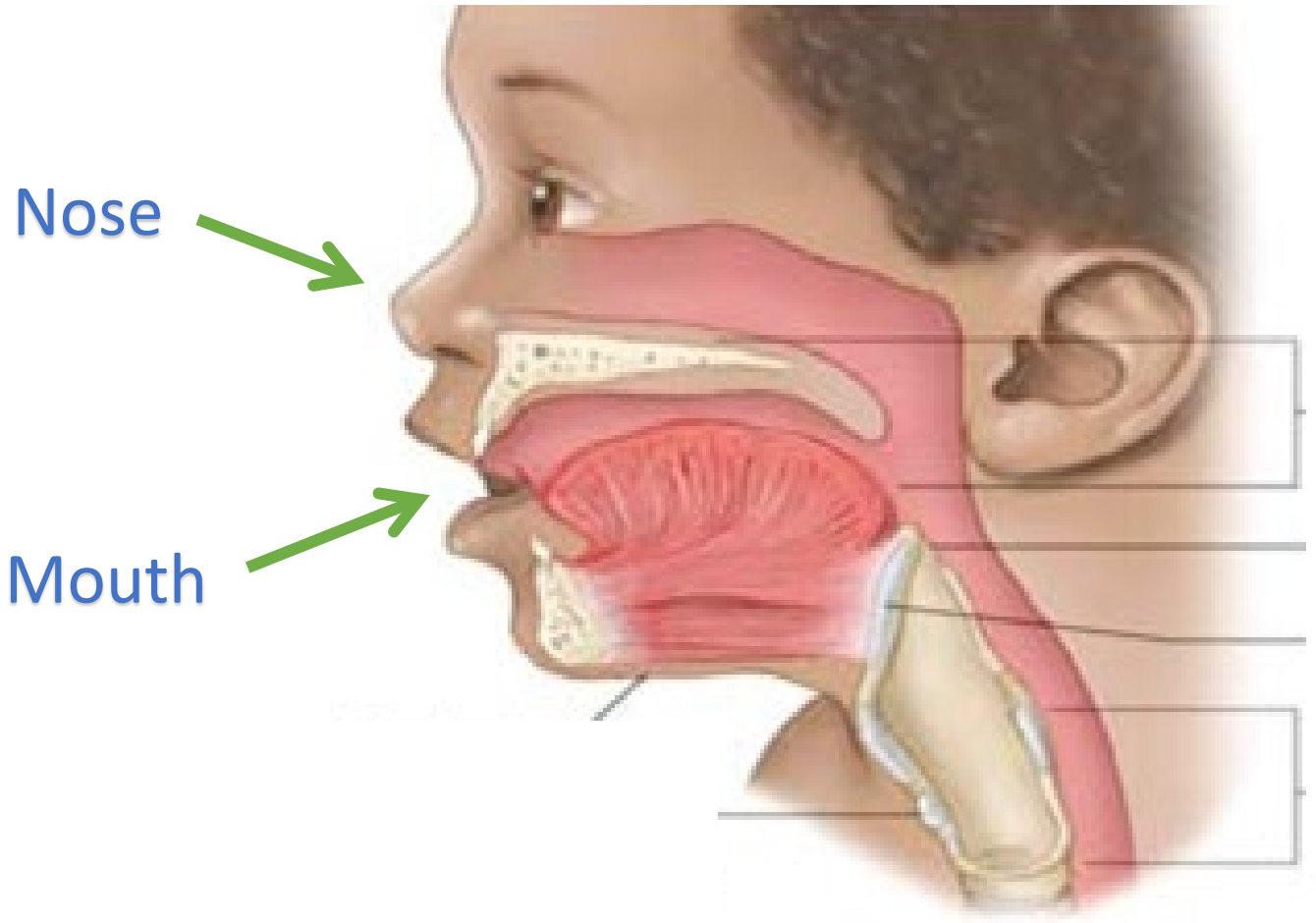
University of New Mexico
Department of Emergency Medicine
Center for Rural and Tribal EMS

Objectives

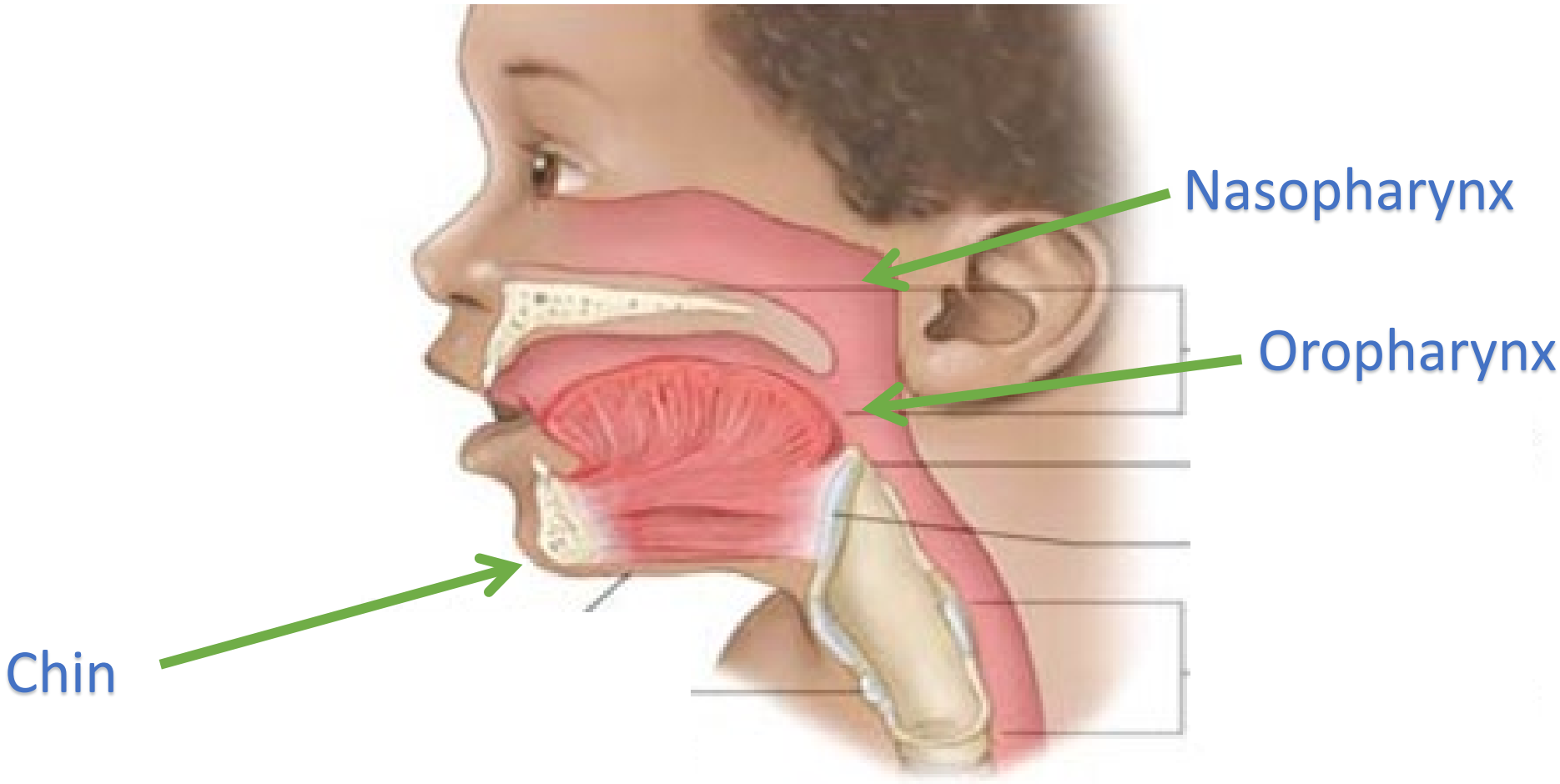
By the end of this session, participants will be able to:

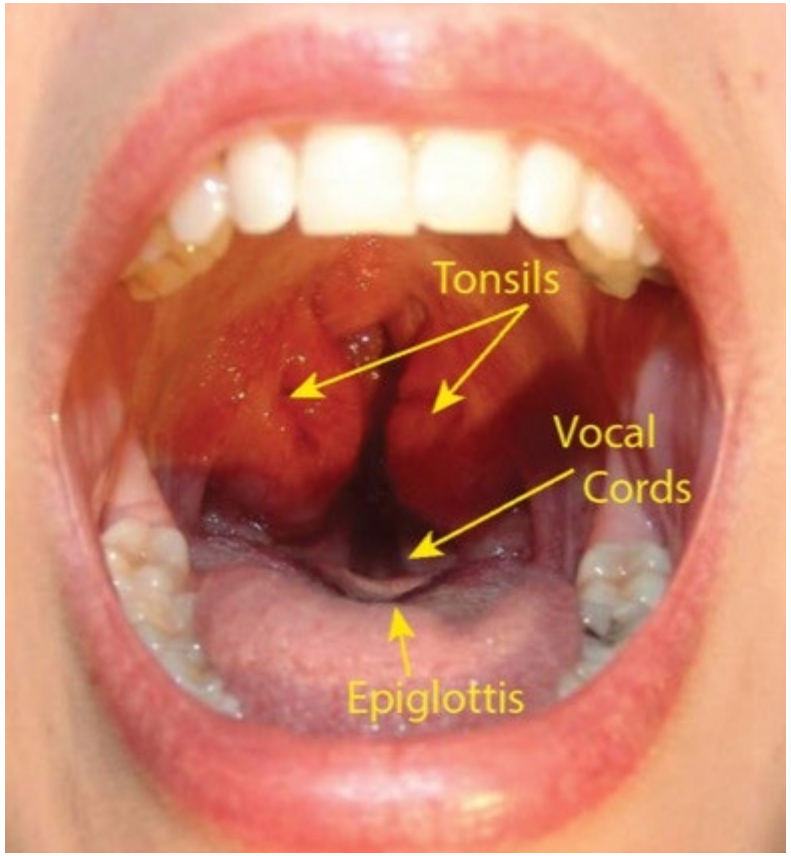
1. Recognize early signs and symptoms of respiratory distress and impending failure in pediatric patients.
2. Differentiate mild, moderate, and severe asthma exacerbations based on objective and clinical findings.
3. Implement evidence-based interventions for pediatric asthma and acute respiratory emergencies.
4. Collaborate with interdisciplinary teams for safe transfer, escalation of care, and discharge education.

Pediatric Airway: An Anatomy Review



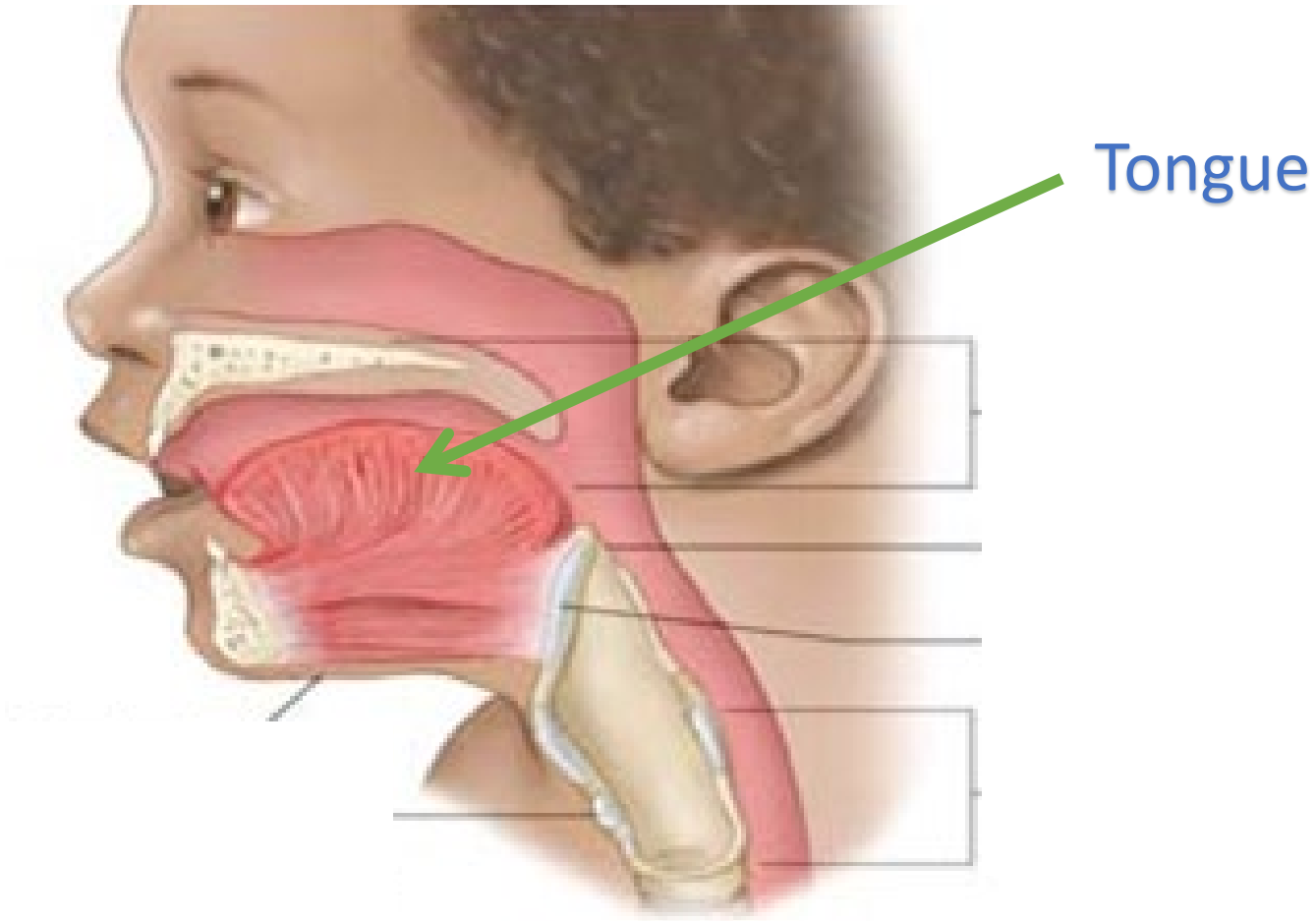
Pediatric Airway: An Anatomy Review





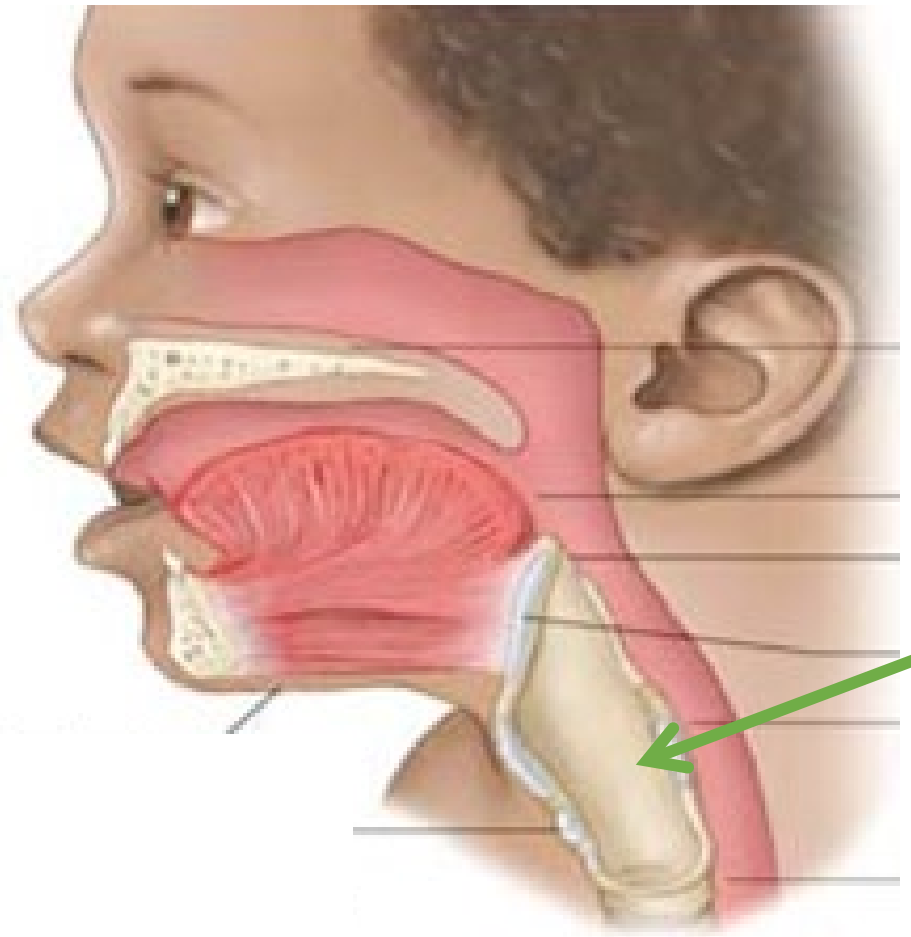
Sometimes so anterior and superior that you can see… the epiglottis

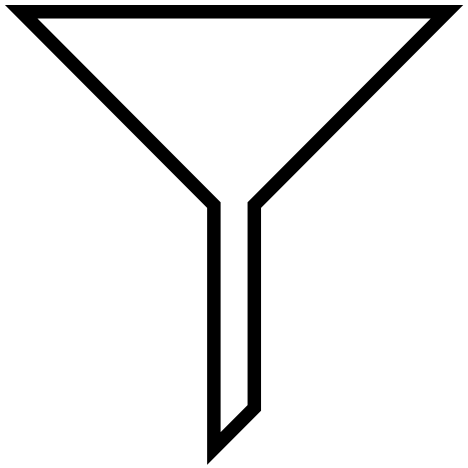
Pediatric Airway: An Anatomy Review



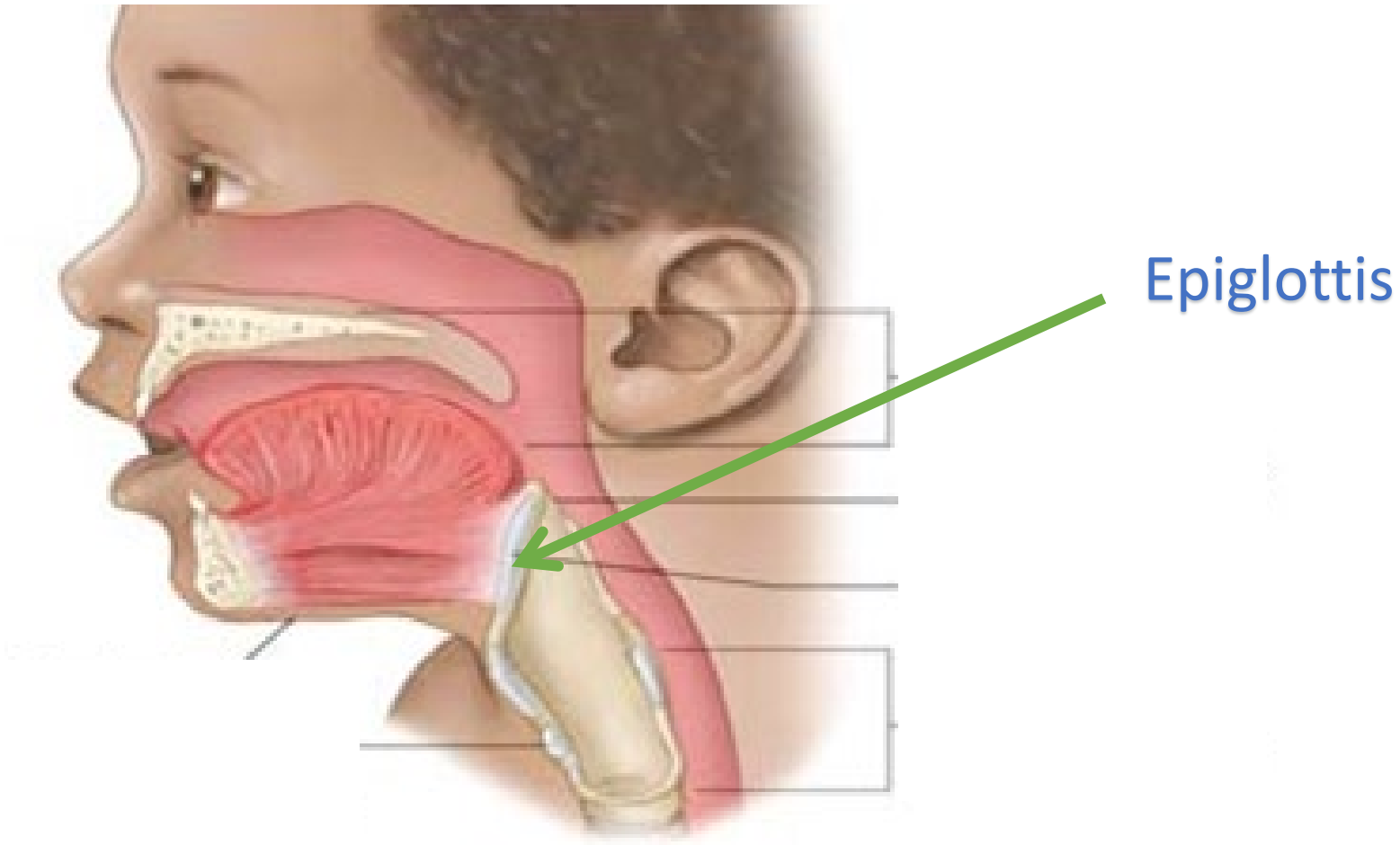
It’s huuuuuge….

Pediatric Airway: An Anatomy Review



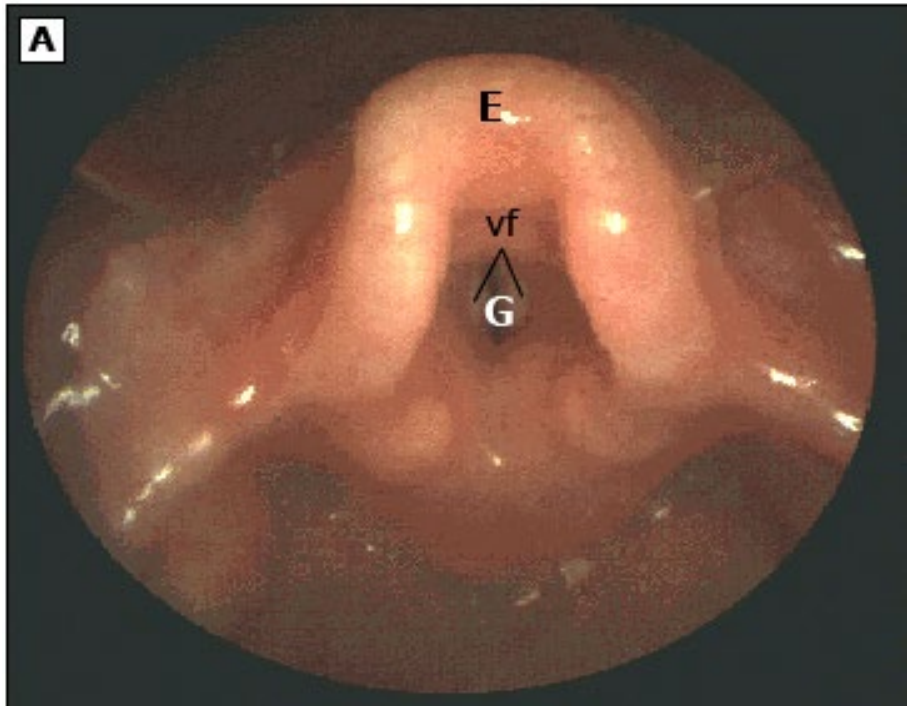


Pediatric Airway: An Anatomy Review

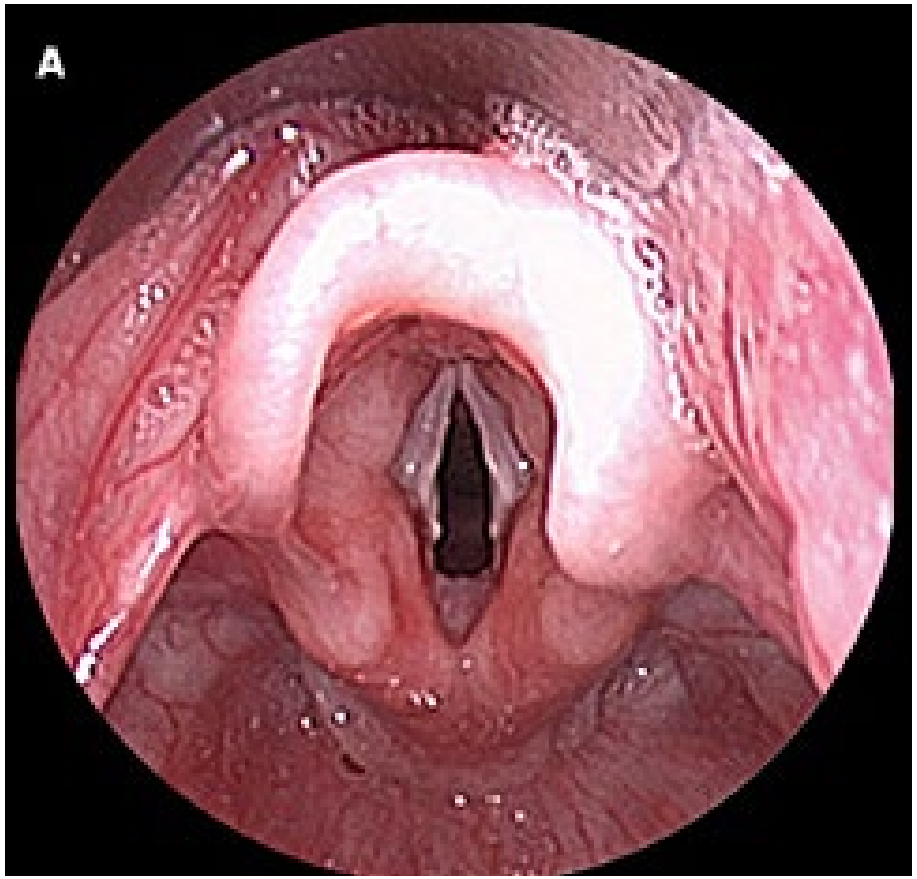


Intubating Views: Pediatric vs. Adult

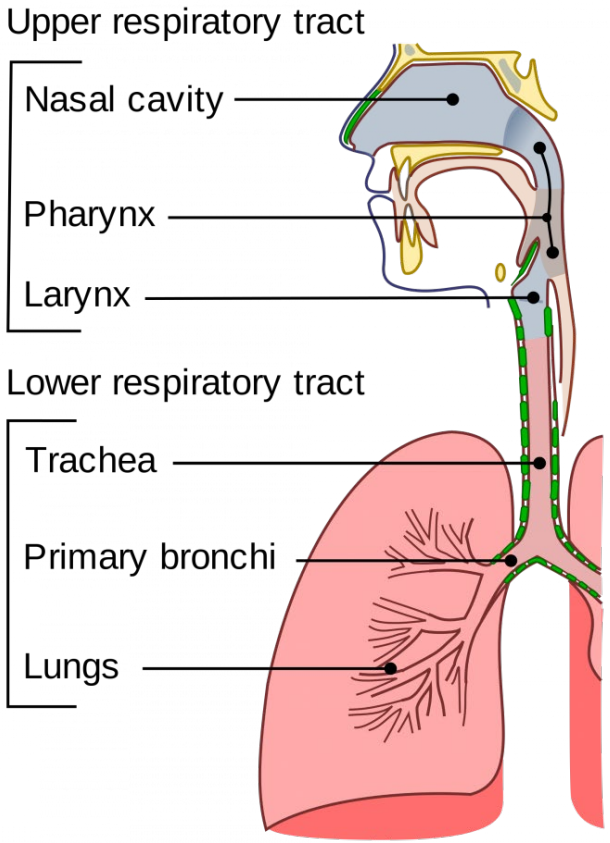
Pediatric



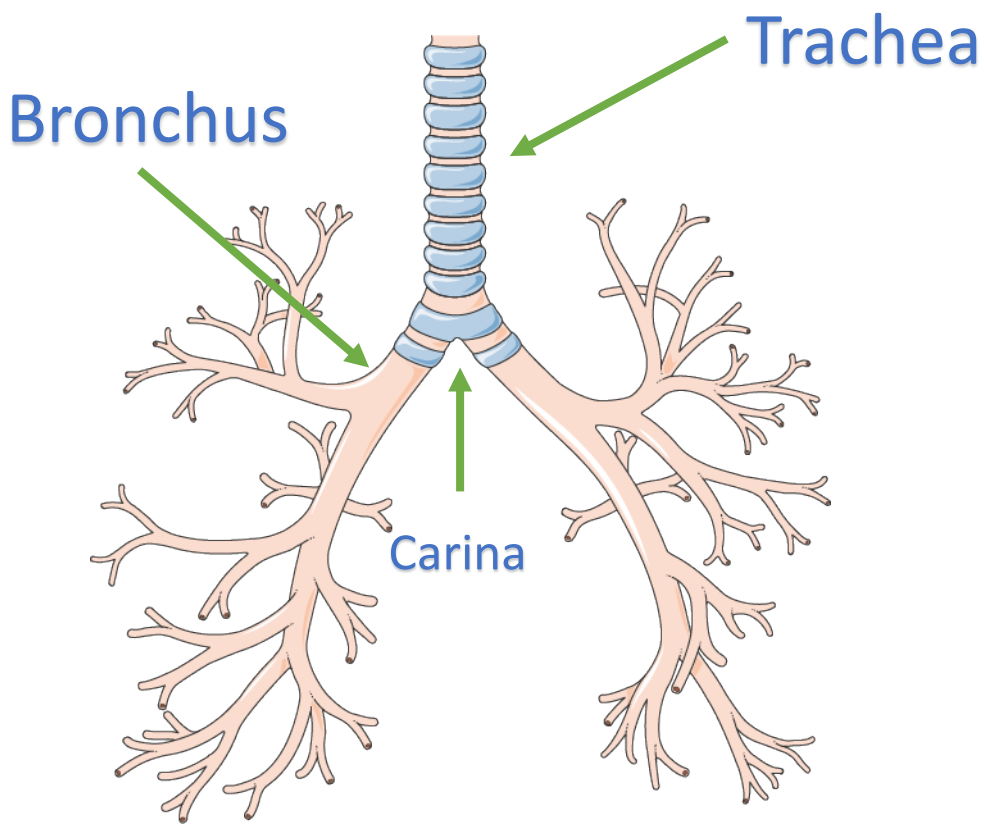
Adult

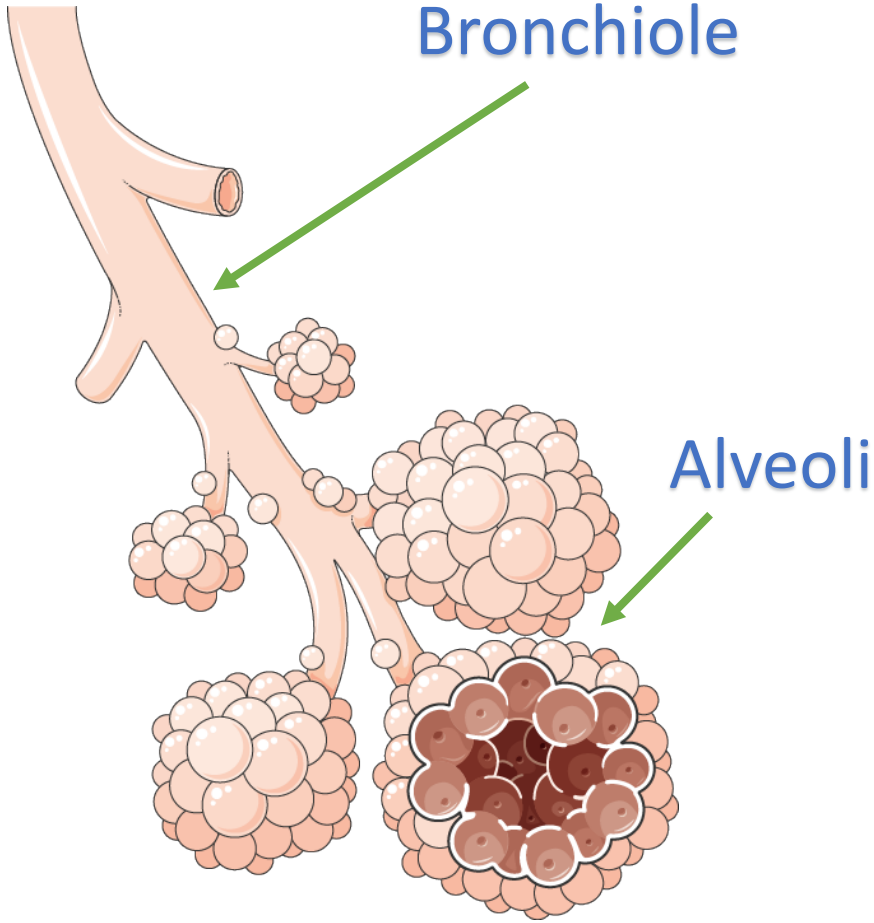


Now diving lower…

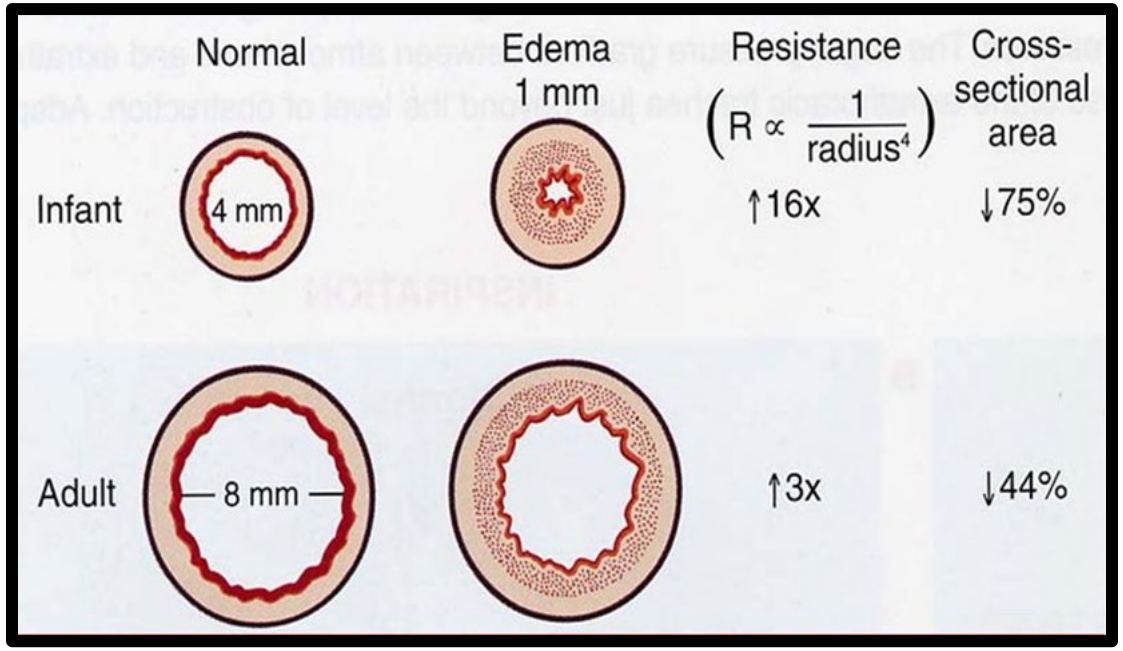


Lower Respiratory Tract



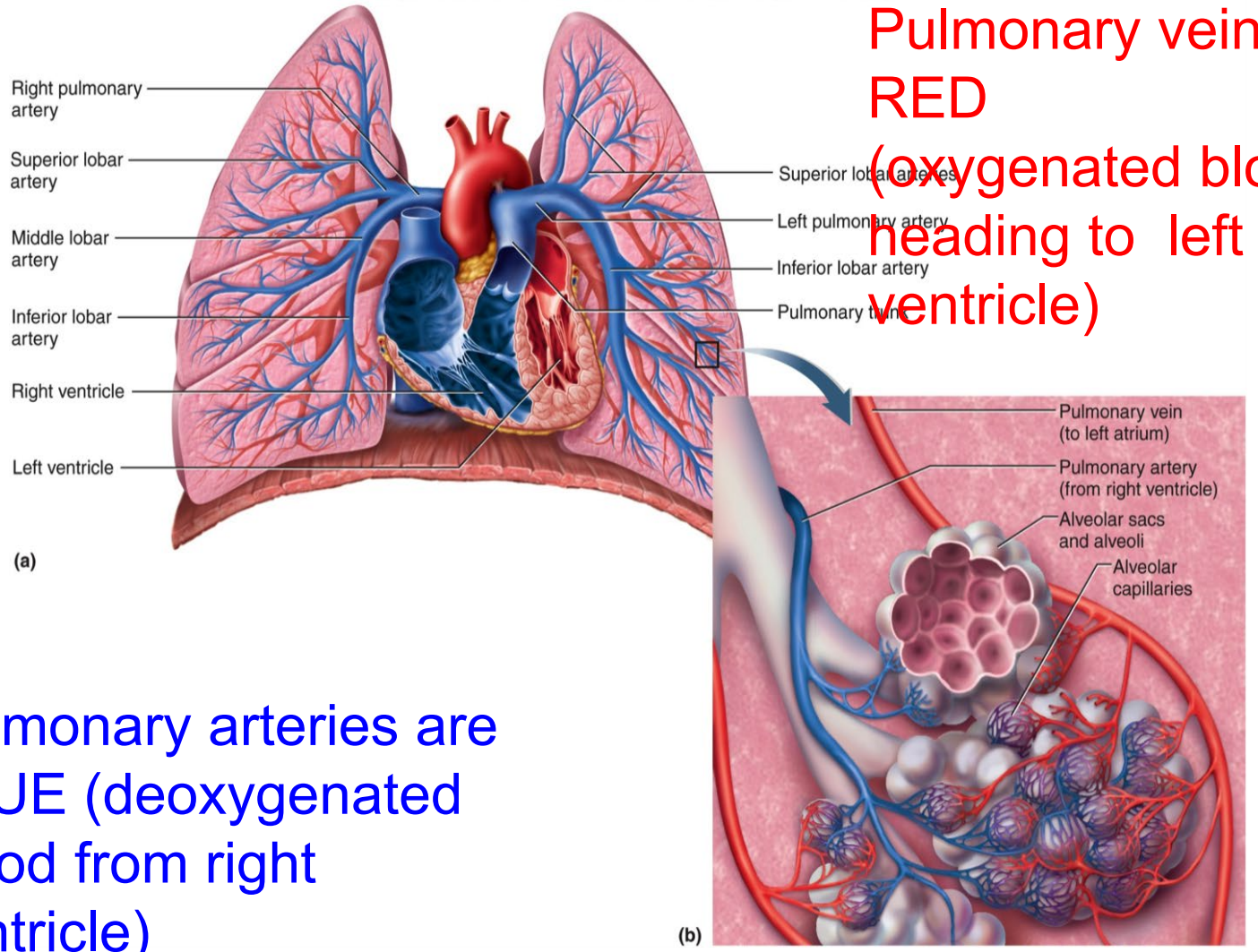


Flow Depends on Radius



- A small increase in radius has a large effect on flow
- Smaller airways have more resistance

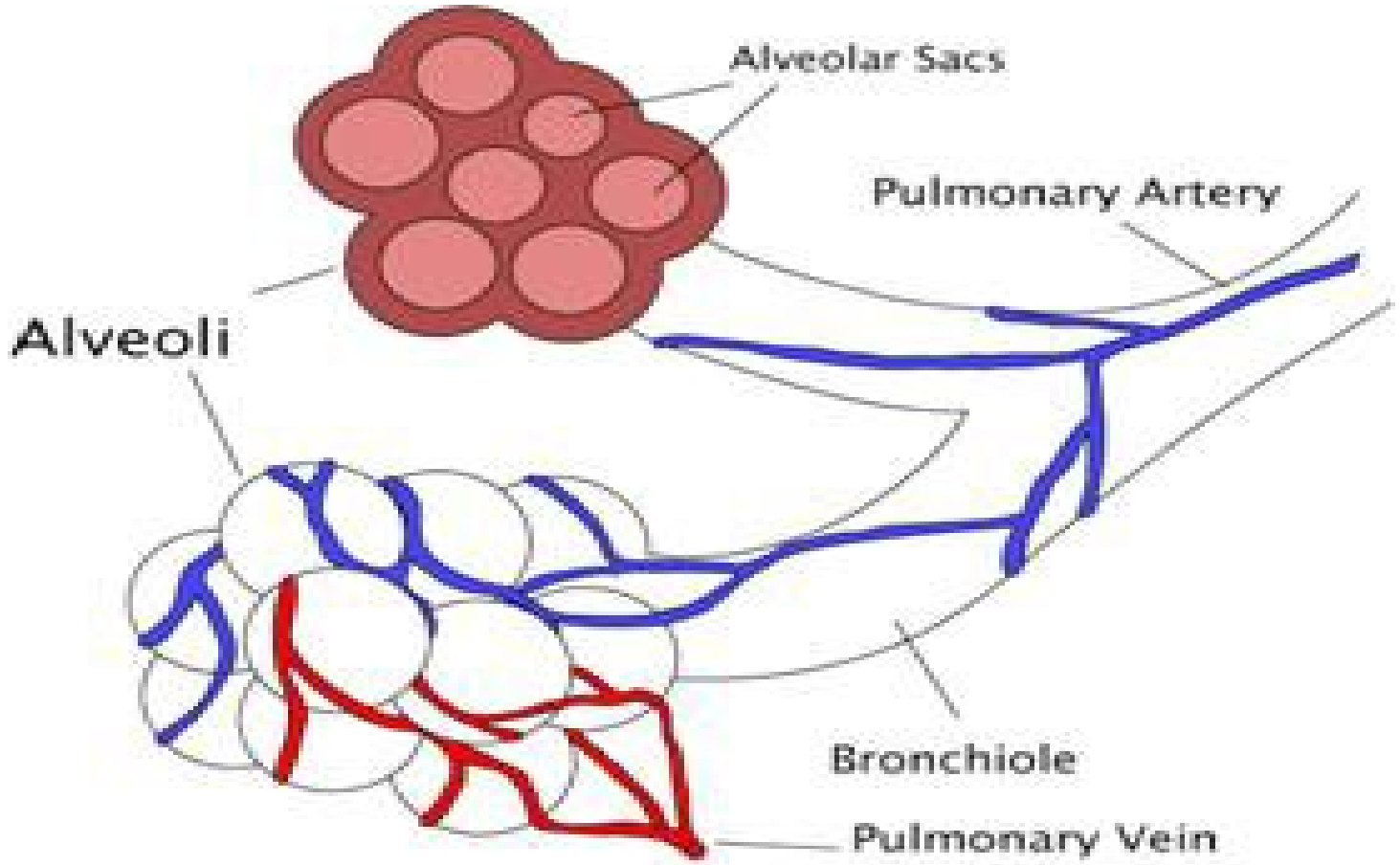
Gas Exchange



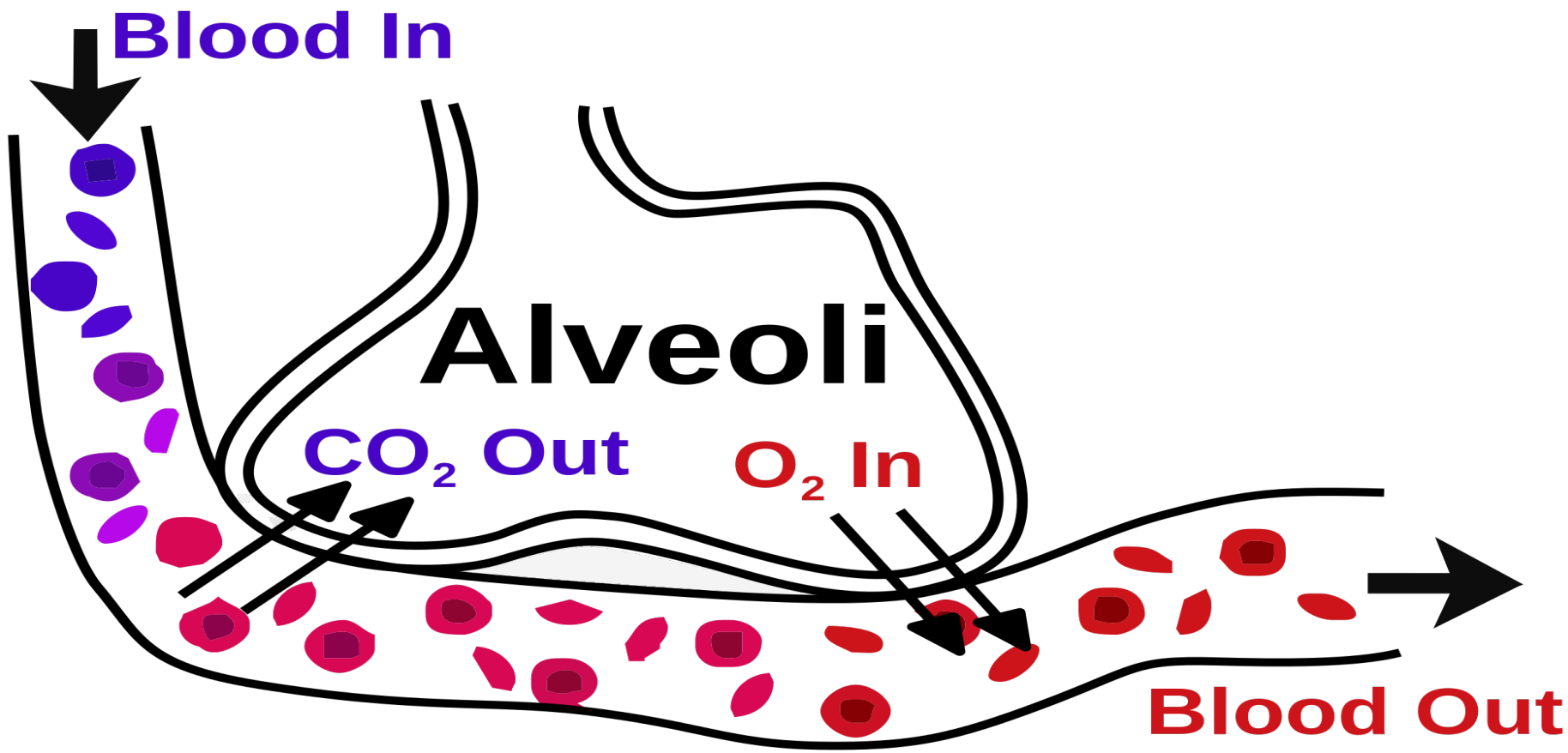
Pulmonary veins are RED (oxygenated blood heading to left ventricle)

Pulmonary arteries are BLUE (deoxygenated blood from right ventricle)

Gas Exchange



Gas Exchange



Pediatric Airway

- Smaller +
- More anterior +
- Floppier cartilage

  = Easier to obstruct

The Pediatric Respiratory System

Differences in respiratory anatomy between kids and adults most notable in infants

The Pediatric Respiratory System

By age 8, respiratory structures have grown and changed such that it is more similar to that of adults

Key Points

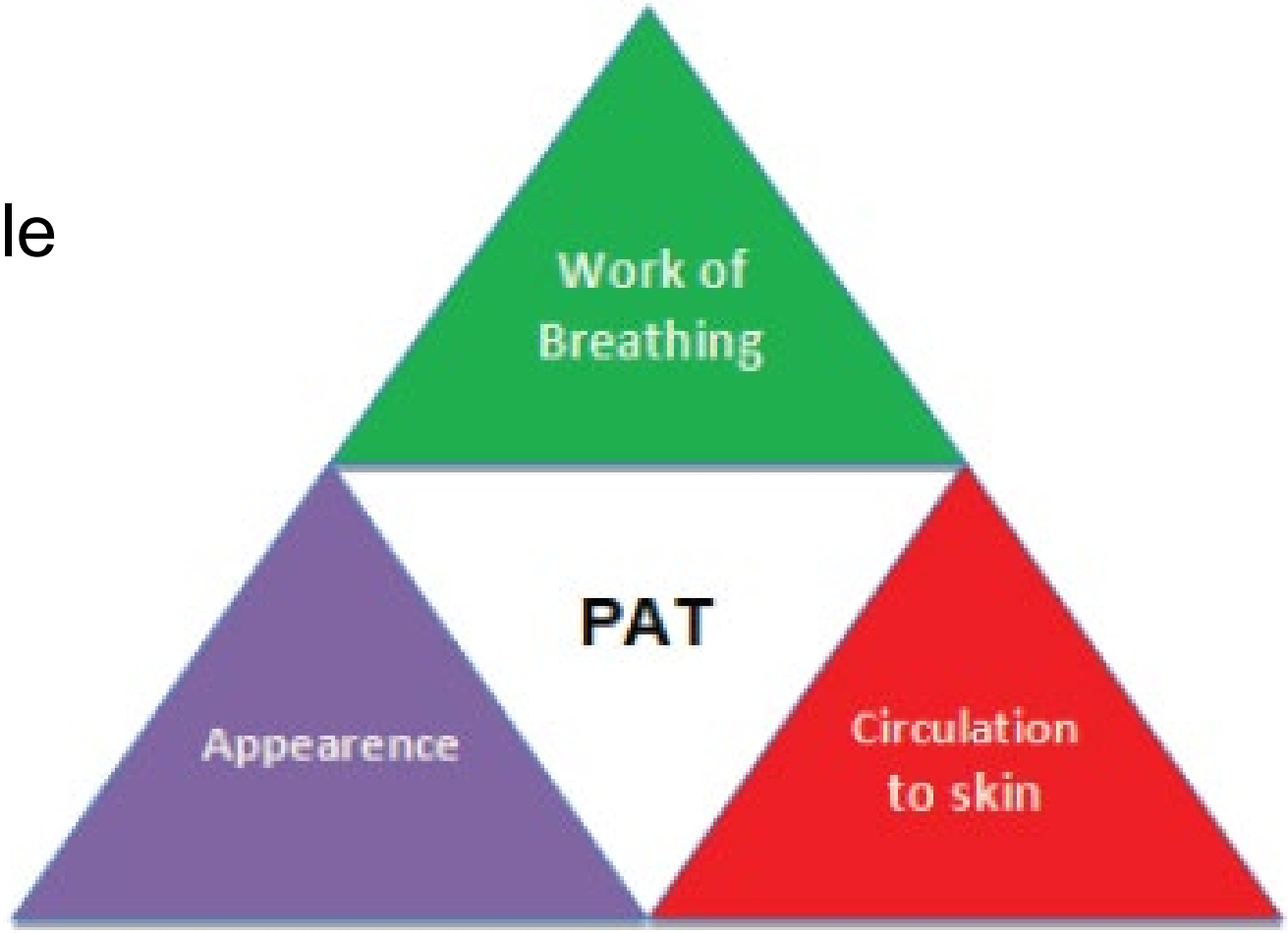
Healthy breathing is quiet, slow, and effortless

Diseased breathing is loud, fast, and labored

Pediatric Assessment

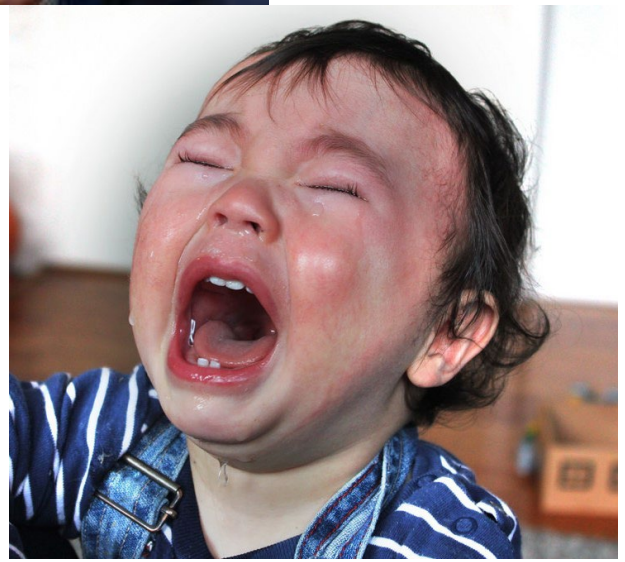
Pediatric Assessment

- ABCs
- Pediatric assessment triangle
  - Appearance
  - Work of breathing
  - Circulation



Appearance

Assess from afar!



Appearance

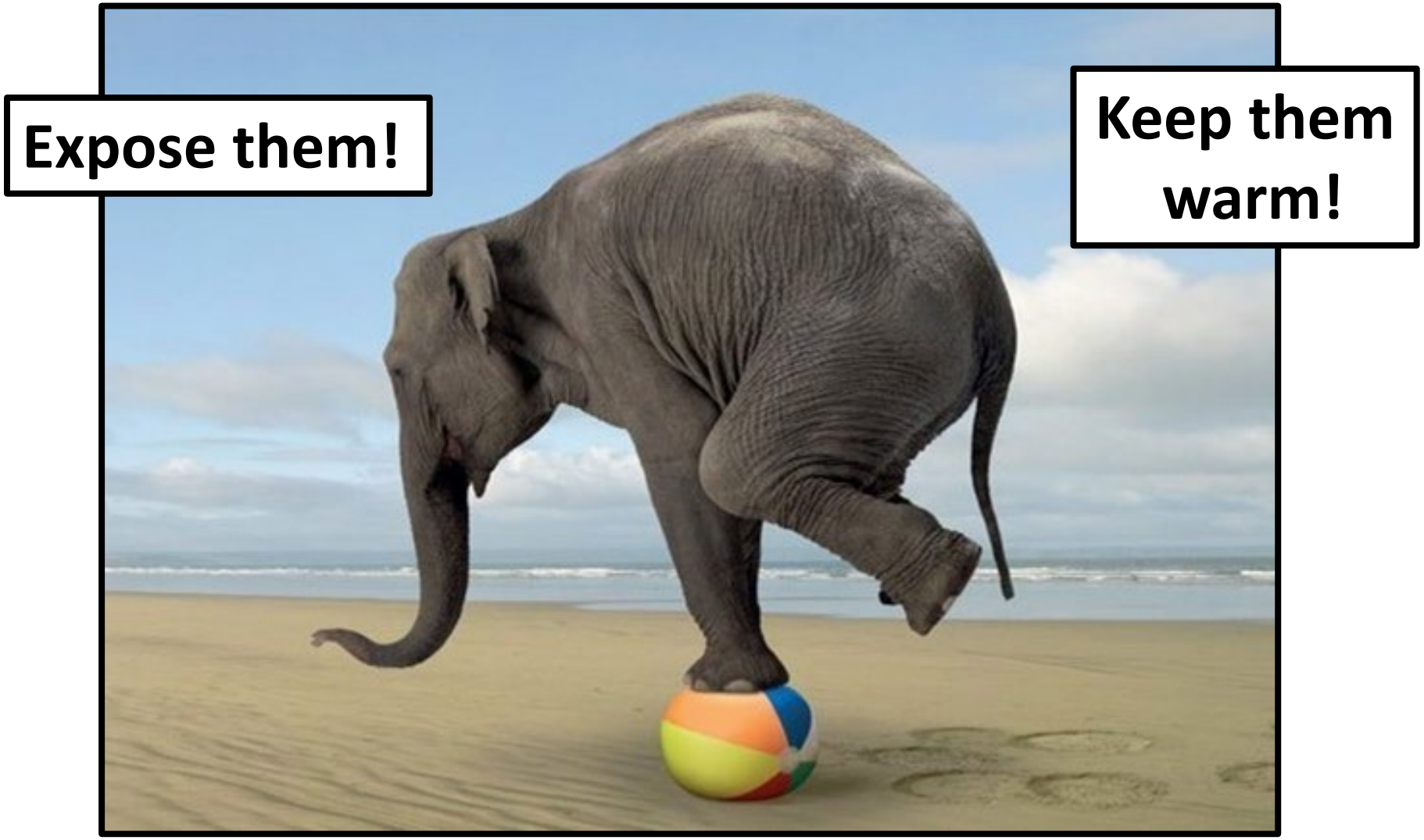
- Assess from afar
- Use your observation skills
- Engage the caregiver (especially for chronic kids)

Appearance

- Assess from afar
- Use your observation skills
- TICLS
  - **T**one
  - **I**nteractiveness
  - **C**onsolability
  - **L**ook/gaze
  - **S**peech/cry

Sick or not sick?

Then…



Circulation

- Skin is the best clue to circulation
- Temperature
- Capillary refill
- Wet diapers
- Fluid intake

Circulation

- Skin is the best clue to circulation
- Temperature
- Capillary refill
- Wet diapers
- Fluid intake

Breathing

- Respiratory rate
- Head
  - Nasal flaring
  - Head bobbing
- Chest
  - Retractions
  - Belly breathing
- Airway sounds
  - Stridor
  - Grunting

Age	Heart Rate	Respiratory Rate
Infants	110-170	30-40
Toddlers	90-140	20-30
Pre-school	80-120	20-30
School age	70-110	16-20

Head Bobbing

Tracheal Tug

Retractions

Grunting

Upper vs. Lower Airway?

- Upper airway obstruction
  - Stridor
  - Drooling

Usually inspiratory sounds

- Lower airway obstruction
  - Wheezing
  - Crackles

Treat th breathing!

N

Respiratory failure is the leading cause of arrest in pediatric patients

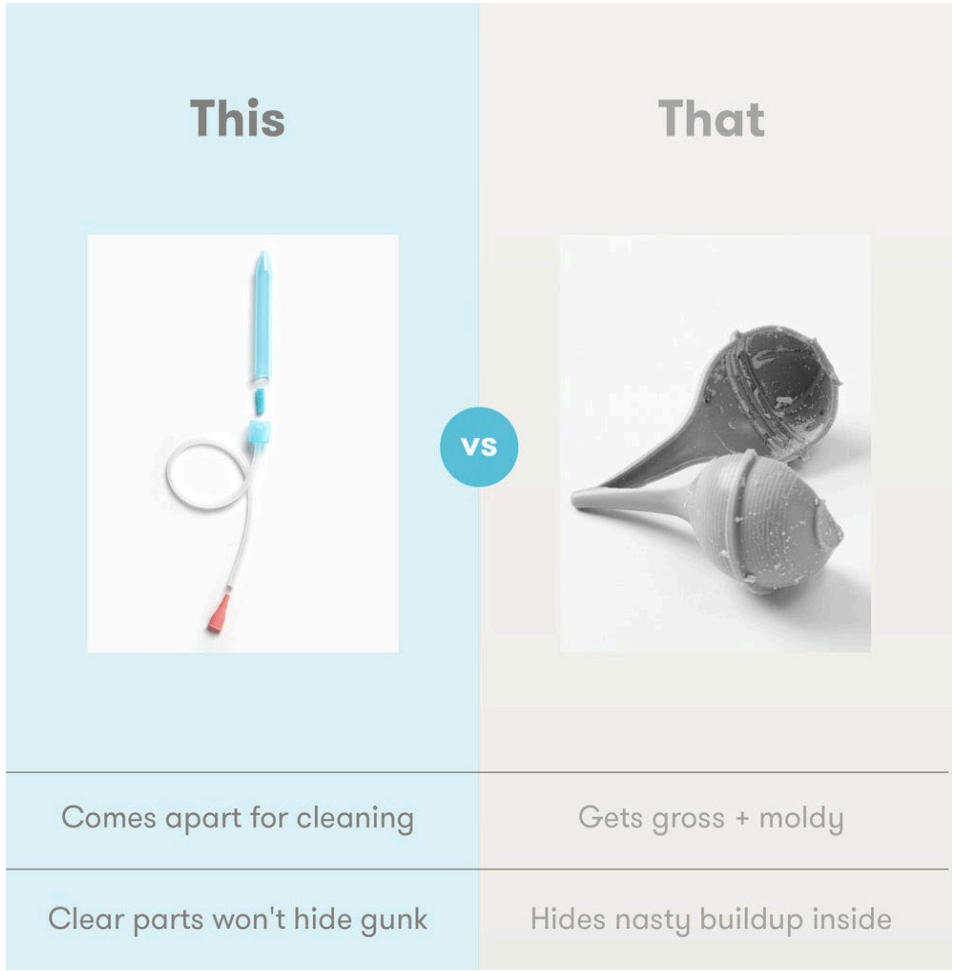
Oxygen

- Elemental gas
- Facilitates aerobic metabolism
- 21% atmospheric air content
- CPAP/BiPAP helps push fluid out of alveoli
- Higher oxygen concentrations can aid in alveolar recruitment

System	Flow Range	Oxygen Delivered (normal breathing)
Nasal Canula	1/8 - 4 L	24 - 40%
Blowby Oxygen	15 L	24%
Simple Facemask	5 - 15 L	40 - 60%
Non-rebreather	10 - 15 L	80 - 90%

Nasal congestion contributes significantly to respiratory distress

Suction!



Treat the Fever: Decrease Metabolic Demand

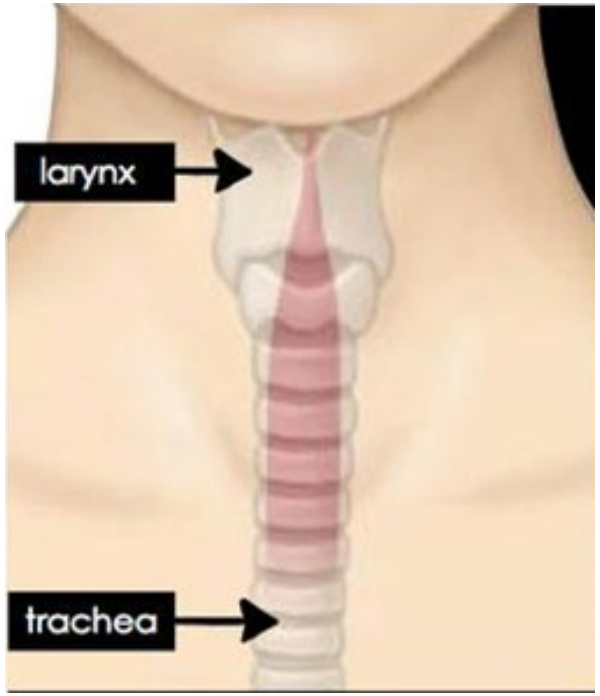
15 mg/kg

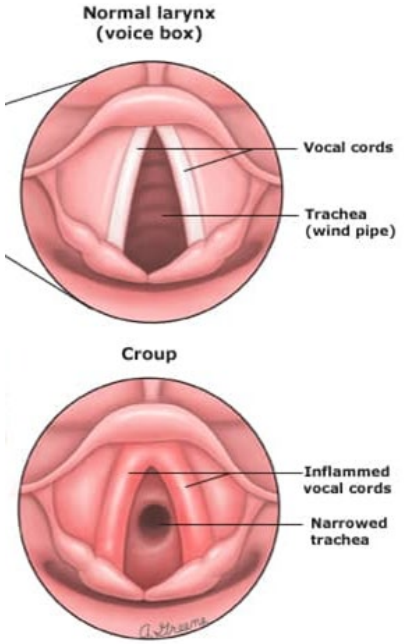
10 mg/kg

Bring on the (respiratory) problems…

Croup (laryngotracheobronchitis)

- 6 months-3 years
- URI symptoms
  - Days 1-3: upper respiratory symptoms
  - Days 2-3: maximal symptoms
- Tissue edema narrows airway
  - Stridor
  - Barking cough
  - Hoarseness
- Symptoms worse at night
- Hypoxia less common





Croup: Treatment

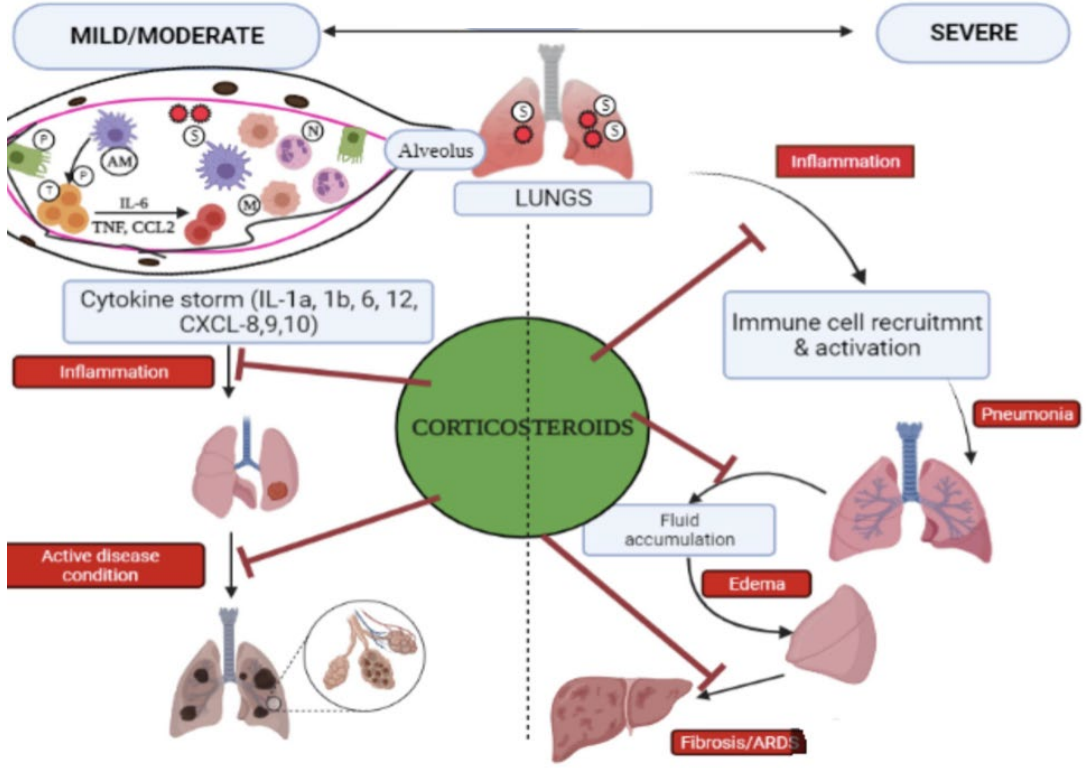
Stridor?

<u>Dexamethasone:</u>
0.6mg/kg (max 10mg)
IV/IM/PO

<u>Nebulized Epi:</u>
0.05mg/kg of 1:1000 epi
in 3mL NS to max 3mg

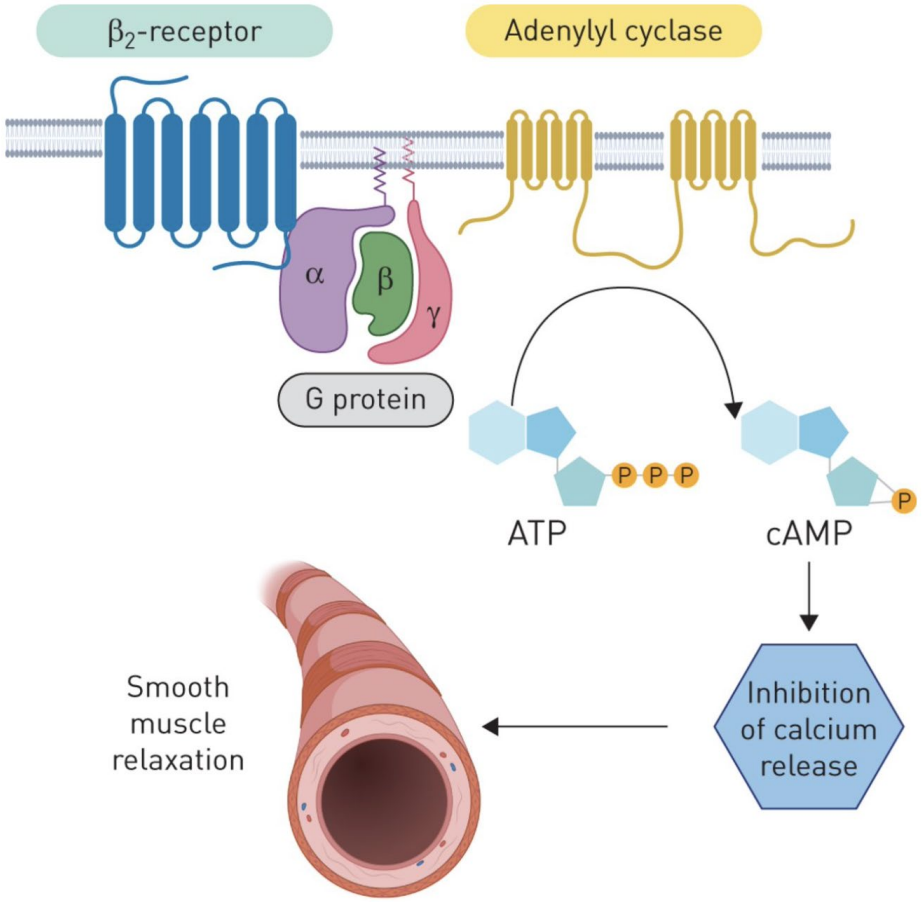
Dexamethasone

- Class: corticosteroid
- Action
  - Reduces inflammation by multiple mechanisms
- Indications
  - Anti-inflammatory agent for numerous medical conditions
  - Asthma, airway edema, AMS, cerebral edema
- Adverse effects
  - Mood dysregulation, headache, restlessness, HTN, bradycardia, nausea/vomiting, diarrhea, weakness
- Contraindications
  - Fungal infections, known sensitivity



Racemic epinephrine/racepinephrine (micronefrin S2)

- Class: bronchodilator, adrenergic agonist
- Action
  - Stimulates alpha and beta receptors
  - Vasoconstriction (reduces edema)
  - Bronchodilation
- Indications
  - Asthma, croup
- Adverse effects
  - Anxiety, dizziness, headache, tremor, palpitations, HTN, nausea/vomiting
- Contraindications
  - Cardiac disease, elderly, HTN, thyroid disease, diabetes



Cold air: A Good Adjunct?

Randomized Controlled Trial > Pediatrics. 2023 Sep 1;152(3):e2023061365.
doi: 10.1542/peds.2023-061365.

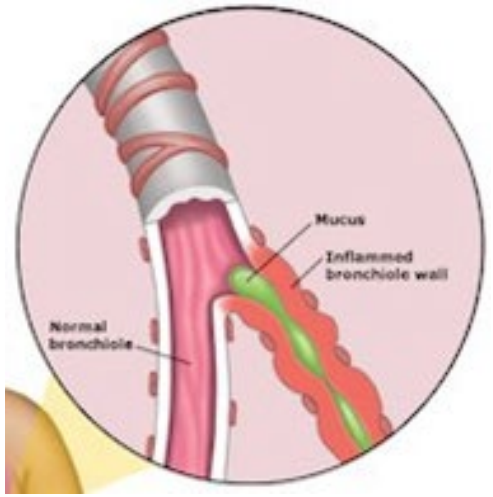
Outdoor Cold Air Versus Room Temperature Exposure for Croup Symptoms: A Randomized Controlled Trial

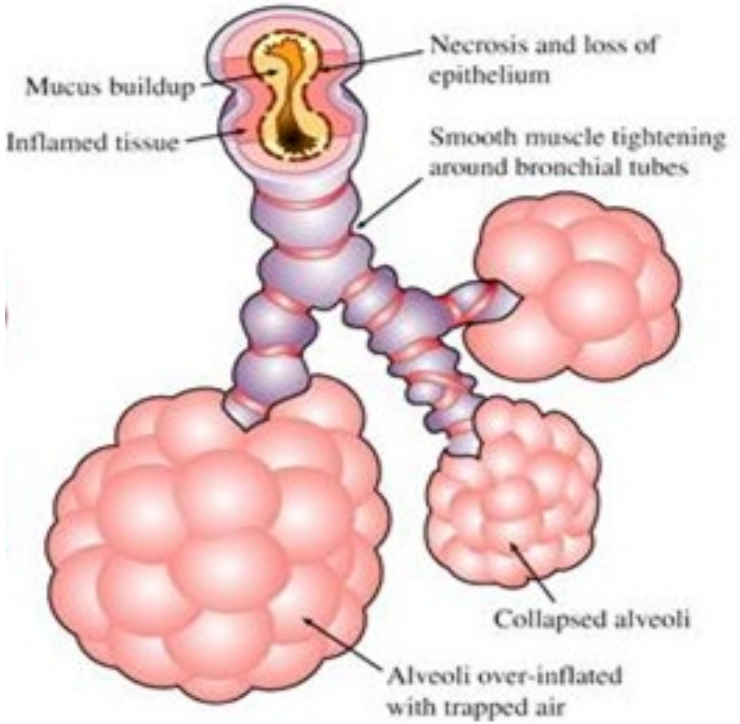
Johan N Siebert [1 2], Coralie Salomon [1], Ilaria Taddeo [1], Alain Gervaix [1 2], Christophe Combescure [3], Laurence Lacroix [1 2]

- Children with croup symptoms
- Randomized to 30 minutes of waiting outside in the cold vs. in the waiting room
- Significant symptom improvement in
  - 49.2% of kids left outdoors
  - 23.7% of kids indoors

Bronchiolitis: presentation

- Viral infection of the bronchioles (75% RSV)
- Younger than 2 y/o
  - Peak hospitalization 2-6 months
- URI symptoms with fever
  - Days 1-3: upper respiratory symptoms (congestion)
  - Days 2-3: lower respiratory symptoms (cough, crackles/wheezes)
  - Worst on days 3-5
- Complications:
  - Apnea, dehydration, respiratory failure





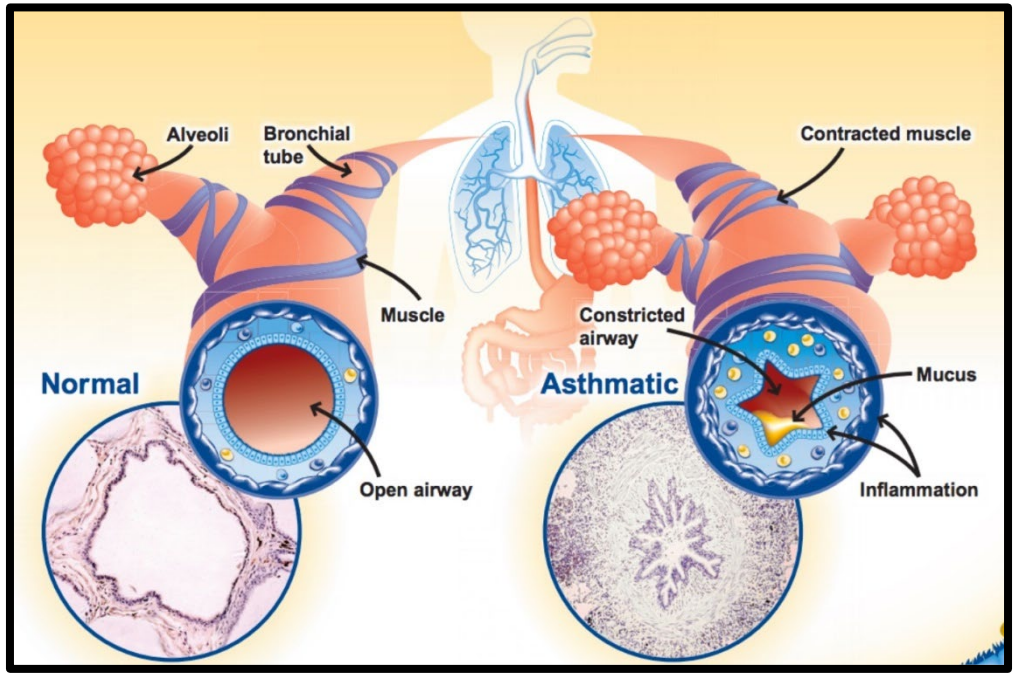
Treatment

- Treatment is supportive
  - Oxygen
    - High-flow nasal cannula, CPAP
  - Fever management
  - Rehydration
  - If there's snot… Suction, Suction, Suction!
- Bronchodilators and steroids are NOT beneficial

Let’s talk about things that kids *and* adults get…

Asthma/Reactive Airway Disease

- Chronic airway inflammation
  - Bronchial narrowing, mucus plugging, and hypersensitivity
- Acute bronchoconstriction triggered by
  - Allergens, irritants, exercise, infection, temperature/weather
- Shortness of breath, cough, wheezing, chest tightness



Epidemiology

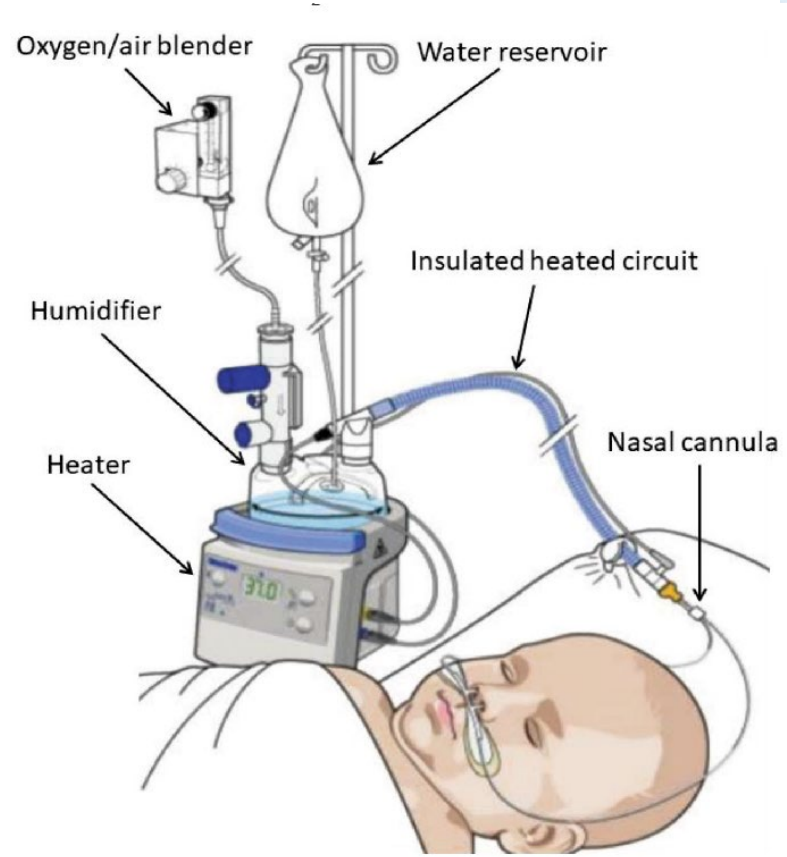
- Asthma: #1 chronic illness worldwide

- Disparities:
  - Males (7%) > Females (5.4%)
  - Non-Hispanic Black 2x more likely to be effected than white children
  - Increased in low-income, urban areas, and Native American populations

- Leading cause of missed school days and hospitalizations

Non-Pharmacologic Support

- IV access
  - Fluids for dehydration
- Non-invasive ventilation (HFNC, BiPAP)
  - If work of breathing remains high
- Intubation
  - Only if impending arrest!



Asthma Pharmacologic Management

1. **Short-acting beta agonists (SABA)**
   - Albuterol (MDI or neb)
2. **Anticholinergics**
   - Ipratropium (add for moderate-severe).
3. **Corticosteroids**
   - Oral or IV; give early (within 1 hour)
4. **Magnesium sulfate IV**
   - for severe exacerbations
5. **Epinephrine IM or Terbutaline**
   - for refractory bronchospasm

Asthma Treatment Options

Ipratroprium/ Albuterol Duoneb

Dexamethasone

or

Methylprednisolone

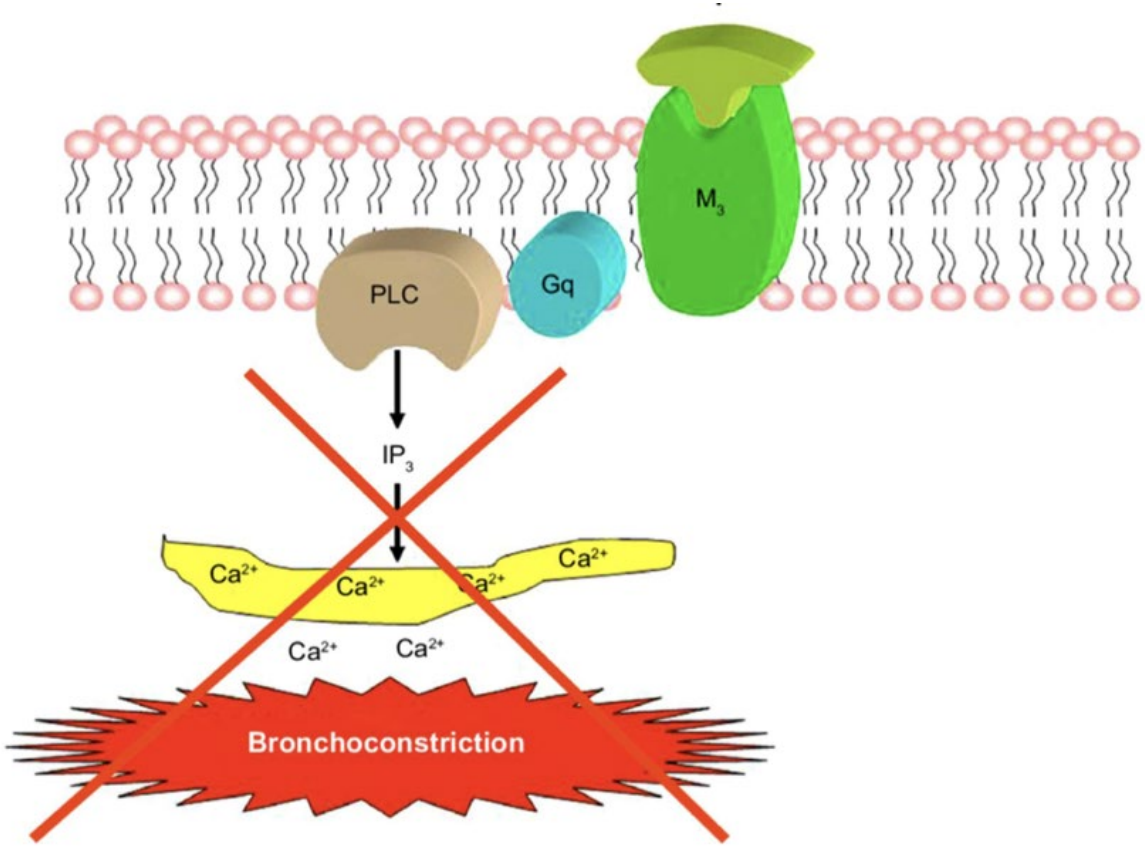
Magnesium Sulfate

Albuterol (Ventolin)

- Class: bronchodilator, beta-2-agonist
- Action
  - Relaxation of bronchial wall smooth muscle
- Adverse effects
  - Hyperglycemia, hypokalemia, palpitations, tachycardia, anxiety, tremor, nausea, vomiting
- Contraindications
  - Use with caution in lactation and pregnancy

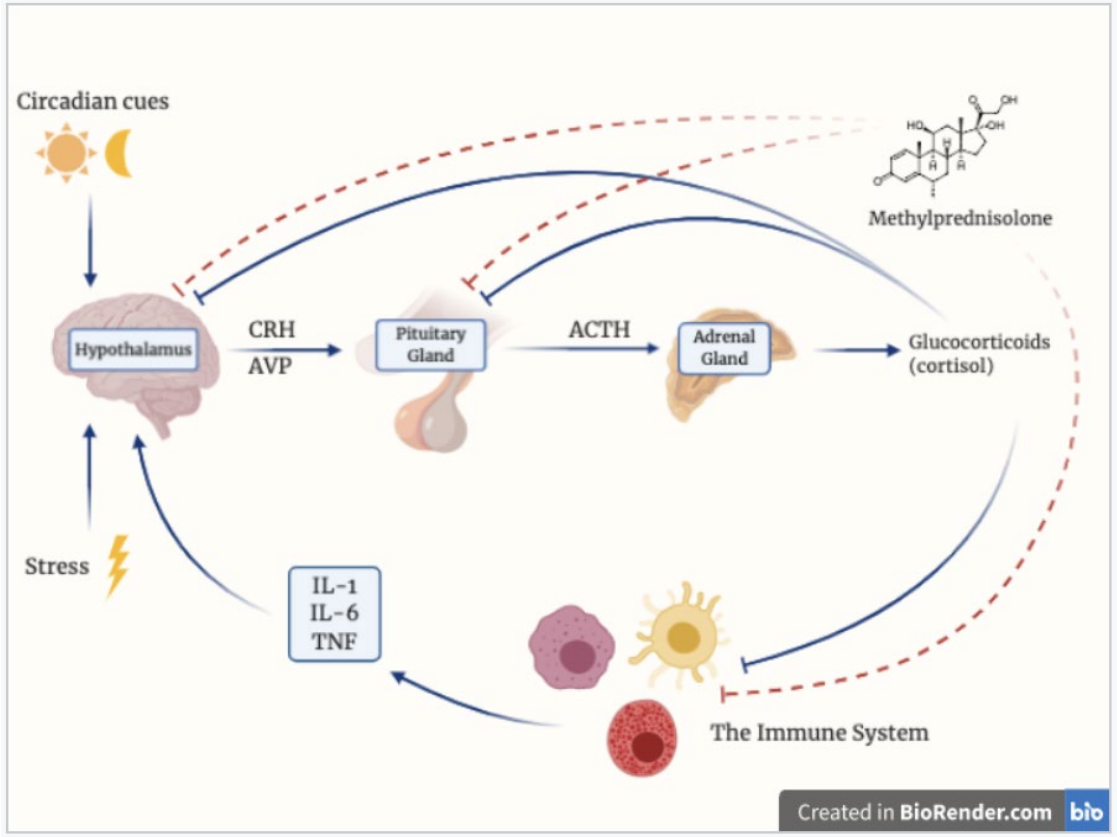
Ipratropium bromide

- Class: anticholinergic bronchodilator
- Action
  - Antagonizes acetylcholine receptors in the bronchial smooth muscle
  - Bronchodilation
- Contraindications
  - Closed-angle glaucoma, bladder neck obstruction, BPH



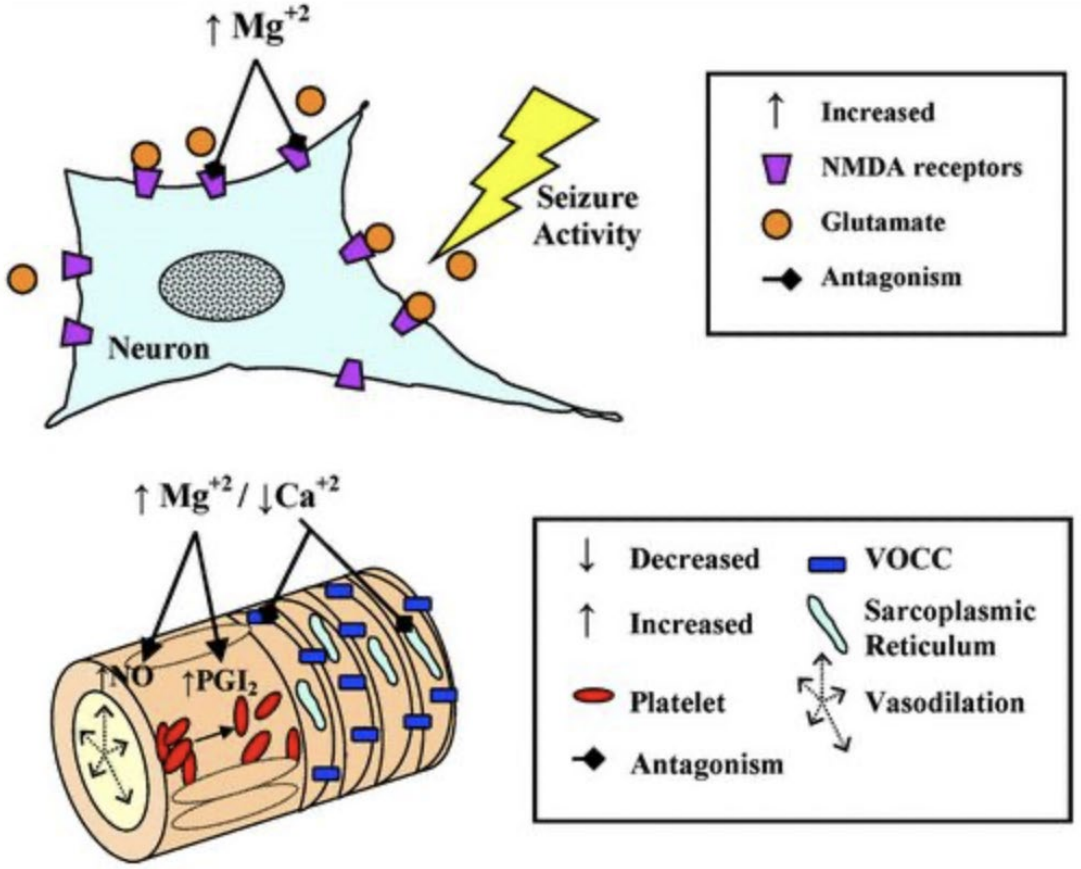
Methylprednisolone sodium succinate (solu-medrol)

- Classification: corticosteroid
- Mechanism
  - Reduces inflammation
  - Many mechanisms
- Indications
  - Anaphylaxis, asthma, COPD
- Contraindications
  - Cushing syndrome, CHF, HTN, diabetes, psychosis

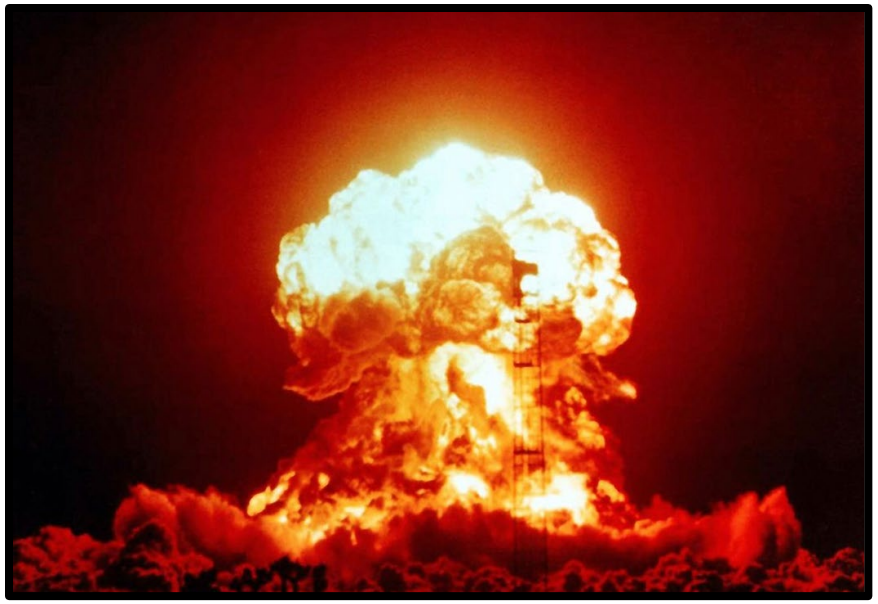


Magnesium sulfate

- Class: electrolyte, tocolytic, mineral
- Mechanism
  - Cofactor in neurochemical transmission
  - Smooth muscle dilation with peripheral vasodilation
  - Blocks neuromuscular transmission
- Adverse effects
  - Mg toxicity (flushing, loss of reflexes, muscle weakness, paralysis, cardiac/CNS/respiratory depression)
- Contraindications
  - AV block, GI obstruction
  - Use with caution in pts with renal dysfunction



Epinephrine → Respiratory Failure



Consider Use In Impending Respiratory Arrest

ASSESS ASTHMA SEVERITY

MODERATE

- SpO2 ≥ 92%
- Still feeding
- Using accessory muscles
- Audible wheezing

SEVERE

- SpO_2 < 92%
- Too breathless to feed
- Marked respiratory distress

LIFE THREATENING

SpO_2 < 92% plus **any** of:

- Apnoea
- Cyanosis
- Poor respiratory effort
- Bradycardia

What about the non-acute kids?

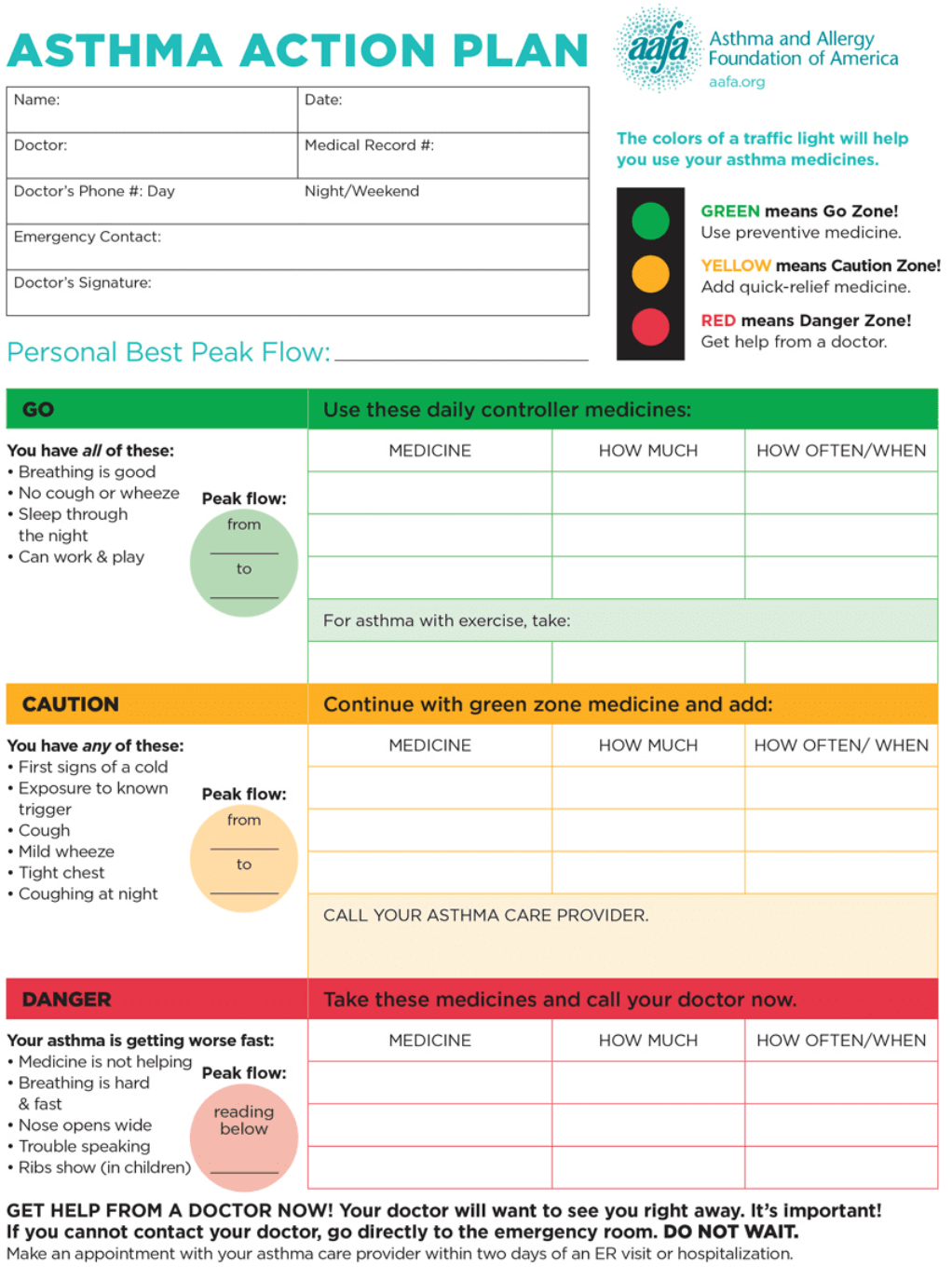
Daily control

- Use controller meds exactly as prescribed
  - usually inhaled corticosteroids
- Don’t skip doses—even when symptoms are quiet
- Always use a spacer

Asthma Action Plan

- Follow the written **green/yellow/red** plan at home

- Know when to increase meds and when to seek urgent care



ASTHMA ACTION PLAN

Asthma and Allergy Foundation of America
aafa.org

Name:	Date:
Doctor:	Medical Record #:
Doctor's Phone #: Day	Night/Weekend
Emergency Contact:	
Doctor's Signature:	

Personal Best Peak Flow: _____

The colors of a traffic light will help you use your asthma medicines.

GREEN means Go Zone!
Use preventive medicine.

YELLOW means Caution Zone!
Add quick-relief medicine.

RED means Danger Zone!
Get help from a doctor.

GO

You have *all* of these:
- Breathing is good
- No cough or wheeze
- Sleep through the night
- Can work & play

Peak flow: from _____ to _____

Use these daily controller medicines:

MEDICINE	HOW MUCH	HOW OFTEN/WHEN

For asthma with exercise, take:

CAUTION

You have *any* of these:
- First signs of a cold
- Exposure to known trigger
- Cough
- Mild wheeze
- Tight chest
- Coughing at night

Peak flow: from _____ to _____

Continue with green zone medicine and add:

MEDICINE	HOW MUCH	HOW OFTEN/ WHEN

CALL YOUR ASTHMA CARE PROVIDER.

DANGER

Your asthma is getting worse fast:
- Medicine is not helping
- Breathing is hard & fast
- Nose opens wide
- Trouble speaking
- Ribs show (in children)

Peak flow: reading below _____

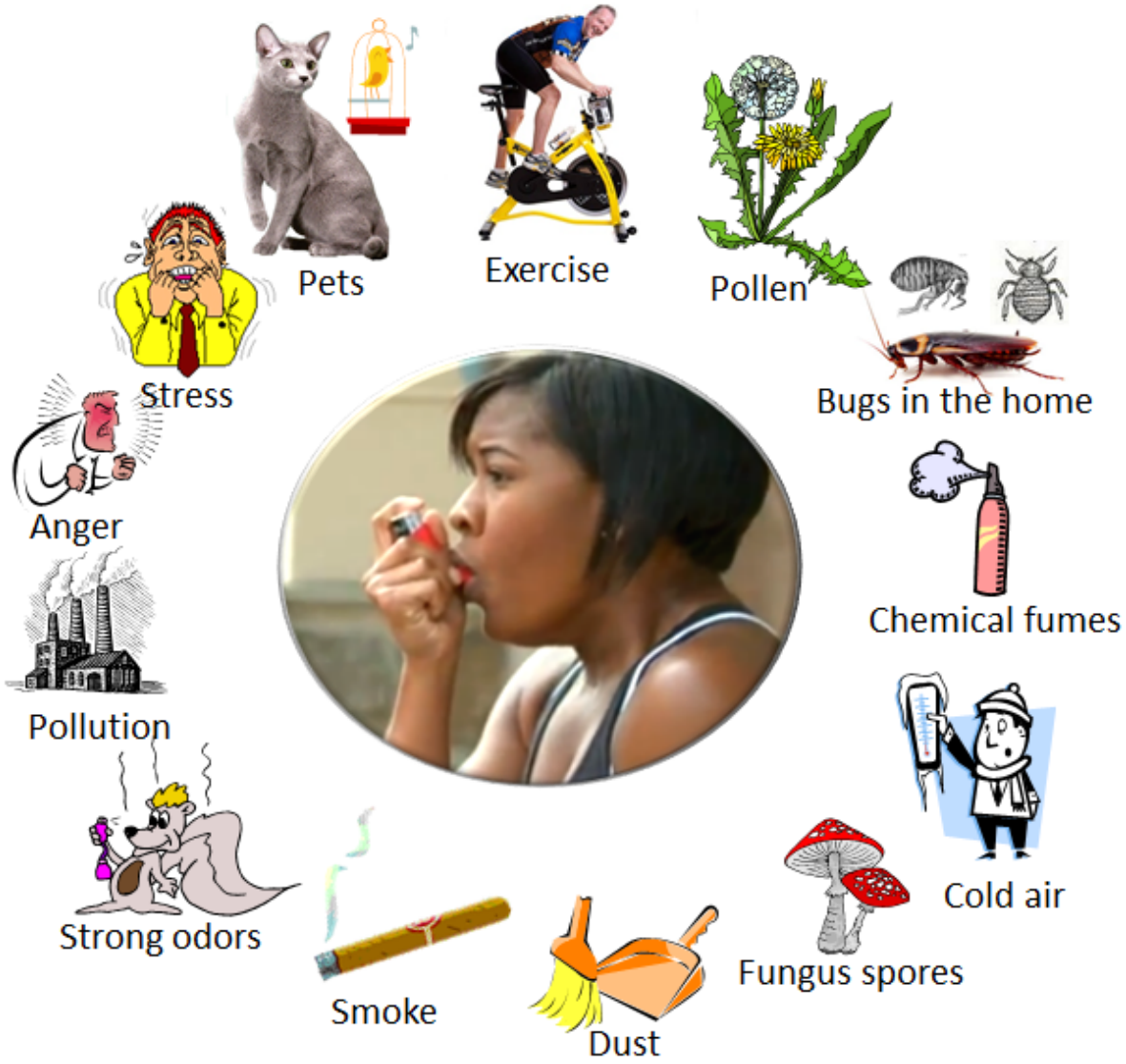
Take these medicines and call your doctor now.

MEDICINE	HOW MUCH	HOW OFTEN/WHEN

GET HELP FROM A DOCTOR NOW! Your doctor will want to see you right away. It's important!
If you cannot contact your doctor, go directly to the emergency room. DO NOT WAIT.
Make an appointment with your asthma care provider within two days of an ER visit or hospitalization.

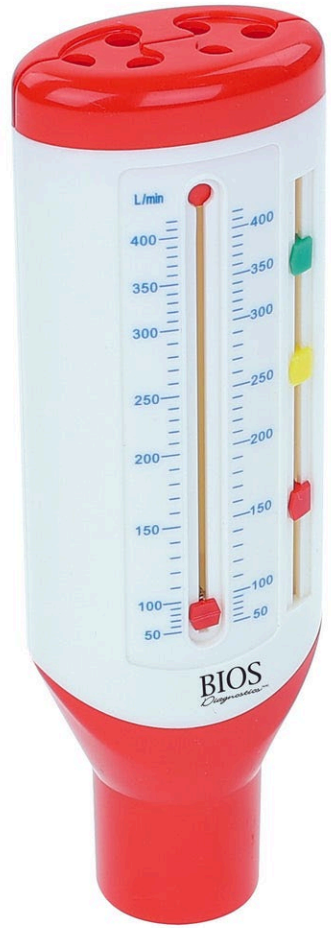
Trigger control

- Avoid smoke/vape exposure
- Manage allergies
  - dust mites, pets, pollen, mold
- Watch viral illnesses, cold air, and exercise
  - Pre-treat if advised



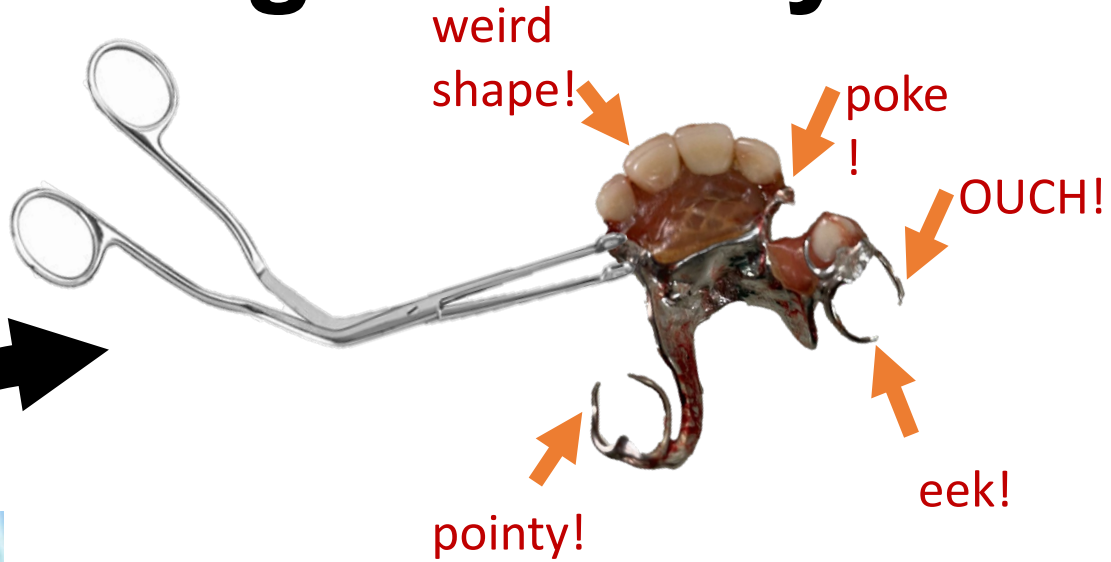
Monitoring

- Track symptoms
  - Older kids may use peak flow
- Early signs of worsening:
  - Night cough
  - Exercise intolerance
  - Increased rescue use



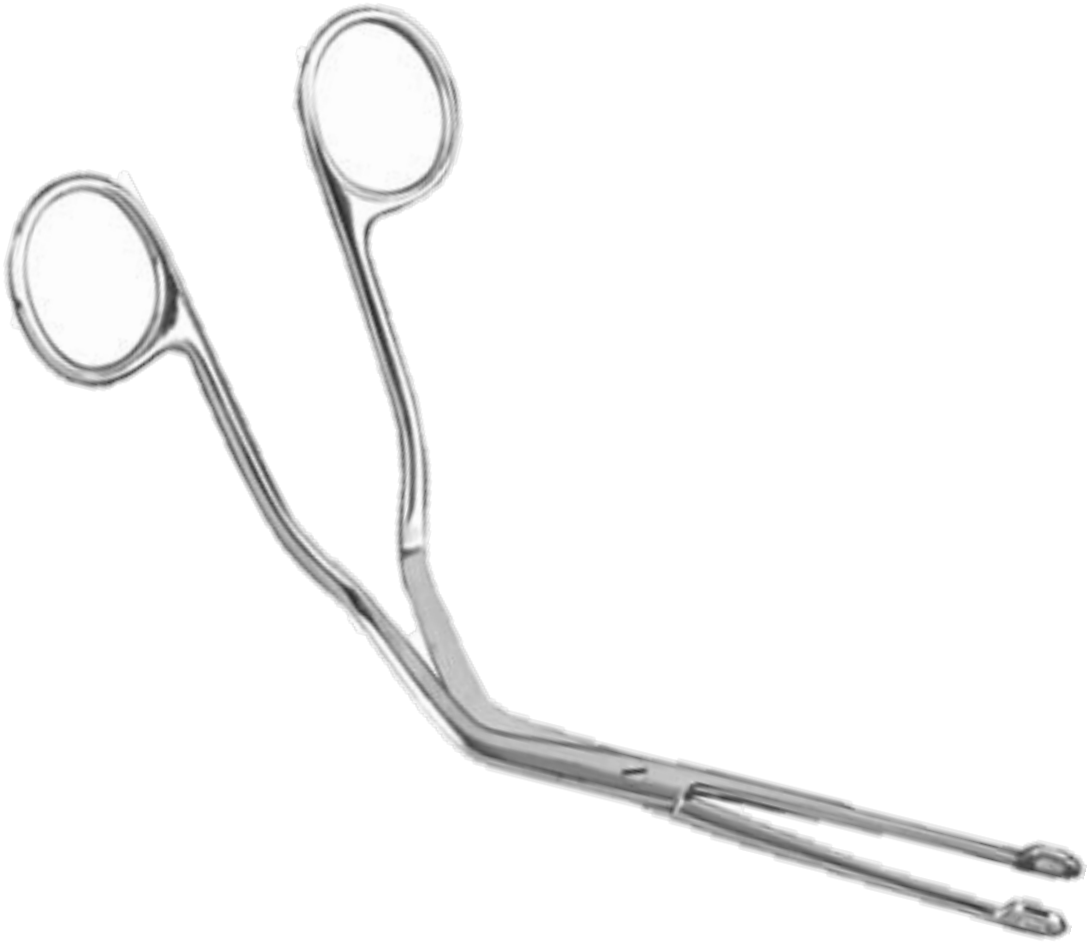
Foreign body airway obstruction: things that do not belong in airways

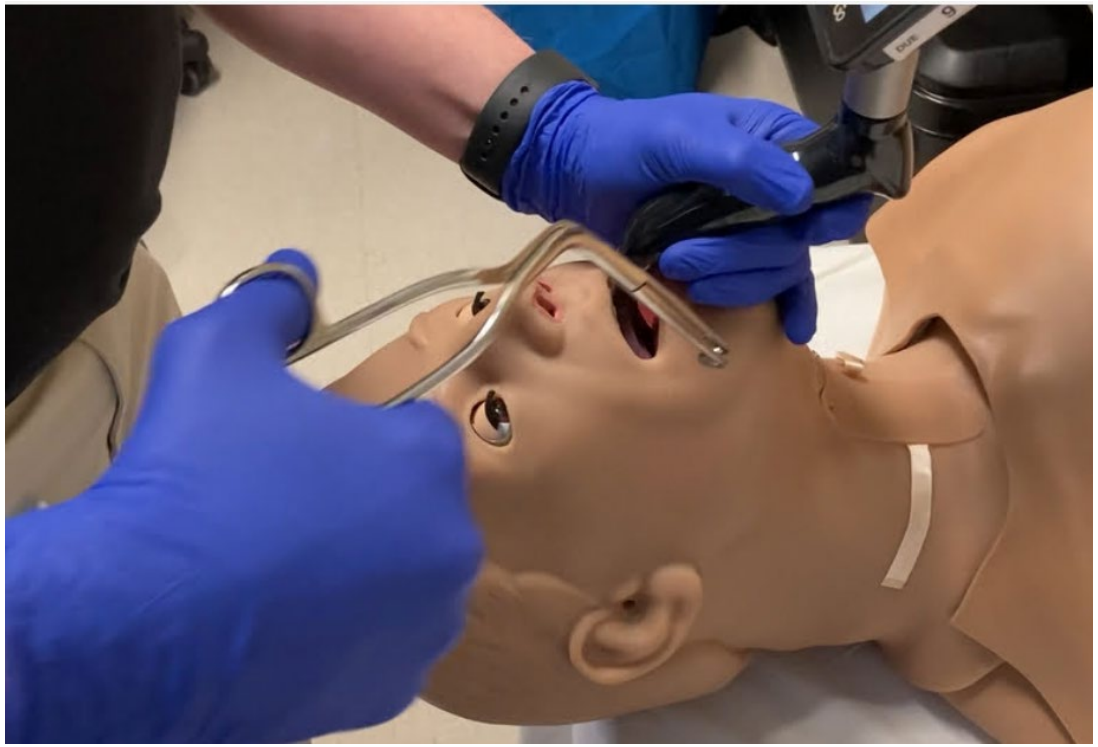
- Keep a high suspicion
- Choking/gagging episode
- Drooling
- Stridor



Un-choking the child (or grandma)

Magill forceps





What about drowning?

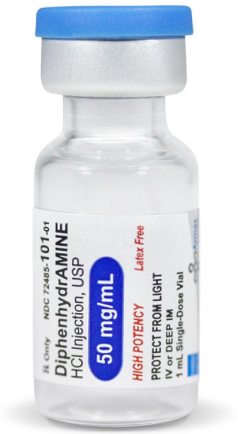
Drowning

- Supplemental oxygen
- PPV with BVM if needed

What about a kid that looks like this?

Allergic Reactions

- Anaphylaxis involves at least 2 systems:
  - Cardiovascular
  - Respiratory
  - Skin
  - GI
  - Neurological
- Treatment
  - Epi 1:1000, 0.01ml/kg IM
  - IVF, Benadryl, dexamethasone
  - Airway management



Diphenhydramine

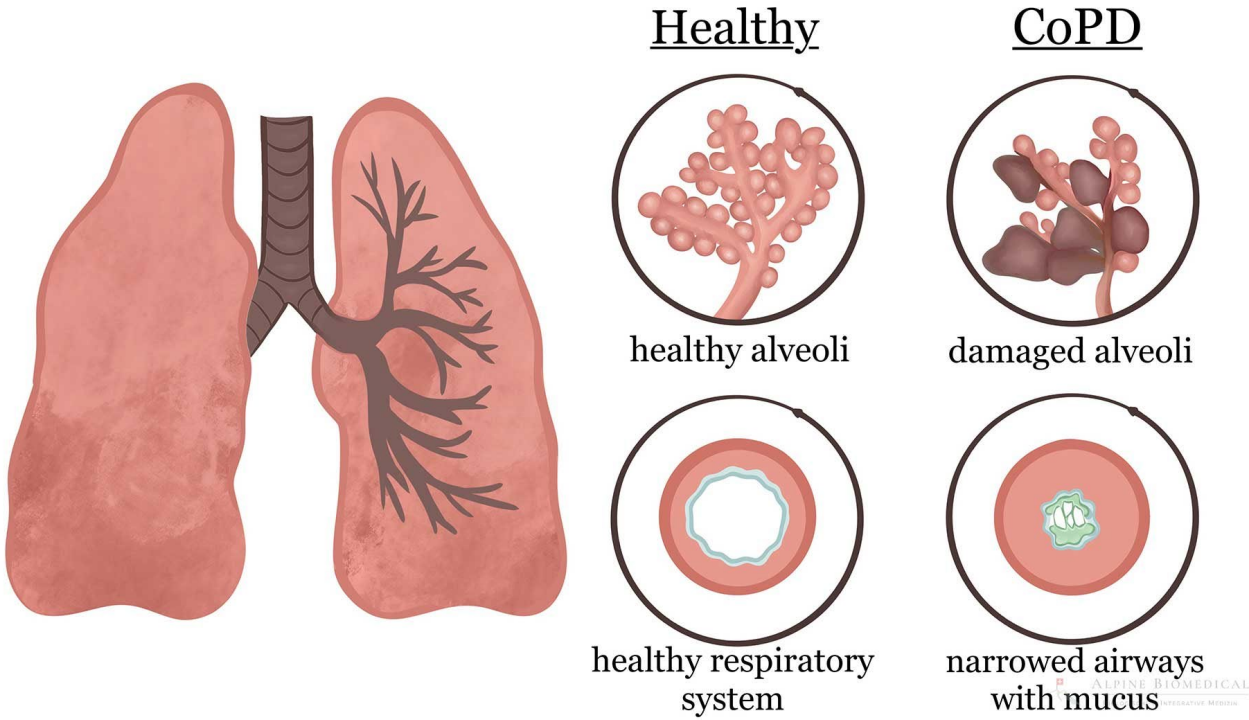
Dexamethasone

Epi, Epi, Epi!

And finally, something for adults only…

COPD

- Third-ranked cause of death in U.S.
- Associated with smoking
- Chronic inflammation leads to narrowing and increased mucus production
  - Air trapping
- Flares triggered by
  - Infection (70%)
  - Environmental/unknown (30%)
- Symptoms
  - Worsening dyspnea
  - Worsening cough
  - Changes in sputum



COPD treatment

Ipratroprium/ Albuterol Duoneb

Dexamethasone

or

Methylprednisolone

Antibiotics

Let’s practice…

Case Study

- 4 month old Male
- 911 call @ 0200
- S/S: Mother states “He’s breathing fast!”

- Home Meds: None
- Weight: 5.5 kg

Mother reports:

•3 days of nasal congestion and cough

•Decreased feeding today

•Increased work of breathing tonight

•One episode of post-tussive emesis

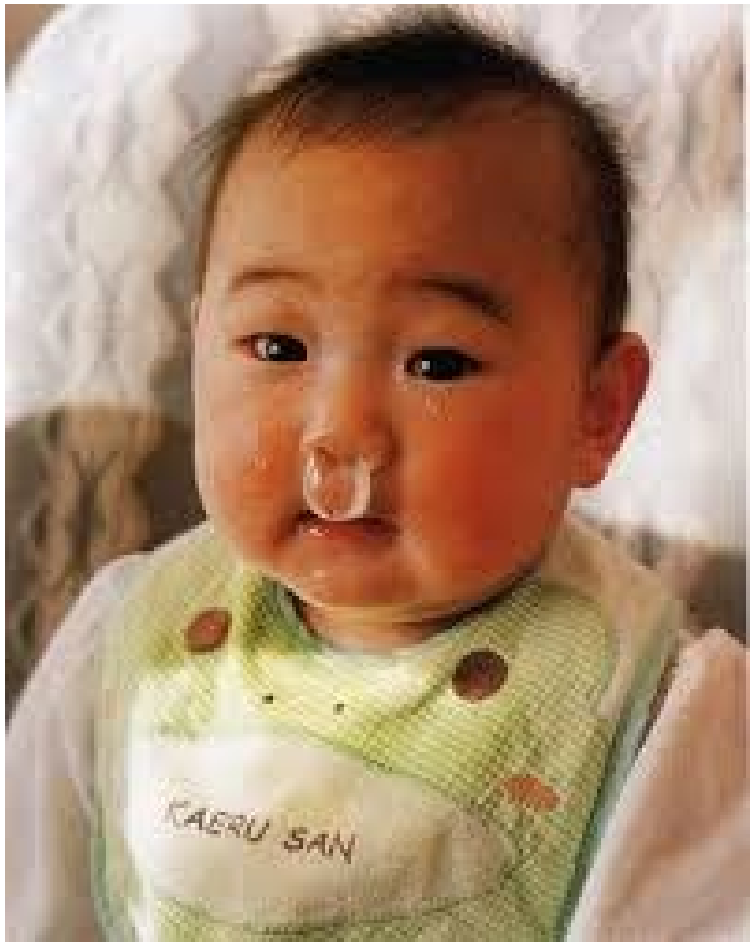
•Fewer wet diapers today

•No choking episode

•No subjective fever

Exam

- Awake but irritable
- Tachypneic
- Mild intercostal retractions
- Fine crackles
- Lots of snot
- O2 sat 91%
- Appears fatigued
- Pink, no cyanosis



What's going on?

- Differential Diagnosis:
  - Asthma/reactive airway (less likely at 5 months)
  - Pneumonia
  - Foreign body aspiration
  - Croup (no barky cough/stridor)
  - Congenital heart disease
  - Sepsis

Bronchiolitis

Bronchiolitis

- Age <12 months
- Viral prodrome
- Gradual worsening
- Diffuse crackles
- Moderate hypoxia

Treatment

•What is the FIRST intervention EMS should perform?
→ **Nasal suction**
•When should bronchiolitis patients receive oxygen?
→ **SpO_2 < 94%**
•Why are infants at higher risk?
→ **Small airways + obligate nose breathing**
•What finding would worry you most in the field?
→ **Apnea or exhaustion**


JUST
ONE
MORE

Case Study

- 6 y/o Female
- Hx: moderate persistent asthma
- S/S: increased WOB, cough x 1 day
- Home Meds:
  - Budesonide 2 puffs BID
  - Montelukast 5mg QHS
  - Certirizine QD

Exam

- Alert
- Tachypneic
- Mild intercostal retractions
- Prolonged expiratory phase
- Diffuse expiratory wheezing
- O2 sat 93%
- Able to speak in full sentences
  - Appears fatigued


200 Metered Inhalations
Ventolin® HFA
(albuterol sulfate)
Inhalation Aerosol
90 mcg per actuation
With Dose Counter


Prednisolone Sodium
Phosphate Oral Solution
Equivalent to prednisolone
15 mg/5 mL
8 fl oz (237 mL)


UNM CHILDREN'S HOSPITAL
KOB 4


ASTHMA ACTION PLAN
Take this ASTHMA ACTION PLAN with you when you visit your doctor
DANGER SIGNS
DIAL 000 FOR AMBULANCE


911

Moderate Asthma Exacerbation

- Her asthma is well controlled at baseline

- Symptoms triggered by:
  - Viral illness
  - Increased airway inflammation

Take-homes

- Airway inflammation (whether acute, chronic, or acute-on-chronic) leads to airway obstruction
- Supportive care for everyone: oxygen, decongestion, fever management
- Most targeted treatments work by decreasing bronchoconstriction and swelling
- Keep a broad differential and treat aggressively
  - Bad breathing leads to dying

Contact

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