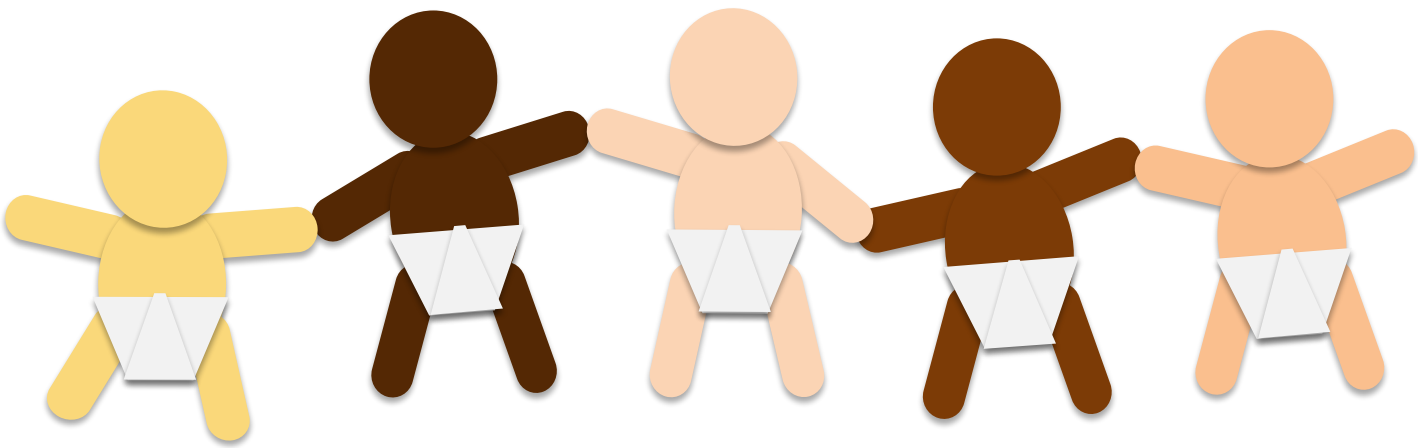
Pediatric Readiness Simbox

Bronchiolitis



Objectives

At the end of this simulation participants will be able to:

1. Perform a systematic triage of an infant in respiratory distress.
2. Locate equipment/resources to care for a critically ill infant.
3. Demonstrate two interventions required for an infant in respiratory distress.
4. Demonstrate a team based response to an infant with apnea.
5. Determine the disposition of a critically ill infant (transfer vs admit).

Scenario outline (30-45 minutes)

3 mins	<u>Prebrief:</u> Use narrated video or your own script
2 mins	<u>Prepare for the patient:</u> Assign roles/ assemble equipment (adapt based on availability): Team Lead, Airway, Bedside Nurse, Medication Nurse, Physician, PA/NP, Recorder, Parent Liaison, Respiratory, Pharmacy, Social Work
10 mins	<u>Run Case:</u> Stem: A 4 mo is brought to the ED with respiratory distress: improves slightly with suction and placement of a nasal cannula, but develops a severe apneic episode that self resolves.
15 mins	<u>Debrief:</u> Use narrated video or your own script.
10 mins	Option: Re-run scenario

Link to video

Scenario script:

Video will state: "ED, this is an ALS unit, coming in with a 4 month old boy with respiratory distress. He has been sick for 4 days, with cough, congestion, decreased feeding and wet diapers, and difficulty breathing. His RR is 80, oxygen saturation is 86% on RA, but increases to 99% on blow-by oxygen. HR is 170, we are working on getting a BP now. We'll arrive in approximately 2 minutes."

2 minute countdown clock

- Team assembles + confirms roles
- Get equipment/meds (monitors, access, respiratory)
- Get resources (apps/Broselow)
- Calls for help

Facilitator states: "The patient is arriving now. The infant continues to be tachypneic, working hard to breathe, and desaturates if we take off the blow-by O2."

Step 1
Blow-by

Sats 98%
RR 90

- Team places patient monitors, pulse oximeter, BP cuff, checks temp
- Estimates weight using length-based tape/scale/ask parent
- Verbalizes PAT + ABCDE + vitals
- Exposes the infant's chest and performs a skin examination

Facilitator states: "The patient is in significant respiratory distress, exhibiting head bobbing, nasal flaring, tracheal tugging, and retractions. Saturating 99% on blow-by O2. Diffuse crackles and wheeze are heard on both lungs. Temperature is 36.5C."

Step 2
RA/ Hypoxia

HR 170
BP 70/40
Sats 86% RA
RR 90

- Team assesses the patency/clearance of the airway
- Attempts airway repositioning (chin lift, jaw thrust, neck roll) and suction
- Calls respiratory therapist (if available) to start high flow nasal cannula at 2L/kg or CPAP (based on local protocol and availability)
- Initiates access (IV/IO)

Facilitator states: "The patient's oxygen saturation is not improving much after suctioning and repositioning, and he is still working very hard to breathe. Respiratory has been called, but it will be a while before they are here. Is there anything else we can do in the meantime?"

Step 3
NC

HR 170
BP 68/39
Sats 98% RA
RR 60

- Team verbalizes illness state: Infant with acute respiratory failure, likely secondary to bronchiolitis or pneumonia
- Places on nasal cannula or non-rebreather (request HFNC/ CPAP)
- Performs suctioning

Case progression: Bronchiolitis

SAMPLE: Signs/Symptoms: 4 m/o boy with 4 days of cough and congestion, 1 day of heavy breathing. Has not fed well in the past 3 days. No fevers.
Allergies/Medications: None/none.
Birth/ Medical history: Uneventful birth at 38 weeks gestation. History of eczema. Family history remarkable for asthma in his father and 7 year old sister. Vaccinations are up to date.
Last meal: Formula (Similac Advance) attempted bottle 4 hours ago with little success.
Events: Preceding URI symptoms, +sick contacts at home and at daycare.

Facilitator states: "Saturations initially improve on nasal cannula but he is still working hard to breathe. As the team is working on getting IV access, the patient becomes apneic."

Step 4
Apnea

HR 80
BP 72/42
Sats 65%
RR 0

- Team members verbalize apnea
- Initiates appropriate interventions: bag-valve mask ventilation with 100%% oxygen, stimulation, jaw-thrust/ chin-lift/ neck roll

Facilitator states: "The apneic episode resolves- patient is breathing on his own/ with BVM ventilation, saturations are coming up."

BRANCH POINT:
The facilitator now has two options.

STANDARD	ADVANCED LEARNERS
Proceed to Step 5. The patient will improve and the simulation will conclude by having the receiving team (transport/ PICU) arrive.	Proceed to Step 6 (on next page). The patient will have persistent severe work of breathing and the team will apply CPAP or proceed with intubation.

Facilitator states: "The patient is breathing more comfortably on nasal cannula (or nonrebreather)."

Step 5
NC

HR 130
BP 73/42
Sats 99%
RR 44

- Team notes improvement in breathing
- Checks blood glucose and hydration status
- Asks the patient to be covered up in warm blankets/ clothes
- Verbalizes need to to admit/ transfer patient to higher level of care

Facilitator states: "POC glucose is 80. His perfusion and cap refill time are normal. The receiving team has arrived."

Wrap up

- Team handoffs to the receiving Transfer/ ICU team
- Updates family and answers their questions
- Prepares for transfer

After team performs handoff, state "This concludes the simulation" and move to debrief.

Advanced case progression: Bronchiolitis

ADVANCED LEARNER SCENARIO

The patient continues to have severe respiratory distress and the team needs to apply HFNC/ CPAP.

Of note, the video only includes a clip of CPAP (not HFNC). If your team decides to place the patient on HFNC, you can still use the CPAP animation clip (step 6) and ask the team to assume that the patient has been placed on HFNC instead.

Facilitator states: "The respiratory therapist has arrived and they are placing the patient on CPAP of 8, FiO2 of 0.3."

Step 6
CPAP

HR 170
BP 67/38
Sats 99 %
RR 90

- Team reassesses patient while on positive pressure ventilation
- Notes that the patient is still working very hard to breathe
- Verbalizes the need to proceed with endotracheal intubation
- Utilizes airway checklist per local protocol

Facilitator states: "Team verbalizes prep for endotracheal intubation +/- performs. ETCO2 present and ETT position confirmed with CXR."

Step 7
ETT

HR 130
BP 73/42
Sats 99%
RR 45

- Team reassesses the patient after intubation
- Formulates plan for maintenance of sedation, fluid management. and titration of respiratory support

Facilitator states: "The receiving team (transport/ PICU) has arrived. Please sign out the patient."

Wrap up

- Team hands off to the receiving Transfer/ ICU team
- Updates family and answers their questions
- Prepares for transfer

After team performs handoff, state "This concludes the simulation" and move to debrief.

	Observed/verbalized/documented?	Yes	No	Notes
Pediatric Readiness	Proper weight in kg			
	Pediatric Assessment Triangle			
	Vital signs assessed AND re-assessed (including BP)			
	Precalculated med dosing tool used			
	Family permitted to stay in room AND updated by team (if present)			
	Required pediatric equipment located and functioning			
	Pain assessed			
	Mental status assessed using scale (GCS, AVPU, PAT)			
	Activation of transport			
Teamwork	Roles designated			
	Closed loop communication throughout			
	Effective handoff to receiving team			
Bronchiolitis	Airway assessment			
	Airway repositioned			
	Suctioning performed			
	Work of breathing/respiratory distress verbalized			
	Noninvasive ventilation requested			
	Apnea recognized			
	Effective BVM response to apnea			
	Dextrose checked			

Sample Questions for Debrief

This page provides possible questions to elicit teaching points during the debrief. These questions are not meant to replace your team's discussion, but can help to steer the debriefing session.

PERFORM A SYSTEMATIC PRIMARY ASSESSMENT/ REASSESSMENT OF AN INFANT IN RESPIRATORY DISTRESS

How does your team perform a systematic assessment of an ill pediatric patient?

- PAT Pediatric Assessment Triangle
- Appearance TICLS: tone, interactivity, consolability, look/gaze, speech/cry
- Work of breathing: Important to undress to visualize WOB
- Circulation/capillary refill: Where and how is this assessed in the pediatric patient?

Airway Breathing Circulation Caveats: Consider pediatric anatomical differences - ABC vs CAB (in adult patient)

SAMPLE mnemonic: signs/symptoms, allergies, medications, last meal, events preceding

DEMONSTRATE A STEPWISE APPROACH TO INTERVENTION IN AN INFANT WITH RESPIRATORY DISTRESS

Explain your stepwise approach to intervention after the primary assessment.

- Focus on the vital signs and your clinical exam findings (mental and hydration status, respiratory, cardiovascular exams).
- Suction, increase oxygen and positive pressure supplementation, consider early trial of high flow nasal cannula (escalate further PRN).
- After any intervention, remember to reassess the patient to note any positive/negative changes based on your intervention.

What medications will help this patient?

- The medications to treat respiratory distress will depend on your working diagnosis. In classic bronchiolitis, no medications are indicated.
- Treatment is supportive: suction, breathing, hydration, antipyretics PRN.
- In setting of fever (T >38C, 100.4F), antipyretics are indicated (note: avoid non-steroidal anti-inflammatory medication, ie: Motrin, in children <6 months of age due to theoretical nephrotoxic risk).
- If clinical presentation and workup indicates bacterial pneumonia, influenza, pertussis, or other etiology, treat accordingly.
- Note on bronchodilators: Studies have NOT demonstrated a consistent benefit for albuterol treatment in infants with typical bronchiolitis. May consider an albuterol trial if features suggestive of possible asthma (recurrent wheezing, age >12 mos, prior albuterol and/or inhaled corticosteroid use, family history of asthma).

Sample Questions for Debrief

This page provides possible questions to elicit teaching points during the debrief. These questions are not meant to replace your team's discussion, but can help to steer the debriefing session.

IDENTIFY SIGNS OF DEHYDRATION AND HYPOGLYCEMIA

How do you identify signs of dehydration in an infant?

- Dehydration will often present as tachycardia, sunken eyes, lack of tears, sunken fontanelle, fatigue, dry mucous membranes, and pale or mottled skin with prolonged capillary refill >3 seconds on exam.
- History red flags for dehydration include: poor eating, vomiting, decreased urine output.

What is the value of obtaining a POC glucose and what is the intervention associated with it?

- With a history of poor feeding and decreased urine output in an infant, think about checking a basic chemistry panel to assess dehydration status and electrolyte abnormalities.
- Laboratory studies often take some time to return, but POC glucose (point of care) is easily accessible and can result within seconds.
- Treat dehydration with NS fluids and hypoglycemia with a dextrose-containing bolus.
- Hypoglycemia can present with hemodynamic instability, seizures, fatigue, or tremors, but can be managed with administering a D10 bolus (starting with 5 ml/kg) and then following glucose levels closely.

DESCRIBE THE DESIRED DIAGNOSTIC WORKUP AND WHEN TO OBTAIN IT THROUGH THE SCENARIO

When should you obtain imaging and laboratory studies?

- If the clinical course suggests classic bronchiolitis, imaging and viral testing are not routinely recommended.
- If there is indication of superinfection (ie: prolonged fever, local epidemiology indicates significant flu activity) or if the patient is toxic/severely ill in appearance, consider obtaining x-ray and labs: CBC w/ differential, chemistry, blood gas + lactate, respiratory viral panel, blood cultures, and can also consider inflammatory markers (ESR, CRP, procalcitonin).
- If there is paroxysmal or prolonged cough, apnea, or known pertussis exposure, consider pertussis testing.

BRONCHIOLITIS

LOWER RESPIRATORY TRACT INFECTION

Viral obstruction of bronchioles due to mucus plugging and ventilation-perfusion mismatch, worse on day 3-4 of illness with no cure.
Common causes: Respiratory Syncytial Virus, Influenza, Human Rhinovirus, Human Metapneumovirus

EPIDEMIOLOGY

Most common in children less than 2

Outbreaks from winter to spring with peak in January-February

1.4 MILLION ED visits per year

150000 admissions per year

SIGNS AND SYMPTOMS

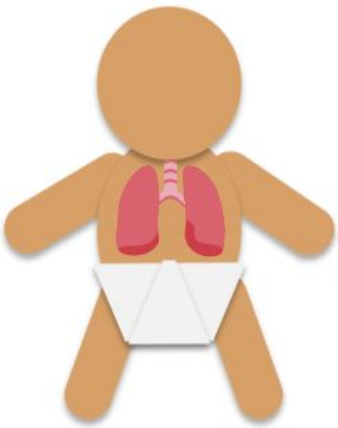
Fever and fussiness

Congestion

Decreased intake/output

Post tussive emesis

APNEA



Characteristic cough
Respiratory distress +
Increased respiratory rate

- nasal flaring
- retractions
- grunting

Lung exam :
crackles + wheezes

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HTTPS://PEDIATRICS.AAPPUBLICATIONS.ORG/CONTENT/134/5/E1474

DO

- Suction Promptly
- Treat shock if present
- Give antipyretics
- Provide Oxygen by facemask or High Flow Humidified Nasal Cannula if saturations <90% or resp distress
- Give PO/IV/NG fluids as indicated

DON'T ROUTINELY

- Order viral testing or CXR
- Treat with systemic corticosteroids
- Treat with bronchodilators
- Give oral or IV antibiotics unless concomitant bacterial infection or high suspicion of SBI
- Give O2 if work of breathing is stable and saturations >90%

RISK FACTORS FOR SEVERE DISEASE

Premature or age <12 weeks

Cardiac or pulmonary disease

Immune deficiency.

Neuromuscular disease

CONSIDER ADMISSION

- O2 sat < 90%
- increased work of breathing
- Poor perfusion
- high risk patients.

Follow insitutional treatment guide if available.

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SIMBOX EDUCATIONAL MEDIA 2020: AAP CLINICAL PRACTICE GUIDELINE
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PEDIATRIC HUMIDIFIED HIGH FLOW NASAL CANNULA (HFNC) INITIATION GUIDELINE

INITIAL EVALUATION — Perform suction, treat fever & consider LFNC if O_2 sat ≤88% asleep or ≤90% awake

@ 30 minutes post — Obtain respiratory score (RS): single highest rating in any category = current score

Respiratory Score		Mild	Moderate	Severe
Respiratory rate	<3 mo	30-60	61-80	>80
	3-11 mo	25-50	51-70	>70
	1y-3y	20-40	41-60	>60
	≥ 4y	12-20	21-30	>30
Work of breathing		Subcostal or intercostal retractions	2 of the following: ❑ subcostal / intercostal retractions / suprasternal ❑ nasal flaring	3 or more: ❑ subcostal / intercostal retractions / suprasternal ❑ nasal flaring or ❑ head bobbing or ❑ grunting
Mental Status		Playful, less active than usual	Fussy but consolable, tired appearing	Inconsolable, lethargic, or cyanotic
Aeration (BS)		Good	Fair	Poor

Rescore and assess whether the pt is able to maintain O_2 sat	≥ 90% via room air:	≥ 90% via LFNC	If O_2 sat <90% severe WOB
	DISCHARGE HOME	OBS ADMIT General Pediatric Ward	Consider HFNC and admit

ED HFNC titration guide		Max flow for admission*	
Patient Weight	Increase flow by	Gen Peds Ward	Intermediate care unit
≤ 10 kg	2 LPM	1.5 L/kg	2 L/kg
11-15 kg	2 LPM	15 LPM	20 LPM
16-20 kg	5 LPM	20 LPM	25 LPM
21-40 kg	5 LPM	25 LPM	30 LPM
>40 kg	5 LPM	40 LPM	50 LPM

HFNC initiation guide: USE CLINICAL JUDGMENT

This guide was developed by Drs. A. Weis, C. Port and N.Gupta and adapted for use in the ED at the LJ Murphy Children's Hospital, Inova Fairfax Medical Campus by @DrM_Kou with permission

Initiate HFNC at 1-1.5L/kg @ 25-30% FiO_2.
Re-score @ 30 mins.
Signs of improvement : ↓ RR, retractions, irritability and improved air mov't.

Admit if improved RS with ≤ max flow for admission*

If no change, ↑flow as directed & admit to PICU

If no improvement within 60 mins despite adjustments, consider ↑supportive measures, checking ABG/VBG, BiPAP via RAM cannula or intubation in consultation with critical care service.

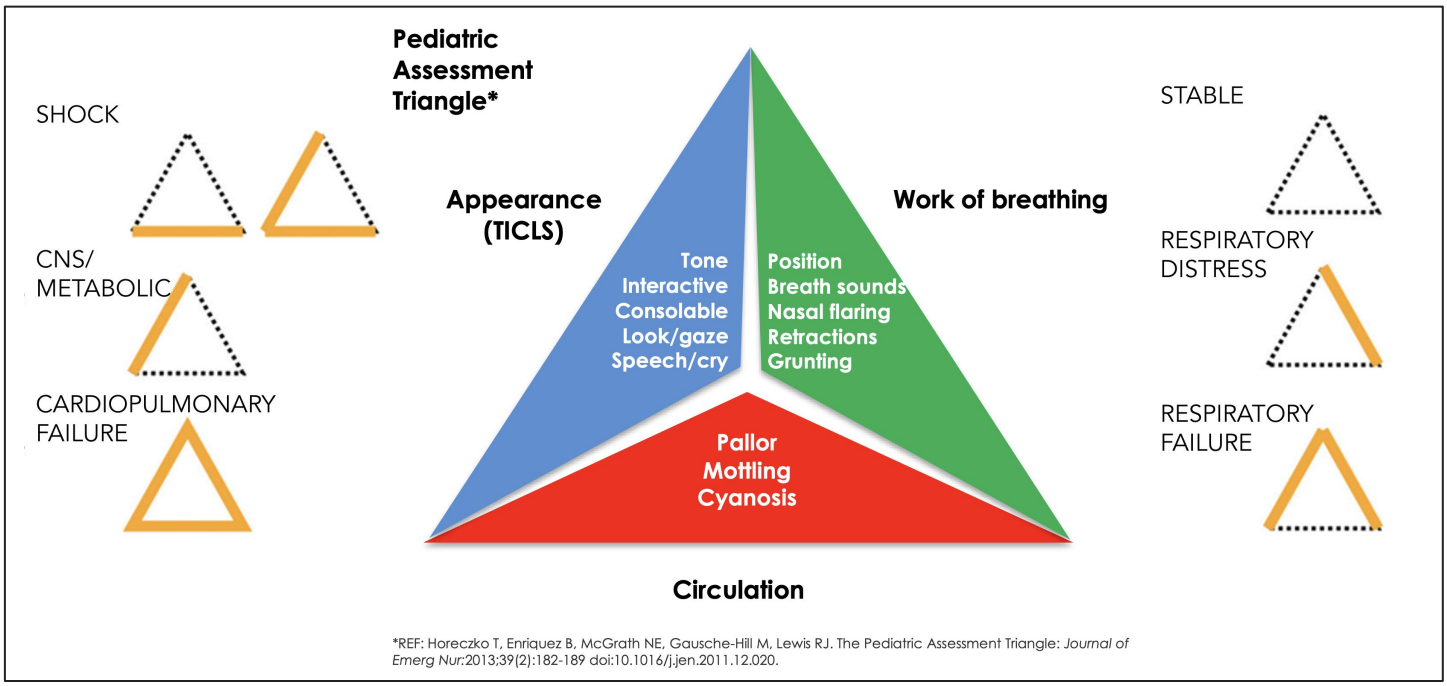
@DrM_Kou

Pediatric Vital Signs/Weight by Age

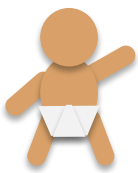
Age	Weight (kg)	Pulse	Resp	Systolic BP*
Newborn	3	100-180	30-60	60-70
6 mos	7	100-160	30-60	70-80
1 yr	10	100-140	24-40	72-107
2	12	80-130	24-40	74-110
3	15	80-130	24-40	76-113
4	16	80-120	22-34	78-115
5	18	80-120	22-34	80-116
6	20	70-110	18-30	82-117
8	25	70-110	18-30	86-120
10	35	60-100	16-24	90-123
12-15+	40-55	60-100	16-24	90-135

*BP in children is a late and unreliable indicator of shock

Using the Pediatric Assessment Triangle (PAT)



*REF: Horeczko T, Enriquez B, McGrath NE, Gausche-Hill M, Lewis RJ. The Pediatric Assessment Triangle: *Journal of Emerg Nur*:2013;39(2):182-189 doi:10.1016/j.jen.2011.12.020.



Pediatric Mental Status Assessment: response to stimuli

A	V	P	U
Alert	Verbal	Pain	Unresponsive

OVERVIEW

Friedman, Jeremy N., et al. "Bronchiolitis: recommendations for diagnosis, monitoring and management of children one to 24 months of age." *Paediatrics & child health* 19.9 (2014): 485-491. Available at: Bronchiolitis: Recommendations for diagnosis, monitoring and management of children one to 24 months of age

VIDEOS & PODCASTS

Brad Sobolewski, PEM Currents. Bronchiolitis, 2017. Available at:
Bronchiolitis – PEM Currents: The Pediatric Emergency Medicine Podcast

"Recognizing Respiratory Distress" by Monica Kleinman, MD for OPENPediatrics

"Respiratory Distress in the Newborn" by Megan Connelly for OPENPediatrics

Pediatric Respiratory Distress

Know the Signs of RSV: Help Keep Your Baby Out of the Hospital

https://www.youtube.com/watch?v=lIE_UElOk3c

ALGORITHMS

Bronchiolitis Clinical Pathway/Algorithm by Children's Hospital of Philadelphia. Available at:
Bronchiolitis Clinical Pathway — Emergency Department | Children's Hospital of Philadelphia

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A big Thank You to OPENPediatrics for the animations used in the video:

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Thank you for participating in the simulation.
Please complete the facilitator and participant surveys by clicking on the links or scanning the QR codes below:

Facilitator Survey

Participant Survey

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