

Bronchiolitis v.8.0 Criteria and Respiratory Score

[Approval & Citation](#)

[Summary of Version Changes](#)

[Explanation of Evidence Ratings](#)

PHASE I (Criteria & Respiratory Score)

[Epidemiology,
Pathophysiology
& Natural History](#)

Inclusion Criteria

- Age <2 years
- Viral upper respiratory symptoms & lower respiratory symptoms that may include: increased work of breathing, cough, feeding difficulty, tachypnea, wheeze, fever
- Prematurity and/or age < 12 weeks: Expect a more severe course of illness

Exclusion Criteria

- Cardiac disease requiring baseline medication
- Anatomic airway defects
- Neuromuscular disease
- Immunodeficiency
 - Chronic lung disease

RESPIRATORY SCORE (RS)

Variable	0 points	1 points	2 points	3 points
<u>RR</u>				
≤2 mo		≤ 60	61-69	≥ 70
2-12 mo		≤ 50	51-59	≥ 60
1-2 yr		≤ 40	41-44	≥ 45
<u>Retractions</u>	None	Subcostal or intercostal	2 of the following: subcostal, intercostal, substernal, OR nasal flaring (infant)	3 of the following: subcostal, intercostal, substernal, suprasternal, supraclavicular OR nasal flaring / head bobbing (infant)
<u>Dyspnea</u>				
0-2 years	Normal feeding, vocalizations and activity	1 of the following: difficulty feeding, decreased vocalization or agitated	2 of the following: difficulty feeding, decreased vocalization or agitated	Stops feeding, no vocalization or drowsy and confused
<u>Auscultation</u>	Normal breathing, no wheezing present	End-expiratory wheeze only	Expiratory wheeze only (greater than end-expiratory wheeze)	Inspiratory and expiratory wheeze OR diminished breath sounds OR both

Bronchiolitis v.8.0: ED Management

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Urgent Care to ED Transfer Criteria

- Respiratory score 9-12 after suctioning and reevaluation
- Consider transferring for respiratory score 5-8 after suctioning and reevaluation
- Inability to maintain oral hydration
- Signs of clinical deterioration
- Transfer by ALS

Inclusion Criteria

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Exclusion Criteria

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Explanation of Evidence Ratings

Summary of Version Changes

Therapies NOT routinely recommended

- [Albuterol](#)
- [Racemic Epinephrine](#)
- [Corticosteroids](#)
- [Chest Physiotherapy](#)
- [Montelukast](#)
- [Antibiotics](#)
- [Hypertonic Saline](#)

!
 Routine testing for viral pathogens NOT recommended unless for cohorting

!
 Chest X-rays NOT routinely recommended

ED Initial Assessment

- Place in viral isolation
- Respiratory score and suction (**SCORE, SUCTION, SCORE**), use olive tip unless score >8
- Assess SpO2, provide supplemental O2 to keep saturation >90% (>88% asleep). Start at ½ L and titrate as needed.

Assess need for IV or NG fluids

- Administer supplemental fluids if severely dehydrated or in severe respiratory distress
- If safe for PO feeds and mildly to moderately dehydrated, attempt oral feeding

Start family teaching on bronchiolitis

- Viral illness, treated by hydration and suction
- Signs of respiratory distress (retractions, nasal flaring, bobbing, grunting, tachypnea, cyanosis)
- How to suction (bulb or mouth-operated nasal aspirator)
- When to suction (prior to feeds or if worsening distress)
- Frequent feeds and watch hydration status
- Cough may last 2-4 weeks, do not use OTC cough and cold medications, avoid tobacco smoke

Suction and reevaluate

- **Respiratory score (SCORE, SUCTION, SCORE) Q 1 hour + prn**
- Feed (if safe for oral feeds)

Considerations for severely ill patients

A one time trial of albuterol via MDI may be considered for patients with:

- Severe respiratory distress OR
- Patients at increased risk for asthma (>12 months old with wheeze, risk factors: history of atopy or recurrent wheezing OR strong family history of atopy or asthma)

If patient responds to albuterol (score decreases by 2 or more) and is felt to clinically have asthma, change to asthma pathway. If patient responds to albuterol but is still felt clinically to have bronchiolitis as a primary pathology, albuterol should be continued on a prn basis only.

High flow nasal cannula (HFNC) may be considered for selected patients with [severe respiratory distress or significant hypoxia \(see chart\)](#), after suction, albuterol, and adequate time for reevaluation. ([Go to HFNC Phase](#)).

Decision to Admit / Discharge

Able to discharge

Discharge Recommend follow up in 24-48 hours

Medical Unit Admit Criteria

(any of the following)

- Respiratory score >8 and not meeting ICU criteria
- Consider admission if respiratory score 5-8
- Hypoxemia (O2 saturation < 90% awake, 88% asleep)
- Apnea
- Dehydration/inability to eat requiring ongoing IV or NG fluids
- HFNC trial initiated, clinically improved or unchanged

ICU Admit Criteria

(any of the following)

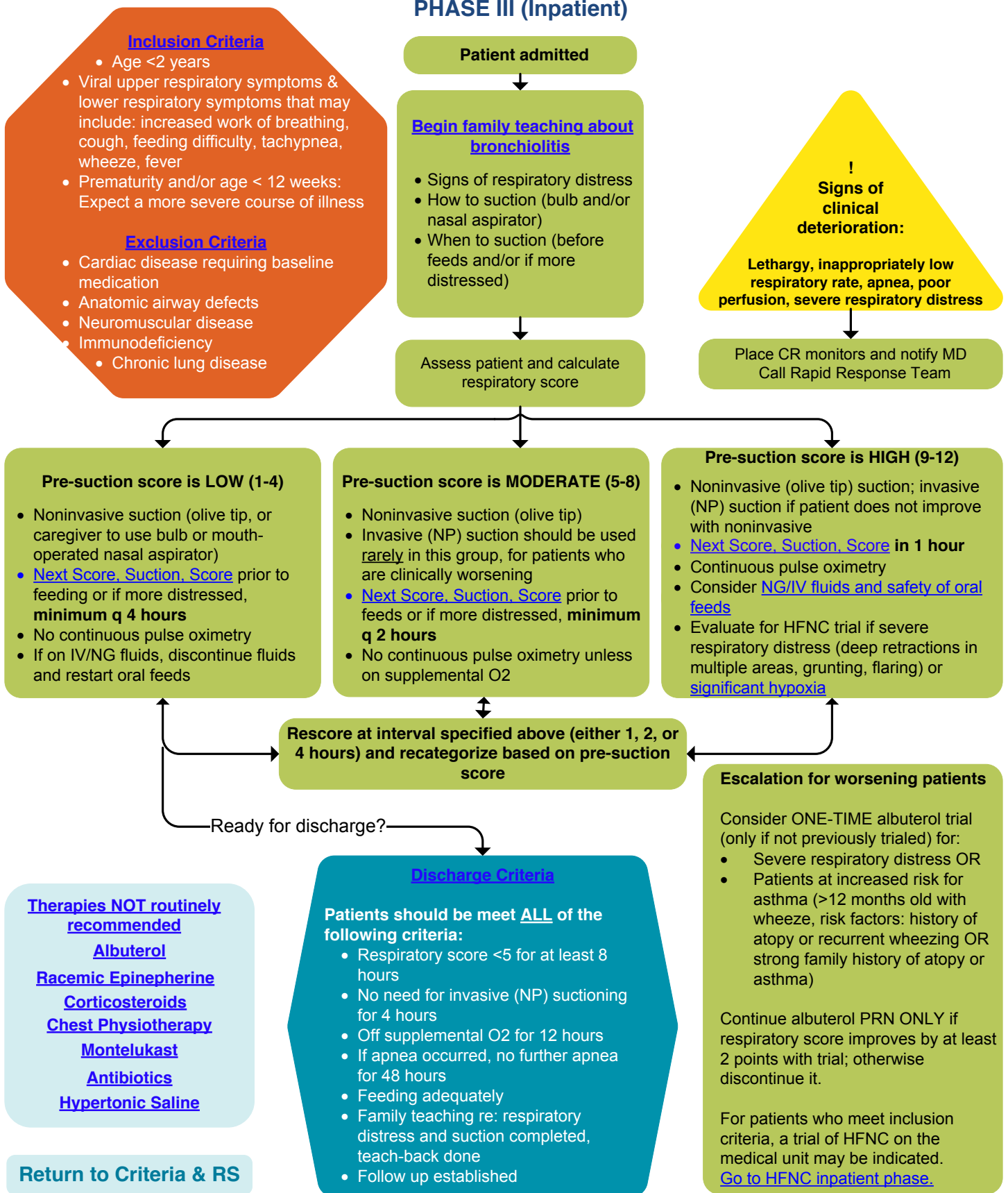
- Apnea with bradycardia and cyanosis
- Lethargy
- Poor perfusion
- Respiratory failure
- Failed HFNC trial (Clinically deteriorating)

Bronchiolitis v.8.0: Inpatient Management

Approval & Citation

Summary of Version Changes

Explanation of Evidence Ratings



Bronchiolitis v.8.0: HFNC Management

Approval & Citation

Summary of Version Changes

Explanation of Evidence Ratings

PHASE IV (HFNC)

Prior to HFNC initiation:

- Score, suction, score (use NP catheter if not already done)
- Consider albuterol trial ONCE if not already done
- Call medical hospitalist (76058)
- **If on medical unit: Call RRT; resident to notify attending MD.**

MD to order (using HFNC orderset):

- Place PIV (consider normal saline bolus)
- NPO

Initiate HFNC, 50% FiO2:

- 4 lpm for 30-90 days
 - 6 lpm for 91 days – 2 years
- Score, suction, score + VS q 30 min until huddle

Huddle 90 minutes post HFNC initiation

ED (RN, RT, resident, and fellow/attending), hospitalist, and accepting floor resident

HFNC Inclusion Criteria

- Children on bronchiolitis pathway
- Age 44 weeks PMA to < 2 years
- ONE of the following:
 - 1) Severe respiratory distress (deep retractions in multiple areas, grunting, head bobbing), or
 - 2) Significant hypoxia (need for > 1 lpm NCO2 if 30-90 days, >1.5 lpm for 91 days – 6 months, >2 lpm for 6 months – 2 years)

HFNC Exclusion Criteria

- Cardiac disease requiring baseline medication
- Anatomic airway defects
- Neuromuscular disease
- Immunodeficiency
- Chronic lung disease
- Born prematurely at less than 34 weeks (if <6 mo)
- History of intubation for respiratory failure
 - Concern for respiratory failure (lethargy, poor perfusion, apnea)
 - Concurrent treatment of pneumonia, asthma, or croup with antibiotics/steroids

Failing (Clinically worsening)

- Call PICU (if in ED)
- Call RRT (if on floor)
- Transfer patient to ICU
- May increase respiratory support with HFNC or other therapies while waiting for transfer, with ICU guidance

Off Pathway

Clinically unchanged or improving

- **In ED:** If unchanged, call PICU; PICU may recommend transfer to floor or ICU. If improving, transfer to floor. Suction and vitals q1h while waiting.
- **On floor:**
 - Suction at least every 2 hours until off HFNC, with VS every 2 hours x 12 hours, then every 4 hours
 - Place NG if anticipated NPO > 2 days
 - Wean flow rates as tolerated
 - May orally feed only if patient has weaned to 2 lpm or less for 30-90 days or 4 lpm or less for patients 91 days – 2 years

Sign of clinical improvement:

- Improving respiratory score
- Lower respiratory rate (not inappropriately low for age)
- Lower heart rate

Criteria for transfer to the ICU:

- Clinical worsening on HFNC trial
- Any apnea > 20 seconds requiring intervention
- Desaturations below 90% despite 50% FiO2
- Altered mental status (irritability, lethargy), poor perfusion (cool extremities, capillary refill >3 seconds)

Criteria for transfer from the ICU to floor:

- Meets pathway criteria, stable on flow rate at or below the floor maximum for >12 hours AND respiratory score <8 prior to transfer
- *If does not meet bronchiolitis HFNC pathway criteria, see HFNC policy*

Weaning HFNC on the medical unit:

FiO2 should be weaned by RN/RT after 90 minute huddle to maintain saturations >90% awake and >88% asleep.

HFNC flow rate should be weaned quickly in improving patients, including at night. RN/RT should call provider to wean patient's flow rate by at least 1 lpm every 2 hours as long as patient is:

- Clinically improving (respiratory distress, respiratory rate)
- Requiring less than 30% FiO2

When HFNC is stable at 2 lpm for 2 hours, next step is to trial patient directly to room air. Place low flow NC O2 if needed to keep sats >90% awake, 88% asleep.

! Do not exceed flow rates of:
4 lpm for 30-90 days old
6 lpm for 91 days to 2 years on the floor.

Weaning by conducting a trial directly to off HFNC to room air (from any rate) is also possible, as patient's condition allows.

May restart HFNC without RRT, if within 8 hours of failed trial off, and if clinical severity does not warrant RRT.

Scope of the Problem

Bronchiolitis is the leading cause of infant hospitalization in the U.S.

- Approximately 3% of all children are hospitalized with bronchiolitis at some point in their lives
- Annual mid-winter epidemics of bronchiolitis lead to a 239% increase in hospitalizations in children <6 months

The charges associated with hospitalizing children for bronchiolitis is \$1.7 billion annually, which is higher than charges for asthma.

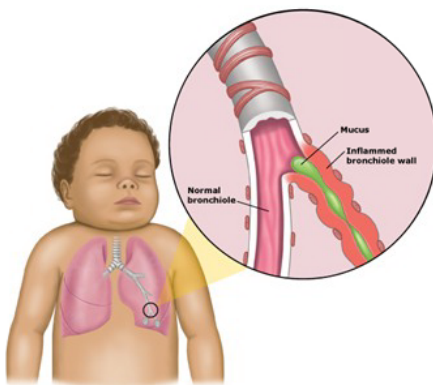
- Charges are increasing over time, and the use of mechanical ventilation is also increasing

Source: Hasegawa 2013, AAP Clinical Practice Guideline 2014



Definition

Bronchiolitis is an acute infectious inflammation of the bronchioles resulting in obstructive airway disease.



- Age <2 years (peak 3-6 months)
- Viral upper respiratory symptoms followed by lower respiratory tract symptoms
- Lower respiratory symptoms are caused by small airway edema and sloughing of epithelial cells → mucus production, bronchospasm, hyperinflation

Source: AAP 2014

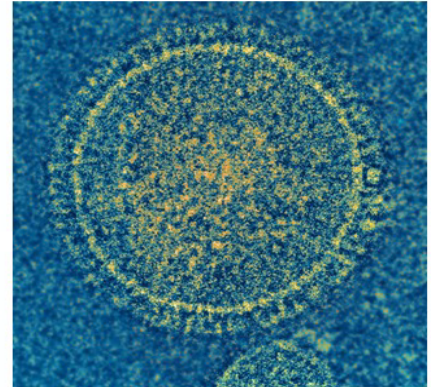
Image source: <http://www.healthuse.com>

[Return to Criteria & RS](#)



Etiology

- **Respiratory Syncytial Virus (50-80%)**
- Other viruses
 - Human Metapneumovirus
 - Rhinovirus
 - Coronavirus
 - Parainfluenza
 - Influenza
 - Adenovirus
- **Coinfection (multiple pathogens) in up to 30%**



Source: Zorc 2010, AAP 2014.

IMAGE SOURCE: <http://globalbiodefense.com/2013/11/08/nih-scientists-develop-candidate-vaccine-for-rsv>



Natural History

- Epidemiology
 - Highest incidence December–March
 - >90% infected with RSV by 2 years of age
 - 40% develop a lower respiratory tract infection with first infection, and most do not require hospitalization
- Transmission
 - Via direct contact with secretions (including on fomites, where it can persist for >6 hours)
 - Young children typically shed virus for 2 weeks
 - 30-70% of household contacts become ill
- Course of symptoms
 - Begins with a URI, usually progresses in 2-6 days to LRI
 - Variable and dynamic course
 - Lasts ~2-4 weeks
- Reinfection is common



Source: AAP 2014, Zorc 2010
Image source: Getty Images

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Diagnosis

The diagnosis of bronchiolitis is clinical and based on the history and physical exam. Evidence does not support routine ordering of labs or radiologic studies (AAP 2014).



Image Source: <http://www.healthcare-information-guide.com/images/at-pediatrician-office.jpg>



Diagnosis: Symptoms



IMAGE SOURCE:
<http://www.amsj.org/archives/3369>

- Upper followed by lower respiratory tract infection
 - URI: Rhinorrhea, congestion, cough
 - LRI: Airway obstruction (tachypnea, wheezing, respiratory distress)

Sometimes:

- Fever (low grade)
- Feeding difficulty
- Post-tussive emesis

Diagnosis: Physical Exam

- Vital signs
 - Tachypnea
 - Hypoxemia
- Inspection
 - Respiratory distress
 - Grunting, flaring, retractions
- Auscultation
 - Prolonged expiratory phase
 - Wheezes
 - Crackles



NOTE: The exam may change quickly / often due to varying clearance of obstruction.

Source: AAP 2014, Zorc 2010



Diagnosis: Differential Diagnosis

Consider especially for the child with severe respiratory distress, lack of viral symptoms, or frequent / recurrent episodes.

- Viral-triggered asthma
- Infection
 - Pneumonia
 - Pertussis
- Irritant
 - Gastro-esophageal reflux
 - Aspiration
- Anatomic
 - Foreign body aspiration
 - Congenital airway anomaly
- Congestive heart failure

Source: Zorc 2010, AAP 2014



[Return to Criteria & RS](#)

Diagnosis: Imaging

There is no evidence to support the routine use of chest X-rays in bronchiolitis (AAP 2014).

- *The risk of bacterial pneumonia is low.*
- *Chest X-ray findings do not correlate with disease severity.*
- *Chest X-rays lead to unnecessary antibiotic use.*
- Obtaining a chest X-ray could be considered if the child has >2 days of fever, an asymmetric chest exam, does not demonstrate improvement, or has an unusually high O₂ need.



Image source:
http://www.allposters.com/-sp/Normal-Chest-X-Ray-3-Year-Old-Child-Posters_i4257610_.htm



Diagnosis: Identification of Pathogen

Identification of a pathogen is not recommended routinely (AAP 2014).

- Although it may be necessary for cohorting patients, it is not recommended for diagnosis.
- Diagnostic testing may be considered in the following cases: uncertain clinical diagnosis, possible diagnosis of influenza (treatment available), or age <2 months.
- Pathogen identification IS recommended for any patient with hospital acquired infection or in high risk patients (immune-compromised, chronic lung / heart disease).



Image Source:
<http://www.cdhb.govt.nz/measles/images/throat-swab.jpg>

[Return to Criteria & RS](#)



Identifying Patients Appropriate for the Bronchiolitis Pathway

Patients who meet these criteria should be placed on the bronchiolitis pathway via use of the bronchiolitis ordersets (AAP 2014).

Inclusion Criteria	Exclusion Criteria
Age <2 years Viral upper respiratory symptoms & lower respiratory symptoms that may include: increased work of breathing, cough, feeding difficulty, tachypnea, wheeze, fever	Chronic lung disease or other significant lung disease (e.g., cystic fibrosis)
	Cardiac disease requiring daily medications or with baseline symptoms
	Anatomic airway defects
	Neuromuscular disease
	Immunodeficiency

NOTE: *Ex-premature infants and those <12 weeks of age are not excluded from the pathway, but providers should be aware that these children may have a more severe course of illness.*



Defining Admission Criteria

Patients should be admitted if they meet **ANY** of the following criteria:

- Moderate / severe respiratory distress
 - Admit patients with respiratory score 9-12 after suctioning
 - Consider admission case-by-case for those with respiratory score 5-8
 - Severe distress requiring high flow nasal cannula (HFNC) initiation
- Hypoxemia (O₂ saturation <90% awake, 88% asleep)
- Apnea
- Dehydration or inability to eat requiring ongoing IV fluids.
- Consider admission for adherence risk as defined by inability to maintain hydration status, lack of reliable caregiver at home, inability to follow recommended care plan, risk for loss to follow-up.
- **Admit to the ICU for:**
 - Apnea with bradycardia and cyanosis, lethargy, poor perfusion, respiratory failure, or if worsening after a trial of HFNC therapy.



[Return to Criteria & RS](#)

Respiratory Scoring Tool (Slide 1 of 3)

How do I use the respiratory scoring tool?

4 Respiratory Assessment Elements	Score
1. RESPIRATORY RATE : assessed over 60 seconds	(1-3)
2. RETRACTIONS : work of breathing	(0-3)
3. DYSPNEA : shortness of breath	(0-3)
4. AUSCULTATION : wheezing on lung exam	(0-3)
TOTAL SCORE	1-12

- The respiratory scoring tool consists of 4 elements that make up the respiratory assessment of the patient in distress.
- You assess each component distinctly and add them to make a total between 1-12.
 - A patient's RR is 1-3 whereas all other categories are scored 0-3.

- *The Seattle Children's respiratory scoring tool was adapted from the Seattle Children's asthma pathway, and has been validated by comparing the assessment amongst various types of providers (see asthma pathway for references).*
- *There are other scoring tools that have been validated but no single tool that has been adopted universally, or has clearly superior performance to all others for bronchiolitis care*
- The respiratory scoring tool is displayed on the next page and is always included with the pathway for convenience.



Respiratory Scoring Tool (Slide 2 of 3)

Respiratory Scoring Tool Table (Part 1 of 2)

Variable	0 points	1 point	2 points	3 points
1. RESPIRATORY RATE : assessed over 60 seconds (1-3)				
<2 mo		≤60	61-69	≥70
2-12 mo		≤50	51-59	≥60
1-2 yr		≤40	41-44	≥45
2-3 yr		≤34	35-39	≥40
4-5 yr		≤30	31-35	≥36
6-12 yr		≤26	27-30	≥31
>12 yr		≤23	24-27	≥28

NOTE: This is the same respiratory score as used for asthma.

[Return to Criteria & RS](#)

Respiratory Scoring Tool (Slide 2 of 3)

Respiratory Scoring Tool Table (Part 2 of 2)

Variable	0 points	1 point	2 points	3 points
2. RETRACTIONS: work of breathing (0-3)				
	None	Subcostal or intercostal	2 of the following: subcostal, intercostal, substernal, OR nasal flaring (infant)	3 of the following: subcostal, intercostal, substernal, suprasternal, supraclavicular OR nasal flaring / head bobbing (infant)
3. DYSPNEA: shortness of breath (0-3)				
0-2 years	Normal feeding, vocalizations and activity	1 of the following: difficulty feeding, decreased vocalization or agitated	2 of the following: difficulty feeding, decreased vocalization or agitated	Stops feeding, no vocalization, drowsy or confused
2-4 years	Normal feeding, vocalizations and play	1 of the following: decreased appetite, increased coughing after play, hyperactivity	2 of the following: decreased appetite, increased coughing after play, hyperactivity	Stops eating or drinking, stops playing, OR drowsy and confused
>4 years	Counts to ≥ 10 in one breath	Counts to 7-9 in one breath	Counts to 4-6 in one breath	Counts to ≤ 3 in one breath
4. AUSCULTATION: wheezing on lung exam (0-3)				
	Normal breathing, no wheezing present	End-expiratory wheeze only	Expiratory wheeze only (greater than end-expiratory wheeze)	Inspiratory and expiratory wheeze OR diminished breath sounds OR both

NOTE: This is the same respiratory score as used for asthma.



Defining Discharge Criteria

Patients should be discharged when they meet **ALL** of the following criteria:

- Respiratory distress only mild / moderate (respiratory score < 5 for at least 8 hours)
- No need for invasive (nasopharyngeal) suctioning x 4 hours
- Off supplemental O_2 for 12 hours
- If apnea occurred, no further apnea 48 hours
- Feeding adequately
- Caregiver / family teaching re: respiratory distress and suction completed, teach-back done
- Follow up established

[Return to Criteria & RS](#)



Caregiver and Family Teaching

- Teaching should start on patient and caregiver arrival, to include:
 - Signs of respiratory distress
 - When to call PCP, go to ED, call 911
 - How and when to nasally suction (bulb syringe or mouth operated nasal aspirator)
 - Maintaining hydration
 - Small frequent feeds if having difficulty
 - Signs of dehydration
 - Anticipatory guidance: cough can last up to 4 weeks, do not use over the counter cough/cold medications



Treatment: Therapies that Work

Current best practice is **FEWER** interventions.

- Therapy is primarily supportive:
 - Suctioning
 - Intravenous or nasogastric fluids if dehydrated
 - Supplemental oxygen if hypoxemic
 - Escalation therapies only if at high risk of respiratory failure



[Return to Criteria & RS](#)



Treatment: Suctioning (Slide 1 of 2)

Suctioning is not discussed often in the literature but is generally considered an important part of the care of infants with bronchiolitis.

- Used to clear secretions from the nares / airway that the child is unable to clear himself / herself.
- Generally thought to reduce work of breathing and improve oral intake.
- Suction gaps may be associated with longer LOS
- *Patients admitted with bronchiolitis should receive suction of the nares at regular intervals*

Source: Mussman 2013, AAP 2014



Bulb suction



Olive tip suction



Mouth-operated nasal aspirator
(TO BE USED BY CAREGIVERS ONLY)



Nasopharyngeal (NP)
suction catheter



Treatment: Suctioning (Slide 2 of 2)

- Suction should be primarily noninvasive:
 - **Noninvasive suction** (with an olive tip catheter, bulb, or parental mouth-operated nasal aspirator) should be used routinely, at regular intervals.
 - **Invasive suction** (defined as any suction with a nasopharyngeal catheter) should be used only in patients who are in severe respiratory distress and fail to improve with olive tip suction. Some articles show that invasive suction is associated with a longer LOS, and using it less often does not make outcomes worse (Mussman 2013, Mittal in press), and nasal edema may result from repeated invasive suction events.
- The response to suctioning should be DOCUMENTED, with a respiratory score recorded before and after all types of suctioning.
- The child's family should be trained on how and when to use bulb suction at home.



[Return to Criteria & RS](#)

Treatment: Supplemental Oxygen

Supplemental oxygen should be provided if a previously healthy child with bronchiolitis has an SpO₂ (oxyhemoglobin saturation) that falls persistently below 90%. The goal is to provide oxygen to maintain SpO₂ at or above 90%.

- Supplemental oxygen is usually supplied via nasal cannula, using the lowest flow rate possible.
- SpO₂ drops to 88% are acceptable during sleep.
- <20 sec drops in SpO₂ to the 80s while the child is sleeping do not require supplemental oxygen; these may occur in healthy infants.

(Source: Hunt 1999, AAP 2014)



Treatment: IV Fluids (Slide 1 of 2)

Intravenous (IV) or nasogastric (NG) fluid administration should be considered if the patient cannot maintain hydration orally or is severely dehydrated (AAP 2014).

- *NG hydration is as effective as IV hydration in patients with bronchiolitis, and requires fewer attempts at placement. It is advisable to involve caregivers in the decision of how to hydrate their child.*
- Because respiratory distress may increase the risk of aspiration:
 - Patients who experience significant coughing, choking, gagging, or worsening tachypnea with feeds should be made NPO, and IV/NG feeds started
 - Patients who have a sustained respiratory rate > 60 should be evaluated for safety of a feeding trial. If in severe distress, do not attempt feeding trial and make NPO
 - Patients on HFNC at flow rates > 2 lpm for patients 30-90 days and 4 lpm for patients 91 days – 2 years should be NPO



[Return to Criteria & RS](#)

Treatment: IV Fluids (Slide 2 of 2)

- By local consensus, hypotonic IV fluids should not be used in patients with bronchiolitis.
 - Suggested starting fluid is D5NS, with potassium if not contraindicated.
 - There is evidence that hyponatremia is a marker for severe bronchiolitis, and ADH secretion can be increased in patients with bronchiolitis.
 - Consider checking a sodium level in patients with severe bronchiolitis on IV fluids.
- (Source: AAP 2014)

Treatment: Therapies *NOT* Routinely Recommended

Randomized controlled trials do not demonstrate benefit as an inpatient for:

- Bronchodilators
 - Albuterol OR racemic epinephrine
- Corticosteroids
- Chest physiotherapy
- Antibiotics
- Leukotriene receptor antagonists



Treatment: Bronchodilators (Slide 1 of 2)

*There is **NO** consistent improvement in duration of illness or length of hospitalization due to bronchodilators, and, as with any medication, there are side effects and financial burdens (cost of medication, labor, etc.); albuterol should **NOT** be used routinely in children with bronchiolitis (AAP 2014, Gadomski 2010).*



Treatment: Bronchodilators (Slide 2 of 2)

- Because there is a paucity of data on critically ill infants, and clinical uncertainty, albuterol may be trialed in patients with **severe distress** or **risk factors for asthma** (>12 months with wheeze, history of recurrent wheeze, strong family history of atopy or asthma).
 - Document response (pre /post respiratory score and exam).
 - Continue (**PRN** only) if there is a significant improvement in respiratory score (2 or more point improvement in respiratory score) after albuterol administration.
 - If no significant response, albuterol should not be trialed more than once.
 - If not effective, higher doses are not better.
 - MDI is the preferred delivery method (see asthma WBT).

Treatment: Racemic Epinephrine

Racemic epinephrine has no definite benefit over albuterol for the treatment of inpatients with bronchiolitis and should not be used routinely (AAP 2014).

- Though there is some evidence to show it may help in the outpatient setting, there are conflicting studies. There is no evidence to support its use in inpatients with bronchiolitis.
- The bronchodilator of choice, if a child is to have a trial, should be albuterol (due to its longer duration of action, low risk for adverse effects, and common use in other settings).



Treatment: Corticosteroids

Corticosteroids do not improve length of stay in the hospital, length of illness, or clinical score, and they should not be used routinely (AAP 2014).

- May be considered in those with chronic lung disease who are EXCLUDED from the pathway (+/- in consultation with pulmonary medicine).



[Return to Criteria & RS](#)

Treatment: Chest Physiotherapy

Chest physiotherapy does not improve respiratory score, length of stay, or O₂ requirement, and is not recommended for routine use in bronchiolitis (AAP 2014).

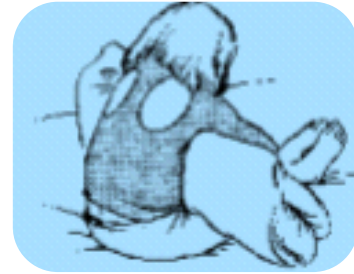


Image source: www.uwhealth.org

Treatment: Antibiotics

The risk of serious bacterial infection in infants with bronchiolitis is low, and antibiotics do not improve length of stay in the hospital for patients with bronchiolitis.

Antibiotics should not be used routinely, and they should only be used in patients with evidence of specific secondary bacterial infections (AAP 2014).

Treatment: Montelukast

There is no evidence for improvement with montelukast and it is not recommended for use in bronchiolitis (AAP 2014).



Treatment: Hypertonic Saline

There is currently insufficient evidence regarding the efficacy vs. cost of hypertonic saline use. Thus, hypertonic saline is not recommended for routine use in outpatients. Hypertonic saline may be used in inpatients anticipated to have longer LOS (> 3 d) (AAP 2014, Zhang 2015).



- Hypertonic saline is thought to increase mucociliary clearance of secretions.
- Although evidence exists that hypertonic saline may reduce risk of hospitalization or LOS, studies are of variable generalizability and the magnitude of the effect is small.
- Questions remain:
 - Which patients benefit most?
 - How best to administer it?
 - What is the cost benefit analysis for routine administration?
- It may be considered in patients with severe respiratory distress or anticipated to have LOS > 3 days.



[Return to Criteria & RS](#)

Monitoring: Continuous Pulse Oximetry

Continuous pulse oximetry should be discontinued when patients are clinically improving and no longer require supplemental oxygen (AAP 2014).

- Continuous pulse oximetry is a useful tool in patients with respiratory illness.
- Pulse oximetry can also lead to alarm fatigue, caregiver distress, and overtreatment. In some studies, it is associated with higher admission rates or longer LOS without evidence of patient benefit.
- Pulse oximetry should be used judiciously and discontinued once patients improve.

Source: Shuh 2014, Hunt 1999, AAP 2014.



Monitoring: Blood Gas Monitoring

Clinicians may check a CBG if there are signs of clinical deterioration (apnea, lethargy, poor perfusion, signs of respiratory failure).

[Return to Criteria & RS](#)



Monitoring: Apnea

- Initiate ABC (apnea / bradycardia / cyanosis) monitoring if patient has an episode of apnea while inpatient or a significant history of apnea.
- Consider ICU consult / transfer for persistent episodes of apnea or for apnea with bradycardia and/or cyanosis.

NOTE: Pertussis PCR is recommended for infants with apnea.

Escalation Therapies

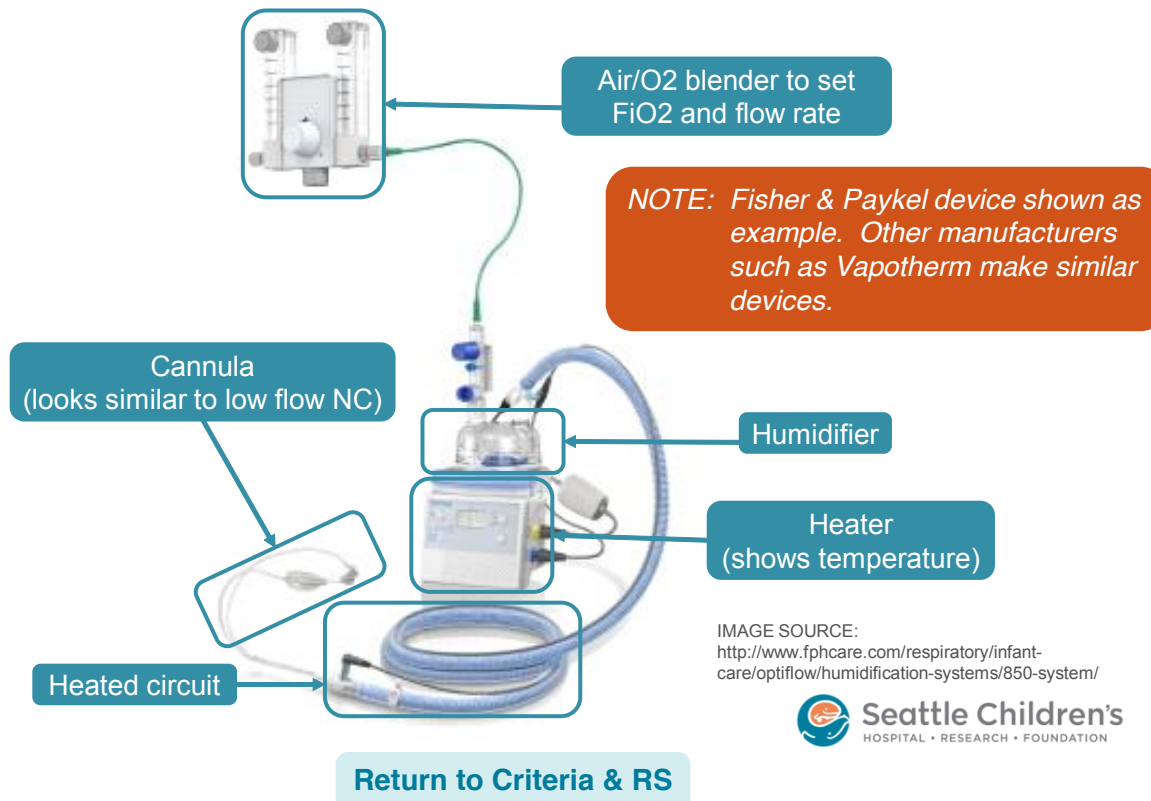
- Cochrane reviews on HFNC and CPAP state there is insufficient evidence to recommend their use in acute bronchiolitis
- Paucity of high quality research on critical illness
- Retrospective ICU studies show decreased intubation rates with HFNC use in bronchiolitis

- 2014 AAP guideline on HFNC: “Although promising, the absence of any completed randomized trial of the efficacy of high-flow nasal cannula in bronchiolitis precludes specific recommendations on its use at this time.”

Escalation Therapies: High Flow Nasal Cannula

- Also called high-flow, high-humidity nasal cannula, HFNC is a device to safely deliver a higher flow of air or oxygen than normal nasal cannula (NC). Gas is delivered with a mixer so that FiO_2 can be adjusted (21-100%), although actual delivered FiO_2 does not reach 100%.
- **By contrast:** Oxygen delivered by low flow NC is not humidified and dries out the airways at higher flow rates
- Proposed mechanisms of HFNC action in bronchiolitis:
 - Provides low-level positive pressure (PEEP) and aids in lung recruitment
 - However, exact amount of PEEP is variable and depends on flow rates, nasal cannula fit to nares, and whether mouth is open or closed
 - Provides CO_2 “washout” of respiratory physiologic dead space
 - Warmth and humidity keep secretions moist, improve mucociliary clearance, and inhibit inflammatory reactions and nasopulmonary bronchoconstriction reflexes triggered by cold and dry air

Escalation Therapies: HFNC Setup Example



Escalation Therapies: HFNC Recommendations

- HFNC has been shown to improve work of breathing and decrease the need for intubation in patients with severe bronchiolitis.
- However, HFNC has little benefit for patients who are less severely ill, and it is associated with adverse effects (pneumothorax) and considerable cost.

Consider a trial of HFNC for patients at high risk of deterioration, such as patients with:

- **Severe respiratory distress**
- **Significant hypoxia** (see below; NC O₂ flow rate necessary to keep SpO₂ > 90% awake, 88% asleep)

Age	Significant hypoxia if NC O ₂ flow rate greater than:
30-90 days	1 lpm
91 days – < 6 months	1.5 lpm
6 months – 2 years	2 lpm



Escalation Therapies: HFNC Pathway Criteria

Patients eligible for the HFNC for bronchiolitis pathway are:

- Children on bronchiolitis pathway
- Age 44 weeks PMA to <2 years with clinical bronchiolitis
- ONE of the following:
 - Severe respiratory distress
 - Significant hypoxemia (need for > 1 lpm NCO₂ if 30-90 days, >1.5 lpm for 91 days – 6 months, >2 lpm for 6 months – 2 years)

Exclusion Criteria	
Cardiac disease requiring baseline medication	Concern for respiratory failure: <ul style="list-style-type: none"> • Lethargy • Poor perfusion • Apnea
Anatomic airway defects	
Neuromuscular disease	
Immunodeficiency	Born prematurely at less than 34 weeks if < 6 mo
Chronic lung disease	History of intubation for respiratory failure
Concurrent treatment of pneumonia, asthma, or croup	



[Return to Criteria & RS](#)

Escalation Therapies: HFNC Initiation

For patients felt to need HFNC therapy, here are the first steps:

1. Suction well prior to any HFNC use (do not make the decision to use HFNC if adequate suction is not done)
2. Consider albuterol trial ONCE if not already done
3. **For inpatients:** Call RRT, notify attending MD
For ED: Call respiratory therapist and medical hospitalist (76058)
4. Make patient NPO
5. Place PIV (consider normal saline bolus)
6. Set up HFNC initially at 50% FiO₂, flow rate of **4 lpm** for patients 30-90 days and **6 lpm** for patients 91 days – 2 years.

Continue to suction patient's nares frequently both pre- and post-HFNC initiation.

NOTE: *If patients have weaned off HFNC and it must be re-initiated >12 hours later, an RRT must still be called.*



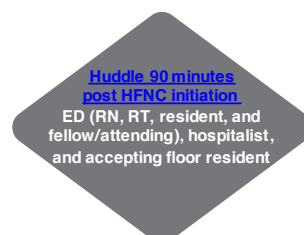
Escalation therapies: HFNC 90-minute huddle

Studies show that responders to HFNC tend to have improvements in respiratory rate, heart rate, and work of breathing within 60-90 minutes of starting HFNC.

Recommendations:

- *Conduct a huddle, in which key players in the patient's care re-evaluate the patient's clinical course 90 minutes post HFNC initiation*
- *Clinically worsening* patients are transferred to the PICU
- *Clinically improving or unchanged* patients may stay on the floor with frequent monitoring

Huddle participants:



[Return to Criteria & RS](#)

Escalation Therapies: HFNC Weaning

HFNC should be weaned quickly in improving patients.

- FiO2 may be weaned by RN/RT
- Flow rate must be weaned by provider order
 - Flow should be weaned quickly in improving patients, including at night
 - RN/RT should call provider to wean patient's flow rate by at least 1 lpm every 2 hours
 - Weaning by conducting a trial directly to off HFNC to room air (from any rate) is also permitted if clinically indicated
 - After reaching flow of 2 lpm, next step is to trial directly to room air. Place low flow NC O2 as needed for hypoxemia.



IMAGE SOURCE: <http://www.qmed.com>



Escalation Therapies: HFNC PICU–to–Floor Transfers

For PICU patients on HFNC age 44 weeks PMA to 2 years, prior to ward transfer, the patient must:

- Be stable on a flow rate at or below the floor maximum (4 lpm for 30-90 days, 6 lpm for 91 days – 2 years) for **>12 hours**
- Have a **respiratory score <8** prior to transfer
- Have **no pathway EXCLUSION criteria** (i.e. no history of respiratory failure, no chronic lung disease, etc.)

For patients who do not meet criteria for HFNC pathway:

- Transfer subject to the current hospital-wide policy (See policy on CHILD: Care of the Patient on High Flow Nasal Cannula (HFNC))



[Return to Criteria & RS](#)

Escalation Therapies: Feeding Patients on HFNC

No strong evidence exists to guide feeding practices on HFNC. Patients may receive significant PEEP at higher flow rates, which makes feeding difficult and potentially unsafe.

Recommendations:

- Patients who have weaned by at least 2 L after starting HFNC (rates of 2 lpm or less in 30-90 days, or 4 lpm or less in 91 days – 2 years) may be eligible to resume oral feeds.
- Patients should only attempt oral feedings if they are clinically improving, have no known issues with aspiration, and have a RR < 60.
- The initial oral feeding should be supervised by an RN or SLP/OT, and halted if the patient coughs, chokes, or has worsening respiratory distress.
- An NG tube should be placed and enteral feeds initiated for patients who are anticipated to be NPO for > 2 days.



Signs of Deterioration in a Patient With Bronchiolitis

- Increasing respiratory distress
- Increasing respiratory rate (or conversely, inappropriately low RR for the patient's condition)
- Increasing heart rate
- Worsening hypoxia
- Apnea
- Lethargy
- Poor perfusion

[Return to Criteria & RS](#)



Prevention

RSV can persist on fomites for hours and has been identified in the air up to 22 feet from the patient's bed. The following considerations are key in prevention:

- *Viral isolation is the standard for inpatients at Seattle Children's:*
 - *Strict handwashing / alcohol-based rubs, gown, gloves, mask*
 - *Wash hands or gel before and after patient contact, after contact with inanimate objects directly near the patient, and after glove removal*
 - *Limits to visitation by young children*
- *Family education re: hand hygiene (AAP 2014)*
- *Consideration of RSV monoclonal antibody (monthly Synagis) for at-risk infants (See AAP palivizumab policy statement 2014)*



Source: AAP 2014, AAP Committee on Infectious Diseases 2014



Bronchiolitis Approval & Citation

Approved by the CSW Bronchiolitis Team for the November 4, 2015 go live.

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Retrieval Website: <http://www.seattlechildrens.org/pdf/bronchiolitis-pathway.pdf>

Please cite as:

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[Return to Home](#)



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Evidence Ratings

This pathway was developed through local consensus based on published evidence and expert opinion as part of Clinical Standard Work at Seattle Children's. Pathway teams include representatives from Medical, Subspecialty, and/or Surgical Services, Nursing, Pharmacy, Clinical Effectiveness, and other services as appropriate.

When possible, we used the GRADE method of rating evidence quality. Evidence is first assessed as to whether it is from randomized trial or cohort studies. The rating is then adjusted in the following manner (from: Guyatt G et al. J Clin Epidemiol. 2011;4:383-94.):

Quality ratings are *downgraded* if studies:

- Have serious limitations
- Have inconsistent results
- If evidence does not directly address clinical questions
- If estimates are imprecise OR
- If it is felt that there is substantial publication bias

Quality ratings are *upgraded* if it is felt that:

- The effect size is large
- If studies are designed in a way that confounding would likely underreport the magnitude of the effect OR
- If a dose-response gradient is evident

Guideline – Recommendation is from a published guideline that used methodology deemed acceptable by the team.

Expert Opinion – Our expert opinion is based on available evidence that does not meet GRADE criteria (for example, case-control studies).

Quality of Evidence:

★★★★ High quality

★★★○ Moderate quality

★★○○ Low quality

★○○○ Very low quality

Guideline

Expert Opinion

[To Bibliography](#)

[Return to Home](#)

Summary of Version Changes

- **Version 1.0 (10/10/2011): Go live**
- **Version 1.1 and 1.2 (07/20/2012): Copyrighted photos and diagrams removed**
- **Version 2.0 (10/22/2012): Updated to SpO2 monitoring recommendations**
- **Version 3.0 (12/10/2013): Go live of Bronchiolitis HFNC Pathway**
- **Version 3.1 (12/13/2013): Changes made to add contact hospitalist; correction to oral feeds to match training slide; wording change in trial of albuterol to match the orders**
- **Version 3.2 (01/15/2014): Changes to inclusion and exclusion criteria; changes to reflect medical hospitalist at ED 90 minute huddle; admit to medical hospitalist**
- **Version 4.0 (02/5/2014): Pathway document was divided into two documents and posted as Bronchiolitis Pathway and HFNC Pathway.**
- **Version 5.0 (10/01/2014): Added citation page and link; removed “HFNC Test Your Knowledge” link; updated training slides L, M, and V. In the HFNC phase only: Removal of daily CBG while on HFNC; highlighting of ability to recheck PCO2 after HFNC started for improved patients to meet floor admit criteria; PCO2 removed from inclusion criteria; composition of members of ED huddle; ability to admit to general medicine service; ability to trial patient on RA or low flow NC O2 after stable on HFNC at 2 lpm for 4 hours**
- **Version 6.0 (01/30/2015): HFNC Phase ONLY: Update to the pathway inclusion criteria to include severe respiratory distress; added ICU to floor transfer criteria and link to education slide in transfer criteria box**
- **Version 7.0 (11/04/2015): Periodic Review; updated literature search, recommendations and pathway tools. Combined bronchiolitis and HFNC pathway documents.**
- **Version 8.0 (3/7/2016): HFNC inclusion/exclusion criteria amended, HFNC huddle participants amended, changes to HFNC ED management for unchanged patients, HFNC restarting after weaning clarified**

Medical Disclaimer

Medicine is an ever-changing science. As new research and clinical experience broaden our knowledge, changes in treatment and drug therapy are required.

The authors have checked with sources believed to be reliable in their efforts to provide information that is complete and generally in accord with the standards accepted at the time of publication.

However, in view of the possibility of human error or changes in medical sciences, neither the authors nor Seattle Children's Healthcare System nor any other party who has been involved in the preparation or publication of this work warrants that the information contained herein is in every respect accurate or complete, and they are not responsible for any errors or omissions or for the results obtained from the use of such information.

Readers should confirm the information contained herein with other sources and are encouraged to consult with their health care provider before making any health care decision.

[Return to Home](#)

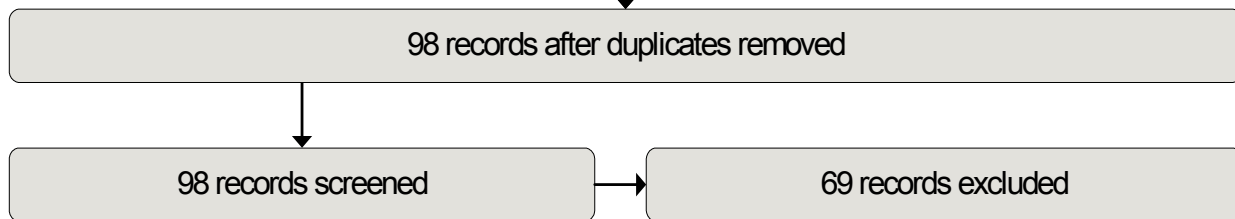
Bibliography

Studies were identified by searching electronic databases using search strategies developed and executed by a medical librarian, Susan Groshong. This periodic review search was completed in April, 2015, and updated searches originally performed in 2010, 2012 and 2013. The following databases were searched: Cochrane Database of Systematic Reviews via the Ovid platform, CINAHL, and Cincinnati Children's Evidence-Based Care Recommendations. Retrieval was limited to ages 0-18, English, French or German languages, and the period October 1, 2013 to current, reflecting incorporation of a 2014 American Academy of Pediatrics guideline. For review of Medline and Embase, the team relied upon ongoing quarterly alert results. Appropriate CINAHL Headings were used, along with text words, and the search strategy was adapted for other databases using text words. Concepts searched were bronchiolitis, respiratory syncytial viruses and metapneumovirus. All retrieval was further limited to certain evidence categories, such as relevant publication types, index terms for study types and other similar limits.

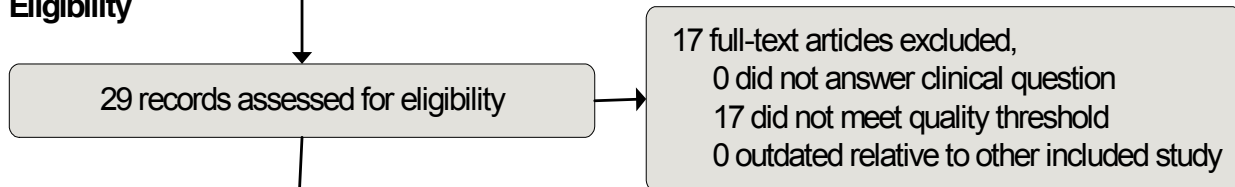
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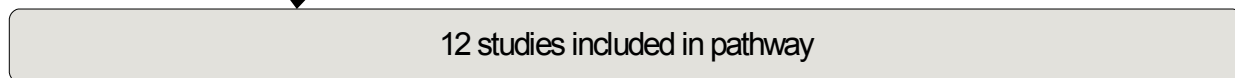
Screening



Eligibility



Included



Flow diagram adapted from Moher D et al. BMJ 2009;339:bmj.b2535

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