Bronchiolitis Pathway v13.0: **Table of Contents**

Stop and **Review**

Inpatient & ED Inclusion Criteria

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

Inpatient & ED Exclusion Criteria

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

Stop and **Review**

HFNC Inclusion Criteria

- Primary diagnosis of bronchiolitis
- Age 44 weeks PMA to <2 years
- Severe respiratory distress PLUS persistent SpO2 <92% on maximum low-flow NC (1L if 30-90 days, 1.5L if 91 days-6 months, 2L if 6 months-2 years)

HFNC Exclusion Criteria

- Concern for impending respiratory failure (lethargy, poor perfusion, apnea)
- Primary diagnosis of pneumonia, asthma, or croup
- Born prematurely <34 weeks (if <6 mo)
- History of intubation for respiratory failure
- Cardiac disease requiring baseline medication
- Anatomic airway defects
  - Neuromuscular disease
  - Immunodeficiency
  - Chronic lung disease

Bronchiolitis Care

Appendix

Last Updated: March 2022
Next Expected Review: December 2025

For questions concerning this pathway, contact:
bronchiolitis@seattlechildrens.org

If you are a patient with questions contact your medical provider, Medical Disclaimer

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Bronchiolitis Pathway v13.0: **Criteria and Respiratory Score**

Stop and **Review**

Inclusion Criteria

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

Exclusion Criteria

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

RESPIRATORY SCORE (RS)

Variable	0 points	1 point	2 points	3 points
RR				
<2 mo		≤60	61-69	≥70
2-12 mo		≤50	51-59	≥60
1-2 yr		≤40	41-44	≥45
Retractions	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)
Dyspnea				
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
Auscultation	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

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bronchiolitis@seattlechildrens.org

Bronchiolitis Pathway v13.0: **ED Management**

Stop and **Review**

Inclusion Criteria

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

Exclusion Criteria

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

Therapies NOT routinely recommended

- Albuterol
- Racemic Epinephrine
- Corticosteroids
- Chest Physiotherapy
- Montelukast
- Antibiotics
- Hypertonic Saline

Urgent Care Transfer Criteria

- Severe respiratory distress after suction and reevaluation
- Inadequate oral hydration
- Hypoxemia
- Apnea
- Signs of clinical deterioration

*Transport via ALS

!

Routine testing for viral pathogens NOT recommended unless for cohorting

!

Chest X-rays NOT routinely recommended

Initial assessment

- SCORE, SUCTION, SCORE: nasal suction; follow with NP suction if needed
- **Provide** supplemental O2 to keep saturation >90% (>88% asleep). Start at ½ L and titrate as needed.

Rehydration

- Give supplemental NG or IV fluids if moderately to severely dehydrated; NPO and IV fluids if severe respiratory distress
  - Encourage NG over IV fluids, esp. if <1 year old
- If safe for PO feeds and mildly to moderately dehydrated, attempt oral feeding

Family teaching

- Viral illness, treated by hydration and suction
- Signs of respiratory distress
- When and how to suction
- 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 reevaluation

- Respiratory score (SCORE, SUCTION, SCORE) Q 1 hour + prn if mild to moderate distress
- Respiratory score and suction q30 minutes + prn if severe respiratory distress
- For patients with prolonged ED stays, may space suctioning per MD discretion

Escalation for severe respiratory distress

- Start low-flow NC if SpO2 <92% (1L if 30-90 days, 1.5L if 91 days-6 months, 2L if 6 months-2 years)
- May consider one-time albuterol trial (continue PRN if improves work of breathing)
- Suction and administer antipyretic as clinically indicated
- Consider CBG

SpO2 <92% on low-flow NC after **30 min** → **Go to HFNC Phase**

Concern for clinical deterioration → Escalate respiratory support

Decision to Admit or Discharge

Able to discharge → **Discharge**
Recommend follow up in 24-48 hours

Medical Unit Admit Criteria (any of the following)

- Sustained hypoxemia (SpO2 <90% awake, 88% asleep)
- Apnea
- Dehydration/impaired oral hydration requiring ongoing IV or NG fluids
- HFNC trial initiated, clinically improved or unchanged
- Moderate to severe respiratory distress AND one of the above criteria

ICU Admit Criteria (any of the following)

- Clinical worsening despite acute care max HFNC support
- Desaturations below 90% despite 50% FiO2
- Other late findings of respiratory failure:
  - Inappropriately low respiratory rate with worsening obstruction
  - Lethargy despite noxious stimuli
  - Poor perfusion
- Apnea >20 seconds with associated bradycardia/desaturation requiring intervention

Last Updated: March 2022
Next Expected Review: December 2025

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Bronchiolitis Pathway v13.0: **Inpatient Management**

Stop and **Review**

Inclusion Criteria

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

Exclusion Criteria

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

Therapies NOT routinely recommended

- Albuterol
- Racemic Epinephrine
- Corticosteroids
- Chest Physiotherapy
- Montelukast
- Antibiotics
- Hypertonic Saline

!
Signs of clinical deterioration:

Lethargy despite noxious stimuli, inappropriately low respiratory rate with worsening obstruction, apnea, poor perfusion; Deterioration does not correlate with day of illness

- Place CR monitors
- Notify MD
- Call Rapid Response Team

Patient admitted

Begin family teaching

- Signs of respiratory distress
- How to suction
- When to suction

- Assess patient
- Calculate respiratory score

Pre-suction score is LOW (1-4)

- Score, Suction, Score **minimum q4 hours**, prior to feeds or if more distressed
- Nasal suction
- No continuous pulse oximetry
- If on NG/IV fluids, discontinue fluids and restart oral feeds

Pre-suction score is MODERATE (5-8)

- Score **minimum q 2 hours**
- Suction **minimum q2-4 hours**. Score after suctioning.
- Nasal suction
- NP suction if clinically indicated for work of breathing after nasal suctioning
- Spot SpO2 checks; continuous pulse oximetry if on supplemental O2 or per care team request due to clinical concerns

Pre-suction score is HIGH (9-12)

- Score **minimum q 1 hours**
- Suction **minimum q2-4 hours**. Score after suctioning.
- Nasal suction
- NP suction if clinically indicated for work of breathing after nasal suctioning
- Continuous pulse oximetry
- Consider albuterol trial and HFNC trial (see below)

- Rescore at interval specified above (either 1, 2, or 4 hours)
- Recategorize based on pre-suction score

Ready for discharge?

Inadequate PO Intake

- Encourage NG over IV fluids, especially if <1 year old
- NPO and IV fluids if severe respiratory distress

Discharge Criteria

Patients should be meet ALL of the following criteria:

- Respiratory score <5 for at least 8 hours
- No need for NP suctioning for 4 hours
- Off supplemental O2 for 12 hours
- If apnea occurred, no further apnea for 48 hours
- Feeding adequately
- Family teaching completed, teach-back done
- PCP follow up as needed

Escalation for severe respiratory distress

- Start low-flow NC if SpO2 <92% (1L if 30-90 days, 1.5L if 91 days-6 months, 2L if 6 months-2 years)
- May consider one-time albuterol trial (continue PRN if improves work of breathing)
- Suction and administer antipyretic as clinically indicated
- Consider end-tidal CO2 monitoring x1 hour or CBG (if EtCO2 not available)

SpO2 <92% on low-flow NC after **1 hour**

Concern for clinical deterioration

Go to HFNC Phase

Call RRT

Bronchiolitis Pathway v13.0: **HFNC Management**

Stop and **Review**

HFNC Inclusion Criteria

- Primary diagnosis of bronchiolitis
- Age 44 weeks PMA to <2 years
- Severe respiratory distress PLUS persistent SpO2 <92% on maximum low-flow NC (1L if 30-90 days, 1.5L if 91 days-6 months, 2L if 6 months-2 years)

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  - Chronic lung disease

Acute Care initiation: call RRT
Initiate HFNC at acute care max flow, FiO2 21%

- Titrate FiO2 to maintain SpO2 ≥92%; max acute care FiO2 is 50%
- VS q30 min x3
- Ensure NPO

Age	HFNC floor maximum (L/min)	HFNC floor minimum (L/min)
44wk PMA - 90 days*	4	3
91 days - 6 months*	6	4
>6 months - 1 year	8	5
>1 year - <2 years	10	5

*Correct for gestational age

Trial HFNC at acute care max flow

Huddle 60 minutes post HFNC initiation

- ED: Include ED (RN, RT, APP/MD) and accepting acute care MD
- Acute Care: Include RISK RN, PICU APP/MD (optional), RN, RT, and general medicine MD

Hypoxia or Respiratory Distress Not Improved

- **In ED**: Call PICU
- **Acute Care**: Call RRT
- If transferring to PICU:
  - May escalate respiratory support with ICU guidance
  - Vitals q1h

Off Pathway

Hypoxia or Respiratory Distress Improved

In ED:

- Transfer to acute care
- Suction + vitals q2hr until transfer

Acute Care:

- Wean flow rates and FiO2 as tolerated (see below)
- Suction q2-4 hours until off HFNC
- VS q2 hours x 12 hours, then q4 hours
- Place NG if anticipated NPO >2 days
- May orally feed once weaned to acute care min flow and safe for feeding
  - RN or MD to observe first feed
  - Use extra caution in neonates <90 days old

Criteria for transfer to the ICU

- Clinical worsening despite acute care max HFNC support
- Desaturations below 90% despite 50% FiO2
- Other late findings of respiratory failure:
  - Inappropriately low respiratory rate with worsening obstruction
  - Lethargy despite noxious stimuli
  - Poor perfusion
  - Apnea >20 seconds with associated bradycardia/desaturation requiring intervention

Criteria for transfer from the ICU to acute care

- Meets pathway criteria and stable on flow rate at or below the acute care maximum for >12 hours
- If does not meet bronchiolitis HFNC pathway criteria, see HFNC policy

Weaning HFNC on the medical unit

- **Rapidity**: wean flow and FiO2 quickly in improving patients, including at night
  - Acute care max flow → min flow → off OR max flow → off, as patient condition allows
  - Avoid gradual weans using other flow
- **Frequency**: at least once a day, unless worsening trajectory or ongoing resp distress
  - RT or RN to assess improving patients for readiness to wean q4 hours
- **Team guidance**: observe patient for 10 minutes after flow wean, and reassess within 2 hours to ensure sustained successful wean
- **Definition of failed wean**: increased work of breathing that the team judges difficult to sustain for next 12-24 hours, which resolves when flow wean is reversed
- **RRT considerations**: may restart HFNC without RRT, if within 24 hours of failed trial off, and if severity does not warrant RRT

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Respiratory Scoring Tool

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. Interrater reliability was validated (see asthma pathway for references).
- Other scoring tools have been validated, but no single tool has been adopted universally or has clearly superior performance in bronchiolitis.

Return to Criteria and Respiratory Score **Return to ED** **Return to Inpatient**

Treatment: Supplemental Oxygen

Supplemental oxygen should be provided if SpO2 falls persistently below 90%. The goal is to provide oxygen to maintain SpO2 at or above 90%. (AAP 2014)

- Oxygen is supplied via nasal cannula, using the lowest flow possible.
- SpO2 drops to 88% are acceptable during sleep.
- <20 sec drops in SpO2 to the 80s in the sleeping child do not require supplemental oxygen; these may occur in healthy infants. (Hunt 1999)
- Deeper self-resolving desaturations may not be clinically meaningful in mild-to-moderate bronchiolitis patients, who should therefore be taken off continuous pulse oximetry once off supplemental oxygen. (Principi 2016)

Return to ED

Treatment: NG or IV Fluids

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 with significant coughing, choking, gagging, or worsening tachypnea with feeds should be made NPO, and IV/NG feeds started.
  - Patients with a sustained respiratory rate > 60 should be evaluated for safety of a feeding trial. If severe distress, do not attempt feeding trial and make NPO.
  - Patients on HFNC at acute care maximum flow rates should be NPO.

Return to ED

Caregiver and Family Teaching

Teaching should start on arrival:

- Signs of respiratory distress
  - When to call PCP, go to ED, call 911
- How and when to nasally suction
  - Using bulb syringe or mouth operated nasal aspirator
- Maintaining hydration
  - Small frequent feeds
  - Signs of dehydration
- Anticipatory guidance:
  - Cough can last up to 4 weeks
  - Do not use over-the-counter cough/cold medications

Return to Inpatient

Prevention

RSV can persist on fomites for hours and has been identified in the air up to 22 feet from the patient's bed.

- Viral isolation is 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
  - Limit visits by young children
- Family education re: hand hygiene (AAP 2014)

- Consider RSV monoclonal antibody (i.e. monthly Synagis) for at-risk infants (AAP palivizumab policy statement 2014)

Source: AAP 2014, AAP Committee on Infectious Diseases 2014

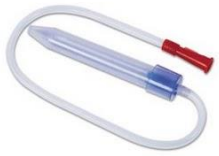
Return to Inpatient

Treatment: Suctioning

Suctioning is not widely evaluated in the literature, but is considered essential to bronchiolitis care.

- Used to clear secretions from the nares / airway that the child is unable to clear himself / herself.
- Induces coughing, which allows child to clear lower airway secretions.
- Reduces work of breathing and improves oral intake.
- Suction gaps may be associated with longer LOS
- Patients admitted with bronchiolitis should receive suction of the nares at frequent intervals

Mussman 2013, AAP 2014



Mouth-operated nasal aspirator
(To be used by caregiver only)

Nasopharyngeal (NP) suction catheter

Olive tip suction

Bulb suction

Suction should be primarily nasal:

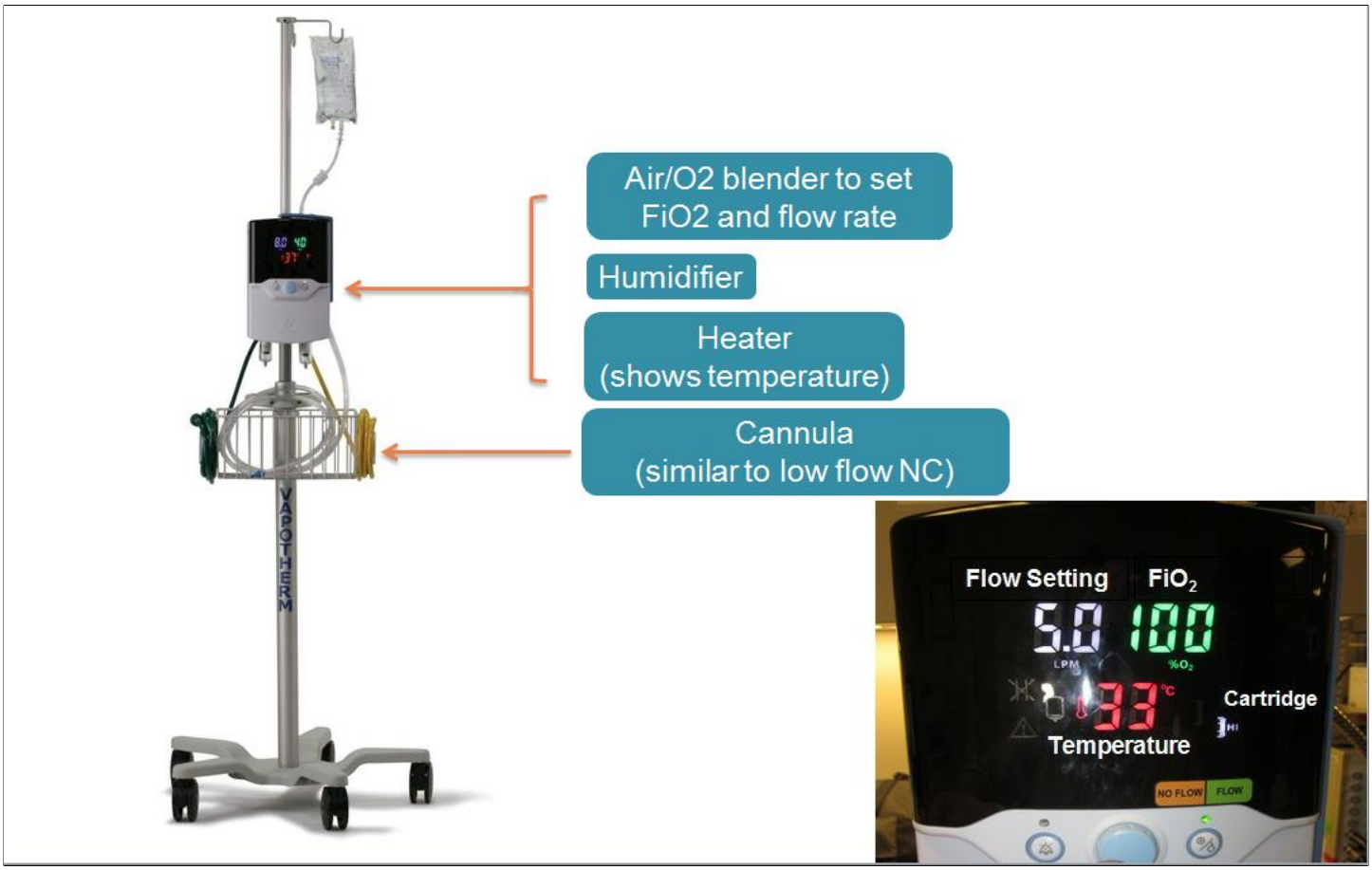
- **Nasal suction** (with an olive tip catheter, bulb, or parental mouth-operated nasal aspirator) should be used routinely, at regular intervals.
- **Nasopharyngeal suction** should be used in patients in severe respiratory distress and fail to improve with olive tip suction. Nasal edema may result from repeated nasopharyngeal suction events. Some articles suggest nasopharyngeal suction is associated with a longer LOS, and using it less often does not make outcomes worse (Mussman 2013, Mittal 2014).
- Suction response should be documented, with a respiratory score recorded before and after all types of suctioning.
- Family should be trained how/when to use nasal suction at home.

Return to Inpatient

Escalation Therapies: High Flow Nasal Cannula

- Terms: Also called high-flow, or high-humidity nasal cannula
- Function: HFNC delivers a higher flow of air or oxygen than nasal cannula. Gas is delivered with a mixer so FiO2 can be adjusted (21-100%), although actual delivered FiO2 does not reach 100%. By contrast, nasal cannula oxygen is not humidified and dries airways at higher flow rates.

- Proposed mechanisms of HFNC action in bronchiolitis:
  - Provides CO2 “washout” of respiratory physiologic dead space
  - Provides very low-level positive pressure that aids lung recruitment
    - Exact amount of PEEP varies based on:
      - Flows
      - Nasal cannula fit to nares
      - Whether mouth is open or closed
- Warmth and humidity
  - Keep secretions moist, improving mucociliary clearance
  - Inhibit bronchoconstriction reflexes triggered by cold and dry air



Return to ED Management **Return to Inpatient** **Return to HFNC**

To Table of Contents

Escalation Therapies: HFNC Weaning

HFNC should be weaned quickly in improving patients.

- FiO2 may be weaned by RN/RT
- Flow must be weaned by provider order
  - RN/RT should assess readiness to wean flow every 4 hours, and prompt team to wean if appropriate
  - Teams should wean flow at least daily, unless team holds due to anticipated trajectory or patient severity
  - Flow should be weaned stepwise, from acute care max to min to off.
  - Trials off: Flow can be weaned from max flow to off if appropriate

Return to HFNC

Escalation Therapies: Feeding Patients on HFNC

No strong evidence exists to guide feeding practices on HFNC.

Recommendations:

- Patients who wean to minimum acute care flow are eligible to resume oral feeds.
- Patients should only attempt oral feeding if clinically improving and if no known aspiration history
- First oral feeding should be supervised by an RN, SLP/OT, or provider
- Oral feeding should be stopped if associated with increased coughing, choking, or worsening respiratory distress.
- An NG tube should be placed and enteral feeds initiated for patients NPO for > 2 days.

Return to HFNC

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 (1/15/2014):** Changes to inclusion and exclusion criteria; changes to reflect medical hospitalist at ED 90 minute huddle; admit to medical hospitalist
- **Version 4.0 (2/5/2014):** Pathway document was divided into two documents and posted as Bronchiolitis Pathway and HFNC Pathway
- **Version 5.0 (10/1/2014):** 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 PC02 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 (1/30/2015):** 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 (11/4/2015):** 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
- **Version 9.0 (1/3/2017):** Process Improvement Change; optimization of secretion management, focusing on high-flow cannula use, and improving high-flow efficacy
- **Version 9.1 (2/27/17):** Title of first green box on HFNC Phase changed and grammar adjustment made in Inclusion Criteria
- **Version 10.0 (11/13/2017):** Removal of hospitalist involvement for HFNC initiation/huddle
- **Version 11.0 (12/14/2018):** Removal of respiratory score from admit criteria and change to “moderate to severe distress”
- **Version 12.0 (12/7/2020):** Periodic review go live with new formatting style and minor content changes: removal of respiratory score as an UC to ED transfer criterion, more stringent albuterol trial criteria, time range flexibility for inpatient suctioning for moderate and severe respiratory scores, addition of text to encourage NG over IV use, PRN PCP follow-up, and removal of antibiotic or steroid use as an exclusion criterion for HFNC use
- **Version 13.0 (3/22/2022):** Changed HFNC inclusion criteria from "severe respiratory distress or hypoxia" to "severe respiratory distress PLUS hypoxia" defined as <92% O2 saturation, added severe respiratory distress escalation algorithm

Approval & Citation

Approved by the CSW Bronchiolitis Pathway team for December 7, 2020, go-live

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Retrieval Website: https://www.seattlechildrens.org/pdf/bronchiolitis-pathway.pdf

Please cite as:
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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, Hultcrantz M et al. J Clin Epidemiol. 2017;87:4-13.):

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

Certainty of Evidence

✪✪✪✪ High: The authors have a lot of confidence that the true effect is similar to the estimated effect
✪✪✪○ Moderate: The authors believe that the true effect is probably close to the estimated effect
✪✪○○ Low: The true effect might be markedly different from the estimated effect
✪○○○ Very low: The true effect is probably markedly different from the estimated effect
Guideline: Recommendation is from a published guideline that used methodology deemed acceptable by the team
Expert Opinion: Based on available evidence that does not meet GRADE criteria (for example, case-control studies)

Bibliography

Literature Search Methods

For this update, we revised the search strategies in line with current Library practices. Literature searches were conducted in July 2020 to target synthesized literature on bronchiolitis for 2015 to current and limited to English. The search was executed in Ovid Medline, Embase, Cochrane Database of Systematic Review (CDSR), and Turning Research into Practice database (TRIP).

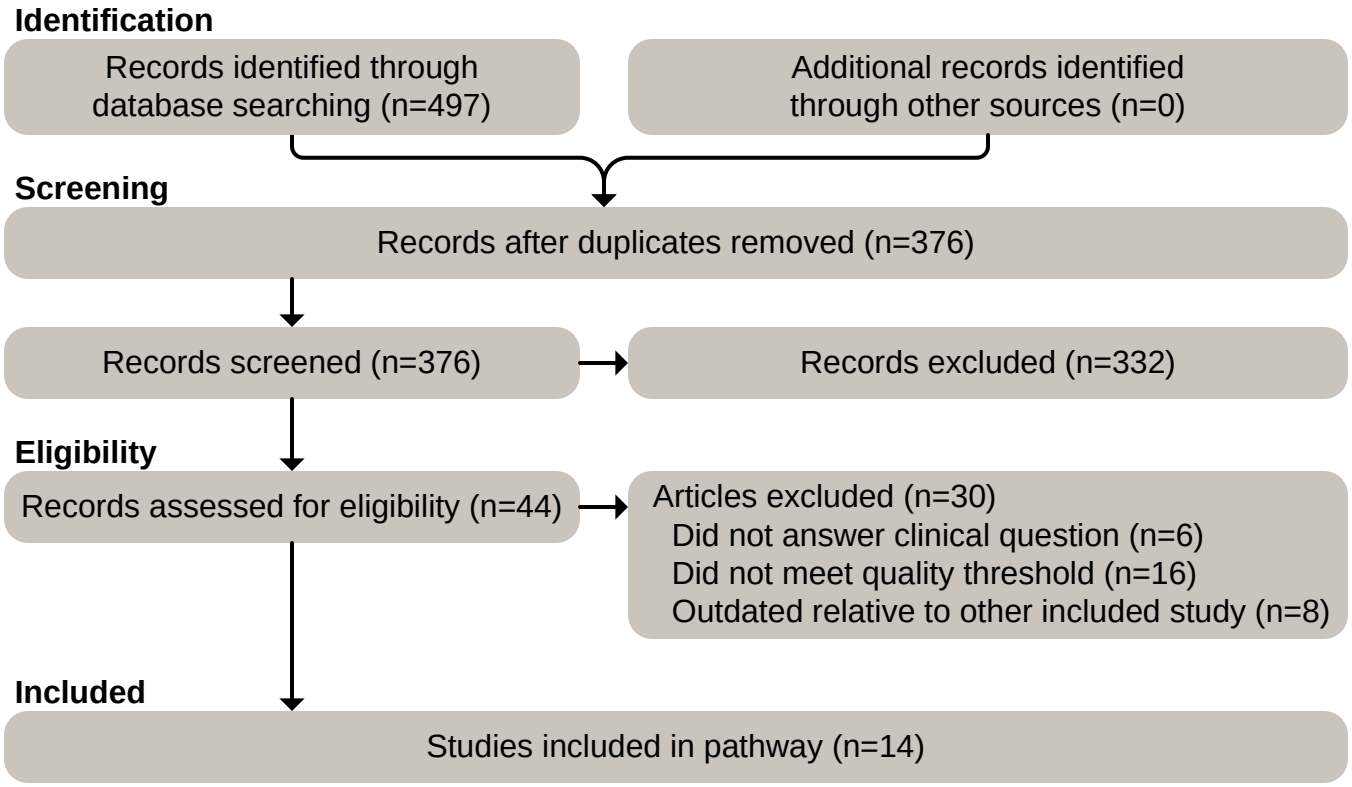
Screening and data extraction were completed using DistillerSR (Evidence Partners, Ottawa, Canada). Two reviewers independently screened abstracts and included guidelines and systematic reviews that addressed optimal diagnosis, treatment, and prognosis of patients who meet pathway inclusion/exclusion criteria. One reviewer screened full text and extracted data and a second reviewer quality checked the results. Differences were resolved by consensus.

Literature Search Results

The searches of the 4 databases (see Electronic searches) retrieved 497 records.

Once duplicates had been removed, we had a total of 376 records. We excluded 332 records based on titles and abstracts. We obtained the full text of the remaining 44 records and excluded 30.

We combined these studies with those previously identified for prior versions of this pathway, and for this update we have included a total 14 new studies. The flow diagram summarizes the study selection process.



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

Bibliography

Included Studies

Bronchiolitis in children: diagnosis and management. (2015). National Institute for Health and Clinical Excellence - Clinical Guidelines.

Bronchiolitis in Children. (2018). SA Health Paediatric Clinical Practice Guidelines.

Cai, Z., Lin, Y., & Liang, J. (2020). Efficacy of salbutamol in the treatment of infants with bronchiolitis: A meta-analysis of 13 studies. Medicine, 99(4), e18657. doi:https://dx.doi.org/10.1097/MD.0000000000018657

Gates, M., Shulhan-Kilroy, J., Featherstone, R., MacGregor, T., Scott, S. D., & Hartling, L. (2019). Parent experiences and information needs related to bronchiolitis: A mixed studies systematic review. Patient Education & Counseling, 102(5), 864-878. doi:https://dx.doi.org/10.1016/j.pec.2018.12.013

Guo, C., Sun, X., Wang, X., Guo, Q., & Chen, D. (2018). Network Meta-Analysis Comparing the Efficacy of Therapeutic Treatments for Bronchiolitis in Children. Jpen: Journal of Parenteral & Enteral Nutrition, 42(1), 186-195. doi:https://dx.doi.org/10.1002/jpen.1030

Heikkila, P., Mecklin, M., & Korppi, M. (2018). The cost-effectiveness of hypertonic saline inhalations for infant bronchiolitis: a decision analysis. World Journal of Pediatrics, 14(1), 26-34. doi:https://dx.doi.org/10.1007/s12519-017-0112-8

Heikkila, P., Renko, M., & Korppi, M. (2018). Hypertonic saline inhalations in bronchiolitis-A cumulative meta-analysis. Pediatric Pulmonology, 53(2), 233-242. doi:https://dx.doi.org/10.1002/ppul.23928

Lin, J., Zhang, Y., Xiong, L., Liu, S., Gong, C., & Dai, J. (2019). High-flow nasal cannula therapy for children with bronchiolitis: a systematic review and meta-analysis. Archives of Disease in Childhood, 104(6), 564-576. doi:https://dx.doi.org/10.1136/archdischild-2018-315846

Liu, F., Ouyang, J., Sharma, A. N., Liu, S., Yang, B., Xiong, W., & Xu, R. (2015). Leukotriene inhibitors for bronchiolitis in infants and young children. Cochrane Database of Systematic Reviews(3), CD010636. doi:https://dx.doi.org/10.1002/14651858.CD010636.pub2

O'Brien, S., Borland, M. L., Cotterell, E., Armstrong, D., Babl, F., Bauert, P., . . . Paediatric Research in Emergency Departments International Collaborative Network, A. (2019). Australasian bronchiolitis guideline. Journal of Paediatrics & Child Health, 55(1), 42-53. doi:https://dx.doi.org/10.1111/jpc.14104

O'Brien, S., Craig, S., Babl, F. E., Borland, M. L., Oakley, E., & Dalziel, S. R. (2019). 'Rational use of high-flow therapy in infants with bronchiolitis. What do the latest trials tell us?' A Paediatric Research in Emergency Departments International Collaborative perspective. Journal of Paediatrics and Child Health, 55(7), 746-752. doi:10.1111/jpc.14496

Roque i Figuls, M., Gine-Garriga, M., Granados Rugeles, C., Perrotta, C., & Vilaro, J. (2016). Chest physiotherapy for acute bronchiolitis in paediatric patients between 0 and 24 months old. Cochrane Database of Systematic Reviews, 2, CD004873. doi:https://dx.doi.org/10.1002/14651858.CD004873.pub5

Zhang, L., Gunther, C. B., Franco, O. S., & Klassen, T. P. (2018). Impact of hypertonic saline on hospitalization rate in infants with acute bronchiolitis: A meta-analysis. Pediatric Pulmonology, 53(8), 1089-1095. doi:https://dx.doi.org/10.1002/ppul.24066

Zhang, L., Mendoza-Sassi, R. A., Wainwright, C., & Klassen, T. P. (2017). Nebulised hypertonic saline solution for acute bronchiolitis in infants. Cochrane Database of Systematic Reviews, 12, CD006458. doi:https://dx.doi.org/10.1002/14651858.CD006458.pub4

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