Texas Children's Hospital

TEXAS CHILDREN'S HOSPITAL
EVIDENCE-BASED OUTCOMES CENTER
Bronchiolitis
Evidence-Based Guideline

Definition: Bronchiolitis is an acute inflammatory disease of the lower respiratory tract, resulting from obstruction of small airways. It is the most common lower respiratory infection in children 0-2 years in addition to being one of the most common diseases leading to hospitalization in infants less than one year of age, costing more than $700 million annually in the United States. [1,2]

Pathophysiology: Bronchiolitis causes acute inflammation, edema, and necrosis of epithelial cells lining the small airways, resulting in increased mucus production and bronchospasm. Infants and children aged 2-24 months are most likely to become infected. It occurs most frequently between December and March and is usually caused by a viral infection, with Respiratory Syncytial Virus (RSV) being the most common etiology. Other common viruses include parainfluenza, influenza, adenovirus, and human metapneumovirus. [1,2]

Inclusion Criteria [1]
- Age 0-2 years with respiratory symptoms

Exclusion Criteria [1-3]
- Asthma, cystic fibrosis, bronchopulmonary dysplasia, or other chronic respiratory disease
- Recurrent wheezing
- Immunodeficiency
- Serious bacterial infection, shock, or toxic appearance
- Neuromuscular disease
- Artificial airway
- Cyanotic heart disease

Differential Diagnosis
Community-acquired pneumonia
Foreign body aspiration
Trauma/Tumors
Gastroesophageal reflux
Congenital malformations
Congenital heart disease

Diagnostic Evaluation: A clinical history and physical examination is sufficient to diagnose bronchiolitis. Infants present with symptoms of a common cold (i.e., runny nose and mild cough). Over the next few days, the cough worsens. A fever, difficulty breathing, and wheezing may develop. Symptoms, especially coughing and wheezing, can persist for 3-4 weeks, although they gradually improve during that time period. [2]

History: Assess for [1,2]
- Upper Respiratory Illness (URI) with rhinorrhea
- Exposure to viral URI
- Poor fluid intake (e.g., inability to suck)
- Fever
- Personal or family history of allergy, asthma, or atopy
- Prior beta-agonist utilization
- Previous wheezing
- Passive exposure to smoking

Physical Examination
- Observe for rhinitis, tachypnea, cough, nasal flaring, shortness of breath, grunting, skin color changes, wheezing, and fever
- Obtain Clinical Respiratory Score (CRS) after nasopharyngeal suction. The CRS includes assessment of: respiratory rates, auscultation, use of accessory muscles, mental status, SpO_2, and color (see below).

Clinical Respiratory Score (CRS)			
Assess	**Score 0**	**Score 1**	**Score 2**
Respiratory Rate	<2 mos: <50 2-12 mos: <40 1-5 yrs: <30 >5 yrs: <20	<2 mos: 50-60 2-12 mos: 40-50 >1-5 yrs: 30-40 >5 yrs: 20-30	<2 mos: >60 2-12 mos: >50 >1-5 yrs: >40 >5 yrs: >30
Auscultation	Good air movement, scattered expiratory wheezing, loose rales/crackles	Depressed air movement, inspiratory and expiratory wheezes or rales/crackles	Diminished or absent breath sounds, severe wheezing, or rales/crackles, or marked prolonged expiration
Use of Accessory Muscles	Mild to no use of accessory muscles, mild to no retractions, no nasal flaring on inspiration	Moderate intercostal retractions, mild to moderate use of accessory muscles, nasal flaring	Severe intercostal and substernal retractions, nasal flaring
Mental Status	Normal to mildly irritable	Irritable, agitated, restless	Lethargic
Room Air SpO_2	>95%	90-95%	<90%
Color	Normal	Pale to normal	Cyanotic, dusky

(Add score from all rows to calculate total CRS score)

Critical Points of Evidence*

Evidence Supports

- History and physical should be the basis for diagnosis. [1-3] – Strong recommendation, low quality evidence
- Consider a trial dose of 0.5 mL of nebulized epinephrine to rapidly deteriorating patients only. If no effect noted from the trial dose, discontinue nebulized epinephrine. [1-14] – Weak recommendation, moderate quality evidence
- Obtain a Clinical Respiratory Score (CRS) to identify the severity of diagnosis. Pulse oximetry should be used as part of the CRS. [15-19] – Strong recommendation, low quality evidence
- Consider high flow nasal cannula therapy for patients with a CRS ≥7. If the patient is rapidly deteriorating and/or cannot maintain oxygen saturation levels ≥90% while awake and ≥88% while sleeping on 2 LPM of low-flow oxygen, consider high flow nasal cannula therapy. [20-23] – Weak recommendation, low quality evidence
  Remarks: For patients ≤2 years of age, the limitation for HFNC in acute care is 2 L/kg/min. At 2 L/kg/min consider Watcher's List/RRT. Consider Watcher's List/RRT if FiO2 is trending up, no ability to wean, or rapidly escalating.
- Consider a trial dose of albuterol only if there is a suspicion of asthma (based on historical and prior beta-agonist utilization risk factors). [1,2,7-14] – Weak recommendation, moderate quality evidence
- If patient requires supplemental oxygen, monitoring should be followed based on the oxygen weaning protocol. [1-3,24-26] – Weak recommendation, low quality evidence
- Consider withholding feedings if severe intercostal and substernal retractions, nasal flaring, and respiratory rate >60-70. [1,27-29] – Weak recommendation, very low quality evidence
- Consider NG feeding for the following patients: unable to maintain hydration orally, age 2-12 months, CRS <5, not receiving high flow oxygen, not on BiPAP or CPAP, no craniofacial abnormalities precluding NG placement. [1,4-6,30-37] – Weak recommendation, very low quality evidence
- Admit the patient if: oxygen saturation consistently <90% while awake and <88% while sleeping, CRS ≥5, patient requires continuous clinical assessment of airway clearance and maintenance using suctioning, patient is unable to maintain oral feedings at a level to prevent dehydration, or it is unsafe to send the patient home/poor follow-up. [38] – Strong recommendation, low quality evidence
- Discharge the patient when the following criteria are met: room air, oral feedings tolerated at a level to maintain hydration, parents can demonstrate clearance of the patient's airway using a nasal suction device, PCP follow-up appointment scheduled within 5 days, and parent discharge teaching completed. [39-41] – Strong recommendation, low quality evidence
- Provide supplemental oxygen for previously healthy hospitalized patients with bronchiolitis based on the SpO_2 values below. Brief desaturations (<20 seconds) are acceptable.[1,42-51] – Strong recommendation, low quality evidence
  - Persistent (>20 seconds) SpO_2 below 90% while awake
  - Persistent (>20 seconds) SpO_2 below 88% while sleeping

  Remarks: The guideline development team is aware that pulse oximetry may be overestimated in patients with darker skin tone. There is ongoing research at Texas Children's Hospital to explore this topic. Guidelines will be updated as new research is published.
- Intermittent pulse oximetry may be utilized in previously healthy hospitalized patients that have been stabilized off oxygen. [1,52-55] – Weak recommendation, low quality evidence

Evidence Against

- Do not routinely administer antibiotics unless evidence of a bacterial infection. [2,3,56-59] – Strong recommendation, moderate quality evidence
- Do not routinely administer bronchodilators. [1,2, 7-14] – Strong recommendation, moderate quality evidence
- Do not use chest physiotherapy. [1-3,60,61] – Strong recommendation, high quality evidence
- Do not routinely administer systemic or inhaled corticosteroids. [1-3,12,62-68] – Strong recommendation, moderate quality evidence
- Do not use anticholinergic drugs. [69] – Strong recommendation, moderate quality evidence
- Do not routinely administer hypertonic saline. [1,4-6,70-76] – Weak recommendation, moderate quality evidence
- Do not use high flow nasal cannula therapy for patients with a CRS <7 unless the patient is rapidly deteriorating and/or hypoxemic requiring ≥2 LPM of low-flow oxygen to maintain oxygen saturation levels ≥90% while awake or ≥88% while sleeping. [20-23] – Weak recommendation, low quality evidence
- Do not perform laboratory tests for diagnosis. [1,3,77-80] – Strong recommendation, low quality evidence
- Do not use ribavirin. [81] – Weak recommendation, moderate quality evidence
- Do not obtain a chest x-ray for diagnosis. [1,3,77,82] – Strong recommendation, low quality evidence

Evidence Lacking/Inconclusive

- Work-up and treatment for infants <28 days with fever should be based on clinical judgment. [83-85] – Consensus recommendation
- There is insufficient evidence to address the following topic: safety of discharging patients home with oxygen. [86-90]
- There is no definitive recommendation on whether pulse oximeters systematically overestimate oxygen saturation in patients with darker skin tones and the impact on clinical outcomes. [91-98] – Evidence Lacking
  Remarks: Recent studies concluded that overestimation of saturation by pulse oximetry may be associated with darker skin tones[97]; however, there is a paucity of pediatric evidence on the clinical impact of this occurrence. The studies reviewed for this topic have significant limitations due to the methodological procedures. There is ongoing research at Texas Children's Hospital to explore this topic. Guidelines will be updated as new research is published.

*NOTE: The references cited represent the entire body of evidence reviewed to make each recommendation.

Condition-Specific Elements of Clinical Management

Treatment Recommendations

- Nasopharyngeal suctioning [2,3]
  - As needed for upper airway obstruction
  - Prior to feeding
  - During assessment
  - Pre- and post-suctioning respiratory assessment

Admission Criteria [2,39]

- Oxygen saturation consistently <90% while awake and <88% while sleeping
- CRS ≥5
- Patient requires continuous clinical assessment of airway clearance and maintenance using suctioning
- Patient is unable to maintain oral feedings at a level to prevent dehydration
- Unsafe to send home/poor follow-up

Discharge Criteria [2,3,39-41]

- Room air
- Oral feedings tolerated at a level to maintain hydration
- Parents can demonstrate he/she can clear the patient's airway using a nasal suction device
- Parent discharge teaching completed on:
  - Signs and symptoms of concern (e.g., wheezing, difficulty breathing, difficulty feeding, cough, fever)
  - Proper use of nasal suction device (bulb syringe or other commercial products) to aspirate the infant's nose
  - Proper handwashing techniques
  - Discharge care
  - Risks of passive smoking exposure

Follow-Up Care

Primary care physician follow-up appointment scheduled within 5 days

Prevent Transmission [1-3]

Transmission occurs by direct inoculation of contagious secretions from hands or from large-particle aerosols in the eyes and nose.

- Place patient on contact isolation
- Adhere to strict handwashing guidelines

Parent Teaching [1-3]

- Stress importance of strict handwashing
- Teach parents to use nasal suction device (bulb syringe or other commercial product) to aspirate the infant's nose
- Emphasize that infants should NOT be exposed to passive smoking; explore options for parents to quit smoking
- Encourage breastfeeding

Balanced Scorecard Measures

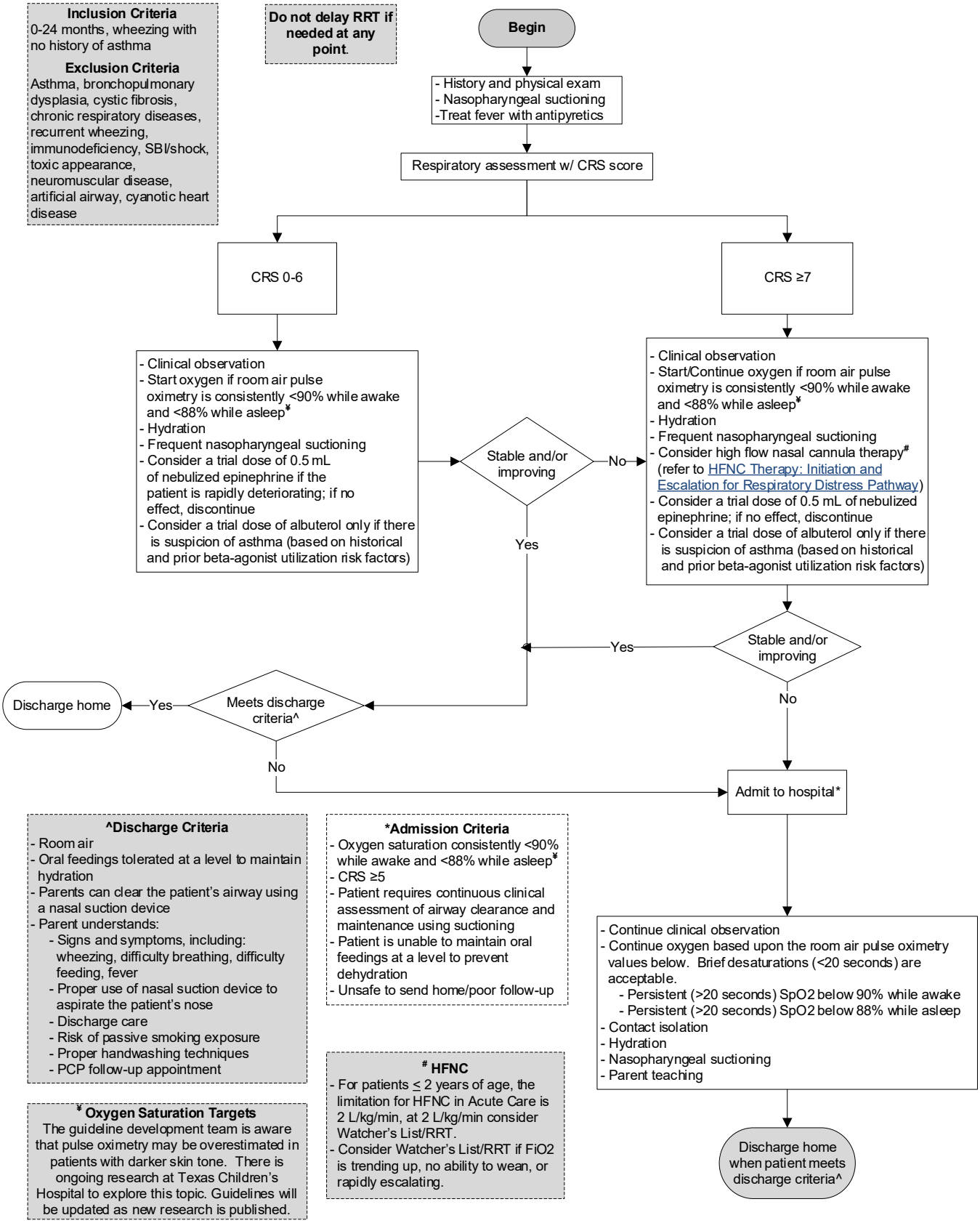
Process

- Order set utilization
- Routine testing (i.e., viral testing, chest x-rays)
- Use of non-evidence-based medications (i.e., use of oral and inhaled steroids, repeated doses of a beta-agonist, antibiotics)

Outcome

- Mean time on oxygen
- Percentage of patients who have an RRT within X hours of admission
- Percentage of patients with a change in level of care within X hours of arrival to unit
- Length of stay
- Readmission rate

TCH Evidence-Based Outcomes Center
Clinical Algorithm for Bronchiolitis



Clinical standards are developed for 80% of the patient population with a particular disease. Each practitioner must use his/her clinical judgment in the management of any specific patient.

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Clinical Standards Preparation

This clinical standard was prepared by the Evidence-Based Outcomes Center (EBOC) team in collaboration with content experts at Texas Children's Hospital. Development of this clinical standard supports the TCH Quality and Patient Safety Program initiative to promote clinical standards and outcomes that build a culture of quality and safety within the organization.

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Development Process

This clinical standard was developed using the process outlined in the EBOC Manual. The literature appraisal documents the following steps:

1. Review Preparation
   - PICO questions established
   - Evidence search confirmed with content experts

2. Review of Existing External Guidelines
   - American Academy of Pediatrics Diagnosis and Management of Bronchiolitis (2014), National Institute for Health and Clinical Excellence Bronchiolitis in Children: Diagnosis and Management (2015), Children's Hospital/Kaiser/Denver Health Bronchiolitis (2006), Cincinnati Children's Hospital Bronchiolitis (2010), Children's Hospital of Philadelphia Bronchiolitis (2024), Seattle Children's Hospital Bronchiolitis (2024), Dell Children's Hospital Bronchiolitis (2017), Canadian Paediatric Society (2021), American Association of Respiratory Care (2021)

3. Literature Review of Relevant Evidence
   - Searched: PubMed, CINAHL, SUM search, Google Scholar

4. Critically Analyze the Evidence
   - 24 systematic reviews/meta-analyses, 24 randomized controlled trials, and 41 nonrandomized studies

5. Summarize the Evidence
   - Materials used in the development of the clinical standard, literature appraisal, and any order sets are maintained in a bronchiolitis evidence-based review manual within EBOC.

Evaluating the Quality of the Evidence

Published clinical guidelines were evaluated for this review using the **AGREE II** criteria. The summary of these guidelines are included in the literature appraisal. AGREE II criteria evaluate Guideline Scope and Purpose, Stakeholder Involvement, Rigor of Development, Clarity and Presentation, Applicability, and Editorial Independence using a 4-point Likert scale. The higher the score, the more comprehensive the guideline.
This clinical standard specifically summarizes the evidence *in support of* or *against* specific interventions and identifies where evidence is *lacking/inconclusive*. The following categories describe how research findings provide support for treatment interventions.
"Evidence Supports" provides evidence to support an intervention
"Evidence Against" provides evidence against an intervention.
"Evidence Lacking/Inconclusive" indicates there is insufficient evidence to support or refute an intervention and no conclusion can be drawn *from the evidence.*
The **GRADE** criteria were utilized to evaluate the body of evidence used to make practice recommendations. The table below defines how the quality of the evidence is rated and how a strong versus weak recommendation is established. The literature appraisal reflects the critical points of evidence.

Recommendation	
STRONG	Desirable effects clearly outweigh undesirable effects or vice versa
WEAK	Desirable effects closely balanced with undesirable effects
Quality	**Type of Evidence**
High	Consistent evidence from well-performed RCTs or exceptionally strong evidence from unbiased observational studies
Moderate	Evidence from RCTs with important limitations (e.g., inconsistent results, methodological flaws, indirect evidence, or imprecise results) or unusually strong evidence from unbiased observational studies
Low	Evidence for at least 1 critical outcome from observational studies, RCTs with serious flaws or indirect evidence
Very Low	Evidence for at least 1 critical outcome from unsystematic clinical observations or very indirect evidence

Recommendations

Practice recommendations were directed by the existing evidence and consensus amongst the content experts. Patient and family preferences were included when possible. The Content Expert Team and EBOC team remain aware of the controversies in the management of bronchiolitis in children. When evidence is lacking, options in care are provided in the clinical standard and the accompanying order sets (if applicable).

Approval Process

Clinical standards are reviewed and approved by hospital committees as deemed appropriate for its intended use. Clinical standards are reviewed as necessary within EBOC at Texas Children's Hospital. Content Expert Teams are involved with every review and update.

Disclaimer

Practice recommendations are based upon the evidence available at the time the clinical standard was developed. Clinical standards (guidelines, summaries, or pathways) do not set out the standard of care and are not intended to be used to dictate a course of care. Each physician/practitioner should use his or her independent judgment in the management of any specific patient and is responsible, in consultation with the patient and/or the patient's family, to make the ultimate judgment regarding care.

Version History

Date	Comments
Dec 2008	Originally completed
Jan 2010	Updated
Mar 2014	Updated
Jul 2016	Minor revisions
Feb 2017	Algorithm edits
Feb 2018	Changed hypertonic saline recommendation and CRS cutoff for HFNC therapy; added option for feedings via NG tube
Oct 2021	Reaffirmed
Dec 2023	Minor Algorithm Edit
Mar 2025	RAM Cannula Changes
Aug 2025	Pulse Oximetry Recommendation Changes
Dec 2025	Pulse Oximetry Target Revisions