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)

©2026 Texas Children's Hospital

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 ≥88% 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 <88%, 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 with persistent SpO2 <88%. Brief desaturations (<20 seconds) are acceptable.[1,42-54] – Strong recommendation, low quality evidence
  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. [1,55-58] – Weak recommendation, low quality evidence

Evidence Against

- Do not routinely administer antibiotics unless evidence of a bacterial infection. [2,3,59-62] – Strong recommendation, moderate quality evidence
- Do not routinely administer bronchodilators. [1,2, 7-14] – Strong recommendation, moderate quality evidence
- Do not use chest physiotherapy. [1-3,63,64] – Strong recommendation, high quality evidence
- Do not routinely administer systemic or inhaled corticosteroids. [1-3,12,65-71] – Strong recommendation, moderate quality evidence
- Do not use anticholinergic drugs. [72] – Strong recommendation, moderate quality evidence
- Do not routinely administer hypertonic saline. [1,4-6,73-79] – 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 ≥88%. [20-23] – Weak recommendation, low quality evidence
- Do not perform laboratory tests for diagnosis. [1,3,80-83] – Strong recommendation, low quality evidence
- Do not obtain a chest x-ray for diagnosis. [1,3,80,84] – Strong recommendation, low quality evidence

Evidence Lacking/Inconclusive

- Work-up and treatment for infants <28 days with fever should be based on clinical judgment. [85-87] – Consensus recommendation
- 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. [88-95] – Evidence Lacking
  Remarks: Recent studies concluded that overestimation of saturation by pulse oximetry may be associated with darker skin tones[94]; 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.

©2026 Texas Children's Hospital

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 <88%
- 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 as needed. If follow up required, appointment should occur 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

Outcome

- Rate of patients on HFNC use
- Length of stay
- Hospital readmissions within 15 and 30 days

Process

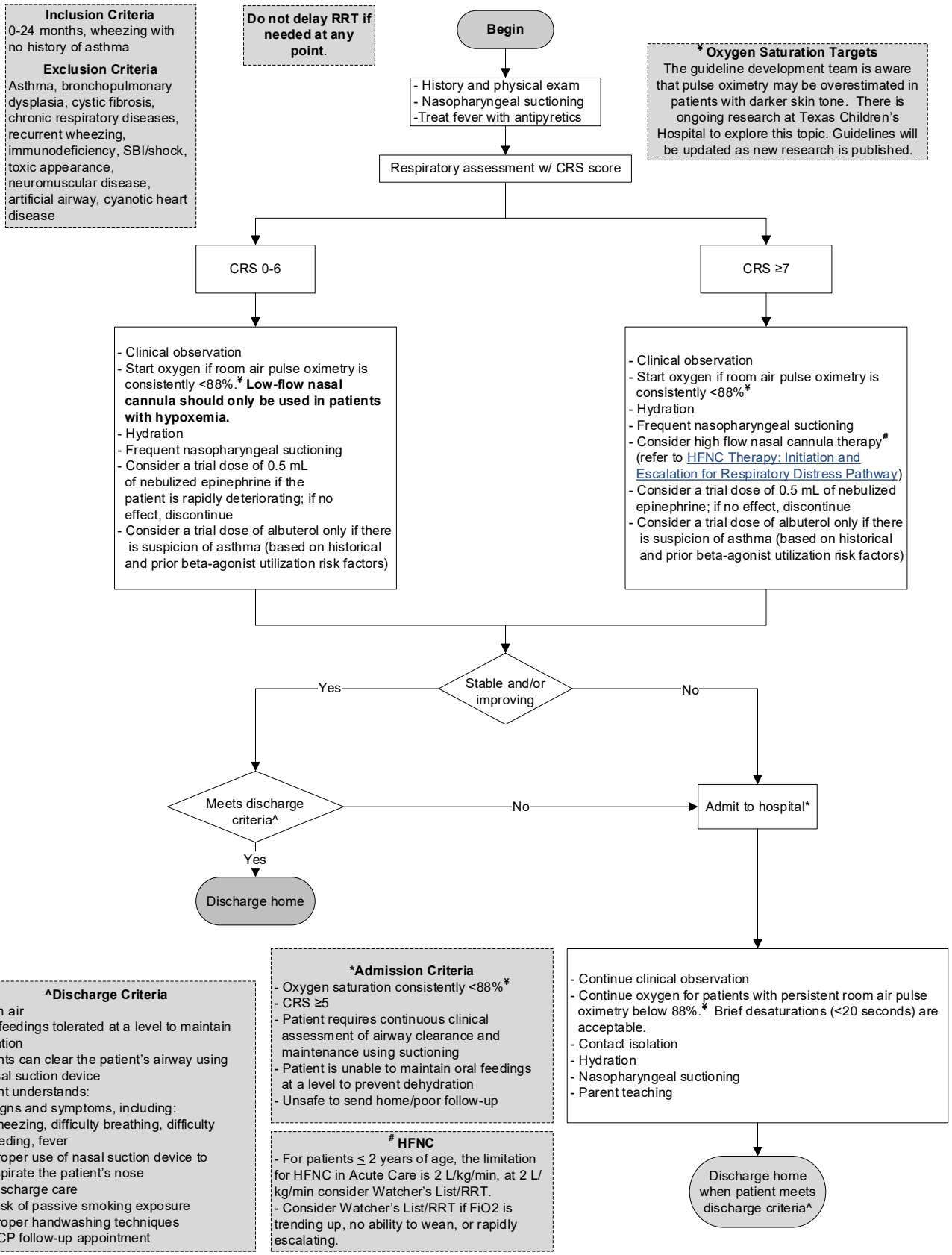
- Percentage of patients who had HFNC initiated with a CRS>7
- Inpatient order set utilization
- Percentage of patients started on appropriate settings of HFNC
- Mean time on oxygen
- Rate of viral testing in patients admitted to acute care
- Rate of chest x-ray testing in patients admitted to acute care
- Rate of beta-agonist and steroid use in patients admitted to acute care

Outcome

- Intubation rates
- Percent of initial admissions to ICU
- Patients with an escalation of care (RRT/REACT events)
- EC length of stay
- Rate of non-invasive positive pressure ventilation (CPAP, BiPAP) initiation from EC

©2026 Texas Children's Hospital

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.

©2026 Texas Children's Hospital

References

1. American Academy of Pediatrics Subcommittee on Diagnosis and Management of Bronchiolitis. (2014). Diagnosis and management of bronchiolitis. *Pediatrics, 134*(5), e1474-e1502.
2. Cincinnati Children's Hospital. (2010). Evidence based clinical practice guideline for medical management of bronchiolitis in infants 1 year of age or less presenting with a first time episode.
3. Bronchiolitis clinical care guideline. December 2006. Children's Hospital/Kaiser/Denver Health. http://Planettch.policies/general/index.cfm?CategoryID=9.
4. Children's Hospital of Philadelphia. (2016). Bronchiolitis. https://www.chop.edu/clinical-pathway/bronchiolitis-emergent-evaluation-clinical-pathway
5. Seattle Children's Hospital (2017). Bronchiolitis. https://www.seattlechildrens.org/globalassets/documents/healthcare-professionals/clinical-standard-work/bronchiolitis-pathway.pdf
6. Dell Children's Hospital (2017). Bronchiolitis. https://healthcare.ascension.org/-/media/project/ascension/healthcare/markets/texas/dell-childrens/documents/evidence-based-outcome-center/bronchiolitis/bronchiolitis-clinical-pathway.pdf
7. Conway, E., Schoettker, P. J., Moore, A., Britto, M. T., Kotagal, U. R., & Rich, K. (2004). Empowering respiratory therapists to take a more active role in delivering quality care for infants with bronchiolitis. *Respiratory Care, 49*(6), 589-599.
8. Flores, G., & Horwitz, R. I. (1997). Efficacy of beta2-agonists in bronchiolitis: A reappraisal and meta-analysis. *Pediatrics, 100*(2 Pt 1), 233-239.
9. Gadomski, A. M., & Bhasale, A. L. (2006). Bronchodilators for bronchiolitis. *Cochrane Database of Systematic Reviews*(3), CD001266.
10. Hartling, L., Wiebe, N., Russell, K., Patel, H., & Klassen, T. P. (2003). A meta-analysis of randomized controlled trials evaluating the efficacy of epinephrine for the treatment of acute viral bronchiolitis. *Archives of Pediatrics and Adolescent Medicine, 157*(10), 957-964.
11. Hartling, L., Wiebe, N., Russell, K., Patel, H., & Klassen, T. P. (2004). Epinephrine for bronchiolitis. *Cochrane Database of Systematic Reviews*(1), CD003123.
12. Hartling, L., Fernandes, R. M., Bialy, L., Milne, A., Johnson, D., Plint, A., et al. (2011). Steroids and bronchodilators for acute bronchiolitis in the first two years of life: Systematic review and meta-analysis. *BMJ, 342*, d1714.
13. Skjerven, H. O., Hunderi, J. O., Brugmann-Pieper, S. K., Brun, A. C., Engen, H., Eskedal, L., et al. (2013). Racemic adrenaline and inhalation strategies in acute bronchiolitis. *New England Journal of Medicine, 368*(24), 2286-2293.
14. Wainwright, C., Altamirano, L., Cheney, M., Cheney, J., Barber, S., Price, D., et al. (2003). A multicenter, randomized, double-blind, controlled trial of nebulized epinephrine in infants with acute bronchiolitis. *New England Journal of Medicine, 349*(1), 27-35
15. Corneli, H. M., Zorc, J. J., Holubkov, R., Bregstein, J. S., Brown, K. M., Mahajan, P., & Kuppermann, N. (2012). Bronchiolitis: Clinical characteristics associated with hospitalization and length of stay. *Pediatric Emergency Care, 28*(2), 99-103.
16. Mallory, M. D., Shay, D. K., Garrett, J., & Bordley, W. C. (2003). Bronchiolitis management preferences and the influence of pulse oximetry and respiratory rate on the decision to admit. *Pediatrics, 111*(1), e45-51.
17. Marlais, M., Evans, J., & Abrahamson, E. (2011). Clinical predictors of admission in infants with acute bronchiolitis. *Archives of Disease in Childhood, 96*(7), 648-652.
18. Destino, L., Weisgerber, M. C., Soung, P., Bakalarski, D., Yan, K., Rehborg, R., et al. (2012). Validity of respiratory scores in bronchiolitis. *Hospital Pediatrics, 2*(4), 202-209.
19. Rodl, S., Resch, B., Hofer, N., Marschitz, I., Madler, G., Eber, E., & Zobel, G. (2012). Prospective evaluation of clinical scoring systems in infants with bronchiolitis admitted to the intensive care unit. *European Journal of Clinical Microbiology & Infectious Diseases, 31*(10), 2667-2672.
20. Abboud, P. A., Roth, P. J., Skiles, C. L., Stolfi, A., & Rowin, M. E. (2012). Predictors of failure in infants with viral bronchiolitis treated with high-flow, high-humidity nasal cannula therapy*. *Pediatric Critical Care Medicine, 13*(6), e343-e349.
21. Kelly, G. S., Simon, H. K., & Sturm, J. J. (2013). High-flow nasal cannula use in children with respiratory distress in the emergency department: Predicting the need for subsequent intubation. *Pediatric Emergency Care, 29*(8), 888-892.
22. McKiernan, C., Chua, L. C., Visintainer, P. F., & Allen, H. (2010). High flow nasal cannulae therapy in infants with bronchiolitis. *Journal of Pediatrics, 156*(4), 634-638.
23. Schibler, A., Pham, T. M., Dunster, K. R., Foster, K., Barlow, A., Gibbons, K., & Hough, J. L. (2011). Reduced intubation rates for infants after introduction of high-flow nasal prong oxygen delivery. *Intensive Care Medicine, 37*(5), 847-852.
24. Ralston, S., & Hill, V. (2009). Incidence of apnea in infants hospitalized with respiratory syncytial virus bronchiolitis: A systematic review. *Journal of Pediatrics, 155*(5), 728-733.
25. Schroeder, A. R., Marmor, A. K., Pantell, R. H., & Newman, T. B. (2004). Impact of pulse oximetry and oxygen therapy on length of stay in bronchiolitis hospitalizations. *Archives of Pediatrics and Adolescent Medicine, 158*(6), 527-530.
26. Unger, S., & Cunningham, S. (2008). Effect of oxygen supplementation on length of stay for infants hospitalized with acute viral bronchiolitis. *Pediatrics, 121*(3), 470-475.
27. Corrard, F., de La Rocque, F., Martin, E., Wollner, C., Elbez, A., Koskas, M., et al. (2013). Food intake during the previous 24 h as a percentage of usual intake: A marker of hypoxia in infants with bronchiolitis: An observational, prospective, multicenter study. *BMC Pediatrics, 13*, 6.
28. Khoshoo, V., & Edell, D. (1999). Previously healthy infants may have increased risk of aspiration during respiratory syncytial viral bronchiolitis. *Pediatrics, 104*(6), 1389-1390.
29. Khoshoo, V., Ross, G., Kelly, B., Edell, D., & Brown, S. (2001). Benefits of thickened feeds in previously healthy infants with respiratory syncytial viral bronchiolitis. *Pediatric Pulmonology, 31*(4), 301-302.
30. de Betue, C. T., van Waardenburg, D. A., Deutz, N. E., van Eijk, H. M., van Goudoever, J. B., Luiking, Y. C., et al. (2011). Increased protein-energy intake promotes anabolism in critically ill infants with viral bronchiolitis: A double-blind randomised controlled trial. *Archives of Disease in Childhood, 96*(9), 817-822.
31. Halvorson, E. E., Chandler, N., Neiberg, R., & Ervin, S. E. (2013). Association of NPO status and type of nutritional support on weight and length of stay in infants hospitalized with bronchiolitis. *Hospital Pediatrics, 3*(4), 366-370.
32. Kugelman, A., Raibin, K., Dabbah, H., Chistyakov, I., Srugo, I., et.al. Riskin, A. (2013). Intravenous fluids versus gastric-tube feeding in hospitalized infants with viral bronchiolitis: A randomized, prospective pilot study. *Journal of Pediatrics, 162*(3), 640-642 e641.
33. Oakley, E., Borland, M., Neutze, J., Acworth, J., Krieser, D., Dalziel, S., et al. (2013). Nasogastric hydration versus intravenous hydration for infants with bronchiolitis: A randomised trial. *Lancet Respiratory Medicine, 1*(2), 113-120.
34. Oakley, E., Bata, S., Rengasamy, S., Krieser, D., Cheek, J., Jachno, K., & Babl, F. E. (2016). Nasogastric hydration in infants with bronchiolitis less than 2 months of age. *Journal of Pediatrics, 178*, 241-245 e241.
35. Sammartino, L., James, D., Goutzamanis, J., & Lines, D. (2002). Nasogastric rehydration does have a role in acute paediatric bronchiolitis. *Journal of Paediatrics and Child Health, 38*(3), 321-322.
36. Srinivasan, M., Pruitt, C., Casey, E., Dhaliwal, K., DeSanto, C., Markus, R., & Rosen, A. (2017). Quality improvement initiative to increase the use of nasogastric hydration in infants with bronchiolitis. *Hospital Pediatrics, 7*(8), 436-443.
37. National Institute for Health and Clinical Excellence. (2015). Bronchiolitis in children: Diagnosis and management. https://www.ncbi.nlm.nih.gov/books/NBK573086/

©2026 Texas Children's Hospital

38. Yusuf, S., Caviness, A. C., & Adekunle-Ojo, A. O. (2012). Risk factors for admission in children with bronchiolitis from pediatric emergency department observation unit. *Pediatric Emergency Care, 28*(11), 1132-1135.
39. Cunningham, S., & McMurray, A. (2012). Observational study of two oxygen saturation targets for discharge in bronchiolitis. *Archives of Disease in Childhood, 97*(4), 361-363.
40. Mansbach, J. M., Clark, S., Christopher, N. C., LoVecchio, F., Kunz, S., Acholonu, U., & Camargo, C. A., Jr. (2008). Prospective multicenter study of bronchiolitis: Predicting safe discharges from the emergency department. *Pediatrics, 121*(4), 680-688.
41. Sandweiss, D. R., Corneli, H. M., & Kadish, H. A. (2010). Barriers to discharge from a 24-hour observation unit for children with bronchiolitis. *Pediatric Emergency Care, 26*(12), 892-896.
42. Briggs, S., Gupta, V., Thakkar, N., Librizzi, J., Temkit, H., & Engel, R. (2023). Decreasing goal oxygen saturations in bronchiolitis is associated with decreased length of stay. *Hospital Pediatrics, 13*(8), 688 – 693.
43. Im, J., Wahi, G., Giglia, L., Bayliss, A., Kanani, R., et al. (2024). Oxygen saturation targets in infants hospitalized with bronchiolitis: A multicenter cohort study. *Hospital Pediatrics, 14*(2), 67-74.
44. Principi, T., Coates, A., Parkin, P., Stephens, D., DaSilva, Z., & Schuh, S. (2016). Effect of oxygen desaturations on subsequent medical visits in infants discharged from the emergency department with bronchiolitis. *JAMA Pediatrics, 170*(6), 602-608.
45. Peters, M., Gould, D., Ray, S., Thomas, K., Chang, I., et al. (2024). Conservative versus liberal oxygenation targets in critically ill children (Oxy-PICU): a UK multicentre, open, parallel-group, randomized clinical trial. *Lancet, 403*, 355-364.
46. Peters, M., Jones, G., Wiley, D., Wulff, J., Ramnarayan, P., Ray, S., et al. (2018). Conservative versus liberal oxygenation targets in critically ill children: The randomized multiple-centre pilot Oxy-PICU trial. *Intensive Care Medical, 44*, 1240-1248.
47. Barrott, L., Asfar, P., Mauny, F., Winiszewski, H., Montini, F., et al. (2020). Liberal or conservative oxygen therapy for acute respiratory distress syndrome. *The New England Journal of Medicine, 382*(11), 999-1008.
48. Li, X., Liu, D., Liu, C., Mao, Z., Liu, Y., et al. (2021). Conservative or liberal oxygen therapy in relation to all-cause mortality among patients in the intensive care unit: A systematic review of randomized controlled trials with meta-analysis and trial sequential analysis. *Medicina Intensiva, 47*(2), 73-83.
49. Nishimoto, K., Umegaki, T., Ohira, S., Soeda, T., Anada, N., et al. (2021). Impact of permissive hypoxia and hyperoxia avoidance on clinical outcomes in septic patients receiving mechanical ventilation: A retrospective single-center study. *BioMed Research International*, 7332027.
50. Panwar, R., Hardie, M., Bellomo, R., Barrot, L., Eastwood, G., et al. (2016). Conservative versus liberal oxygenation targets for mechanically ventilated patients: A pilot multicenter randomized controlled trial. *American Journal of Respiratory and Critical Care Medicine, 193*(1), 43-51.
51. Zhao, X., Xiao, H., Dai, F., Brodie, D., & Meng, L. (2021). Classification and effectiveness of different oxygenation goals in mechanically ventilated critically ill patients: Network meta-analysis of randomised controlled trials. *European Respiratory Journal, 58*, 2002928.
52. Louman, S., Stralen, K., Koppelman, G., Vaessen-Verberne, A., Bekhof, J., et al. (2026). Oxygen saturation thresholds in children with acute respiratory distress (OxyKids): A multicentre, open parallel-group, randomised clinical trial. The Lancet Respiratory Medicine, 12 May 2026 (published online first).
53. Moler-Zapata, S., Peters, M., Gould, D., Giallongo, E., et al. (2025). Longer-term survival, quality of life, and cost-effectiveness of conservative versus liberal oxygenation targets in critically ill children: A pre-specified analysis from Oxy-PICU, a multicentre, open, parallel-group, randomized controlled trial.
54. Verma, S., Sahoo, M., Jindal, A., & Mohapatra, E. (2026). Conservative versus conventional oxygenation target in children admitted in PICU: A randomized controlled trial. European Journal of Pediatrics, 185(4), 203.
55. Mahant, S., Wahi, G., Bayliss, A., Giglia, L., Kanani, R., Pound, C., et al. (2021). Intermittent vs continuous pulse oximetry in hospitalized infants with stabilized bronchiolitis: A randomized controlled trial. *JAMA Pediatrics, 175*(5), 466-474.
56. McCulloh, R., Koster, M., Ralston, S., Johnson, M., Hill, V., Koehn, K., Weddle, G., & Alverson, B. (2015). Use of intermittent vs. continuous pulse oximetry for nonhypoxemic infants and children hospitalized with bronchiolitis: A randomized clinical trial. *JAMA Pediatrics, 169*(10), 898-904.
57. Mittal, S., Marlowe, L., Blakeslee, S., Zieniuk, G., Doshi, S., Gray, B. J., Bowen, M., et al. (2019). Successful use of quality improvement methodology to reduce inpatient length of stay in bronchiolitis through judicious use of intermittent pulse oximetry. *Hospital Pediatrics, 9*(2), 73-78.
58. Moretti, M., Jegathisawaran, J., Wahi, G., Bayliss, A., Kanani, R., Pound, C., Sakran, M., Parkin, P., Mahant, S., & Canadian Paediatric Inpatient Research Network (PIRN). (2022). Cost-effectiveness of intermittent vs continuous pulse oximetry monitoring in infants hospitalized with stabilized bronchiolitis. *JAMA Network Open, 5*(11), e2243609.
59. McCallum, G. B., Morris, P. S., & Chang, A. B. (2012). Antibiotics for persistent cough or wheeze following acute bronchiolitis in children. *Cochrane Database of Systematic Reviews, 12*, CD009834.
60. Pinto, L. A., Pitrez, P. M., Luisi, F., de Mello, P. P., Gerhardt, M., Ferlini, R., et al. (2012). Azithromycin therapy in hospitalized infants with acute bronchiolitis is not associated with better clinical outcomes: A randomized, double-blinded, and placebo-controlled clinical trial. *Journal of Pediatrics, 161*(6), 1104-1108.
61. Spurling, G. K., Fonseka, K., Doust, J., & Del Mar, C. (2007). Antibiotics for bronchiolitis in children. *Cochrane Database of Systematic Reviews*(1), CD005189.
62. Spurling, G. K., Doust, J., Del Mar, C. B., & Eriksson, L. (2011). Antibiotics for bronchiolitis in children. *Cochrane Database of Systematic Reviews*(6), CD005189.
63. Perrotta, C., Ortiz, Z., & Roque, M. (2007). Chest physiotherapy for acute bronchiolitis in paediatric patients between 0 and 24 months old. *Cochrane Database of Systematic Reviews*(1), CD004873.
64. Roque i Figuls, M., Gine-Garriga, M., Granados Rugeles, C., & Perrotta, C. (2012). Chest physiotherapy for acute bronchiolitis in paediatric patients between 0 and 24 months old. *Cochrane Database of Systematic Reviews*(2), CD004873.
65. Alansari, K., Sakran, M., Davidson, B. L., Ibrahim, K., Alrefai, M., & Zakaria, I. (2013). Oral dexamethasone for bronchiolitis: A randomized trial. *Pediatrics, 132*(4), e810-816.
66. Schuh, S., Coates, A. L., Dick, P., Stephens, D., Lalani, A., Nicota, E., et al. (2008). A single versus multiple doses of dexamethasone in infants wheezing for the first time. *Pediatric Pulmonology, 43*(9), 844-850.
67. Plint, A. C., Johnson, D. W., Patel, H., Wiebe, N., Correll, R., Brant, R., et al. (2009). Epinephrine and dexamethasone in children with bronchiolitis. *New England Journal of Medicine, 360*(20), 2079-2089.
68. Blom, D., Ermers, M., Bont, L., van Aalderen, W. M., & van Woensel, J. B. (2007). Inhaled corticosteroids during acute bronchiolitis in the prevention of post-bronchiolitic wheezing. *Cochrane Database of Systematic Reviews*(1), CD004881.
69. Corneli, H. M., Zorc, J. J., Mahajan, P., Shaw, K. N., Holubkov, R., Reeves, S. D., et al. (2007). A multicenter, randomized, controlled trial of dexamethasone for bronchiolitis. *New England Journal of Medicine, 357*(4), 331-339.
70. Garrison, M. M., Christakis, D. A., Harvey, E., Cummings, P., & Davis, R. L. (2000). Systemic corticosteroids in infant bronchiolitis: A meta-analysis. *Pediatrics, 105*(4), E44.
71. Sumner, A., Coyle, D., Mitton, C., Johnson, D. W., Patel, H., Klassen, T. P., et al. (2010). Cost-effectiveness of epinephrine and dexamethasone in children with bronchiolitis. *Pediatrics, 126*(4), 623-631.
72. Everard, M. L., Bara, A., Kurian, M., Elliott, T. M., Ducharme, F., & Mayowe, V. (2005). Anticholinergic drugs for wheeze in children under the age of two years. *Cochrane Database of Systematic Reviews*(3), CD001279.

73. Angoulvant, F., Bellettre, X., Milcent, K., Teglas, J. P., Claudet, I., Gras Le Guen, C., et al. (2017). Effect of nebulized hypertonic saline treatment in emergency departments on the hospitalization rate for acute bronchiolitis: A randomized clinical trial. *JAMA Pediatrics, 171*(8), e171333.
74. Badgett, R. G., openMetaAnalysis Contributors. Hypertonic saline for bronchiolitis: A living systematic review. Available at: https://openmetaanalysis.github.io/Hypertonic-Saline-for-Bronchiolitis/ Accessed November 24, 2017. Contributions archived at: https://github.com/badgettrg
75. Brooks, C. G., Harrison, W. N., & Ralston, S. L. (2016). Association between hypertonic saline and hospital length of stay in acute viral bronchiolitis: A reanalysis of 2 meta-analyses. *JAMA Pediatrics, 170*(6), 577-584.
76. Chen, Y. J., Lee, W. L., Wang, C. M., & Chou, H. H. (2014). Nebulized hypertonic saline treatment reduces both rate and duration of hospitalization for acute bronchiolitis in infants: An updated meta-analysis. *Pediatric Neonatology, 55*(6), 431-438.
77. Maguire, C., Cantrill, H., Hind, D., Bradburn, M., & Everard, M. L. (2015). Hypertonic saline (HS) for acute bronchiolitis: Systematic review and meta-analysis. *BMC Pulmonary Medicine, 15*, 148.
78. Zhang, L., Mendoza-Sassi, R. A., Wainwright, C., & Klassen, T. P. (2013). Nebulised hypertonic saline solution for acute bronchiolitis in infants. *Cochrane Database of Systematic Reviews*(7), CD006458.
79. Zhang, L., Mendoza-Sassi, R. A., Klassen, T. P., & Wainwright, C. (2015). Nebulized hypertonic saline for acute bronchiolitis: A systematic review. *Pediatrics, 136*(4), 687-701.
80. Bordley, W. C., Viswanathan, M., King, V. J., Sutton, S. F., Jackman, A. M., Sterling, L., & Lohr, K. N. (2004). Diagnosis and testing in bronchiolitis: A systematic review. *Archives of Pediatrics and Adolescent Medicine, 158*(2), 119-126.
81. Purcell, K., & Fergie, J. (2007). Lack of usefulness of an abnormal white blood cell count for predicting a concurrent serious bacterial infection in infants and young children hospitalized with respiratory syncytial virus lower respiratory tract infection. *Pediatric Infectious Disease Journal, 26*(4), 311-315.
82. Tarini, B. A., Garrison, M. M., & Christakis, D. A. (2007). Institutional variation in ordering complete blood counts for children hospitalized with bronchiolitis. *Journal of Hospital Medicine, 2*(2), 69-73.
83. Luu, R., DeWitt, P. E., Reiter, P. D., Dobyns, E. L., & Kaufman, J. (2013). Hyponatremia in children with bronchiolitis admitted to the pediatric intensive care unit is associated with worse outcomes. *Journal of Pediatrics, 163*(6), 1652-1656, e1651.
84. Swingler, G. H., Hussey, G. D., & Zwarenstein, M. (1998). Randomised controlled trial of clinical outcome after chest radiograph in ambulatory acute lower-respiratory infection in children. *Lancet, 351*(9100), 404-408.
85. Levine, D. A., Platt, S. L., Dayan, P. S., Macias, C. G., Zorc, J. J., Krief, W., et al. (2004). Risk of serious bacterial infection in young febrile infants with respiratory syncytial virus infections. *Pediatrics, 113*(6), 1728-1734.
86. Kuppermann, N., Bank, D. E., Walton, E. A., Senac, M. O., Jr., & McCaslin, I. (1997). Risks for bacteremia and urinary tract infections in young febrile children with bronchiolitis. *Archives of Pediatrics and Adolescent Medicine, 151*(12), 1207-1214.
87. Yarden-Bilavsky, H., Ashkenazi-Hoffnung, L., Livni, G., Amir, J., & Bilavsky, E. (2011). Month-by-month age analysis of the risk for serious bacterial infections in febrile infants with bronchiolitis. *Clinical Pediatrics, 50*(11), 1052-1056.
88. Andrist, E., Nuppnau, M., Barbaro, R., Valley, T., & Sjoding, M. (2022). Association of race with pulse oximetry accuracy in hospitalized children. *JAMA Open Network, 5*(3), e224584.
89. Coghill, M., Law, M., Webb, L., Asfari, A., & Borasino, S. (2025). Race and the inaccuracy of pulse oximetry with hypoxemia in a pediatric cardiac ICU. *Critical Care Explorations, 7*(4), e1237.
90. Foglia, E., Whyte, R., Chaudhary, A., Mott, A., Chen, J., Propert, K., & Schmidt, B. (2017). The effect of skin pigmentation on the accuracy of pulse oximetry in infants with hypoxemia. *Journal of Pediatrics, 182*, 375-377.
91. Jones, G., Wiegand, M., Ray, S., Gould, D., Agbeko, R., Giallongo, E., et al. (2024). Fraction of inspired oxygen, and clinical outcomes: A Post-hoc analysis of the Oxy-PICU trial of conservative oxygenation. *Pediatric Critical Care, 25*(10), 912-917.
92. Ruppel, H., Makeneni, S., Faerber, J., Lane-Fall, M., Foglia, E., O'Byrne, M., & Bonafide, C. (2023). Evaluating the accuracy of pulse oximetry in children according to race. *JAMA Pediatrics, 177*(5), 540-543.
93. Savorgnan, F., Hassan, A., Borges, N., & Acosta, S. (2023). Pulse oximetry and arterial saturation difference in pediatric COVID-19 patients: Retrospective analysis by race. *Pediatric Critical Care, 24*(6), 458-462.
94. Starnes, J., Welch, W., Henderson, C., Hudson, S., Risney, S., Nicholson, G., et al. (2025). Pulse oximetry and skin tone in children. *The New England Journal of Medicine, 392*(10), 1033-1034.
95. Vesoulis, Z., Tims, A., Lodhi, H., Lalos, N., & Whitehead, H. (2022). Racial discrepancy in pulse oximeter accuracy in preterm infants. *Journal of Perinatology, 42*, 79-85.

©2026 Texas Children's Hospital

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.

Bronchiolitis Content Expert Team

Beckner, MD, PHM – Clinical Lead
Bryan Greenfield, MD, PEM – Clinical Leader
Megan Arnold,
Aarti Bavare, MD, CCM
Stephanie Burger,
Natashia Bush, RN, Nursing
Danny Castro, MD, CCM
Mona Clark, RN, Nursing
Andrea Crayton, RT, Respiratory
Kate D'Ambrosia, RN, Nursing
Jaylon Daniels, RN, Nursing
Charlyn Davis, RN, Nursing
Kimberly Davis, RT, Respiratory
Nicole Dumas, RN, Nursing
Lindsay Duncan, RN, Nursing
Audrey Edwards, RN, Nursing
Kimberly Estavillo, RT, Respiratory
Lee Evey, RT, Respiratory
Zachary Foughty, MD, PEM
Jeanine Graf, MD, CCM
Holly Gregersen, RN, Nursing
Pamela Gregerson, MD, PHM
Lesley Griffith, RN, Nursing
Elit Hadad, MD, PEM
Kimberly Heffernan, RT, Respiratory
Eric Higginbotham, MD, PEM
Yu Inata, MD, CCM
Suzanne Iniguez, RT, Respiratory
Lauren Ivanhoe, RN, Nursing
Jaime Jump, MD, CCM
Steven Kibodeaux, RN, Nursing
Erin Kritz, MD, CCM
Shenila Lallani, MD, PHM
Derek Linklater, MD, PEM
Amanda Macias, MD, PHM
Wendy McCarter Johnson, RN, Nursing
Sondra Morris, RN, Nursing
Brent Mothner, MD, PHM
Matthew Musick, MD, CCM
Bridgette Nava, APP, CCM
Cynthia Nelson, APP, CCM
Binita Patel, MD, PEM
Natalie Pham, RN, Nursing
Melissa Phillips, RT, Respiratory
Craig Pymento, MD, CCM
Ricardo Quinonez, MD, PHM
Patricia Robinson, RN, Nursing
Lisa Rohaly, RN, Nursing
Justin Sandefur, APP, CCM
Julia Shelburne, MD, PHM
Shaine Singson, RN, Nursing
Barbara Snow, RT, Respiratory
Kelly Stewart, RN, Nursing
Shimona Thakrar, MD, PHM
Maryanne Tranter, APP, PEM
Rebecca Trillo, MD, PHM
Cheryl Trimble-Wilkins, RN, Nursing
Grace Troung, MD, PHM
Joyee Vachani, MD, PHM
Erica Ventura, RN, Nursing
Manpreet Virk, MD, CCM
Meliza Walsh, RT, Respiratory
Christopher Ward, RT, Respiratory
Maria Fatima Westry, APP, CCM
Amanda Wollam, RN, Nursing
Jennifer Ziegler, RN, Nursing
EBOC Team

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 (2021), Children's Hospital of Philadelphia Bronchiolitis (2025), 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
   - 25 systematic reviews/meta-analyses, 24 randomized controlled trials, and 47 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.

Permission of Use

All content on this website is protected by copyright law. Unauthorized use, reproduction, or distribution of any part of this work is prohibited without written permission from Texas Children's Hospital. Please contact eboc@texaschildrens.org to obtain necessary permissions for usage of the materials on this website.

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
June 2026	Guideline Update
Oct 2026	Pulse Oximetry Target Revisions

©2026 Texas Children's Hospital