Bronchiolitis

Ilana Waynik, MD
Eric Hoppa, MD

What is a Clinical Pathway?

An evidence-based guideline that decreases unnecessary variation and helps promote safe, effective, and consistent patient care.

Objectives of Pathway

- To standardize delivery of evidence based care to infants with bronchiolitis
- To avoid routine use of therapies and testing that have been shown to have little clinical benefit (i.e. routine viral testing, chest x-rays, antibiotic use, steroids, bronchodilators)
- To maximize the usage of enteral hydration when appropriate (by mouth and/or nasogastric tubes)
- To increase screening for 2nd and 3rd hand smoke exposure
- To decrease unnecessary continuous pulse oximetry use

Why is Pathway Necessary?

- Bronchiolitis is the most frequent cause of hospital admission for children under 1 year of age.
  - Accounts for upwards of 18% of all hospitalizations in the United States

- In 2014 the AAP published updated guidelines on the diagnostic work up, treatment modalities, and prevention of bronchiolitis
  - Provides evidence based recommendations for use in children 1-23 months presenting with bronchiolitis in the absence of complicating medical conditions (i.e. BPD, immunodeficiency, congenital cardiac disease)

- Additionally, literature demonstrates It is safe to feed most infants with bronchiolitis enterally (PO or NGT)

- Pathway gives both providers and nurses guidance based on current best practices.
  - Previously there had been variation in practice amongst providers, and little evidence to support certain commonly used modalities of diagnosis and treatment

Pathophysiology of Bronchiolitis

- Viral infection of lower respiratory tract (bronchioles)
- Most common cause is Respiratory Syncytial Virus (RSV). Other potential causes are rhinovirus, influenza, coronavirus, parainfluenza, metapneumovirus.
- Leads to edema, inflammation and necrosis of respiratory epithelium and significant mucous production
- This is CLINICAL DIAGNOSIS, characterized by cough, tachypnea, retractions, wheezing, rhonchi and air trapping

Epidemiology of Bronchiolitis

- At ~150,000 admissions per year, it is the most common cause of hospital admission during the first year of life
- 90% of children are infected with RSV by the age of 2 years
- Accounts for upwards of 18% of all hospitalizations in the United States
- Annual cost of ~$1.73 billion dollars nationally for bronchiolitis admissions

Why is a Bronchiolitis Pathway so Important?

Choosing Wisely:
5 Things Physicians and Patients Should Question

- An initiative from the Society of Hospital Medicine aimed at promoting the highest quality care for patients
- A list of recommendations created by a rigorous consensus panel of pediatric hospital medicine physicians
- 4 out of 5 recommendations pertain to bronchiolitis management!

Society of Hospital Medicine
Hospitalists. Transforming Healthcare. Revolutionizing Patient Care.

Choosing Wisely:
5 Things Physicians and Patients Should Question

Connecticut Children's

1. Don't order chest radiographs in children with uncomplicated asthma or bronchiolitis
2. Don't routinely use bronchodilators in children with bronchiolitis
3. Don't use systemic corticosteroids in children under 2 years of age with an uncomplicated lower respiratory tract infection
4. Don't treat gastroesophageal reflux in in infants routinely with acid suppression therapy
5. Don't use continuous pulse oximetry routinely in children with acute respiratory illness unless they are on supplemental oxygen

We will discuss the evidence behind these recommendations as we go through the pathway

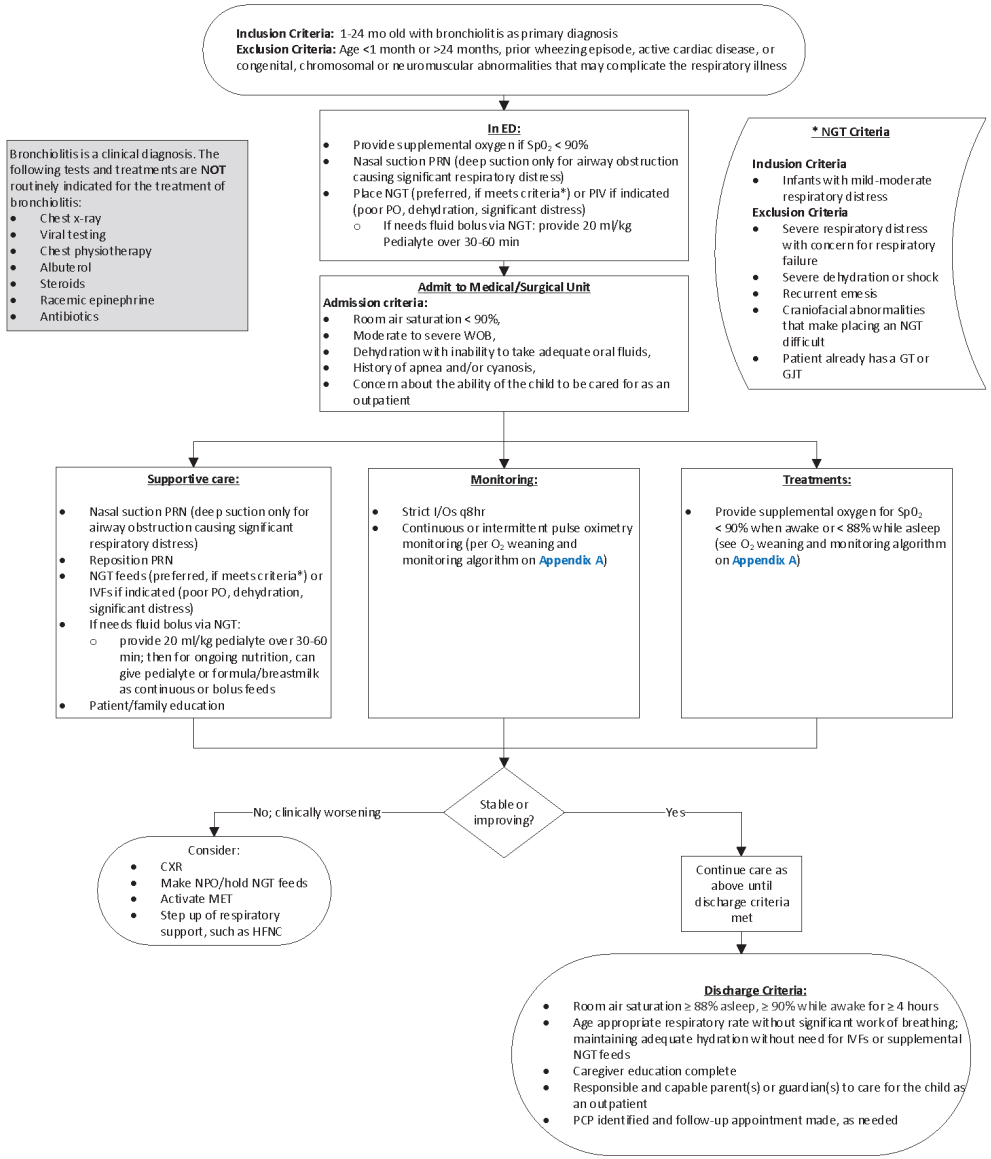
shm
Society of Hospital Medicine
Hospitalists. Transforming Healthcare.
Revolutionizing Patient Care.

This is the Bronchiolitis Clinical Pathway.

We will be reviewing each component in the following slides.

CLINICAL PATHWAY:
Bronchiolitis

THIS PATHWAY SERVES AS A GUIDE AND DOES NOT REPLACE CLINICAL JUDGMENT.



CONTACTS: ERIC HOPPA, MD | ILANA WAYNIK, MD

LAST UPDATED: 10.04.23

This pathway is intended for otherwise healthy babies between 1 month and 24 months of age

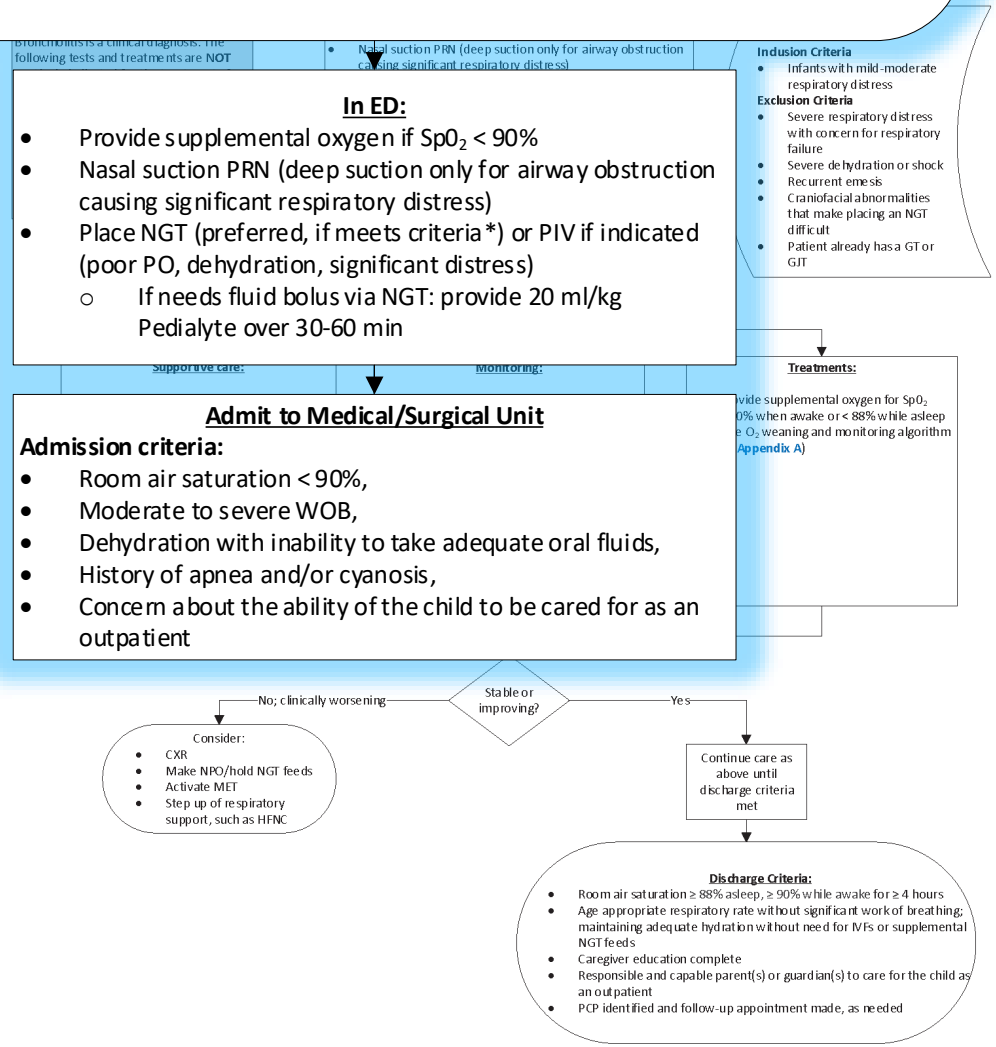
Initial management is focused on respiratory support and rehydration

Specific recommendations are based on AAP guidelines and latest clinical evidence

CLINICAL PATHWAY:
Bronchiolitis

THIS PATHWAY SERVES AS A GUIDE AND DOES NOT REPLACE CLINICAL JUDGMENT.

Inclusion Criteria: 1-24 mo old with bronchiolitis as primary diagnosis
Exclusion Criteria: Age <1 month or >24 months, prior wheezing episode, active cardiac disease, or congenital, chromosomal or neuromuscular abnormalities that may complicate the respiratory illness



CONTACTS: ERIC HOPPA, MD | ILANA WAYNIK, MD

LAST UPDATED: 10.04.23

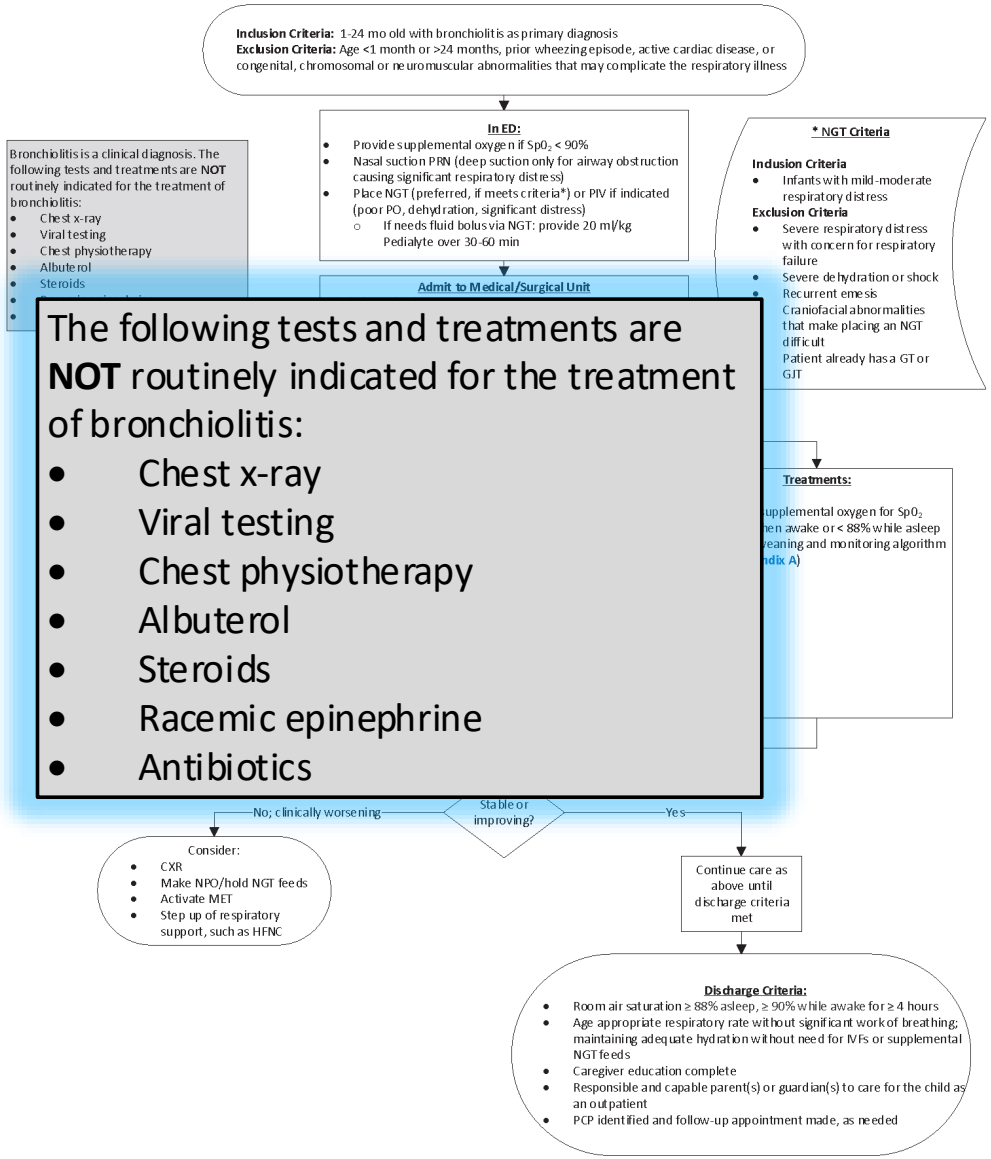
In the past, management of bronchiolitis varied amongst providers, and certain tests and treatments were routine.

However, current AAP guidelines do NOT support the use of the tests or treatments in this box for the treatment of routine bronchiolitis.

We will review the evidence behind these recommendations in the following slides.

CLINICAL PATHWAY:
Bronchiolitis

THIS PATHWAY SERVES AS A GUIDE AND DOES NOT REPLACE CLINICAL JUDGMENT.



CONTACTS: ERIC HOPPA, MD | ILANA WAYNIK, MD

LAST UPDATED: 10.04.23

Review of AAP Guidelines: Diagnostic Work Up

Viral Testing:

- **Currently, AAP does not recommend routine viral testing**
- Non-RSV bronchiolitis have been shown to have shorter hospital courses
- According to Cochrane review 2014, viral testing possibly decreased rate of subsequent antibiotics and CXR (but not blood or urine specimen collection)
- Value of determining specific viral etiology for individual patients has not been demonstrated (with exception of influenza or COVID-19, which have treatment options)

Chest Radiography (CXR):

- **Current evidence does not support CXR for routine work up of bronchiolitis**
- CXR does not correlate with disease severity
- Shown to increase use of antibiotics in treatment of bronchiolitis
- Initial CXR should be reserved for severe disease presentation, warranting ICU admission, or concern for airway complications (i.e. pneumothorax)

Review of AAP Guidelines: Treatment Modalities

Antibiotics:

- **Clinicians should not administer antibiotics unless there is a concomitant bacterial infection or a strong suspicion of one:** (Evidence B; Strong recommendation)
- May be indicated in children with severe bronchiolitis with respiratory failure requiring intubation and mechanical ventilation
- No difference in length of illness or hospitalization with use of antibiotics
- No correlation between WBC and superimposed bacterial infection in patients with bronchiolitis

Steroids:

- **Clinicians should not administer systemic corticosteroids to infants with a diagnosis of bronchiolitis in any setting** (Evidence Quality: A; Recommendation Strength: Strong Recommendation).
- Shown to have no reduction in hospital admissions
- May prolong viral shedding

Review of AAP Guidelines: Treatment Modalities

Bronchodilators:

- **Clinicians should not administer bronchodilators to infants and children with a diagnosis of bronchiolitis** (Evidence Quality: B; Recommendation Strength: Strong Recommendation).
- Evidence based recommendations: Cochrane review 2014
  - Beta-agonists do not improve oxygen saturation, shorten duration of hospitalization or reduce the total time to resolution of illness

Chest Physiotherapy:

- **Clinicians should not use chest physiotherapy for infants and children with a diagnosis of bronchiolitis** (Evidence Quality: B; Recommendation Strength: Moderate Recommendation)
- Evidence shows no difference in length of stay, oxygen requirement or scoring with use of CPT compared to other therapies (Cochrane review 2012)
- There may be some exceptions in patients with poor airway clearance (patients in ICU, neuromuscular impairment)

Review of AAP Guidelines: Treatment Modalities

Racemic Epinephrine:

- **Clinicians should not administer epinephrine to infants and children with a diagnosis of bronchiolitis** (Evidence Quality: B; Recommendation Strength: Strong Recommendation).

Hypertonic Saline:

- **Hypertonic Saline should not be administered to infants with a diagnosis of bronchiolitis in the ED** (Evidence Quality: B; Recommendation Strength: Moderate Recommendation)
- **Clinicians may administer nebulized hypertonic saline to infants and children hospitalized for bronchiolitis** (Evidence Quality: B; Recommendation Strength: Weak Recommendation)
- No difference in rates of admission with outpatient (ED and clinic) use of HTS

Review of AAP Guidelines: Monitoring

- Pulse oximetry
  - Unreliable
  - Poor marker of respiratory distress
  - Normal for healthy infants to have mild intermittent desaturations
  - May increase rate of unnecessary hospitalizations

- **Clinicians may choose not to administer supplemental oxygen if saturations exceed 90% in infants and children with diagnosis of bronchiolitis** (Evidence Quality: D; Recommendation Strength: Weak Recommendation)
- **Clinicians may choose not to use continuous pulse oximetry for infants and children with a diagnosis** (Evidence Quality: C; Recommendation Strength: Weak Recommendation)

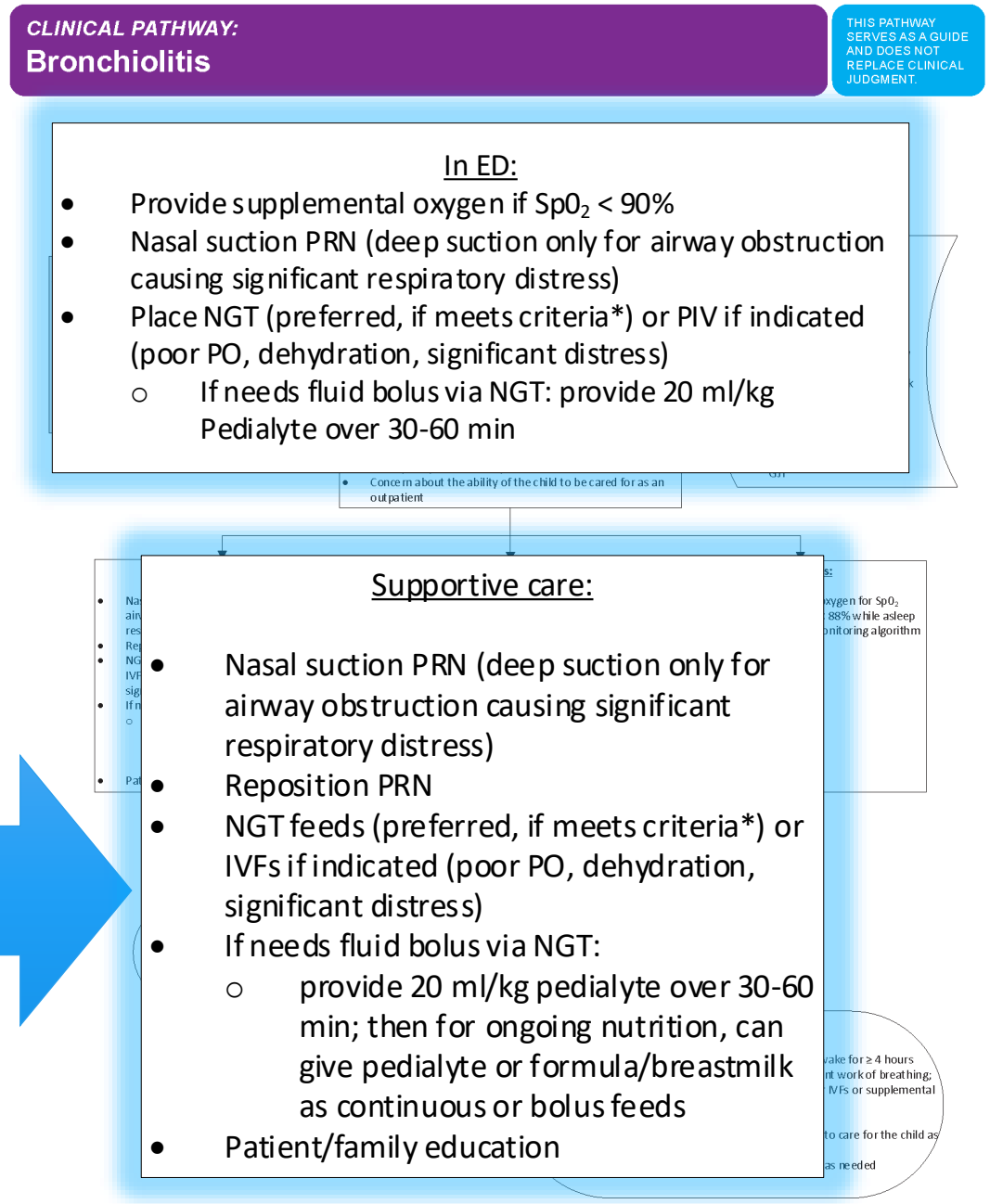
Supportive Care in both the Emergency Department and upon Admission should be based on symptoms present.

Limit deep suction to airway obstruction or significant respiratory distress

Maintain hydration enterally whenever possible.

NG hydration is a safe alternative to IV hydration and does not prolong length of stay.

See following slides



Hydration and Nutrition Management

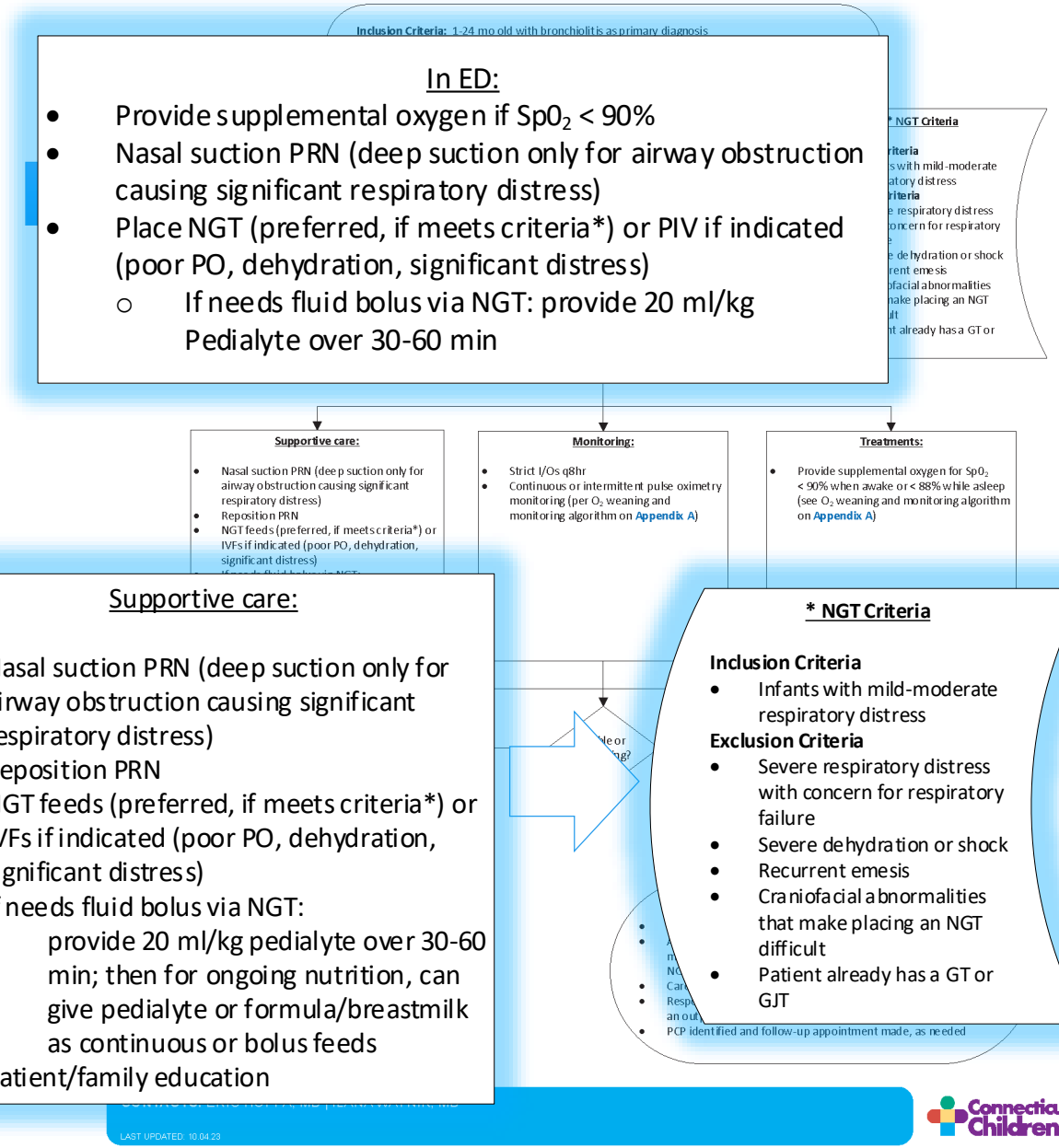
- **Hydration and nutrition are important aspects of the supportive treatment for patients with bronchiolitis.**
  - **82% of infants less than a year of age admitted for bronchiolitis had poor feeding prior to admission (Unger 2008).**
  - **anywhere from 30% to 60% of patients hospitalized for bronchiolitis require hydration (Florin 2015, Johnson 2002, Srinivasan 2017)**
- **2014 AAP Clinical Practice Guideline: The Diagnosis, Management, and Prevention of Bronchiolitis advises that nasogastric or intravenous fluids should be administered to infants with a diagnosis of bronchiolitis who cannot maintain hydration orally**
  - **At many US institutions, IV placement is preferred route of hydration, however it may not be the best option for many patients with bronchiolitis.**

Data has shown that rehydration with Nasogastric tubes (NGT) is just as effective as Peripheral Intravenous (IV) rehydration

NG tubes may be easier to obtain and less invasive than a PIV in a dehydrated infant.

Parents may be weary about NGT placement, however, with proper education evidence shows that parents actually prefer the NGT over PIV

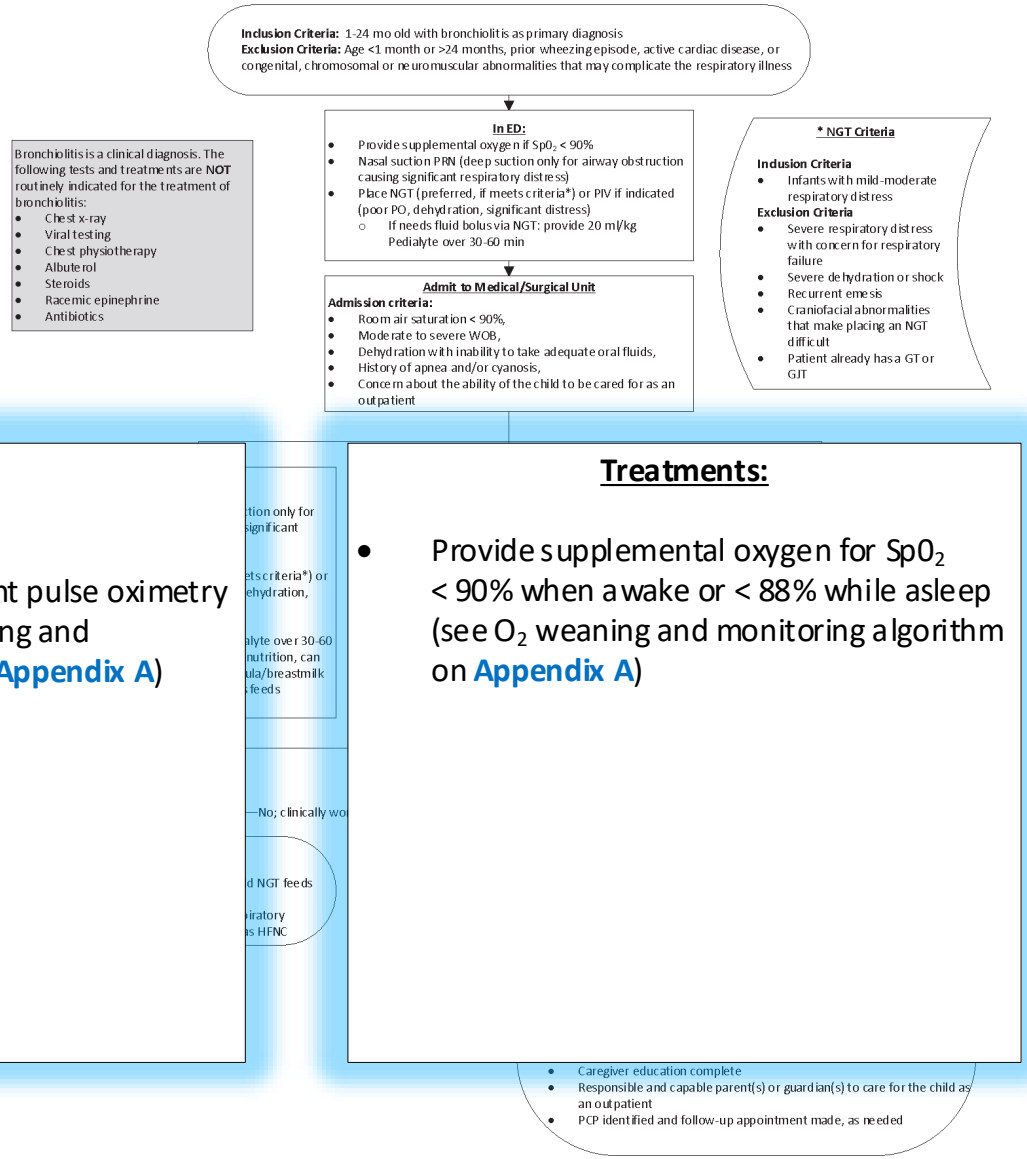
Note that not every patient will be a candidate for NGT placement. See Exclusion criteria



As with Supportive Care, Monitoring and Treatments should be based on a patient's clinical condition.

Limit routine use of continuous pulse oximetry unless supplemental oxygen is being administered

See Appendix A Below



Monitoring:

- Strict I/Os q8hr
- Continuous or intermittent pulse oximetry monitoring (per O_2 weaning and monitoring algorithm on **Appendix A**)

Treatments:

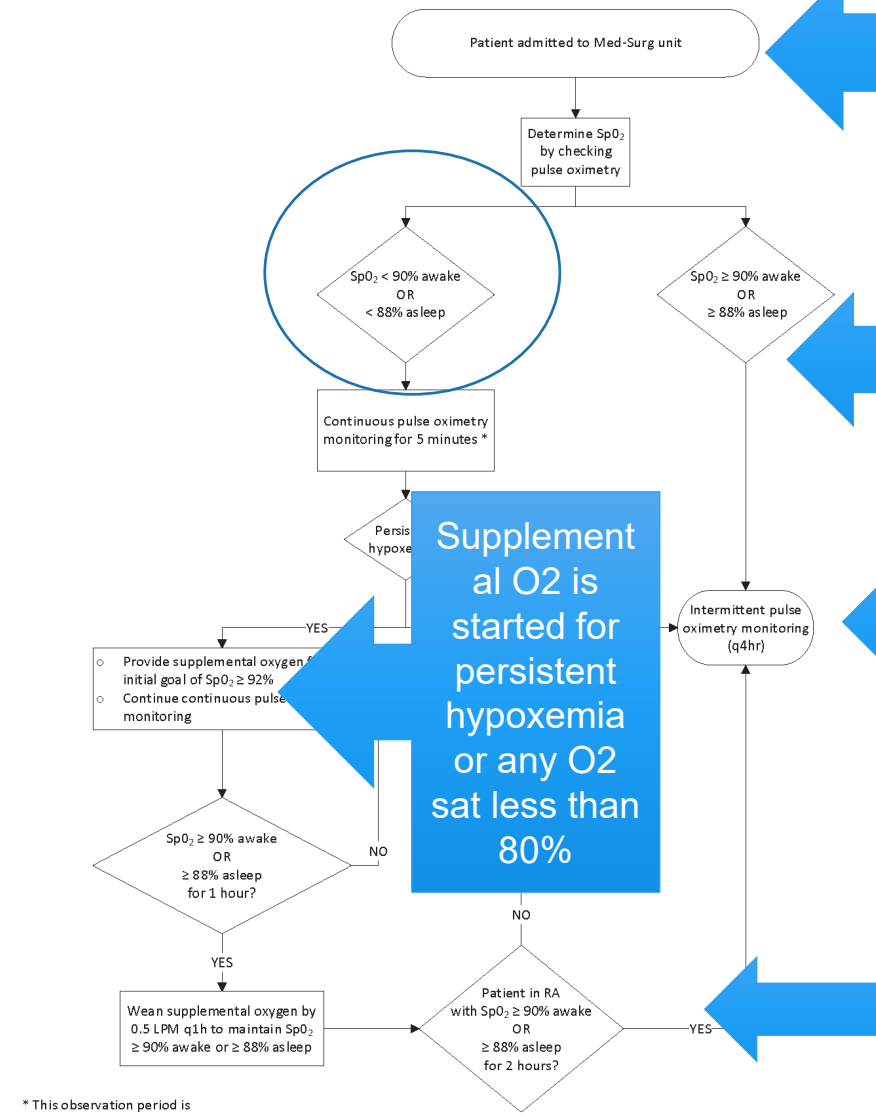
- Provide supplemental oxygen for SpO_2 < 90% when awake or < 88% while asleep (see O_2 weaning and monitoring algorithm on **Appendix A**)

CONTACTS: ERIC HOPPA, MD | ILANA WAYNIK, MD

LAST UPDATED: 10.04.23

CLINICAL PATHWAY:
Bronchiolitis
Appendix A: Inpatient Oxygen Weaning and Pulse Oximetry Monitoring Algorithm

THIS PATHWAY SERVES AS A GUIDE AND DOES NOT REPLACE CLINICAL JUDGMENT.



Sp02 < 90% awake OR < 88% asleep on admission, patient should get only intermittent pulse oximetry checks

If Sp02 < 90% awake OR < 88% asleep, monitor for 5 minutes to determine if hypoxemia is persistent

Supplemental O2 is started for persistent hypoxemia or any O2 sat less than 80%

Finally, if patient on RA with Sp02 < 90% awake OR < 88% asleep for 2 hours, may advance to ***intermittent*** pulse oximetry

If patient is stable, wean O2 every hour as tolerated.

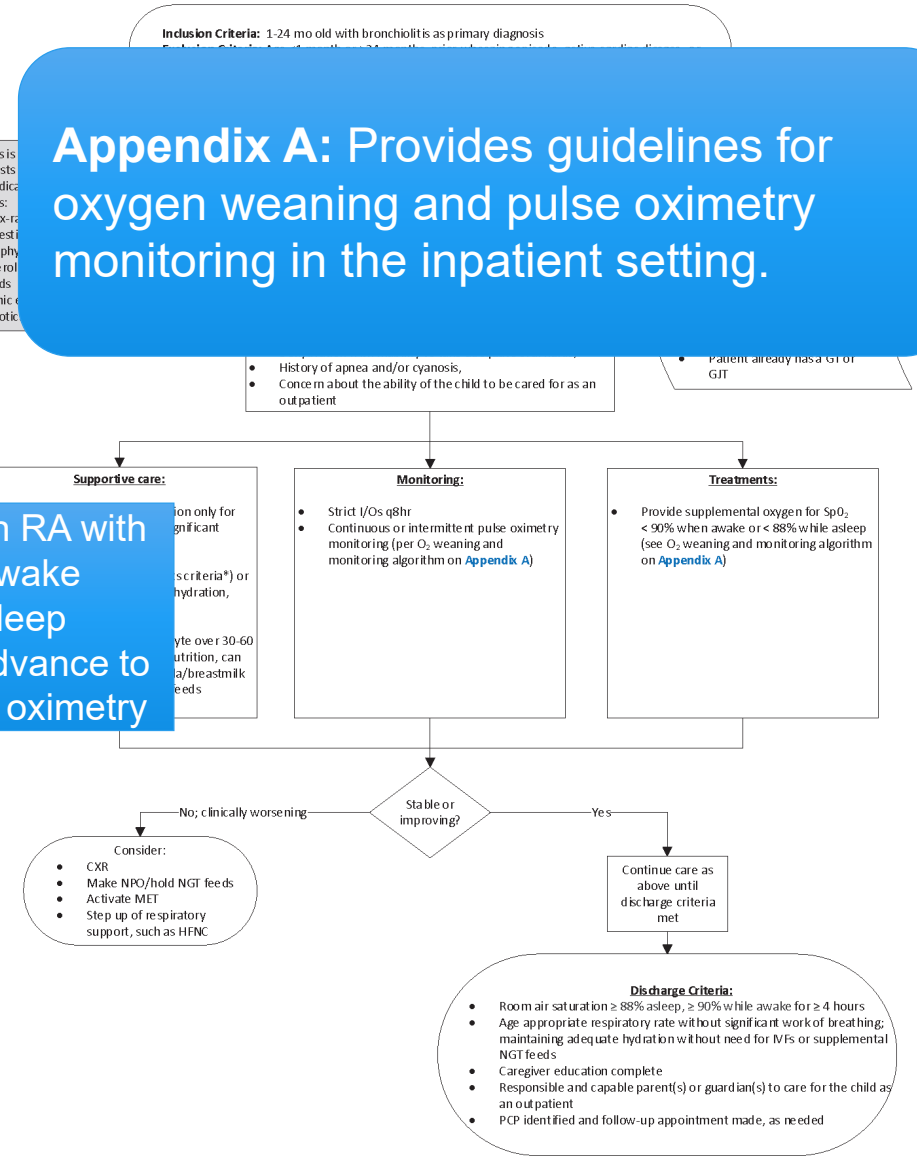
CONTACTS: ERIC HOPPA, MD | ILANA WAYNIK, MD

LAST UPDATED: 10.04.23

CLINICAL PATHWAY:
Bronchiolitis

THIS PATHWAY SERVES AS A GUIDE AND DOES NOT REPLACE CLINICAL JUDGMENT.

Appendix A: Provides guidelines for oxygen weaning and pulse oximetry monitoring in the inpatient setting.



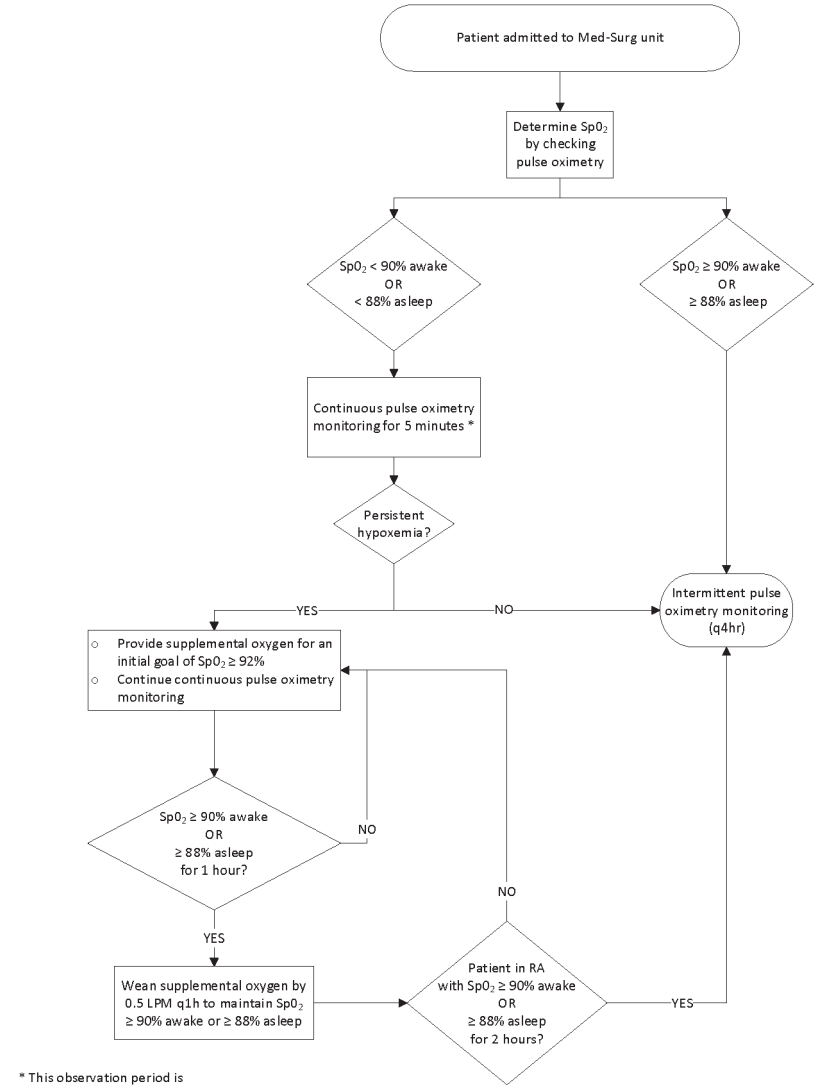
CONTACTS: ERIC HOPPA, MD | ILANA WAYNIK, MD

LAST UPDATED: 10.04.23

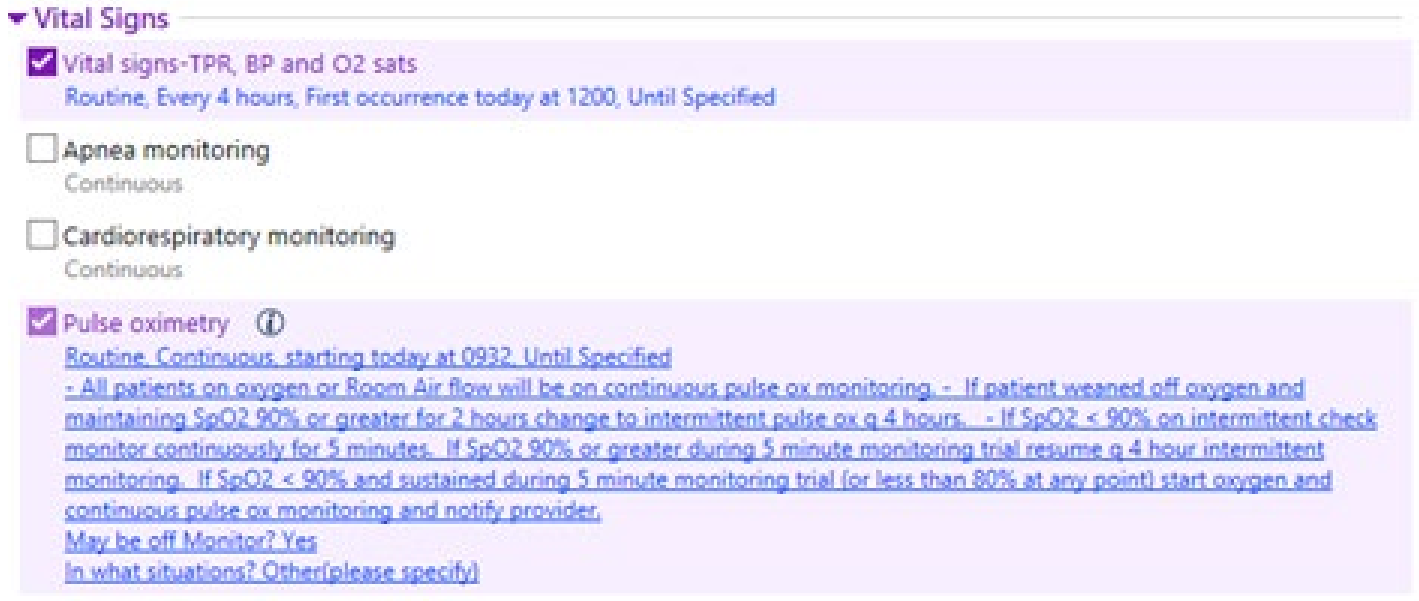
©2019 Connecticut Children's Medical Center. All rights reserved.

CLINICAL PATHWAY:
Bronchiolitis
Appendix A: Inpatient Oxygen Weaning and Pulse Oximetry Monitoring Algorithm

THIS PATHWAY SERVES AS A GUIDE AND DOES NOT REPLACE CLINICAL JUDGMENT.



* This observation period is waived if SpO_2 drops below 80%



- A new order to reflect the oxygen weaning and pulse oximetry monitoring algorithm was added to the Bronchiolitis Pathway admission order set

CONTACTS: ERIC HOPPA, MD | ILANA WAYNIK, MD

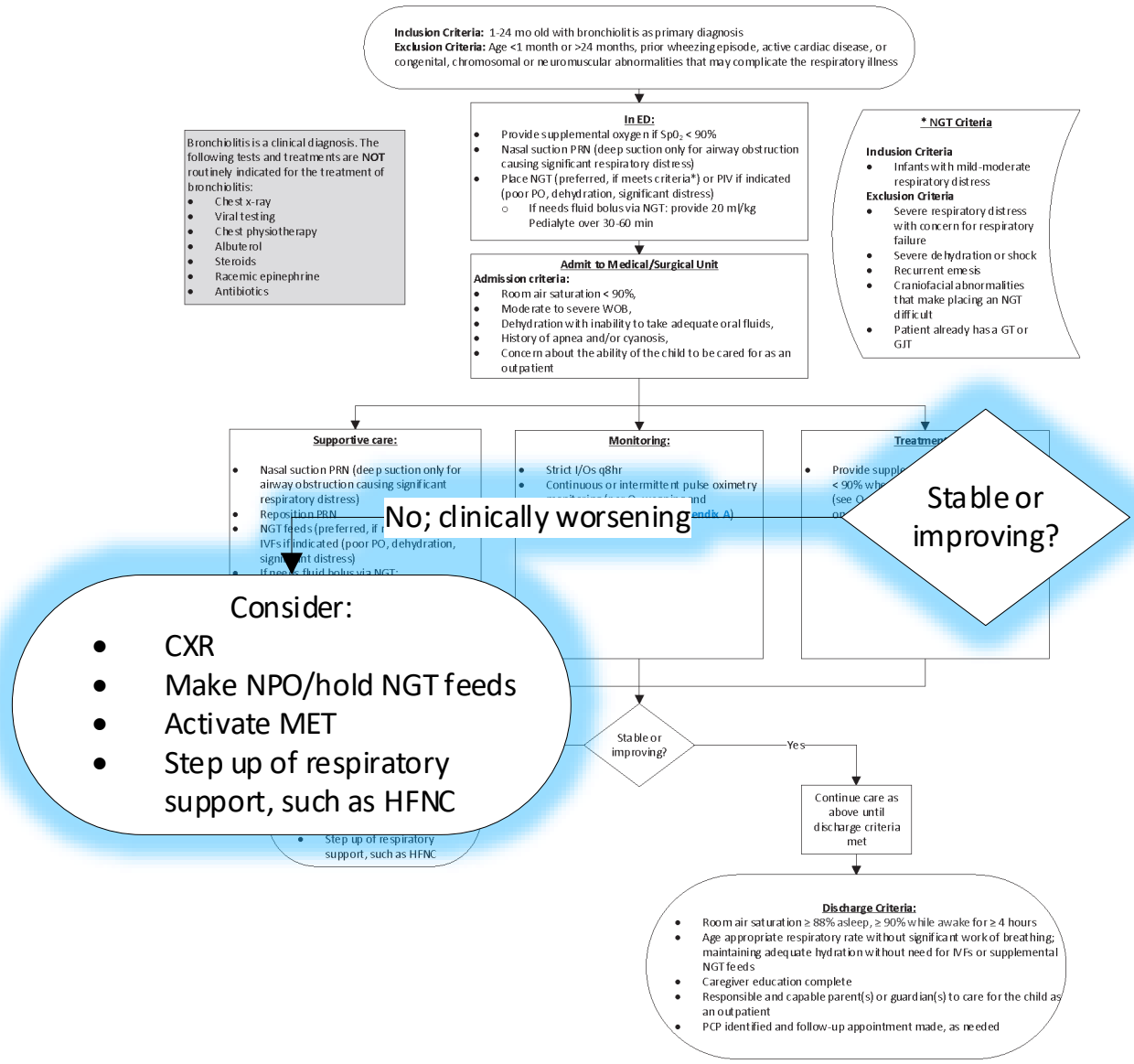
LAST UPDATED: 10.04.23

Connecticut Children's

Clinical Worsening

When patient shows any clinical worsening such as increased work of breathing, persistent hypoxemia, increased supplemental oxygen requirement consider:

- CXR
- Make NPO/holding NGT feeds
- MET activation
- Step up respiratory support, such as HFNC (see HFNC Use Outside the PICU Clinical Pathway)



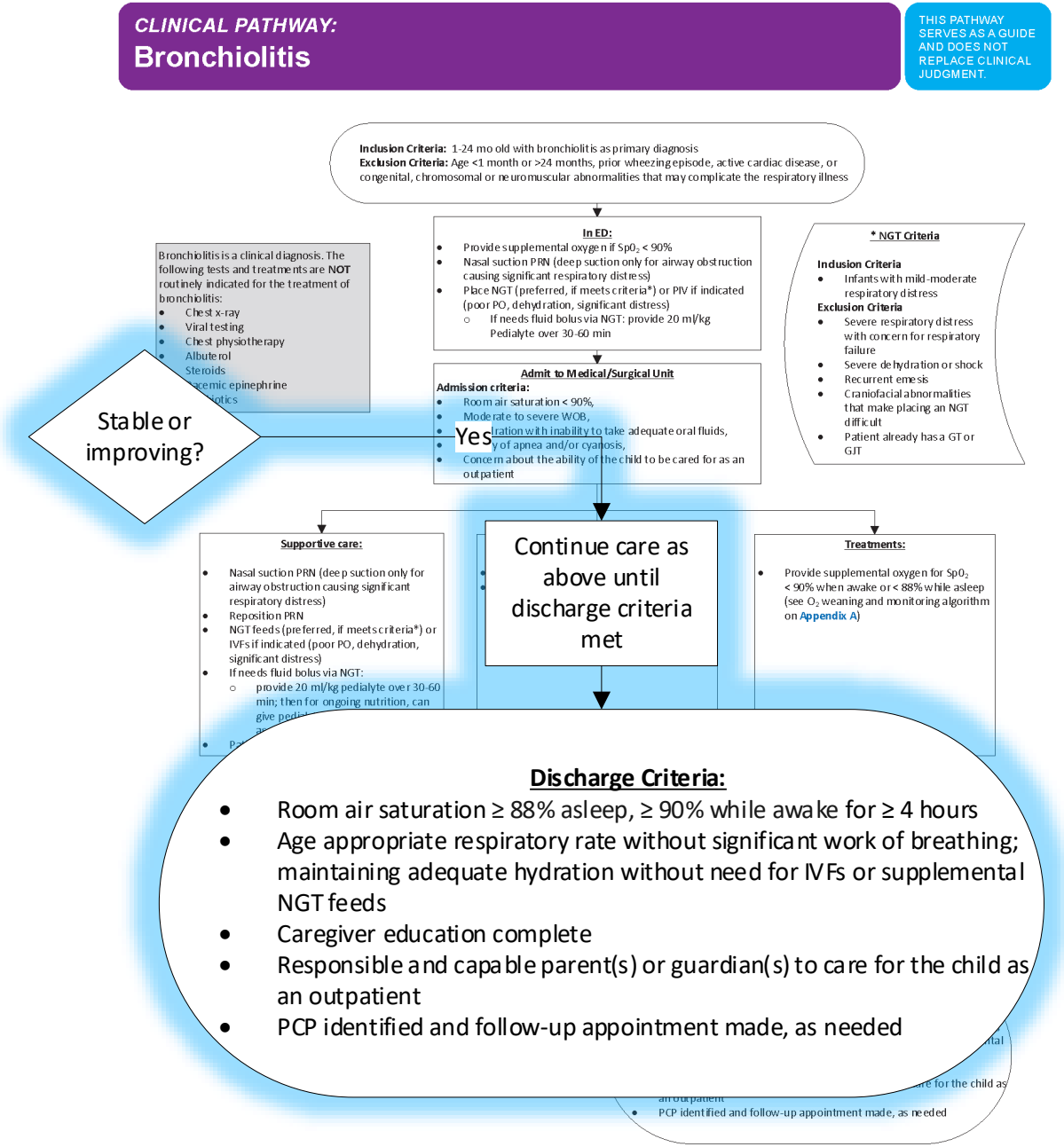
CONTACTS: ERIC HOPPA, MD | ILANA WAYNIK, MD

LAST UPDATED: 10.04.23

Continue Supportive measures until patient meets discharge criteria.

Ensure proper follow up is in place, and that guardian (s) are able to continue to care for the child on an outpatient basis.

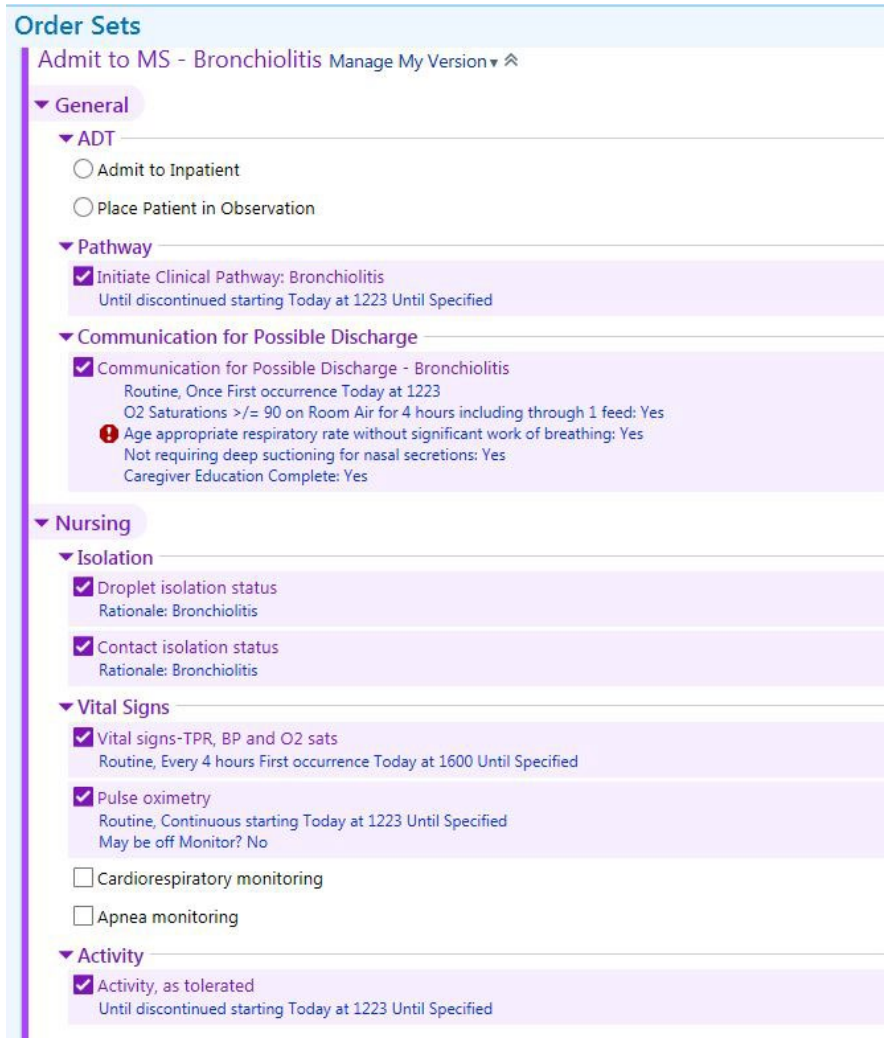
Pathway edited so that now PCP follow up is “as needed”. Literature demonstrates that following up with PCP right after discharge is not helpful in preventing returns to the ED



Review of Key Points

- **Clinicians should diagnose bronchiolitis and assess disease severity on the basis of history and physical**
- Per AAP recommendations, bronchodilators, corticosteroids, antibiotics, and chest physiotherapy **are not** recommended in the treatment of bronchiolitis
- Viral testing, with exception of influenza and COVID-19, does not change management
- Patients on room air without hypoxia **do not** require continuous pulse oximetry monitoring
- NGTs are a safe alternative to IV fluids in infants with bronchiolitis requiring rehydration or who are unable to PO feed

Use of Order Set



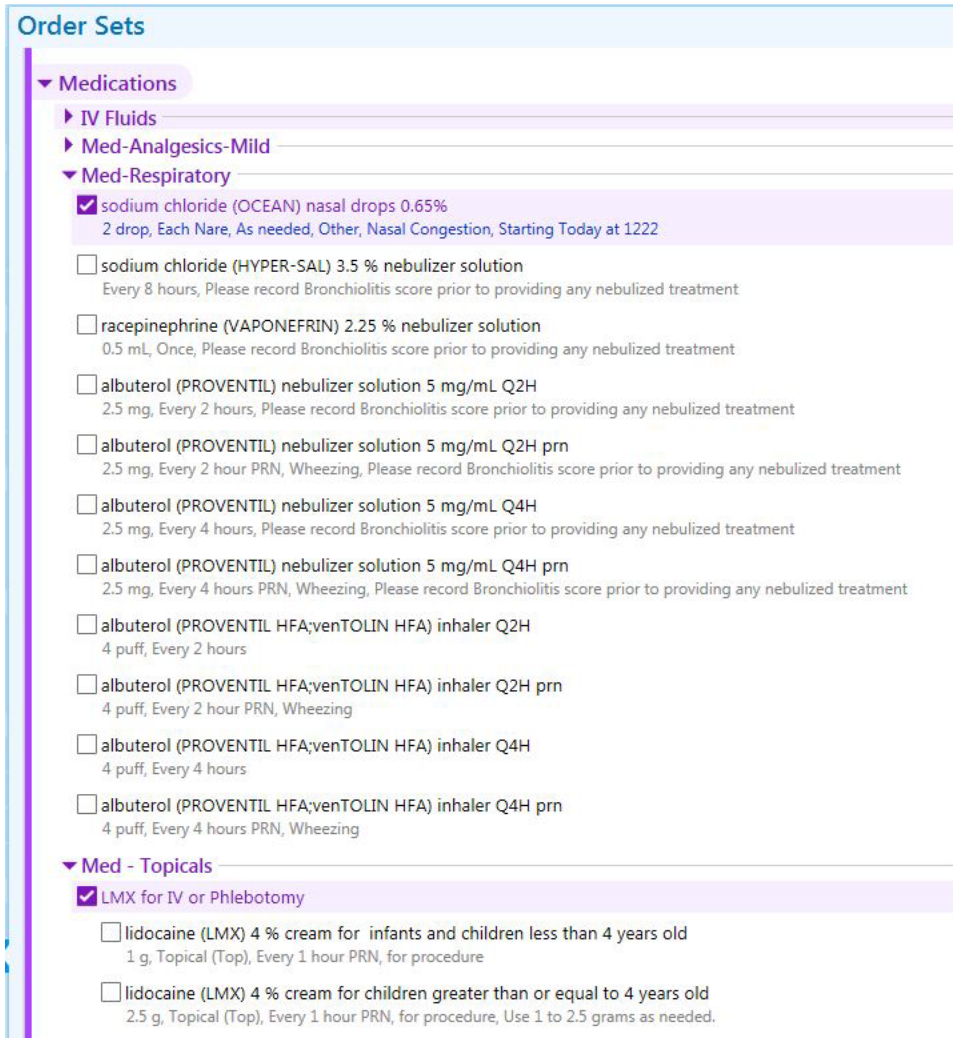
Order Set Use:

- Use of the order set improves compliance with the pathway.
- Also assists with tracking of quality metrics

Several items are preselected in the order set including:

- Communication for discharge readiness
  - Provides guidelines for RNs for when a patient may be considered discharge ready
- Appropriate isolation orders

Use of Order Set



Order Set Use:

- IV fluids and analgesics are available to order as needed.
- The only preselected respiratory medication is sodium chloride nasal drops.
  - Supports the AAP guidelines for avoiding routine use of albuterol and racemic epinephrine

Quality Metrics

- Percentage of eligible patients treated per pathway by order set usage (inpatient)
- Percentage of patients *without* CXR ordered (ED and inpatient)
- Percentage of patients *without* viral testing, excluding influenza & COVID-19 (ED to discharge and ED to inpatient)
- Percentage of patients *without* albuterol ordered (ED to discharge and ED to inpatient and during inpatient stay)
- Percent all inpatients in > 2 doses albuterol (inpatient)
- Average LOS ED (minutes), inpatient (days)
- Percentage inpatients discharged who return to the ED
- Percentage inpatients discharged who are readmitted
- Pathway usage bundle: % without CXR during stay, % without viral testing (except flu/covid-19), % without receiving bronchodilator (ED and inpatient)

Pathway Contacts

- Ilana Waynik, MD
  - Pediatric Hospital Medicine
- Eric Hoppa, MD
  - Pediatric Emergency Medicine

References

- "Clinical Practice Guideline: The Diagnosis, Management, and Prevention of Bronchiolitis," (*Pediatrics 2014*; http://pediatrics.aappublications.org/content/early/2014/10/21/peds.2014-2742)
- Coon ER, Destino LA, Greene TH, Vukin E, Stoddard G, Schroeder AR. Comparison of As-Needed and Scheduled Posthospitalization Follow-up for Children Hospitalized for Bronchiolitis: The Bronchiolitis Follow-up Intervention Trial (BeneFIT) Randomized Clinical Trial. JAMA Pediatr. 2020 Sep 1;174(9):e201937.
- Quinonez RA, Garber MD, Schroeder AR, Alverson BK, Nickel W, Goldstein J, Bennett JS, Fine BR, Hartzog TH, McLean HS, Mittal V, Pappas RM, Percelay JM, Phillips SC, Shen M, Ralston SL. Choosing wisely in pediatric hospital medicine: five opportunities for improved healthcare value. J Hosp Med. 2013 Sep;8(9):479-85.
- Bonafide CP, Xiao R, Brady PW, Landrigan CP, Brent C, Wolk CB, Bettencourt AP, McLeod L, Barg F, Beidas RS, Schondelmeyer A; Pediatric Research in Inpatient Settings (PRIS) Network. Prevalence of Continuous Pulse Oximetry Monitoring in Hospitalized Children With Bronchiolitis Not Requiring Supplemental Oxygen. JAMA. 2020 Apr 21;323(15):1467-1477. doi: 10.1001/jama.2020.2998. PMID: 32315058; PMCID: PMC7175084.
- Hasegawa K, Tsugawa Y, Brown DF, Mansbach JM, Camargo CA Jr. Trends in bronchiolitis hospitalizations in the United States, 2000-2009. Pediatrics. 2013;132(1): 28–36 medical costs of bronchiolitis hospitalizations in the United States." *Pediatrics 118(6): 2418-23. (2006)*
- Mansbech et al. Prospective, multicenter study of viral etiology and hospital length-of-stay in children with severe bronchiolitis Arch Pediatric Adolescent medicine 2012 Auguest 166(8) 700-706
- Roque I Fguls, M. Gine-Garriga M, Gradnados Rugeles C. Perrotta C. Chest Physiotherapy for acute bronchiolitis in paediatric patients between 0 and 24 months old (Review) The Cochrane Library 15 Feb 2012
- Schuh et al. Evaluation of the Utility of Radiography in Acute Bronchiolitis; Journal of pediatrics; 2007; 150; 4 (429-433)
- Zhang, L. Mendoza-Sassi RA, Wainwright C. Klassen TP. Nebulised hypertonic saline solution for acute bronchiolitis in infants (Review). The Cochrane Library 31 July 2013
- Farley R, Spurling, GKP, Eriksson L, Del Mar CB. Antibiotics for bronchiolitis in children under two years of age (Review). Cochrane Library 9 October 2014
- Schondelmeyer AC, Dewan ML, Brady PW, Timmons KM, Cable R, Britto MT, Bonafide CP. Cardiorespiratory and Pulse Oximetry Monitoring in Hospitalized Children: A Delphi Process. Pediatrics. 2020 Aug;146(2):e20193336.

References

- Hartling, L. et al Epinepherine for bronchiolitis (Review) Cochrane library 15 June 2011
- Sood N, Bennett WD, Zeman K, et al. Increasing concentration of inhaled saline with or without amiloride: effect onmucociliary clearance in normal subjects. Am J Respir Crit Care Med. 2003;167(2): 158–163
- Roque I Fguls, M. Gine-Garriga M, Gradnados Rugeles C. Perrotta C. Chest Physiotherapy for acute bronchiolitis in paediatric patients between 0 and 24 months old (Review) The Cochrane Library 15 Feb 2012
- Destino et al. Validity of Respiratory Scores in Bronchiolitis. Hospital Pediatrics 2012;2;202
- Kugelman et al. Intravenous Fluids versus Gastric-Tube Feeding in Hospitalized Infants with Viral Bronchiolitis: A Randomized, Prospective Pilot Study. Journal of Pediatrics 2013; 162: 640-642.
- Oakley et al. Nasogastric Hydration in Infants with Bronchiolitis Less than 2 Months of Age. Journal of Pediatrics 2016; 178: 241-245.
- Oakley et al. Nasogastric hydration versus intravenous hydration for infants with bronchiolitis: a randomized trial. Lancet Respiratory Medicine 2013; 1: 113-120.
- Srinivasan et al. Quality Improvement Initiative to Increase the Use of Nasogastric Hydration in Infants with Bronchiolitis. Hospital Pediatrics 2017; 7 (8): 436-443.
- Society of Hospital Medicine Pediatric Hospital Medicine: Five things Physicians and Patients Should Question 2013; website accessed June 28, 2018 http://www.choosingwisely.org/societies/society-of-hospital-medicine-pediatric/
- Unger et al. Effect of oxygen supplementation on length of stay for infants hospitalized with acute viral bronchiolitis. Pediatrics 2008; 121 (3) 470-475.

Thank You!

About Connecticut Children's Clinical Pathways Program

The Clinical Pathways Program at Connecticut Children's aims to improve the quality of care our patients receive, across both ambulatory and acute care settings. We have implemented a standardized process for clinical pathway development and maintenance to ensure meaningful improvements to patient care as well as systematic continual improvement. Development of a clinical pathway includes a multidisciplinary team, which may include doctors, advanced practitioners, nurses, pharmacists, other specialists, and even patients/families. Each clinical pathway has a flow algorithm, an educational module for end-user education, associated order set(s) in the electronic medical record, and quality metrics that are evaluated regularly to measure the pathway's effectiveness. Additionally, clinical pathways are reviewed annually and updated to ensure alignment with the most up to date evidence. These pathways serve as a guide for providers and do not replace clinical judgment.