Bronchiolitis
Inpatient

Nationwide Children's — When your child needs a hospital, everything matters.

Center for Clinical Excellence

Verify that patient is appropriate for this pathway

Assess Symptom Severity

Bronchiolitis Symptom Severity Assessment Guide

	Low Severity	Moderate Severity	High Severity
Respiratory Rate ≤2 mo	<60	60-69	≥70
3-11mo	<50	50-59	≥60
12-24 mo	<40	40-49	≥50
Work of Breathing (WOB)	Mild or no retractions	Mild to moderate retractions or nasal flaring (infant)	Severe retractions or nasal flaring with head bobbing or grunting (infant)
General Appearance and Feeding	Alert and appropriate; normal feeding & vocalization	Tired but interactive or fussy but consolable; Decreased feeding	Drowsy/lethargic or inconsolable/ agitated; Refusing to feed
Breath Sounds	End-expiratory wheeze, minimal crackles; good aeration	Expiratory wheeze throughout; moderately impaired aeration	Inspiratory and expiratory wheeze or diminished with severity impaired aeration

Low Severity

- **Rest is Best**
- Provide nasal suctioning (non-invasive technique)
- Spot check O_2 saturation when in RA
- **Supplemental O_2 if <90% saturation sustained for ≥ 2 min and not resolved by suctioning**
- PO feeding
- Monitor symptom severity

Moderate or High Severity

- Provide nasal suctioning, followed by nasopharyngeal (deep) suctioning if labored breathing continue.
- **Supplemental O_2 and continuous pulse oximetry if <90% saturation is sustained for ≥ 2 min and not resolved by suctioning**
- Antipyretics PRN and Oxymetazoline (Afrin™) PRN

Reassess Bronchiolitis Symptom Severity

Moderate or High Severity

- Consider **ONE** time **albuterol trial** **if:**
  - >6 mo old **AND** wheezing on exam **AND** a **positive API** (h/o recurrent wheezing episodes **or** eczema **or** parent with asthma
  - **And not previously done** in ED or by PCP, **or** done but without improvement
- Then, **reassess** symptom severity
- Continue albuterol **ONLY if improvement after trial**

Moderate or High Severity

- Review **Diagnostic Timeout**
- Consider hypertonic saline if persistent deep airway secretions
- PIV and isotonic IVFs if indicated by hydration status
- Monitor symptoms
- Consider initiation of **HFNC per protocol** when indicated

Discharge Patient when criteria is met:

- No signs of fatigue from tachypnea or WOB
- O2 saturation is ≥90% in RA
- Secretions manageable by home suction device.
- Feeds well enough to maintain hydration
- PCP f/u plan established
- Discharge education completed

Rest is Best!

Providers should **not** routinely use albuterol, steroids and racemic Epi in patients with a diagnosis of bronchiolitis.
CXR is **not** recommended for patients with a diagnosis of bronchiolitis.

ACT and transfer to PICU if:
Required level of care exceeds floor protocol, including HFNC unavailable

Pre-Pathway Validation

Is this Bronchiolitis?

Bronchiolitis is a lower respiratory tract infection affecting infants and young children characterized by inflammation and congestion of the bronchioles (small airways), caused by RSV or other viruses.

Typical Presentation:

- Starts with viral URI symptoms: rhinorrhea, congestion, cough, fever
- Progresses to lower respiratory tract involvement: increases work of breathing including tachypnea and/or accessory muscle use & Abnormal and shifting lung sounds including rales and/or wheezes

Consider Other Alternate Diagnoses when:

- No upper respiratory symptoms are present. *Consider pneumonia, foreign body aspiration, congenital anomaly, aspiration.*
- Persistently and disproportionately high heart rate or hepatomegaly. *Consider myocarditis or other cardiac etiology.*
- Recurrent episodes:
  - *Consider aspiration or congenital airway anomaly.*
  - *Consider **asthma (& Asthma Pathway)** if **risk factors for asthma** esp. ≥ 12 mo old with wheezing on exam **AND** h/o either recurrent wheezing **OR** atopic dermatitis/ecxema **OR** h/o asthma in 1st degree relative i.e.parent/sibling.*
- Paroxysmal coughing spells, apneic spells, and/or known pertussis exposure. *Consider pertussis.*
- Fever in infant less than 60 days
- Fever late in illness course. *Consider pneumonia or other serious bacterial illness.*

Consider a diagnostic timeout ("What else could this be?") or using a diagnostic checklist.

Inclusion criteria

- Children <24 months old with uncomplicated bronchiolitis

Exclusion criteria

- Critically ill child or requiring PICU
- Underlying respiratory conditions including but not limited to asthma, cystic fibrosis (CF), bronchopulmonary dysplasia (BPD) and laryngotracheomalacia.
- Neuromuscular disease
- Hemodynamically significant congenital heart disease
- Immunodeficiency – confirmed or suspected
- Suspected serious bacterial infections (SBI)

Diagnostic Timeout

Red Flags

- Severe atopy (allergic conditions or eczema, requiring steroids)
- Prolonged fevers
- Fever in child less than 60 days
- Concern for foreign body aspiration
- Severe dehydration
- Persistent tachycardia
- Heart Murmur
- Poor perfusion
- Hepatomegaly

Diagnostic Timeout

Differential Diagnosis

- Asthma
- Febrile Infant
- Pneumonia
- Laryngotracheomalacia
- Foreign body aspiration
- Gastroesophageal reflux
- Congestive heart failure
- Vascular ring
- Allergic reaction
- Cystic fibrosis
- Mediastinal mass
- Tracheoesophageal fistula
- Sepsis

Return to Algorithm

Risk Factors for Severe Disease & Apnea

Risk Factors for Severe Disease

- Age <12 weeks
- Prematurity ≤ 36 weeks
- Birth weight < 5 lbs
- Chronic pulmonary disease
- Airway abnormalities
- Hemodynamically significant CHD
- Immunodeficiency
- Neurologic disease

Risk factors for apnea:

- Age < 2 months
- Prematurity ≤ 36 weeks
- Respiratory rate at presentation < 30 or > 70 BPM
- Oxygen saturation < 90%

Return to Algorithm

Return to Admission Criteria

When do I use **albuterol** in a patient < 24 mo old?

Persisting respiratory distress after non-invasive suctioning?

No

Yes

Nasopharyngeal (deep) **suctioning** and **diagnostic timeout**

Continued respiratory distress ?

No

Yes

Age > 6 months ?

No

Yes

Wheezing on lung exam ?

No

Yes

Asthma Predictive Index (API)

Pt has h/o **recurrent wheezing**
or
atopic dermatitis/eczema
or
parent with asthma?
+/-
Rhinovirus infection

No → **Do not use albuterol**

Yes

Consider **one** time **albuterol trial** if insufficient improvement after **symptomatic care**

Treatments Not Recommended

Admission after albuterol in the ED?

No → Manage as clinically indicated

Yes →

- Consider **IP Asthma Clinical Pathway** if ≥ 12 mo and systemic steroids started
- Consider **IP Bronchiolitis Clinical Pathway** if <12 mo

- Castro-Rodríguez JA, Holberg CJ, Wright AL, Martinez FD. A clinical index to define risk of asthma in young children with recurrent wheezing. Am J Respir Crit Care Med. 2000 Oct;162(4 Pt 1):1403-6
- Leonardi NA, Spycher BD, Strippoli MP, Frey U, Silverman M, Kuehni CE. Validation of the Asthma Predictive Index and comparison with simpler clinical prediction rules. J Allergy Clin Immunol. 2011 Jun;127(6):1466-72.e6.

Return to Algorithm

Admission Criteria

Consider admission if ≥ 1 of following criteria are met:

- Respiratory Status
  - Persistent tachypnea for age
  - Respiratory distress, respiratory fatigue, or apnea
  - Lethargy or poor perfusion
  - Parent unable to clear the patient's airway using nasal noninvasive suction (NoseFrida)
  - O_2 saturation persistently <90% in room air

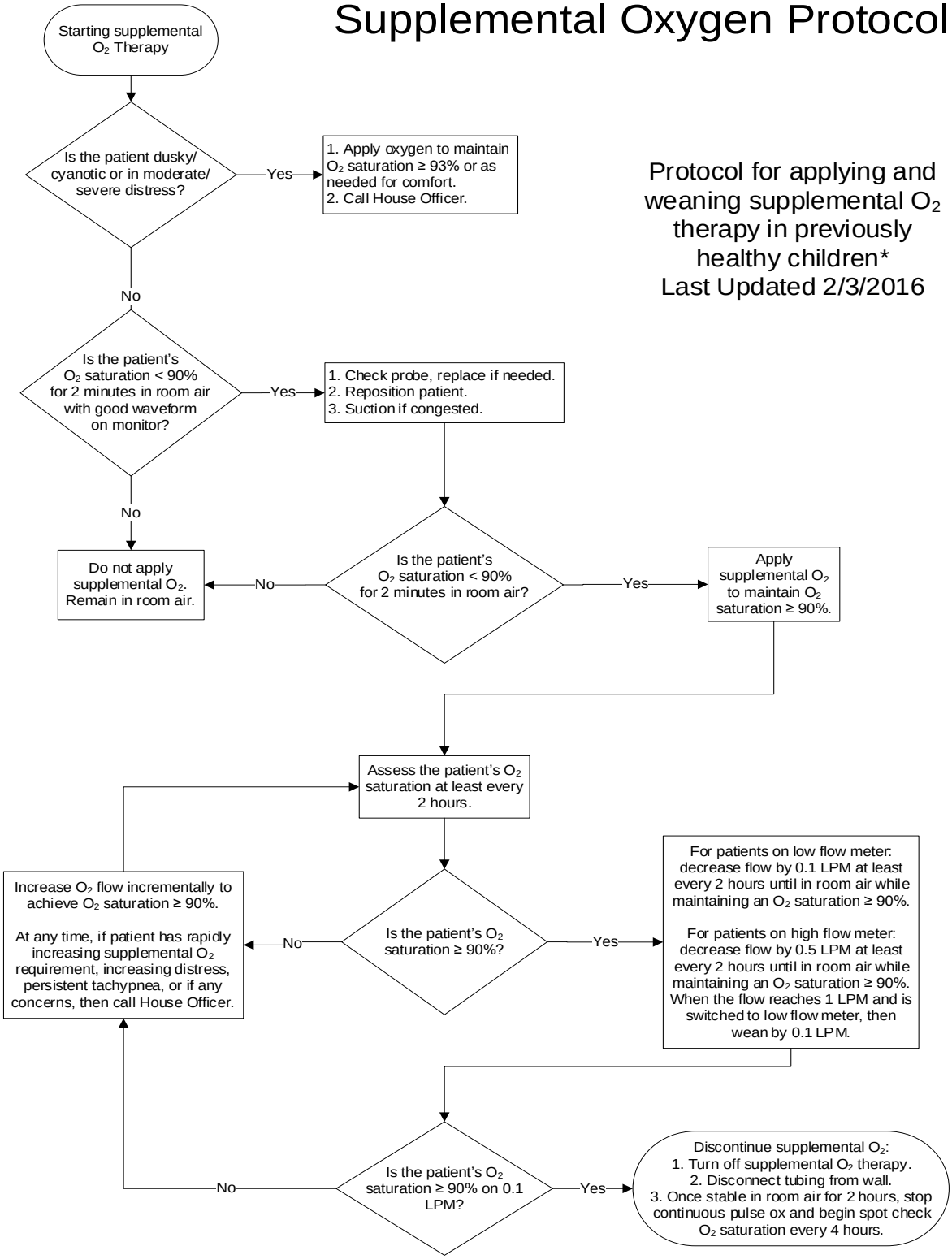
- Hydration & Nutritional Status
  - Inability to maintain level of oral feedings to prevent dehydration

- Inadequate resources for necessary care at home

Lower threshold for admission if risk factors for severe disease or early in the course of illness at time of evaluation

Return to Algorithm

Supplemental Oxygen Protocol



Protocol for applying and weaning supplemental O_2 therapy in previously healthy children*
Last Updated 2/3/2016

*This protocol does not apply to all patients, especially those with underlying conditions such as congenital heart disease or chronic lung disease. These patients should be approached on a case-by-case basis in discussion with the physician team. This is not meant to replace physician judgment. Always refer to the physician order for additional information or clarification.

Return to Algorithm

Monitoring

- Level of **respiratory distress** and **overall appearance** should be monitored.
- The **Bronchiolitis Symptoms Severity Assessment Guide** can assist to determine illness severity
- On admission: **Pulse oximetry spot check** on RA x 2 min. (Discontinue check and provide supplemental O2 if sat <90%)
- **Pulse oximetry spot checks** with vitals when in RA and at any point when clinically indicated, including before and after suctioning.
- Supplemental O_2 if pulse oximetry spot check is <90%. **Continuous pulse oximetry only if receiving supplemental O_2.**
- **Evidence-Based Practice:**

There is **very poor correlation between respiratory distress and oxygen saturations among infants with lower respiratory tract infections.**(3) Accuracy of pulse oximetry is poor, especially in the 76% to 90% range.(2) Further, it has been well demonstrated that oxygen saturation has much less impact on respiratory drive than carbon dioxide concentrations in the blood.(3) Other than cyanosis, no published clinical sign, model, or score accurately identifies hypoxemic children.(5) Among children admitted for bronchiolitis, continuous pulse oximetry measurement is not well studied and potentially problematic for children who do not require oxygen. Transient desaturation is a normal phenomenon in healthy infants. In 1 study of 64 healthy infants between 2 weeks and 6 months of age, 60% of these infants exhibited a transient oxygen desaturation below 90%, to values as low as 83%.(7) A retrospective study of the role of continuous measurement of oxygenation in infants hospitalized with bronchiolitis found that 1 in 4 patients incur unnecessarily prolonged hospitalization as a result of a perceived need for oxygen outside of other symptoms (10) and no evidence of benefit was found. Pulse oximetry is prone to errors of measurement. Families of infants hospitalized with continuous pulse oximeters are exposed to frequent alarms that may negatively affect sleep. Alarm fatigue is recognized by The Joint Commission as a contributor toward in-hospital morbidity and mortality. (6) One adult study demonstrated very poor documentation of hypoxemia alerts by pulse oximetry, an indicator of alarm fatigue. (7) Pulse oximetry probes can fall off easily, leading to inaccurate measurements and alarms. (8) False reliance on pulse oximetry may lead to less careful monitoring of respiratory status. In one study, continuous pulse oximetry was associated with increased risk of minor adverse events in infants admitted to a general ward.(9) The pulse oximetry–monitored patients were found to have less-effective surveillance of their severity of illness when controlling for other variables.

Return to Algorithm

Recommended Treatments

- **Nasogastric or intravenous fluids** should be administered to infants with a diagnosis of bronchiolitis who cannot maintain hydration orally. Agreement with AAP Recommendation

- **Suctioning** of the nares with a non-invasive device (NoseFrida, bulb, Little Sucker®, BBG nasal aspirator) may be performed at scheduled intervals. Suctioning of the nares with a non-invasive device has been shown to decrease length of stay. If nasal suctioning provides inadequate improvement in respiratory symptoms, nasopharyngeal (deep) suctioning is indicated. A respiratory therapy consult should be considered. Evidence Quality: Low; Recommendation Strength: Weak

- **Supplemental O_2** should be provided if pulse oximetry is <90% for ≥2 minutes in room air with good waveform on monitor and no improvement is obtained by repositioning and non-invasive suctioning. Supplemental O2 should be weaned per protocol. (See Appendix B). NCH Consensus Recommendation

- **Positioning** of the child should **adhere to safe sleep guidelines**. Modify patient position as clinically required to optimize respiratory status. NCH Consensus Recommendation

- **High Flow Nasal Canula (HFNC)** is recommended for patients in ED, ICU, H7A, H8A and H9A who meet Indication and Criteria (see Appendix: HFNC Protocol 2022/23). NCH Consensus Recommendation

Return to Algorithm

Treatments Not Recommended

- **Albuterol** should not be administered to infants and children with a diagnosis of bronchiolitis. Multiple randomized controlled trials have shown that administration of albuterol in hospitalized infants and children does not improve oxygenation or clinical symptom scores and does not decrease length of stay. Administration of albuterol in the ED or outpatient setting does not reduce the risk of hospital admission. Airway obstruction and plugging rather than bronchospasm has been shown to be the primary mechanism of wheezing in bronchiolitis. While albuterol may provide small, short-term improvements in symptoms in the outpatient setting, side effects including tachycardia and tremors are common. The risk of side effects and lack of benefit, combined with cost, does not justify the routine use of albuterol in patients with bronchiolitis. *Evidence Quality: High; Recommendation Strength: Strong*

- Consider one time **albuterol trial** with subsequent re-assessment if >12 months old with wheeze, plus history of atopy or recurrent wheezing OR strong family history of atopy or asthma. (AAP: Evidence Quality: IC; Recommendation Strength: Moderate Recommendation).

- **Deep suctioning** such as nasotracheal and nasopharyngeal suctioning (or use of suction catheter) should not be performed routinely in children with bronchiolitis. Deep suctioning is indicated if secretions and respiratory distress is not improved after nasal suctioning. Frequent deep suctioning may cause harmful side effects including increased airway edema and increased length of stay. *Evidence Quality: Moderate; Recommendation Strength: Weak*

- **Systemic corticosteroids** should not be administered to infants with a diagnosis of bronchiolitis. *Agreement with AAP Recommendation*

- **Chest physiotherapy** should not be used for infants and children with a diagnosis of bronchiolitis. *Agreement with AAP Recommendation*

- **Antibacterial medications** should not be administered to infants and children with a diagnosis of bronchiolitis unless there is a concomitant bacterial infection or a strong suspicion of one. *Agreement with AAP Recommendation*

Return to Algorithm

Return to Albuterol Trial Algorithm

Treatments with Inconclusive Evidence

- **Nebulized 3% hypertonic saline** has not been shown to decrease length of stay and should not be routinely administered to infants and children with bronchiolitis. Limited use after individualized patient assessment may be considered as symptomatic improvement may be seen in select patients hospitalized with bronchiolitis. *Evidence Quality: Moderate; Recommendation Strength: Weak*

- **Nebulized racemic epinephrine** should not be routinely administered to infants and children with bronchiolitis. Limited use based on individualized patient assessment may be considered as symptomatic improvement may be seen in select patients with bronchiolitis. *Evidence Quality: Moderate; Recommendation Strength: Weak*

Return to Algorithm

Return to Albuterol Trial Algorithm

Deterioration & Escalation of Care

Signs of deterioration can include ≥1 of the following:

- Persistent RR ≥70 per minute or worsening tachypnea
- Severe respiratory distress or apnea
- Lethargy
- Poor perfusion

Escalation of Care Protocol:

- Nasal suctioning, followed by nasopharyngeal (deep) suctioning if labored breathing continues
- Consider hypertonic saline if persistent deep airway secretions
- Continuous pulse oximetry and supplemental O_2 if cyanotic, severe distress, or O_2 saturation <90%
- Place IV
- NPO with IVF if severe distress
- HFNC if clinically indicated and patient meets criteria
- Individualized management recommended
- ACT as clinically indicated

Return to Algorithm

Discharge Criteria & Planning

Respiratory Status:

- No signs of fatigue from tachypnea or WOB
- Improving and stable work of breathing
- Caregiver able to clear the infant's airway using nasal suctioning device
- For inpatient discharge: patient with stable O2 saturation (>90%) in room air for at least 8 hours; if patient spent time in PICU, stable O_2 saturation for at least 24 hours

Hydration & Nutritional Status:

- Patient taking sufficient oral feedings/fluids to maintain hydration
- For inpatient discharge: urine output >1 mL/kg/hr for one shift (age <12 months) or >0.5 mL/kg/hr for one shift (age ≥12 months)

Social:

- Resources adequate to support the use of any necessary home therapies
- Caregivers confident they can provide care at home
- Caregiver education and smoke exposure counseling (if present) complete

Follow Up:

- PCP follow-up appointment within 1-3 days planned/scheduled
- When indicated, home care and durable medical supply (DMS) agencies notified and arrangements for visits finalized

Return to Algorithm

Caregiver Education

Education on evidence-based diagnosis, treatment, and prevention in bronchiolitis should be provided to caregivers:

- Emphasize proper hand hygiene.
- Assess exposure of the child to tobacco smoke. When smoke exposure is present, counsel the caregiver about harmful effects of exposing the child to environmental tobacco smoke and provide smoking cessation resources (e.g. “Stop Smoking Programs” Helping Hand [HH-37]).
- Encourage exclusive breastfeeding for at least 6 months to decrease the morbidity of respiratory infections.

Return to Algorithm

Risk Awareness & Zero Hero

- Normal O_2 saturation should not be used for reassurance without assessment of respiratory distress and overall appearance as indicators of patient deterioration.

Return to Algorithm

Metrics

Goals:

- Decrease use of:
  - Chest x-ray
  - Rapid RSV lab testing
  - Albuterol use
  - Continuous O_2 saturation monitoring
  - Antibiotic use
- Decrease ED length of stay, admission rate, and revisit rate
- Decrease hospital length of stay and readmission rate

Inpatient:

Utilization Metrics:

1. Use of IP Admission Bronchiolitis Order Set

Outcome Metrics:

1. Rate of albuterol, CXR, continuous O_2 saturation monitoring and antibiotic use
2. IP LOS
3. HFNC Rate
4. Floor to ICU transfer rate

Balancing Metrics:

1. 7 day return visit rate to ED/UC
2. 7 day readmission rate after IP discharge

Return to Algorithm

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Return to Algorithm

Team & Process

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Clinical Pathway Development

This clinical pathway was developed using the process described in the NCH Clinical Pathway Development Manual Version 6, 2022. Clinical Pathways at Nationwide Children's Hospital (NCH) are standards which provide general guidance to clinicians. Patient choice, clinician judgment, and other relevant factors in diagnosing and treating patients remain central to the selection of diagnostic tests and therapy. The ordering provider assumes all risks associates with care decisions. NCH assumes no responsibility for any adverse consequences, errors, or omissions that may arise from the use or reliance on these guidelines. NCH's clinical pathways are reviewed periodically for consistency with new evidence; however, new developments may not be represented, and NCH makes no guarantees, representations, or warranties with respect to the information provided in this clinical pathway.

For more information about our pathways and program please contact:
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Return to Algorithm

MCED High Flow Nasal Cannula
Protocol for Admission to Hospital Pediatrics

Inclusion Criteria:

Patient between 1 month and 12 months of age with a primary condition of Bronchiolitis and respiratory distress or increased work of breathing unresponsive to standard nasal cannula

Exclusion Criteria:

- Patients in severe respiratory failure (lethargy, prolonged apnea, bradycardia)
- Patients with significant comorbidities (cardiac, pulmonary, or neuromuscular disease, craniofacial abnormalities, immunodeficiency)
  - Patients with hemodynamically insignificant cardiac defects (small ASD/ VSD) are not excluded
- History of prematurity < 34 weeks gestation
- Known concurrent bacterial pneumonia

Main Campus Emergency Department to Hospital Pediatrics Admission Process

Criteria:

- Patient on ≤ 2 L/min/kg flow and FiO2 ≤ 30% for at least 30 minutes AND demonstrating response to HFNC:
  - Improvement in tachycardia by ≥10 bpm OR
  - Improvement in tachypnea by ≥10 bpm OR
  - Decrease in the number or severity of retractions
- IV access is established

Initiation on maximum floor settings is encouraged

Above criteria met?

No → **Off Pathway**
Consider admission to PICU

Yes

ED to place bed request for Hospital Pediatrics

ED to page HP Admitting Resident to inform of HFNC admission

Resident holding the admission pager assigns an HP team
If HP is capped, may ask for re-triage to Pulmonary service

Assigned senior resident notifies charge RN of the intended unit

In person evaluation by charge RN/care partner & senior resident/attending **within 30 minutes** of receiving the admission notification

Senior resident calls for sign-out **or** arranges to meet ED team for direct handoff

Any concerns over stability or suitability for the floor must be reconciled by the Primary Attending or Safety Officer of the Day along with ED Attending.

"Care Complete" if the following criteria are met:

- Patient demonstrates >1 hour of improvement/stability after HFNC initiation **AND**
- The floor physician and RN have completed bedside evaluation and communicated acceptance to ED physician team.

Return to Algorithm

LCED High Flow Nasal Cannula
Protocol for Admission to Hospital Pediatrics (HP)

Inclusion Criteria:

Patient between 1 month and 12 months of age with a primary condition of Bronchiolitis and respiratory distress or increased work of breathing unresponsive to standard nasal cannula

Exclusion Criteria:

- Patients in severe respiratory failure (lethargy, prolonged apnea, bradycardia)
- Patients with significant comorbidities (cardiac, pulmonary, or neuromuscular disease, craniofacial abnormalities, immunodeficiency)
  - Patients with hemodynamically insignificant cardiac defects (small ASD/ VSD) are not excluded
- History of prematurity < 34 weeks gestation
- Known concurrent bacterial pneumonia

Lewis Center Emergency Department to Hospital Pediatrics Admission Process

Criteria:

- Patient on ≤ 2 L/min/kg flow and FiO2 ≤ 30% for at least 30 minutes AND demonstrating response to HFNC:
  - Improvement in tachycardia by ≥10 bpm OR
  - Improvement in tachypnea by ≥10 bpm OR
  - Decrease in the number or severity of retractions
- IV access is established or a plan is in place to establish IV access by transport Team or VAT

Initiation on maximum floor settings is encouraged

Clinical stability for admission to HP determined by FiO2 prior to transport

Return to Algorithm

Above criteria met?

No → **Off Pathway** Consider admission to PICU

LCED attending contacts Safety Officer (SOD) by page or Vocera

SOD will notify Hospital Peds admitting pager

Accepting HP team will call LCED attending for signout

Accepting HP senior resident will obtain Vocera and add themselves to “Lewis Center High Flow” group

- Transport to call ECC 15 minutes prior to arriving to NCH
- ECC with then broadcast the “Lewis Center High Flow” vocera group about pending arrival

Transport Team arrives to Trauma Bay hallway, met by senior resident and Floor Charge RN (or designee) for evaluation of continued patient stability for HP admission

Any concerns over suitability to HP service must be resolved prior to transport to HP:

- MCED Orange pod physician and SOD will be notified to assist in determination of appropriate site of care
- If concerns cannot be reconciled within 5-10* minutes, the patient will be admitted to the ED for further evaluation/ stabilization

*There is a limited amount of time a patient can be supported on portable O2 tank

Appendix: HFNC Protocol - Pg 1

PROTOCOL: High Flow Nasal Cannula (HFNC) for use in Bronchiolitis

Protocol Statements:

Inclusion Criteria:

- Patient has primary condition of Bronchiolitis with:
  - Respiratory distress or increased work of breathing **unresponsive to standard nasal cannula**
- Patient is between 1 month and 12 months of age
- Patient is admitted to either Hospital Pediatrics (HP) or Pulmonary services on H7A, H8A or H9A.
  - No more than 6 patients total on HFNC simultaneously between H7A and H9A with up to an additional 4 patients on H8A
    - Hospital Pediatrics "Safety Officer of the Day", along with Respiratory Therapy (RT), will monitor the number of HFNC patients on the floor.

Exclusion Criteria:

- Patients in severe respiratory failure (lethargy, prolonged apnea, bradycardia)
- Patients with significant comorbidities (cardiac, pulmonary, or neuromuscular disease, craniofacial abnormalities, immunodeficiency)
- Patients with hemodynamically insignificant cardiac defects (small ASD/VSD) are not excluded
- History of prematurity < 34 weeks gestation
- Known concurrent bacterial pneumonia

Off-Protocol Patients:

At times when the PICU is at or near capacity, the floor may accept or continue to manage patients who do not meet criteria for this protocol. Please refer to the Addendum for specific guidance on these situations.

COVID-19 Considerations:

Refer to the most recent COVID-19 Inpatient Pathways for additional details and specifics including isolation and personal protective equipment requirements as HFNC is considered an aerosol generating procedure.

Situational Awareness:

The Safety Officer will report the number of floor patients on HFNC on the daily safety call Mon-Fri to increase general awareness of the acuity on the floor.

Last Edited 9/28/2022

Return to Algorithm

Appendix: HFNC Protocol - Pg 2

Units H7A, H8A and H9A:	
Accepts admission from ED on HFNC when:	**Accepts transfer from ICU on HFNC when:**

• Patient on ≤ 2 L/min/kg flow and FiO2 ≤ 30% for at least 30 minutes AND demonstrating response to HFNC with respect to improvement in heart rate, respiratory rate, SpO2 and patient work of breathing as detailed below in “Indications for ACT and potential ICU transfer”.
  ○ Initiation on maximum floor settings is encouraged
• Patient meets all other inclusion/exclusion criteria
• IV access is established
 	
IF the above criteria are met:
 	
• ED may place bed request for Hospital Pediatrics
  ○ ED to page HP Admitting Resident to inform of HFNC admission
  ○ Resident holding the admission pager assigns an HP team
  ▪ If HP is capped, may ask for re-triage to Pulmonary service
  ○ Assigned senior resident notifies charge RN of the intended floor unit
  ○ Senior resident calls for signout **OR** arranges to meet ED team for direct handoff
  ○ Expectation is for **in person** evaluation by charge RN (or care partner) and senior resident (or attending if resident is unavailable) **within 30 minutes** of receiving the admission notification.
• Prior to ED “completing care” the following criteria must be met:
  ○ Patient demonstrates >1 hour of improvement/stability after HFNC initiation **AND**
  ○ The floor physician and RN have completed bedside evaluation and communicated to ED physician team that the patient is accepted.
• Any concerns over stability or suitability for the floor must be reconciled by the Primary Attending or Safety Officer of the Day along with ED Attending.
	• Patient demonstrates > 4 hours stability on ≤ 2 L/min/kg flow and FIO2 ≤ 30%
	• Patient meets all other inclusion/exclusion criteria
	• > 12 hours removed from non-invasive ventilation requirement (i.e. BiPap)
	• No history of mechanical ventilation for current illness
	• No current use of sedation medications or active sedation wean (IV or oral)
	• Communication/agreement by Primary Service Attending or Safety Officer of the Day as well as the accepting unit Charge Nurse.

Return to Algorithm

Last Edited 9/28/2022

Appendix: HFNC Protocol - Pg 3

Procedure for **INITIATION** of HFNC on current H7A, H8A or H9A patient**:**

Procedure	Points to Remember
1. Patient made "Watcher" status for "escalating respiratory support." **Bedside huddle** with RN, charge nurse, RT, resident(s), primary service Attending (if available), and Safety Officer of the Day.	**1.** **ACT is not required prior to initiation of HFNC.** However, if patient fails to respond to HFNC (defined below) or potentially requires transfer to ICU, an ACT should be called. **2.** In the event that there are already 6 HFNC patients on H9A/H7A but less than 4 HFNC patients on H8A, a huddle will include H8A nursing and RT representation to determine whether transfer to that unit is appropriate. **3.** Communication by charge RN to H8B ICU charge RN required to ensure awareness of number of HFNC patients on the floor
2. Patient should initially be kept NPO with IV access established. Continuous pulse oximetry monitoring is indicated.	
3. Patient will be set up on the high flow nasal cannula system by RT.	**1.** Select the appropriate size cannula ensuring less than 50% of the nare is occluded at all times.
4. Goal and maximum **flow rate of 2 L/min/kg.**	**1.** Initiate flow at 6 L/min and increase by 2 L/min every 30 seconds until goal flow rate is reached to allow infant to adjust to high flow. Notify provider if unable to achieve goal flow rate within 10 minutes.
5. **Start at FiO2 of 50%.** Once goal flow rate is achieved, decrease FiO2 by 5% every 2 minutes as tolerated to maintain SpO2 ≥ 90%.	

Last Edited 9/28/2022

Return to Algorithm

Appendix: HFNC Protocol - Pg 4

Procedure for **REASSESSMENT** of HFNC patient**:**

HFNC Initiated in ED or on H7A, H8A or H9A	Transferred from ICU on HFNC	Indications for ACT and potential ICU transfer
1. RT and physician (senior resident and/or attending) will assess the patient every hour for two occurrences. RT will continue to assess every 2 hours thereafter.	**1.** RT and physician will assess patient on arrival to the floor and at 2 hours post-transfer. RT will continue to assess every 2 hours thereafter.	**1.** PEWS score > 7 OR
2. RT will document liter flow, FiO2, heart rate, respiratory rate, SpO2 and patient work of breathing with every patient assessment.		**2.** Requiring ≥ 50% FiO2 for more than 10 minutes to maintain SpO2 ≥ 90% OR
		3. Non-response to HFNC therapy where response is defined as improvement in tachycardia by ≥10 bpm OR improvement in tachypnea by ≥10 bpm OR decrease in the number or severity of retractions. The team may also initiate ACT/ICU transfer on the basis of other clinical concerns.

Last Edited 9/28/2022

Return to Algorithm

Appendix: HFNC Protocol - Pg 5

Procedure for **WEANING** HFNC**:**

Procedure	Points to Remember
Oxygen: **1.** Wean FiO2 by 5% every 2 hours as tolerated to maintain SpO2 ≥90%. Both RT and/or bedside nurse can wean FiO2. **2.** Wean FiO2 to 30% prior to weaning flow.	**1.** If after the wean, SpO2 falls to <90%, HR increases by >20 beats/min AND is >20 above the normal range, RR increases by ≥ 20 breaths/min AND is ≥ 10 above the normal range after weaning, or if the patient demonstrates new or marked retractions the wean has failed. Return to previous FiO2 and reassess for wean in 2 hours.
Flow: **RT is responsible for weaning flow rate.** 1. Wean liter flow when patient meets **weaning criteria**: a. FiO2 is ≤ 30% AND b. RR is ≤ 20 breaths/min above the normal range for at least 2 hours AND c. there are no marked retractions	**1.** For patients > 6 kg, decrease flow by 4 L/min and reassess in 2 hours. For patients ≤ 6 kg, wean by 2 L/min and reassess in 2 hours. **2.** The wean has failed if any of the following criteria are met: a. HR increases by > 20 beats/min and is > 20 above the normal range b. RR increases by ≥ 20 breaths/min and is ≥ 10 above the normal range c. FiO2 requirement increases by ≥ 10% d. Patient demonstrates new or marked retractions **3.** If wean failed, return to previous liter flow and reassess for wean in 4 hours. **4.** If wean successful, continue to assess readiness for subsequent weans every 2 hours. Wean by 4 L/min (> 6 kg) or 2 L/min (≤ 6 kg) when patient meets weaning criteria. **5.** RT will page the physician team if patient does not meet weaning criteria for >8 hours. **a.** It is expected that some patients not be able to wean for > 12-24 hours. **b.** If a patient has previously failed wean or RT/nursing feels that they are not ready to wean this should be communicated to physician team who may write a “Hold Wean” communication order for a specified period of time. The practitioner will remove “Hold Wean” order when weaning attempts may be reinitiated.

Return to Algorithm

Last Edited 9/28/2022

Appendix: HFNC Protocol - Pg 6

Procedure for **FEEDING** patients on HFNC**:**

Goal is for all patients to receive enteral feeds within the first 24 hours of HFNC treatment.

HFNC patients are initially made NPO with IV fluids and maintained for a minimum of 4 hours after initiation to allow for a period of observation and stability prior to considering feeds.

Procedure	Points to Remember
1. Practitioner removes NPO order and enters diet order for patient on HFNC.	**1.** Patient should exhibit stable or improving FiO2 and Flow requirements.
1. Initial feed must be monitored by a nurse, physician, RT, or occupational/speech therapist to ensure no frank signs or symptoms of aspiration (to include: coughing, choking, gagging and/or increased FiO2 requirement by ≥ 10%, increase in RR > 20 bpm).	**1.** Nasal suction prior to attempted feeds when appropriate. **2.** While feeding: The HFNC liter flow should be reduced to 2 L/min, and the FiO2 should be increased to 100% for up to 20 minutes during and immediately after feeding (flow adjustments specific to feeding may be done by the bedside nurse with communication to RT) **3.** NG feeds should be considered for those patients who fail a trial of oral feeds but otherwise demonstrate stability on HFNC. **a.** For patients on >10 L/min receiving NG feeds, the NG tube should be vented prior to every feed and at least q4 hours. **4.** Post-pyloric feeds (NJ) may be considered for patients unable to tolerate pre-pyloric feeds.

Last Edited 9/28/2022

Return to Algorithm

Appendix: HFNC Protocol - Pg 7

Procedure for **HOLIDAY WEAN** for HFNC patient**:**

Consider for patients who meet "weaning criteria" and have tolerated at least one oral feed. Successful feeding is a patient who exhibits **NO** frank signs or symptoms of aspiration (coughing, choking, gagging and/or increased FiO2 requirement by ≥ 10%, increase in RR > 20 bpm).

Procedure	Points to Remember
1. Practitioner places orders for Holiday Wean.	
2. RN to notify RT of plan for Holiday at beginning of feed. **3.** Patient should remain on 2 L/min and 100% FiO2 for 45-60 minutes total with RT assessment at the end of this period. If patient demonstrates any criteria of a failed wean, return to previous settings. If trial is passed, discontinue HFNC.	**1.** Continue to monitor for frank signs or symptoms of aspiration (coughing, choking, gagging and/or increased FiO2 requirement by ≥ 10%, increase in RR > 20 bpm).
4. If Holiday Wean trial is **PASSED**, discontinue HFNC. **a.** RT will transition patient to 2L O2 via simple cannula. **i.** If the patient's FiO2 is ≤ 25%, may transition straight to room air. **b.** RT will continue to assess every 2 hours for 2 occurrences.	**1.** HFNC setup should remain in patient's room for at least 4 hours following discontinuation.
5. If Holiday Wean trial is **FAILED**, RN or RT to reinitiate HFNC at previous rate.	**1.** Patient may retry Holiday Wean Q8H PRN from previously failed wean following the same protocol. **2.** Patient may continue normal feeding protocol until next Holiday Wean attempt.

Last Edited 9/28/2022

Return to Algorithm

Appendix: HFNC Protocol - Pg 8

Procedure for **DISCONTINUING HFNC**:

Procedure	Points to Remember
1. When patient has successfully weaned to a flow rate of: **a.** ≤ 6 L/min if weight > 6 kg **OR** **b.** ≤ 4 L/min if weight ≤ 6 kg **AND** **c.** Weaning criteria met RT will transition patient to 2L O2 via simple cannula.	**1.** RT may choose to transition straight to room air if the patient's FiO2 is ≤ 25%.
2. HFNC setup should remain in patient's room for at least 4 hours following discontinuation.	
3. After discontinuation, RT will continue to assess every 2 hours for 2 occurrences.	

Last Edited 9/28/2022

Return to Algorithm

Appendix: HFNC Protocol - Pg 9

Protocol Disclaimer:

Clinical practice guidelines and algorithms at Nationwide Children's Hospital (NCH) provide general guidance to clinicians. Patient choice and clinician judgment remain central to the selection of diagnostic tests and therapy. The ordering provider is ultimately responsible for care decisions. NCH's guidelines and algorithms are reviewed periodically for consistency with new evidence; however, new developments may not be represented.

During periods of high census, patient safety clearly takes priority and adjustments to the above protocol recommendations may be necessary including number of patients on HFNC on the floor, units and services able to administer HFNC and inclusion/exclusion criteria. Please see the Addendum for general guidelines on how to manage these situations although the judgement of the physician and nursing teams will always need to be exercised.

For questions or clarifications related to this protocol, please contact Dr. Claire Sevov at claire.sevov@nationwidechildrens.org or Dr. Ryan Bode at ryan.bode@nationwidechildrens.org. The protocol was developed and approved by a multidisciplinary HFNC QI team and last updated August, 2022.

Last Edited 9/28/2022

Return to Algorithm

Appendix: HFNC Protocol - Pg 10

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Return to Algorithm

Last Edited 9/28/2022

Appendix: HFNC Protocol - Pg 11

Addendum – Off-Protocol HFNC Patients

During periods of limited PICU bed availability, the decision to keep a patient on the floor, despite being off-protocol, should be based on the collective assessment of the multidisciplinary treatment team including bedside nursing, nursing leadership, respiratory therapy, and physicians from both the floor and PICU teams. Expert clinical judgement and the patient's best interest should always be the primary considerations when managing these situations. The following are general guidelines to follow when this occurs.

When to call an ACT: At any time when it is warranted by patient status, including any patient who is off-protocol due to clinical factors such as age, comorbidities, or level of respiratory support required.

An ACT is not required to transfer a patient from a non-HFNC unit to H9A/H7A/H8A for the purposes of starting HFNC provided the patient otherwise meets all inclusion/exclusion criteria unless the floor is already at a cap of 10 simultaneous HFNC patients.

Patient meeting exclusion criteria or exceeding FiO2 or Flow parameters: During the ACT, all parties (respiratory therapy, bedside nurse, nursing supervisor, floor team, Safety Officer, ICU staff) must convene a "Huddle" outside of the patient's room where all parties have the opportunity to ask questions or voice concerns to the group prior to determining the plan for disposition. If the patient is to remain on the floor, there must be closed-loop communication regarding the clinical parameters that would require reassessment of this initial determination. The ACT recorder will track whether a Huddle has been completed. The nursing manager and/or nursing supervisor must be notified of patients remaining on the floor if not immediately involved in the Huddle.

Patient transferring to H9A/H7A/H8A for HFNC: Requires a huddle between the physician team, Safety Officer, RT, transferring unit charge RN, and the accepting unit charge RN. The nursing manager and/or nursing supervisor should also be notified. HFNC should be started wherever the patient is located, do not wait for transfer to provide increased respiratory support. No transfer of service is required (eg if patient is on ID service, they will stay on the ID service).

Orderset Use: All bronchiolitis patients receiving HFNC on the floor on H9A/H8A/H7A must have the "HFNC Floor Orders for Bronchiolitis" orderset entered – even if technically the patient is off-protocol. It's up to the physician team to modify the protocol orders as needed to suit the clinical situation.

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Return to Algorithm