



State of Maryland

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To: Maryland Emergency Departments

From: Theodore Delbridge, MD, MPH  
Executive Director

Timothy Chizmar, MD  
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State Associate EMS Medical Director for Pediatrics

Re: C4 Pediatrics Guidance on Pediatric Respiratory Distress and High Flow Nasal Cannula

In Maryland, and in many other areas of the United States, there is a current surge of respiratory viruses affecting children and causing bronchiolitis. The Maryland Critical Care Coordination Center Pediatrics (C4P) program is experiencing unprecedented call volume from emergency departments attempting to identify available inpatient resources, including intensive care, for their ill pediatric patients. Scarcity of those resources is sometimes leading to longer than usual ED lengths of stay, necessitating attention to ongoing care. In several cases, use of high flow nasal cannula oxygen has made meaningful differences in temporizing situations and stabilizing patients.

The C4Pediatrics program has created the attached Clinical Guidance on the Use of High Flow Nasal Cannula (HFNC) for children with acute respiratory illness. We hope you will find the guidance useful and make it prominently available in your ED. Any questions about the guidance can be directed to the medical director of C4Pediatrics, Dr. Jennifer Anders at [janders@miemss.org](mailto:janders@miemss.org). Real time, 24/7 consultation with the C4Pediatrics physician on-call can be accessed by calling 410-706-7797.

Thank you.

Enclosure: Maryland C4Pediatrics Clinical Guidance on HFNC

## Maryland C4Pediatrics Guidance on Use of HFNC

This document was developed to support Maryland ED sites and community hospitals dealing with respiratory surge in October 2022. This document represents consensus opinion of physicians experienced with use of HFNC. These guidelines should not replace bedside clinical judgement. Please contact **C4Pediatrics at 410-706-7797** for assistance with critically ill children in need of transfer or patient specific guidance.

### Clinical Guidance for Use of High Flow Nasal Cannula Oxygen and other Respiratory Support in care of Respiratory Distress/Bronchiolitis in Young Children (0-4 years)

Similar principles can be used for high flow nasal cannula (HFNC) use in older children and children with other etiologies for their respiratory failure, including asthma/reactive airway disease, community acquired pneumonia, and lower respiratory viral infections such as influenza and COVID. However, such older children on HFNC will more often require specialty input. In addition, seek early specialty care guidance for acute care of children with:

- congenital heart disease
- chronic lung diseases
- pulmonary hypertension
- neuromuscular disorders that impair respiration
- known or suspected difficult airway
- complex chronic conditions

Initial Assessment – remove clothing to allow visualization of chest and abdominal movement. Keep child calm/attempt to console, but optimize airway positioning (e.g., remove from car seat).

Mild	Moderate	Severe
Comfortable tachypnea Tolerating PO intake	Respiratory Rate <ul style="list-style-type: none"><li>• 60-70/min (age 0-3m)</li><li>• 50-60/min (age 3-12m)</li><li>• 40-50/min (age 1-2y)</li></ul>	Respiratory Rate <ul style="list-style-type: none"><li>• ≥ 70/min (age 0-3m)</li><li>• ≥ 60/min (age 3-12m)</li><li>• ≥ 50/min (age 1-2y)</li></ul>
Abdominal breathing, Subcostal retractions	Intercostal & subcostal retractions	Deep retractions, tracheal tug Head bobbing, grunting
Upper airway noises	Wheezing, prolonged	Poor air movement
Normal/baseline mental status	Fussy, anxious, hard to console (if different from baseline)	Lethargic, little response to pain (if different from baseline)
Oxygen saturations ≥90% on RA		Oxygen saturations < 90% on RA

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### **Mild to Moderate Viral respiratory Illness:**

Young children have incredible respiratory muscle reserve and may tolerate prolonged periods (days) of moderate tachypnea and increased work of breathing. The vast majority of children with bronchiolitis with mild to moderate increased RR or WOB do not need respiratory support.

Supportive care options for mild to moderate bronchiolitis:

- Nasal suction with saline spray or drops – especially important for very young infants who are still obligate nose breathers
- Allow feeding if tolerated - consider clear fluids (Pedialyte) if not tolerating milk
- Control fever

### **Moderate to severe viral respiratory illness:**

**In addition to supportive care above:**

- If hypoxia on room air (RA), Initiate Low Flow oxygen to keep saturation  $\geq 90\%$
- If unable to take PO or signs of dehydration, consider dextrose-containing IV fluids
- Consider trial of Albuterol or other nebulized therapies. While not routinely recommended by evidence-based guidelines, may help in some cases. To trial nebulized therapies, respiratory assessment should be done immediately before and after a treatment. Consider using a scoring system to standardize respiratory assessment. If there is not clear benefit of improved RR or decreased WOB (or improved score) – do not continue.
- Steroid therapy is NOT recommended for the treatment of bronchiolitis

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### Initiation of HFNC

Consider initiation of HFNC if the child has:

- continued hypoxia (<90%) despite Low Flow O<sub>2</sub> (<4L/min from wall oxygen)
- worsening respiratory distress in severe zone (increased RR or WOB)
- abnormal blood gas with hypercarbia and/or hypoxemia

Upon HFNC initiation, the child should be NPO and on dextrose-containing mIVF.

Initiate HFNC at 1 L/kg/min (maximum 15L/min for those over 15kg)

Initiate FiO<sub>2</sub> at 21% and up-titrate as needed up to maximum 60% to keep SaO<sub>2</sub> ≥90%

Vital signs q30 min x 3 (first hour)

Allow child time to settle (20-30 minutes) on initial settings before increasing flow rate.

Titrate FLOW RATE and FiO<sub>2</sub> independently.

Increase flow rate for WOB, Increase FiO<sub>2</sub> to keep SaO<sub>2</sub> ≥ 90%

- Titrate flow rate in increments of 1-2L/min. Pause to allow child to settle before next increase.
- Do not exceed the maximum recommended HFNC rate of 2L/kg/min (or max cannula will allow).
- If child shows severe respiratory distress on 2L/kg/min HFNC – consider other modes of NIPPV (e.g., BiPaP).
- If requiring FiO<sub>2</sub> > 60% to maintain SaO<sub>2</sub> ≥ 90% despite airway clearance therapies (e.g., nasopharyngeal suctioning) and consider increasing flow rate by 1-2L/min or switching to other modes of NIPPV (e.g., CPAP, BiPaP). Consider CXR if not already obtained.

Note: many children are agitated by high rates of flow and will appear WORSE with higher rates. If higher rate is not leading to improvement in respiratory score – consider decreasing flow, suctioning nose and allow child to be tachypneic and retracting so long as child is well oxygenated and able to maintain ventilation (watch for decreased LOC). If child is opening mouth (or infant spits out pacifier) – the flow rate is TOO HIGH; reduction of rate should improve both WOB and comfort.

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### **Continued Care and Weaning of HFNC**

Once child is on stable settings, assess Q4H

For children with hypoxia and WOB, first wean FiO<sub>2</sub> down to 30% before weaning flow rate.

#### **SLOW WEAN STRATEGY:**

- Attempt to wean flow by 1L/min (under 1 year) or 2L/min ( $\geq 1$  year). Repeat weaning q1-2hour if WOB and RR remain in moderate zone (does not need to be normal)
- Observe closely for 10 minutes after weaning to determine if stable on lower flow, then reassess again in 1-2 hours
- Once child is at 4L/min HFNC and FiO<sub>2</sub> 40%, may switch to low flow NC

#### **RAPID WEAN STRATEGY:**

- Reduce HFNC rate by 50%
- Observe closely for 10 minutes after weaning to determine if stable on lower flow, reassess again in one hour
- If WOB and RR remain in moderate zone over 2 hours – can come off, or wean to low flow NC

### **Feeding on HFNC**

There are no established feeding practices on HFNC. In the first 12 hours, most infants and children are not interested in eating. This guideline does not advocate for initiation of feeds at a specific time and the safest course of action is to maintain the child NPO until weaning HFNC support.

Assessment that a child is ready to attempt PO feeding

- Able to clear their own secretions
- Improved cough (few paroxysms that may lead to post-tussive emesis)
- Stable or decreasing respiratory support (HFNC)

Full nutrition is not the goal – continue mIVF with dextrose containing fluid. When allowing PO, by bottle or breast, limit volume/time at first and advance gradually as child proves able to tolerate. If initiating NG feeding, start with trophic feeds (1 ml/kg/hr up to 5mL/hr) and increase slowly.

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### **Maintenance/Monitoring and Escalation to Critical Care**

Note about “concern for tiring out”: otherwise healthy, normal, robust infants will rarely tire out – they will maintain RR in 70-80’s for days as long as other supportive therapies are offered (mIVF). An alert, hydrated infant with RR in the 70s just needs time. Mental status will be the best indicator of respiratory failure, prior to a fall in respiratory rate.

Appropriate respiratory support may allow a child that presented in severe distress to relax and fall asleep. Assessment of mental status can be difficult when a child falls asleep; assessment of arousal to stimulation can help differentiate sleep from altered mental status. If concerns remain for “tiring out”, a venous blood gas can differentiate between an improving (respiratory alkalosis, low CO<sub>2</sub> with high pH) and failing (respiratory acidosis, high CO<sub>2</sub> with low pH) child.

Young infants (<2months), particularly those with complex history (ex-preemies, comorbidities), are the ones to watch closely. These children often do not ‘tire out’ – they just go apneic. Maintain heightened awareness and monitor closely while awaiting transfer to specialty care.

Fever increases metabolic demand resulting in increases in respiratory rate, work of breathing and tachycardia. If respiratory support (HFNC rate) is increased during a fever, treat the fever aggressively and after the child defervesces, consider attempt to wean rapidly/de-escalate.

If respiratory support is stable for period of time (>12hours) and then worsens, consider CXR to evaluate for superinfected PNA or large segment atelectasis.

### **RED FLAGS/CALL FOR HELP**

Clinical worsening despite maximal HFNC support

Desaturations below 90% despite FiO<sub>2</sub> > 50%

Inappropriately low RR (RR decline with persistent signs of increased WOB)

Apnea > 20 seconds with bradycardia or desaturation requiring stimulation

Lethargy/Poor response to noxious stimulus

Poor perfusion