Med-Surg GUIDELINE

HIGH FLOW NASAL CANNULA (HFNC): Introduction

<26 years age

Children's MINNESOTA

Weight Based Guidelines

Age	0-24 Months	2-10 Years	>10 Years
Initial Flow Rates*	2 L/kg/min	1 L/kg/min	1 L/kg/min
Max Flow Rates**	2 L/kg/min up to 15 L/min (i.e. 3 kg = 6 L/min, 8 kg = 15 L/min)	1 L/kg/min up to 20 L/min (round up to the nearest 5 L/min; i.e. 12 kg = 15 L/min)	1 L/kg/min up to 30 L/min

* If patient experiences discomfort with initial flow rate, may reduce by 20% and reassess. For nasal cannula size, equipment and skin care consideration, see notes 1 and 2.

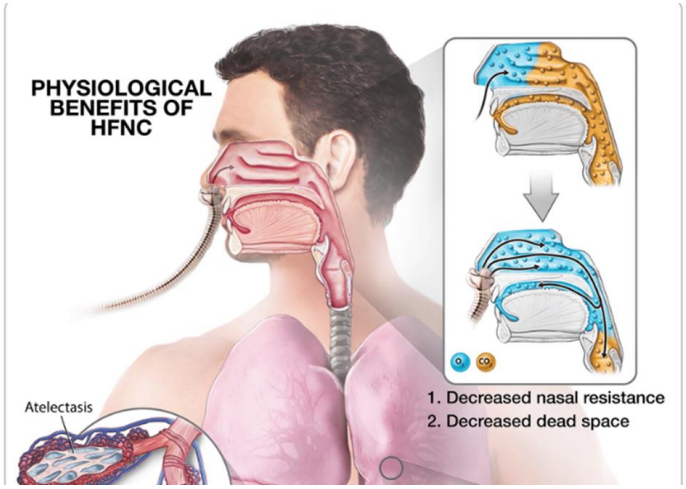
** Patients who are placed on maximal flow rates must show improvement (HR, RR, work of breathing, **SpO2 ≥90%**) within 60 minutes or transfer to a higher level of care should be initiated. **FiO2 must be ≤60% to be admitted to the med/surg floor. L/kg listed is the max per weight and the L/min is absolute max for age for med/surg.**

HFNC Does NOT (Note 3)

- Provide significant positive end-expiratory pressure or PEEP (1-2 L/kg provides a MAX of 2-4 cmH20 pharyngeal pressure under controlled settings) [4]
- Reliably improve nasal secretions
- Decrease length of stay or risk of escalation for *mild* increased work of breathing

Physiologic Benefit: The Why

- Weight based flow can reduce work of breathing in patients with moderate to severe respiratory distress [1]
- Weight based HFNC is a safe and well-established practice across pediatric hospitals
- There is no evidence for increase in pneumothorax, PICU transfer, or intubation (up to 2 L/kg)
- Can deliver higher FiO2 in patients who are unable to maintain saturations with regular nasal cannula.



Alsharani, M, et. Al. (2020) Benefits of HFNC, reprinted with permission. Available from https://doi.org/10.21203/rs.3.rs-111258/v1

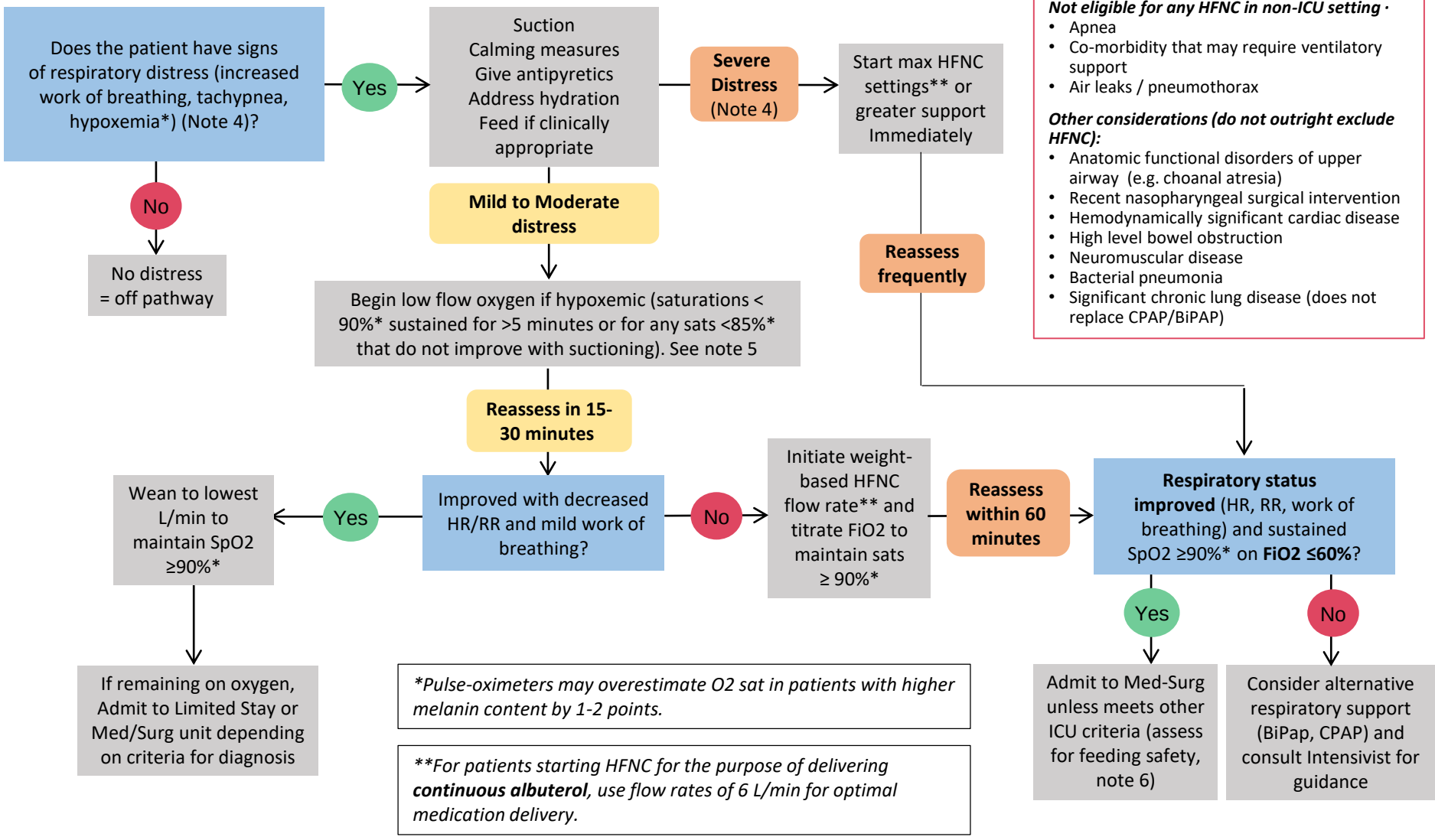
ED/Med-Surg GUIDELINE

HIGH FLOW NASAL CANNULA (HFNC): Initiation

<26 years age

Children's MINNESOTA

Aim: To standardize approach to the initiation, escalation, and weaning for high flow nasal cannula oxygen.



EXCLUSION GUIDELINES

Not eligible for any HFNC in non-ICU setting ·

- Apnea
- Co-morbidity that may require ventilatory support
- Air leaks / pneumothorax

Other considerations (do not outright exclude HFNC):

- Anatomic functional disorders of upper airway (e.g. choanal atresia)
- Recent nasopharyngeal surgical intervention
- Hemodynamically significant cardiac disease
- High level bowel obstruction
- Neuromuscular disease
- Bacterial pneumonia
- Significant chronic lung disease (does not replace CPAP/BiPAP)

**Pulse-oximeters may overestimate O2 sat in patients with higher melanin content by 1-2 points.*

***For patients starting HFNC for the purpose of delivering **continuous albuterol**, use flow rates of 6 L/min for optimal medication delivery.*

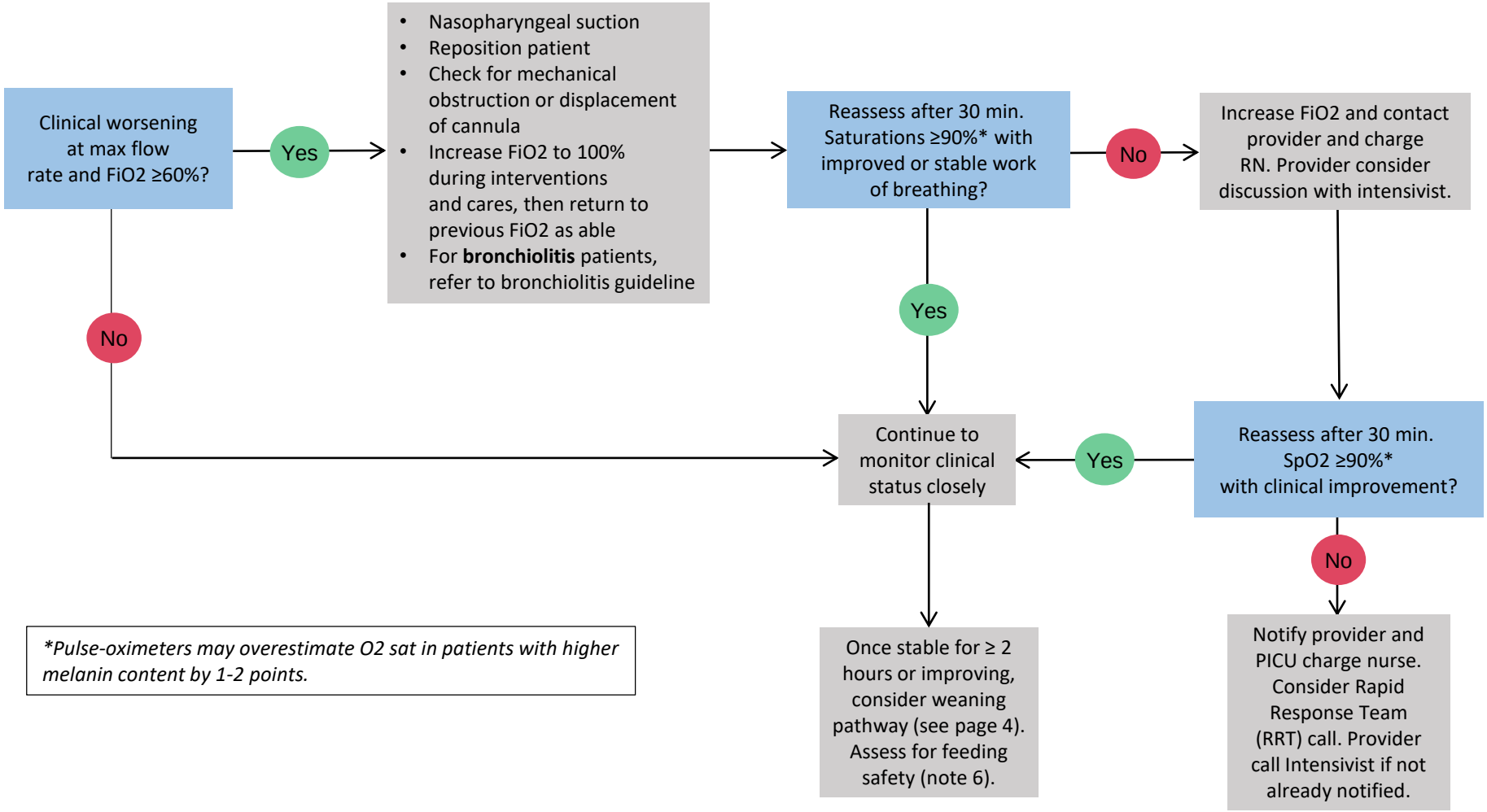
Med-Surg GUIDELINE

HIGH FLOW NASAL CANNULA (HFNC): Med-Surg Escalation

<26 years age

Children's MINNESOTA

Aim: To standardize approach to the initiation, escalation, and weaning for high flow nasal cannula oxygen.

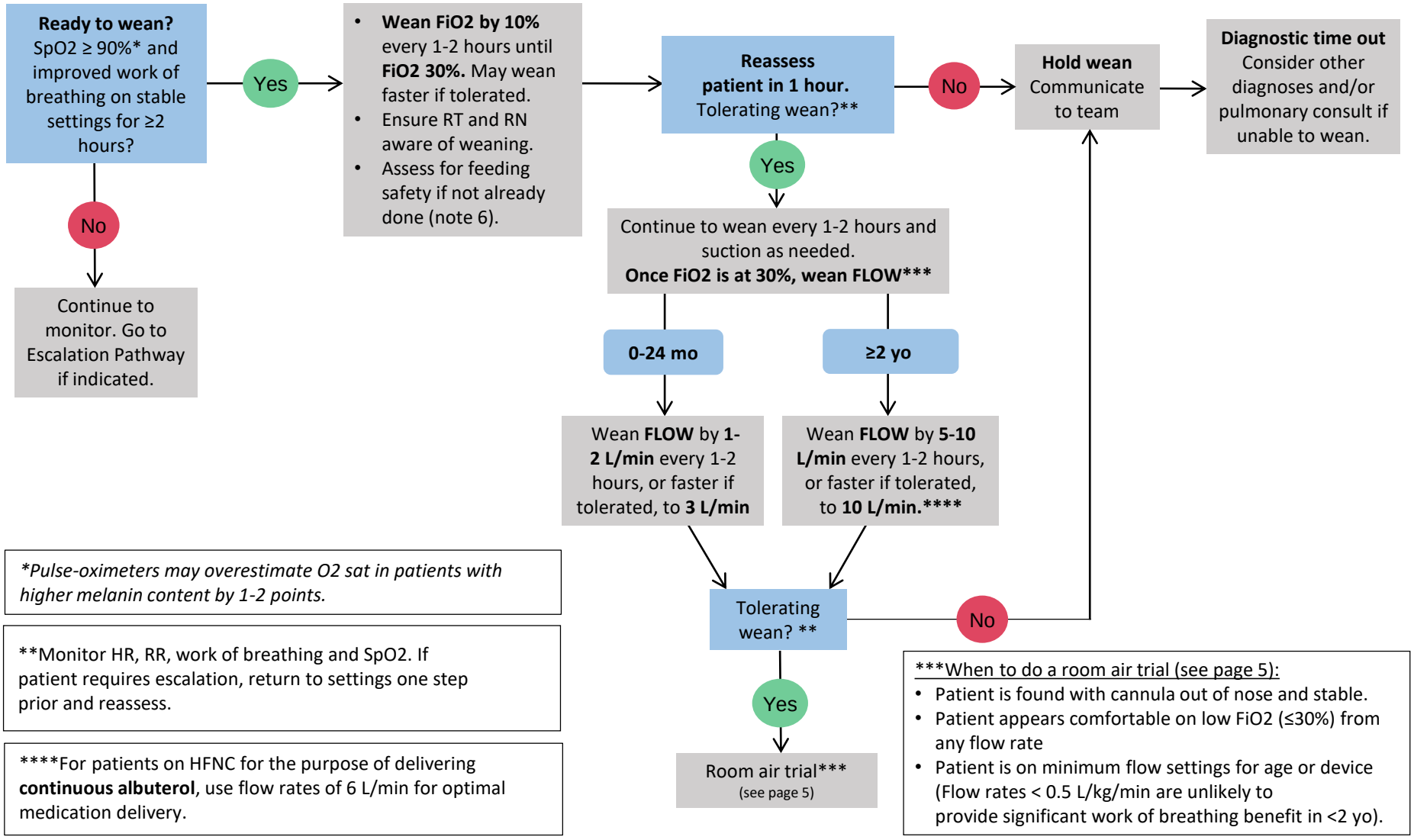


**Pulse-oximeters may overestimate O2 sat in patients with higher melanin content by 1-2 points.*

HIGH FLOW NASAL CANNULA (HFNC): Weaning
<26 years age

Children's MINNESOTA

Aim: To standardize approach to the initiation, escalation, and weaning for high flow nasal cannula oxygen.



**Pulse-oximeters may overestimate O2 sat in patients with higher melanin content by 1-2 points.*

**Monitor HR, RR, work of breathing and SpO2. If patient requires escalation, return to settings one step prior and reassess.

****For patients on HFNC for the purpose of delivering **continuous albuterol**, use flow rates of 6 L/min for optimal medication delivery.

***When to do a room air trial (see page 5):
- Patient is found with cannula out of nose and stable.
- Patient appears comfortable on low FiO2 (≤30%) from any flow rate
- Patient is on minimum flow settings for age or device (Flow rates < 0.5 L/kg/min are unlikely to provide significant work of breathing benefit in <2 yo).

HIGH FLOW NASAL CANNULA (HFNC): Room Air Trial

<26 years age

Children's MINNESOTA

Aim: To standardize approach to the initiation, escalation, and weaning for high flow nasal cannula oxygen.

Patient meets criteria for a room air trial with one of the following:

- Found with cannula out of nose and stable.
- Comfortable on low FiO2 (≤30%) from any flow rate
- Stable on minimum HFNC settings for age or device. (Flow rates < 0.5 L/kg/min are unlikely to provide significant work of breathing benefit in <2 yo)

Perform room air trial:

- Turn HFNC machine off
- Remove nasal cannula from nares (may leave stickers in place)
- Monitor work of breathing and oxygen saturation.

How did patient respond to room air trial?

- Monitor HR, RR, work of breathing, and SpO2 and assess for 15 minutes.
- If patient requires escalation, return to settings one step prior and reassess.
- RN/RT to document room air response in iView and notify team of results.

Stable on room air

Transition to spot check pulse-ox after 1 hour

Saturations <90%* but work of breathing stable

Start **low flow nasal cannula** (LFNC) at ½ L/min and escalate as needed to achieve sats ≥90% (Note 5). Can repeat room air trial after ≥2 hours of stability and meets criteria for room air trial.

If patient continues to require LFNC, but is otherwise stable, assess for home oxygen therapy eligibility (contact pulmonary, case management)

HR/RR elevated above age-appropriate norms or increase in work of breathing

0-24 months old

Resume previous HFNC settings until stable, then resume wean. Can repeat room air trial after ≥2 hours of stability and meets criteria for room air trial.

≥2 yo (on Optiflow)

Resume previous HFNC settings until stable then continue wean. If ≤ 10 L/min, transition to MR850 then decrease by 2 L/min every 1-2 hours, or faster if tolerated. Can repeat room air trial after ≥2 hours of stability and meets criteria for room air trial.

**Pulse-oximeters may overestimate O2 sat in patients with higher melanin content by 1-2 points.*

HIGH FLOW NASAL CANNULA (HFNC): Notes
<26 years age

Children's MINNESOTA

Note 1: Equipment considerations

- Select the cannula size carefully (~70% of nare diameter) so as not to totally occlude patient nares.
- The pop off will prevent excessive pressures in the chamber.
- Set humidifier on invasive mode. Monitor patient temp and system rain out. Invasive mode should be selected for all patient needs (gas is delivered at 37 degrees C and 44 mg/L). The displayed temp will be approximately 37 degrees C in this mode. If excessive rain out affects the patient's tolerance of the system, change to the non-invasive mode.

Note 2: Skin assessment

- Thoroughly inspect the skin beneath and around the oxygen device at least every 4 hrs or with cares (i.e. back of the ears, bridge of the nose and nares)
- Apply skin barrier product per unit guidelines/skin team recommendation.
- Educate patient and caregiver on the importance of frequent skin inspection
- The RN and RT are responsible for inspection and documentation of skin integrity around and under oxygen administration devices. Notify skin team for any abnormal skin assessment.

Note 3: Special considerations

- HFNC is not meant to be a substitute for patients requiring positive pressure (CPAP), specifically in patients with rapidly progressive respiratory distress or impending respiratory failure.
- Caution should be used in patients with functional or anatomical bowel obstruction. HFNC may cause abdominal distention due to the distending airway pressures (up to 2-4 cm H2O).
- Caution should be used in patients with upper airway abnormalities (choanal atresia, cleft lip/ palate).
- **WARNING:** Heated Humidified Nasal Cannula (HFNC) systems may generate back pressure and create a CPAP-like affect. The amount of distending pressure generated by the HFNC depends on the size of the cannula, the flow rate, and the anatomy of the patient's airway.

Note 4: Clinical assessment

	Reassuring	Monitor	Very concerning
Heart rate	Normal	Mild tachycardia	Severe tachycardia or bradycardia
Respiratory rate	Normal	Mild tachypnea	Severe tachypnea or bradypnea
Pulse oximetry*	≥90% on room air	86-89% on room air (start LFNC if >5 min)	≤85% on room air (start oxygen immediately)
Work of breathing	Normal	Mild-moderate retractions	Severe retractions, head bobbing, grunting
Breath sounds	Good air movement	Decreased air movement, scattered crackles/ wheeze	Markedly decreased or absent air movement, diffuse crackles/wheeze
Level of interaction	Normal	Less interactive than normal, fussy but consolable	Obtunded, inconsolably fussy/irritable
Perfusion	Normal	Cool distal extremities, cap refill 3-4 seconds	Cold extremities, cap refill ≥5 seconds

**Pulse-oximeters may overestimate O2 sat in patients with higher melanin content by 1-2 points.*

Note 5: Low Flow nasal cannula recommendations

- Begin supplemental oxygen for oxygen saturations <90% sustained for >5 minutes or for any saturations ≤85% that do not improve with suctioning.

MAX AGE-BASED LOW FLOW OXYGEN SETTINGS		
Age	*Max dry oxygen flow rate	
	**NC	Mask
0-12 months	2 L/min	5 L/min
1-8 years	4 L/min	10 L/min
>8 years	6 L/min	10 L/min

*Recommended flow rates for long-term use (>24 hours); may consider higher rates for short-term use as indicated.
**Nasal cannula (NC) is the recommended delivery system outside ED

Note 6: Feeding on HFNC

- Enteral nutrition helps bodies heal. [7, 8]
- Oral feeding in bronchiolitis patients on HFNC is safe (≤2L/kg/min). [9]
- Consider allowing patients to feed orally (or enterally) once they are stable on HFNC and showing interest in feeding. Home feeding regimen (breastmilk, formula, age-appropriate liquids) is appropriate. Add solids as desired once oral liquids are successfully tolerated.
- Initial feeding (breast, bottle, cup) should be monitored closely by parent and RN for any sign of aspiration.
- Consider an NG tube and enteral feeds for patients who are not taking PO. Enteral feeds mimic patient's typical home feeding regimen (breastmilk, formula, age-appropriate formula if >1 yo).

References

1. Weiler, et al. The Relationship between High Flow Nasal Cannula Flow Rate and Effort of Breathing in Children. J Pediatr. 2017 Oct;189:66-71.e3
2. Franklin, et al. A Randomized Trial of High-Flow Oxygen Therapy in Infants with Bronchiolitis | NEJM. 2018 Mar; 378:1121-1131
3. Willer, et al. Implementation of a Weight-Based High-Flow Nasal Cannula Protocol for Children with Bronchiolitis. Hosp Pediatr. 2021 Aug;11(8):891-895.
4. Ji-Won Kwon, High-flow nasal cannula oxygen therapy in children: a clinical review - PMC (nih.gov). Clin Exp Pediatr v.63(1); 2020 Jan
5. Alshahrani, M. S., Alshaqaq, H. M., Alhumaid, J., Binammar, A. A., AlSalem, K. H., Alghamdi, A., Abdulhady, A., Yehia, M., AlSulaibikh, A., Jumaan, M. A., Albuli, W. H., Ibrahim, T., Yousef, A. A., Almubarak, Y., & Alhazzani, W. (2020). *High-Flow Nasal Cannula Treatment in Patients with COVID-19 Acute Hypoxemic Respiratory Failure* [Preprint]. In Review. https://doi.org/10.21203/rs.3.rs-111258/v1
6. AAP VIP HI-FLO: High flow interventions to facilitate less overuse. HiFlo_v4 on Vimeo Retrieved 8/4/2023.
7. Elizabeth Eby Halvorson, Nicole Chandler, Rebecca Neiberg, Sean E. Ervin; Association of NPO Status and Type of Nutritional Support on Weight and Length of Stay in Infants Hospitalized With Bronchiolitis. *Hosp Pediatr* October 2013; 3 (4): 366–370. https://doi.org/10.1542/hpeds.2013-0011
8. Soshnick, S. H., Mark, G. S., Weingarten-Arams, J., Chuu, Y., Chandhoke, S., Medar, S. S., Philips, K., & Cassel-Choudhury, G. N. (2022). Feeding Pathway for Children on High Flow Nasal Cannula Decreases Time to Enteral Nutrition. *Pediatric quality & safety*, *7*(6), e608. https://doi.org/10.1097/pq9.0000000000000608
9. Sarah Gray, Begem Lee, Michael Levy, Tiranun Rungvivatjarus, Aarti Patel, Elizabeth Mannino Avila, Erin Fisher, Kyung E. Rhee; Oral Feeding on High-Flow Nasal Cannula in Children Hospitalized With Bronchiolitis. *Hosp Pediatr* February 2023; 13 (2): 159–167. https://doi.org/10.1542/hpeds.2022-006740

Workgroup: Bloomquist, Moore, Herring, Kenefick, Gamiao, Yang.