CPG	Shared health Soins communs Manitoba		
	Policy Name: **HSC - Heated High Flow Nasal Cannula (HHFNC)**	Policy Number: **EIPT 089-001**	Page 1 of 13
	Approval Signature: **Shared Health Executive**	Section: **350.210 Child Health**	
Level: **SITE-SPECIFIC** - Applies to all Shared Health staff at the site indicated in the policy name.	Date: **June 2023**	Supercedes: Health Sciences Centre Winnipeg	

1.0 PURPOSE:

1.1 To describe the indication and procedure for using heated high flow nasal cannula in pediatric patients admitted to Children's Hospital wards, Pediatric Intensive Care Unit (PICU), Children's Emergency Department (CHED) and patients transferred to Neonatal Intensive Care Unit (NICU) under the care of PICU

2.0 DEFINITIONS:

2.1 Heated high flow nasal cannula (HHFNC) is used to deliver blended air and oxygen at flow rates that meet or exceed the flow demands of pediatric patients in respiratory distress

2.2 Heated High Flow Nasal Cannula is an aerosol generating medical procedure. Please follow Shared Health guidelines for correct Personal Protective Equipment (PPE) protocols and isolation considerations

2.3 FiO2 – fractional inspired oxygen concentration

2.4 AGMP – Aerosol Generating Medical Procedure. Refer to Shared Health Document: aerosol-generating-medical-procedures-AGMPs.pdf(sharedhealthmb.ca)for guidance

3.0 BACKGROUND:

3.1 Heated high flow nasal cannula enhances upper airway clearance and reduces rebreathing of CO2 by washing out CO2 from the nasopharyngeal space. This limits rebreathing CO2 and reduces anatomical deadspace by creating a pharyngeal reserve of fresh gas for the next inspiration. This therapy may reduce the need for Continuous Positive Airway Pressure (CPAP), intubation or provide support post-extubation in some clinical scenarios. There is some evidence that providing higher flow rates via nasal cannula can produce various levels of CPAP dependent on flow and the degree of occlusion of the nares/mouth. Because the flow is so high, active heated humidification to 37 degrees Celsius, 100% relative humidity is required to avoid drying the nasal secretions and for maintaining nasal cilia function

4.0 PRACTICE LEVEL/COMPETENCIES:

4.1 Set up and management of HHFNC is a basic foundational competency done by a Registered Respiratory Therapist (RRT). The RRT must be present during the initiation of HHFNC

4.2 Initiation of HHFNC will most often occur in PICU and Children's Emergency Department (CHED). HHFNC can be initiated on the in-patient wards in Children's Hospital (CH/CK) when calling, and in collaboration, with the Rapid Response Team or Code Blue

4.3 Monitoring and caring for a patient on HHFNC is within the scope of practice of nurses, provided they have reviewed the guideline and have reviewed HHFNC equipment with the Registered Respiratory Therapist or Nurse Educator. Registered Respiratory Therapist will assist with troubleshooting and maintenance of HHFNC for the duration of therapy

4.4 Pediatric Intensivist/Emergency Room Physician (ERP)/Attending Physician/Prescriber is knowledgeable of the HHFNC guideline with respect to patient selection and parameters required. The Prescriber can call for advice from PICU either via PICU consult or Rapid Response Team consult

5.0 GENERAL INDICATIONS:

5.1 To assist in management of patients with respiratory distress, increased work of breathing from upper or lower respiratory disease processes (i.e. bronchiolitis, asthma, pneumonia) or congestive heart failure

5.2 Providing respiratory support post-extubation and mechanical ventilation

5.3 Weaning a patient from non-invasive ventilation

5.4 Continuing hypoxemia and/or signs of moderate to severe respiratory distress despite age-directed maximal low flow oxygen therapy and other supportive measures

5.5 To assist patients with diminished ability to mobilize secretions

6.0 EXCLUSION CRITERIA:

6.1 This guideline is not to be used for sleep disordered breathing

6.2 This guideline does not apply to patients admitted to NICU under care of neonatology

6.3 This guideline does not apply to patients receiving heated high flow therapy via a face mask or tracheostomy mask/adaptor

6.3.1 Heated High Flow Humidity Therapy delivered via face mask or tracheostomy mask/adaptor may be indicated for patients that require advanced humidity therapy and/or a stable FiO_2. These patients would benefit from the efficient humidity and stable FiO_2 provided by this system, however, when delivered by either mask/adaptor, the therapy would be similar to traditional O_2 therapy

7.0 CONTRAINDICATIONS:

7.1 Trauma to nasal passages/facial surgery

7.2 Excessive nasal secretions or severe rhinitis

7.3 Choanal atresia/blocked nasal passages

7.4 Pneumothorax or other air leak

7.5 Upper GI bleed

7.6 Gastric or esophageal surgery

7.7 Inability to maintain airway

7.8 Recurrent apneas

7.9 Basal skull fracture (risk of pneumocephalus)

8.0 ASSOCIATED RISKS OF HHFNC:

8.1 Skin breakdown

8.2 Masking of worsening hypercapnic respiratory failure (as oxygenation improves)

8.3 Increased work of breathing or forced expiration if flow is set too high

8.4 Gastrointestinal discomfort/distension

8.4.1 Venting of feeding tube may be helpful to reduce risk of aspiration

8.5 Barotrauma/pneumothorax

9.0 PATIENT LOCATION FOR ADMISSION/TRANSFER:

9.1 Patients transferred to Ward from CHED must meet all the following:

9.1.1 Patients were started on HHFNC in CHED and were observed while on HHFNC for a minimum of 60 minutes and appear clinically stable

9.1.2 FiO_2 is less than or equal to 0.49 upon time of transfer

9.1.3 The most recent blood gas on HHFNC shows a pH greater than or equal to 7.30, pCO2 less than 55, and lactate less than 2.0

9.2 Patients transferred to Ward from PICU must include the following:

9.2.1 Patient is considered stable by the PICU Intensivist with respect to HHFNC settings and FiO2 less than or equal to 0.49

9.2.2 The patient is considered stable and will continue current settings or will be weaned off HHFNC as an in-patient on the ward

9.3 Patients transferred to PICU from CHED (not eligible for in-patient admission) due to the following:

9.3.1 Patient has underlying health conditions and does not meet in-patient admission inclusion criteria

9.3.2 Patient has not stabilized or has persistent increased work of breathing despite initiation of HHFNC after one hour

9.3.3 Patient requires Fi02 greater than or equal to 0.50

9.3.4 The most recent blood gas on HHFNC shows a pCO2 greater than or equal to 55 and/or a lactate greater than or equal to 2.0, regardless of pH

10.0 LOCATIONS OUTSIDE OF PICU WHERE HHFNC CAN BE ADMINISTERED:

10.1 All Children's Hospital inpatient wards (CH/CK) that can accommodate patient monitoring, single room patient occupancy and can adhere to the Shared Health AGMP protocol (https://sharedhealthmb.ca/files/aerosol-generating-medical-procedures-AGMPs.pdf)

10.2 CHED – at the discretion of the ERP in consultation with the Registered Respiratory Therapist, and as described above

11.0 INITIATION (SEE APPENDIX C):

11.1 New Initiation of HHFNC for an admitted in-patient must include all the following:

11.1.1 Initiation must occur in conjunction with a Rapid Response Team call/Medical 25/Code Blue call

11.1.2 The patient does not meet any exclusion criteria or contraindications (see section 6.0 & 7.0)

11.1.3 Patient requires assessment at 15 minutes after initiation (or within 1 hour once patient has settled) and blood gas within 1 hour after initiation. The following parameters must be achieved:

11.1.3.1 FiO2 less than or equal to 0.49

11.1.3.2 pH of greater than 7.3 and/or improving, pCO2 less than 55

11.1.3.3 Patient's work of breathing is improved as assessed by Physician, Registered Respiratory Therapist and/or Nurse

11.2 Presence of Prescribing physician, Registered Respiratory Therapist and Nurse are required at time of initiation

11.3 Place patient on continuous cardio-respiratory and oxygen saturation monitoring prior to initiation and for duration of treatment of HHFNC

11.3.1 Patient monitoring as per physician orders: Continuous Cardiorespiratory Monitoring orders (PHOR #152), Child Health Heated High Flow Nasal Cannula (HHFNC) Initiation and Maintenance for Inpatient units (Form # 631) or Children's Emergency Department Initiation and Maintenance of Heated High Flow Nasal Cannula (HHFNC) (Form # 630)

11.4 Registered Respiratory Therapist initiates HHFNC therapy as per physician orders: Child Health Heated High Flow Nasal Cannula (HHFNC) Initiation and Maintenance for Inpatient units (Form #631) or Children's Emergency Department Initiation and Maintenance of Heated High Flow Nasal Cannula (HHFNC) (Form # 630)

11.4.1 Registered Respiratory Therapist to select a delivery system (i.e. Fisher & Paykel OptiFlow ® system, Airvo, or ICU Mechanical Ventilator)

11.4.2 Registered Respiratory Therapist to select size of nasal cannula or other appropriate interface (See Appendix A & B for nasal cannula options)

11.4.2.1 Do not occlude more than 50% of nares

11.4.3 Confirmation of two patient identifiers upon initiation

11.4.4 Registered Respiratory Therapist to assess new patients every hour X 2 or until stabilized, and then every 4 hours when stable

11.5 Start with the following settings:

11.5.1 For patient's equal to and less than 10 kg: 2 Liters per minute (Lpm)/kg

11.5.2 For patients greater than 10 kg: 2 Lpm/kg for the first 10 kg + 0.5 Lpm/kg for each kg above

i.e. 15 kg = (2 Lpm/kg X 10 kg) + (0.5 Lpm/kg X 5 kg) = 22.5 Lpm

11.5.3 Gradually increase to desired flow rate over a few minutes to allow patient to adjust to high flows

11.5.4 Do not exceed recommended max flow rate for nasal cannula (see Appendix B)

11.5.5 Do not exceed 60 Lpm

11.5.6 It is not recommended to use extra small, small and medium Junior prongs with the Airvo system

11.6 Set humidifier range from 31 to 37 degrees Celsius/invasive setting

11.6.1 Registered Respiratory Therapist to ensure water level is appropriate in humidifier

11.7 Set FiO2 to achieve desired saturations as ordered (i.e. greater than 92%)

11.8 Blood gas (capillary or venous) within 1 hour once patient has settled

11.9 Initial HHFNC application and parameter changes to therapeutic flow or temperature are carried out in consultation with Registered Respiratory Therapist. Changes in FiO2 can be performed by all members of the interprofessional team to maintain patient target oxygen saturations. Significant and/or sustained increases to FiO2 (greater than or equal to 0.50) must be reported to the Registered Respiratory Therapist and resident/attending physician

11.10 If no improvement is observed after initiation of HHFNC, the team should consider escalation of care. A positive response to HHFNC therapy can generally be appreciated within one-hour post-initiation

12.0 INDICATIONS OF UNSUCCESSFUL INITIATION OF HHFNC

12.1 Any of the below criteria would indicate patient requires escalation of care and Rapid Response Team call/PICU consult for additional respiratory support (i.e. Non-Invasive Positive Pressure Ventilation/intubation)

12.1.1 FiO2 requirements are greater than or equal to 0.50

12.1.2 Unchanged/increased work of breathing and respiratory rate compared to vital signs at initiation or worsening at anytime

12.1.3 Apneas, bradycardias, deteriorating level of consciousness

12.1.4 Deteriorating blood gas values (i.e. pH less than 7.30 and pCO2 greater than 55)

12.1.5 HHFNC exceeding maximum flow rate (refer to Appendix B)

13.0 FEEDING PATIENTS ON HHFNC:

13.1 Oral feeds can be initiated per prescriber's order when the respiratory rate has normalized (normal respiratory rate for age) and work of breathing is mild

13.2 Enteral feeds can be initiated per physician's order via orogastric, nasogastric, gastrostomy tube, or by jejunal feeding tube (note: nasogastric tube may not be possible based on nare/prong size, consider use of orogastric tube)

13.3 Questions around feeding can be addressed via Occupational Therapy (OT) consult

14.0 DOCUMENTATION (REGISTERED RESPIRATORY THERAPIST):

14.1 Document the following every 4 hours (or following a change in set parameters) on Child Health Ventilator Flow Sheet:

14.1.1 Set flow rate

14.1.2 Measured FiO2

14.1.3 Humidifier temperature

14.1.4 Measured respiratory rate, oxygen saturation

14.2 Integrated Progress Note (IPN) once per shift and as needed

14.2.1 Inspect and document patient for signs of device-related skin breakdown and document accordingly

14.2.2 Any change in patient status

15.0 DOCUMENTATION (NURSING):

15.1 Document the following on: Vital Sign Record (inpatient ward), Pediatric Special Care Daily Flow Sheet (PSCU), Vital Sign Flow Sheet (VSFS) in EDIS (CHED), or PICU patient flow sheet:

15.1.1 Method of high flow delivery hourly

15.1.2 High flow rate and FiO2 hourly

15.1.3 Heart rate, respiratory rate and effort, oxygen saturation (Sp02) readings following physician orders: Child Health Heated High Flow Nasal Cannula (HHFNC) Initiation and Maintenance for Inpatient units (Form # 631) or Children's Emergency Department Initiation and Maintenance of Heated High Flow Nasal Cannula (HHFNC) (Form # 630)

15.1.4 Blood pressure and temperature every 4 hours, or as otherwise ordered

15.1.5 Any other pertinent assessments or interventions (i.e. effect of suctioning, nebulization's, effect of feeding etc.)

15.1.6 Any changes in patient status

15.2 Document the following once per shift and as needed on the Integrated Progress Note (IPN) for inpatient ward, or Vital Sign Flow Sheet (VSFS) for CHED:

15.2.1 Inspect patient for signs of device-related skin breakdown

15.2.2 Any change in patient status

16.0 WEANING (SEE APPENDIX D):

16.1 Ensure there is a written order from physician for weaning

16.2 Weaning of HHFNC will only be performed by the Registered Respiratory Therapist. HHFNC flow may be discontinued in patients with bronchiolitis from 2 Lpm/kg when the FiO2 has decreased to 0.21 for a period of 4 hours (see weaning algorithm)

16.3 When the target SpO2 is stable (outside of suctioning), attempts to wean FiO2 should be made every 4 hours at a minimum

16.4 Once the FiO2 is weaned to room air (0.21), weaning of HHFNC flow rate can begin. If the patient is on home oxygen, the FiO2 at which weaning can occur will be higher than room air

16.5 The medical team may decide to challenge the patient off HHFNC or develop a gradual weaning strategy

16.6 For patients with continued oxygen requirement, traditional oxygen therapy (i.e. nasal prongs, face mask) may be required. It is not uncommon for FiO2 to increase when traditional oxygen delivery devices are used in place of HHFNC. This should not be considered a failure. Consult Registered Respiratory Therapist for any questions or concerns

16.7 Signs of an unsuccessful wean may present as: increased respiratory distress, increased work of breathing, increased respiratory rate, patient anxiety, etc. Medical Team assessment is required for all unsuccessful wean attempts

16.8 Patients who are unsuccessful with their initial wean will be returned to HHFNC by the Registered Respiratory Therapist. Daily assessment should continue to determine suitability to wean from HHFNC. Gradual weaning of the HHFNC may be indicated in some patients and should be planned and discussed with the medical team

17.0 OTHER:

17.1 Nasal prongs are required to be changed every 7 days or as needed

17.2 Heated high flow circuit changed every 30 days or as needed

17.3 Cleaning of Airvo 2 machine by Registered Respiratory Therapist per manufacturer's instructions once therapy has been discontinued

17.4 HHFNC consumable supplies provided by Children's Respiratory Therapy Department

18.0 REFERENCES:

18.1 Fisher & Paykel. (2023). https://www.fphcare.com/en-ca/hospital/infant-respiratory/nasal-high-flow/

18.2 The Royal Children's Hospital Melbourne – PICU. (2021). https://www.rch.org.au/rchcpg/hospital_clinical_guideline_index/High_flow_nasal_prong_(HFNP)_therapy/

18.3 Fisher & Paykel Healthcare Limited. Optiflow Junior Nasal Cannula (2023). Retrieved from https://www.fphcare.com/en-ca/products/optiflow-junior-nasal-cannula/

18.4 Milési, C., Boubal, M., Jacquot, A., Baleine, J., Durand, S., Odena, M. P., & Cambonie, G. (2014). High-flow nasal cannula: recommendations for daily practice in pediatrics. Annals of Intensive Care, 4, 29. http://doi.org/10.1186/s13613-014-0029-5

18.5 Ingvild Bruun Mikalsen, Peter Davis and Knut Øymar. High Flow Nasal Cannula in Children: a literature review. Mikalsen et al. Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine (2016) 24:93

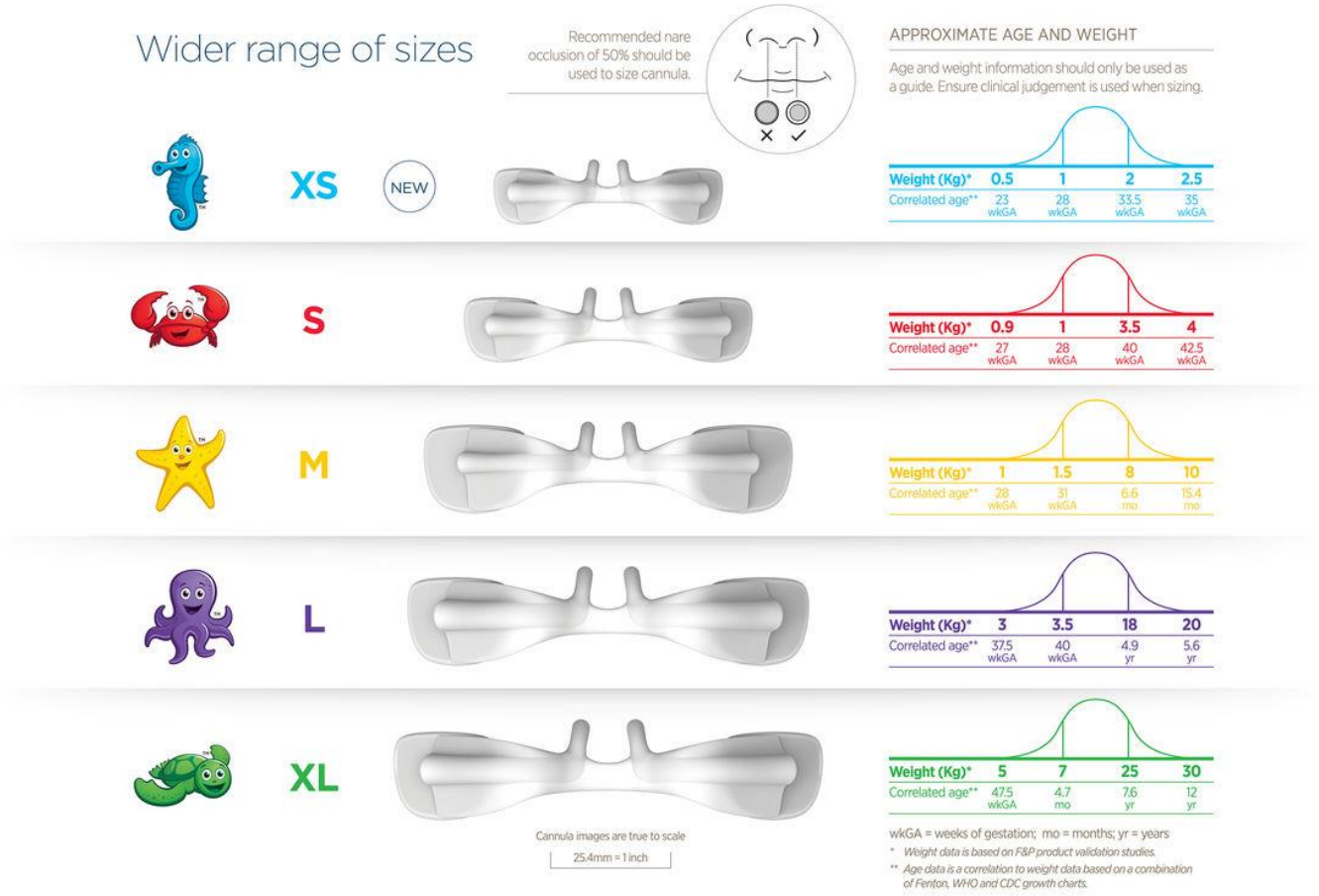
19.0 RESOURCES:

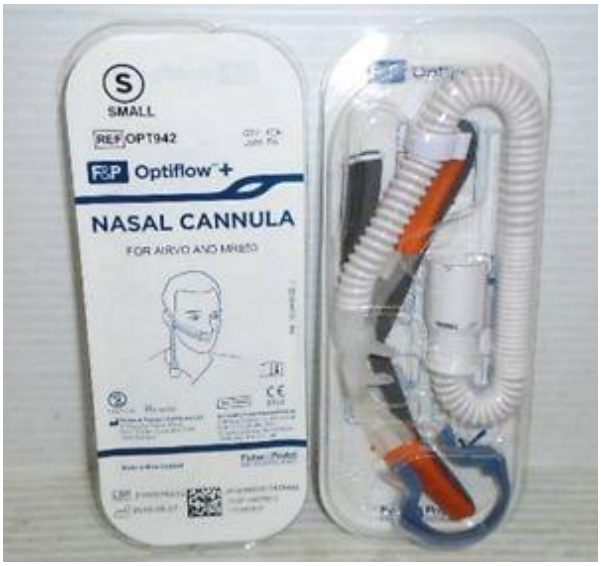
19.1 Registered Respiratory Therapist

19.2 Child Health Nurse Educators

19.3 PICU Attending Physician

Appendix A





Appendix B

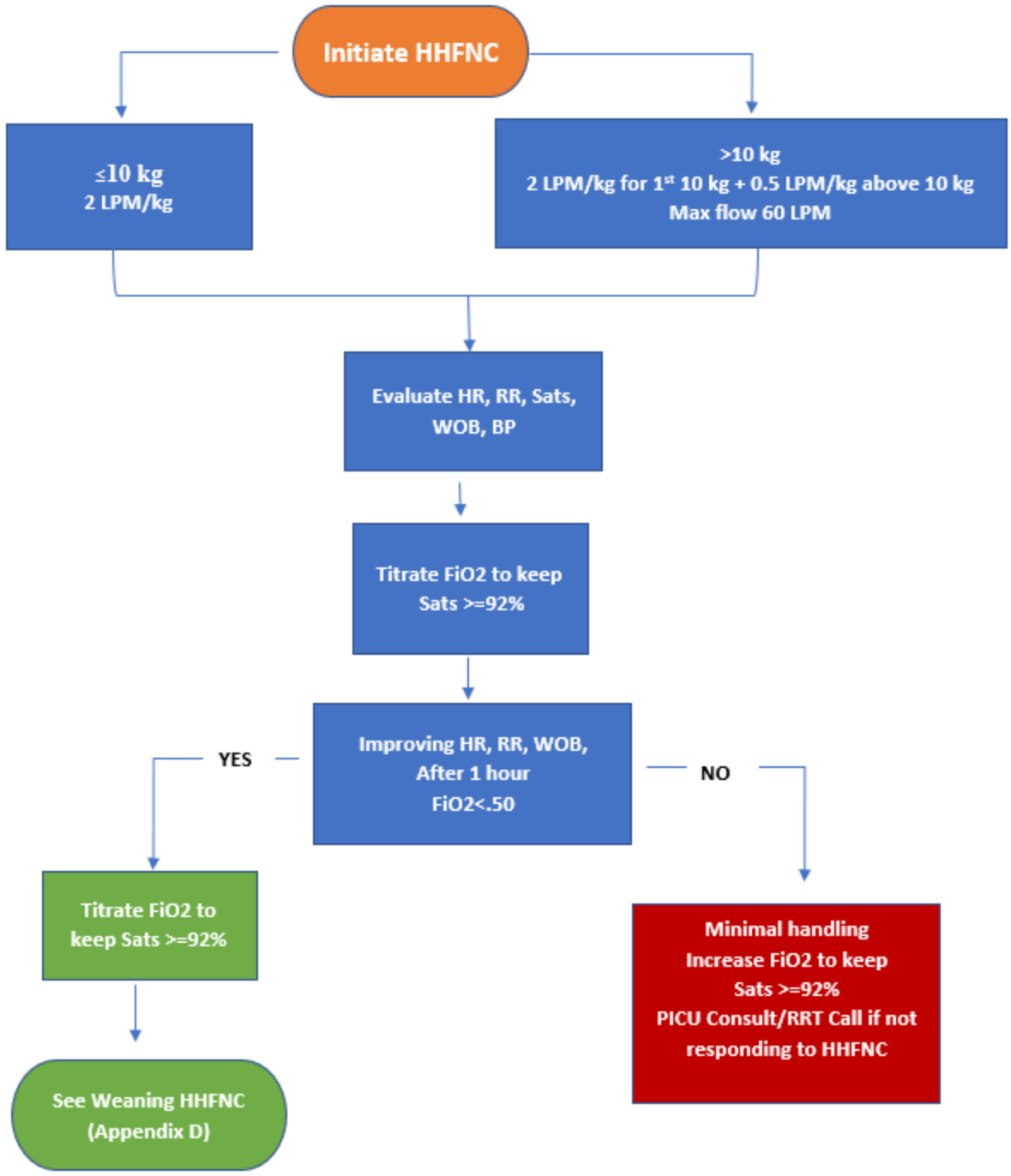
Nasal Cannula size and prong specific flow rates

Nasal cannula size and prong specific flow rates

Patient Weight	Estimated Nasal Prong Size	Prong Flow Rate with Optiflow (min - max)	F&P Mode	Prong Flow Rate with Airvo (min - max)
0.5 - 2.5 kg	Premature (XS)	0.5 - 8 L/min	Junior	-
0.9 - 4 kg	Neonatal (S)	0.5 - 9 L/min	Junior	-
1 - 10 kg	Infant (M)	0.5 - 10 L/min	Junior	-
3 - 20 kg	Intermediate Infant (L)	0.5 - 23 L/min	Junior	2 - 20 L/min
5 - 22 kg	Pediatric (XL)	0.5 - 25 L/min	Junior	2 - 25 L/min
> 22 kg	Small	10 - 50 L/min	Adult	10 - 50 L/min
> 22 kg	Medium	10 - 60 L/min	Adult	10 - 60 L/min
> 22 kg	Large	10 - 60 L/min	Adult	10 - 60 L/min
Note: When increasing the flowrate over 25 L/min, RRT to gradually increase flowrate over two minutes and observe how the change is tolerated.				

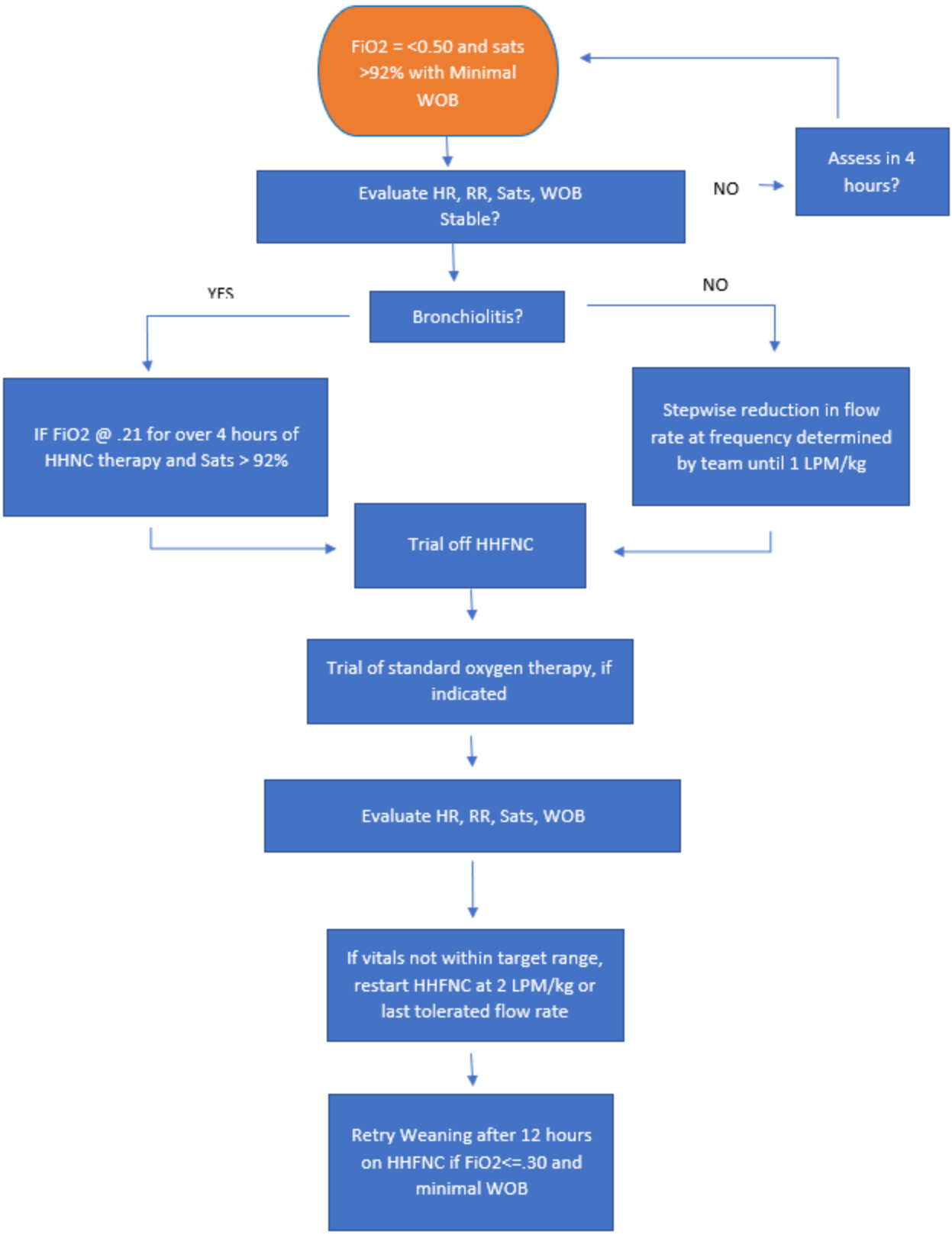
Appendix C

Initiating HHFNC Algorithm



Appendix D

Weaning



Appendix E

Nebulized medication administration with Aerogen

The Aerogen is a gasless nebulizer medication delivery system using vibrating mesh technology. Aerogen unit, components, placement in respiratory equipment/circuit provided by Respiratory Therapy.

To provide Aerogen medication delivery:

1. Lift off medication cup cap to insert medication. Close cap. Ensure medication is sitting in the base of the medication cup (max volume 6 ml). Opening medication cap will not disrupt respiratory support.
2. Press ON/OFF button on Aerogen controller for 1 second. Light will indicate 30-minute/intermittent mode. Aerogen will power off after 30 minutes.
3. Check for medication mist to ensure medication delivery. Intermittent mist will be visible.
4. Little medication should be seen in the medication cup after 30 min. If majority of medication remains, contact Respiratory Therapy.

Continuous infusion of nebulized medication via Aerogen device can be initiated in consultation with the medical team and Respiratory Therapy as required

Cleaning

- Wipe down Aerogen controller and cable per IPC recommendations
- Medication cup replaced every 28 days (30 min/Intermittent mode) or if faulty-contact Respiratory Therapy