Guideline

Nasal High Flow Therapy

Management of the paediatric patient receiving high flow therapy

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Applicable to	All Children's Health Queensland clinical staff	**Review date**	06/06/2027

Standard 5
Comprehensive Care

HUMAN RIGHTS

This governance document has been human rights compatibility assessed. Limitations identified were deemed justifiable indicating reasonable confidence that, if adhered to, there are no implications arising under the *Human Rights Act 2019.*

PURPOSE

The aim of this guideline is to ensure safe and effective use of Nasal High Flow (NHF) therapy for children with acute respiratory illness through supported decision making in relation to initiation, continuation and weaning of therapy and escalation of concerns.

SCOPE

This procedure applies to all Children's Health Queensland (CHQ) staff caring for children receiving **NHF therapy for an acute illness** outside of the Paediatric Intensive Care Unit (PICU) setting. Children with **chronic respiratory failure including infants with Chronic Neonatal Lung Disease (CNLD) and those with congenital cardiac disease or who are palliative** will have **individual NHF therapy management plans** documented by their medical teams that may be outside the scope of this procedure but can be managed in the ward areas with appropriate consultation.

- The decision to initiate NHF therapy should be made in consultation with the treating physician.

- When a patient is to be initiated on NHF therapy please notify the relevant Nurse Unit Manager / Team Leader / Clinical Nurse Consultant (CNC).
- Any patient who does not exhibit signs of clinical stabilisation within two (2) hours of commencement of NHF therapy should be considered for PICU review and escalation of respiratory support.
- Recent evidence in Australia and New Zealand following a large multicentre study, has shown that early use of NHF therapy is safe to use for infants with bronchiolitis outside the intensive care setting. NHF therapy has also been shown to be safe to use in emergency and inpatient areas for acute asthma, for obstructive sleep apnoea and in children with acute hypoxemic respiratory failure.

GUIDELINE

1. INTRODUCTION

- NHF therapy is used to provide a humidified continuous flow of gas that matches the inspiratory flow of the infant or child providing a continuous positive pressure like that achieved with nasal mask continuous positive airway pressure (nCPAP). Oxygen therapy can be added into the flow and used as an adjunct to NHF therapy and can be titrated to the child's oxygen requirements to keep saturations ≥ 92%. Inspired oxygen is prescribed by clinicians as a percentage to maintain saturations ≥ 92%; through the NHF circuit; oxygen can be delivered to a maximum of 40% FiO2 (ward and emergency departments) or can increase to a maximum of 60% for 30 minutes in consultation with the Lead Medical Team SMO, or appropriate consulting Medical Team and Safety CNC.
- Weaning of oxygen (Fi02) occurs prior to weaning of NHF therapy and is directed by the treating medical team.

2. THE AIMS OF NHF THERAPY ARE TO:

1. Provide respiratory support and improve ventilation by assisting opening distal airways and alveoli, improving gas exchange.
2. Reduce mucosal resistance and increases tolerance to therapy through humidification.
3. Reduces inspiratory resistance seen as a reduction in work of breathing.

3. CLINICAL INDICATIONS FOR NHF THERAPY

- The prevention of, or relief from, respiratory distress due to diseases such as acute asthma, bronchiolitis, or pneumonia.
- Respiratory support to infants and children with chronic lung disease.
- Continuing hypoxemia (SpO2 < 90%) in children with moderate to severe respiratory distress with acute lower respiratory tract infection despite the use of low flow oxygen therapy.
- Patients in respiratory distress who exhibit signs of increasing oxygen requirements to prevent further deterioration.
- Respiratory distress from congestive heart failure.

- Respiratory support as part of a documented palliative care plan.
- As a therapy in preparation for intubation to optimise oxygenation.

4. EXCLUSIONS FOR NHF THERAPY INPATIENT UNIT PLACEMENT:

- Critically ill with immediate need for non-invasive ventilation (NIV) or intubation.
- Apnoeas requiring NIV / intubation. (Not improved with commencement of high flow)
- Blocked nasal passages.
- Craniofacial malformations.
- Trauma / surgery to nasopharanyx.
- Pneumothorax.
- Cyanotic congenital heart disease.
- Decreased level of consciousness.
- Foreign body aspiration - suspected or confirmed.

5. SPECIAL CONSIDERATIONS

- Patients with known lung disease or other conditions should be discussed with either the Respiratory Consultant or the treating Paediatrician before transfer to the ward on high flow support.
- Children with craniofacial disorders require special consideration and should be discussed with the treating medical team prior to consideration of HFNC support.
- Children who have a tracheostomy and are being considered for HFNC support are routinely placed in PICU.
- Children with airway adjuncts such as nasopharyngeal tubes (NPT) should be discussed with the treating medical team and the relevant nurse unit manager prior to commencement of HFNC.
- Oncology children should be discussed with treating Oncologist before commencement of HFNC.

6. COMPLICATIONS FROM NHF THERAPY

- Gastric distension.
- Pressure areas.
- Blocked NHF therapy due to secretions.
- Pneumothorax

7. QUEENSLAND CHILDREN'S HOSPITAL POST-ANAESTHESIA CARE UNIT SPECIFIC INFORMATION

- Patients already established on NHF therapy prior to surgery can be re-established on NHF in post-anaesthesia care unit (PACU) post operatively.

- Patients commenced on new NHF therapy postoperatively who have ongoing NHF needs may be transferred to the ward once they have met NHF clinical stabilisation criteria. As per page 6.
- Patients awaiting PICU transfer on NHF therapy need to be reviewed half hourly by an Anaesthetist whilst in PACU.

8. INITIATION OF NHF THERAPY: EMERGENCY & INPATIENT UNITS

Initiation of NHF therapy in response to clinical indications must be ordered by the treating medical team in consultation with nursing teams to ensure appropriately trained staff are available.

NHF therapy via the AIRVO 2™ or AIRVO 3™ should be commenced as per Table 1 below *(where available use universal circuit for all nasal cannula sizes).*

Table 1. Recommended Flow rates by weight for NHF

Child's weight	Flow rate	Maximum flow rate	Comments
0 - 15 kg	2 L/kg/min	Max 30 L/min	Junior Mode to 25L >25L change to Adult mode
16 - 30 kg	35 L/min	Max 40 L/min	Adult Mode
31 - 50 kg	40 L/min	Max 50 L/min	Adult Mode
> 50 kg	50 L/min	Max 50 L/min	Adult Mode

9. COMMENCEMENT OF NHF

- Initial FiO2 should be set at 0.21 (21% = room air).
- If SpO2 < 85%, or if SpO2 remains < 90% after 10 minutes of NHF therapy then FiO2 should be increased and titrated to achieve SpO2 of ≥ 92%. FiO2 is adjusted to maintain SpO2 ≥ 92% avoiding long periods of hyperoxia with SpO2 of 100%. For any flow rates >25 L/min the flow rates are increased gradually over five to ten minutes whilst observing how the patient tolerates the flow rates.
- FiO2 should be ordered on the Electronic medical record: FiO2 to maintain SpO2 ≥ 92% or target saturation as documented.

10. FLOW RATES AND CONSUMABLES

***NHF delivered by the AIRVO 2™, AIRVO 3 ™ & Optiflow™ (Fisher and Paykel Healthcare Systems)**

- Flow rate for NHF therapy is the same for all patients regardless of the acute medical condition.
- Flow is ordered in the Electronic Medical record as per flow chart above.
  - Universal circuit can be used for all nasal cannula sizes (including both junior and adult ranges).
  - Junior mode will deliver 2-25 L/min.

- Adult mode will deliver 25-60 L/min (however the **maximum flow** in paediatrics is 50 L/min (outside PICU).
- The AIRVO 3™ has a single mode for use in paediatric and adult patients and can deliver 2-70L/min
- AIRVO 2™ temperature control will automatically set to 34ºC in Junior mode and 37ºC in Adult mode.

- AIRVO 3™ temperature control range is from 31ºC- 37ºC and is set using the Target Humidity tile on the touch screen.

ALERT

Airvo 3 is classified as a Category 1 humidifier for patients with bypassed airways, (tracheostomies) in the following modes only: 37 °C and 10-60 L/min. Do not use any other mode for patients with bypassed airways (tracheostomies).

Patient Interface

Nasal cannulas for infants and children are selected based on patient weight, flow rate and size of nares.

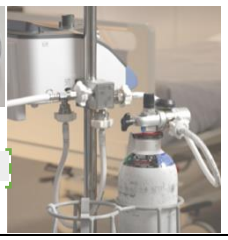
Patient Interface	Neonate – Yellow (Starfish) 	Infant - Purple (Octopus) 	Paediatric - Green (Turtle) 	Junior – Grey (Dolphin) 
Flow Range	2-8L/min	2-20L/min	2-25L/min	10-50L/min
Approximate Age range	32weeks -6 months	37 weeks-4years	1 year-6 years	2yrs-10 years
Approximate Weight range	2-8 kgs	3-18 kgs	7-25 kgs	12.5-30 kgs
Mode (AIRVO 2)	Do not use	Junior	Junior	Adult
AIRVO 3	✓	✓	✓	✓

Patient Interface				Tracheostomy 
Flow Range **AIRVO 2** **AIRVO 3**	10-60L/min 10-60L/min	10-60L/min 10-70L/min	10-60L/min 10-70L/min	10-60L/min 10-60L/min
Mode (AIRVO 2)	Adult	Adult	Adult	Adult

- Optiflow Junior Nasal cannula (green and purple) should be secured using supplied "Wiggle pads" ensuring a good fit into the nares but not completely obstructing the nares.
- Optiflow XXL Dolphin Cannulas(grey) can be secured with Wiggle pads and Optiflow Adult Nasal Cannula (orange, blue and olive green) can be secured in place using Duoderm on the face and Fixomul over the prongs.

ALERT

The standard NHF therapy set up for AIRVO 2™ can be connected to two (2) wall flow meters (0-15 and 0-70 LPM maximal flow).

		AIRVO 2	AIRVO 3
Oxygen connection options	  **Using standard oxygen tubing** attached to **wall standard O_2 flow meter/s** (0-15 LPM max flow), **connect to the oxygen port on the back of the Airvo** * ***for higher FiO_2 levels*** *(> 45%) on children with > 30 L/min flow* ***use a 0-70 L/min flow meter*** *and* ***adjust the flow rate at the wall*** *until the patient's SpO_2 ≥ 92%. Estimated FiO_2 delivered is displayed on the Airvo screen.*	✓	✓
	  **Connect directly to wall outlet via the high-pressure oxygen inlet connection on the thick white hose. Titrate FiO2 on the Airvo3 screen.** *This system allows for easy transition to O2 cylinder for patient transport*	✗	✓

Oxygen adjustment

- O2 is **adjusted** manually using an O2 flow meter (AIRVO 2&3) **OR** via the FiO2 tile on the touch screen (**AIRVO 3 only**).
- The estimated FiO2 delivered to the patient will be displayed on the AIRVO screen.

Clinical stabilisation is indicated by:

- The FiO2 required to maintain SpO2 in the target range (SpO2 ≥92%) is ≤ 40%.
- Heart rate reduced to within normal range for that infant/child's age group.
- Respiratory rate reduced to within normal range for that infant/child's age group.
- Signs of respiratory distress/effort /work of breathing have improved.

11. MONITORING RESPONSE TO COMMENCEMENT OF THERAPY AND PLACEMENT IN INPATIENT AREAS

- Children who have commenced NHF therapy with FiO2 at ≤ 40% and whose observations have stabilised: specifically (e.g., a reduction in heart rate and respiratory rate and effort from therapy

initiation) can be transferred to the inpatient units from the emergency department after consultation with the NUM, TL, Safety CNC and treating medical team.

- Children should not be transferred from the emergency department until clinically stable.
- Medical review of all patients on NHF therapy is required ≤ 4 hours after therapy initiation.

12. CONSULTATION WITH TREATING MEDICAL TEAM AND PICU / REFERRAL / RETRIEVAL SERVICE TEAM AND CONSIDERATION OF TRANSFER TO PICU FOR ESCALATION OF RESPIRATORY SUPPORT SHOULD OCCUR FOR CHILDREN WHO MEET THE BELOW CRITERIA

- Within two (2) hours of commencement of therapy, the child does not show signs of clinical improvement and observations remain unchanged or an increase in heart rate (HR), respiratory rate (RR), respiratory effort; and/or
- SpO2 are unable to be stabilised in target range (SpO2 ≥ 92%), and/or
- If the FiO2 requirement is > 40% or up to 60% (for greater than 30 minutes) to maintain SpO2 ≥ 92 since commencing on NHF therapy.

ALERT

Seek medical review if any of the following occurs:

- Patient is not stabilising as described above.
- Degree of respiratory distress worsens.
- Hypoxemia persists despite high gas flow.
- Requirement for FiO_2 > 40 % in ward areas.

ALERT

If a high FiO_2 is used, oxygen saturation may be maintained in an infant despite the development of hypercarbic respiratory failure. If there is rapid deterioration of oxygen saturation or marked increased work of breathing, a chest x-ray should be done to exclude a pneumothorax. Consider blood gas analysis where clinically indicated.

13. STAFFING REQUIREMENTS IN INPATIENT UNITS

For children requiring NHF therapy and are placed in inpatient wards outside of PICU, a minimum of two (2) staff that have completed the education in paediatric NHF therapy (at least one who is a Registered Nurse RN) must be available to provide care for the child each shift. This means that one of the RNs or Enrolled Nurses (ENs) should always be available to care for the patients on NHF therapy in the ward area. The EN may assist in the care of the patient with NHF therapy, but the RN is the child's primary caregiver.

ALERT

If two (2) staff that have completed the NHF therapy education are unavailable for any shift in an inpatient unit through rostering or redeployment the child should be discussed with NUM /

CNC or medical team for consideration of the appropriate ward placement to ensure patient safety.

14. TRANSPORT FROM EMERGENCY DEPARTMENT TO THE INPATIENT UNITS ON NHF THERAPY

- The AIRVO 2™ device requires a battery for transport from one department to another. The patient needs to be placed on one of the AIRVO 2™ with external battery to allow transport to the ward.
- The AIRVO 3™ has an inbuilt battery with an estimated life of 20-40mins.

15. ONGOING MONITORING AND NURSING CARE

- All children receiving NHF therapy must have continuous SpO2 monitoring.
- RR, HR, respiratory effort, flow rate as per device used and FiO2 are all recorded in the electronic medical record.
- Gentle suction as required to keep nares clear.
- Oral and nasal care must be performed four (4) hourly. Monitor that nasal prongs are in correct position and no pressure areas to nares.

16. NASOGASTRIC TUBE PLACEMENT

- Nasogastric tube placement should be encouraged in infants and children less than two to three (2-3) years prior to initiation of NHF therapy for gastrointestinal (GIT) decompression and remain insitu for the duration of therapy. This is at the discretion of the treating medical team.
- Children > three (3) years may require a nasogastric tube if GIT distension is an issue whilst on NHF therapy.
- If nasogastric in place aspirate the NGT for air 2-4 hourly to de-vent the stomach.
- Infants/children who do not clinically stabilise within 2 hours or who do not tolerate NGT feeds should have an I.V inserted to receive hydration.

17. ONCE STABLE ON NHF THERAPY, THE INFANT/CHILD SHOULD BE ASSESSED AS TO WHETHER THEY CAN FEED

- Some infants/children can continue to breast/bottle feed, but many require feeding via a nasogastric tube.
- Feeds given via the nasogastric tube can be either bolus or continuous.
- Those infants/children who are stable on NHF therapy and wish to orally feed - breastfeed/ bottle/ drink and or eat, the NHF therapy should remain at current levels. If there are concerns regarding stability to feed while on high flow this should be discussed with the treating team.

18. AIRWAY CLEARANCE/PHYSIOTHERAPY TREATMENT

If high flow is increased only for duration of the physio session and returned to baseline with little change in clinical condition within 10minutes (before the physio left)– no additional action.

- If the child's therapy was unable to be returned to baseline by physio at 10 mins but was still within ward parameters for placement (<40% fiO2/ ≤2L/Kg), physio should provide a handover to the bedside nurse preferably or TL (if bedside nurse is unavailable). The nurse completes & documents a full set of observations plus current HF settings with a comment 'post physio'.
- If after physio, HF therapy settings remained outside usual ward placement parameters (>40% FiO2/≤2L/Kg) at 10 minutes, physio to activate the staff assist alarm to initiate immediate nursing review and handover at the patient's bedside. The nurse completes & documents a full set of observations plus current HF settings with a comment 'post physio' and initiate medical review, increase surveillance, and escalate as required.
- **If the child has a significant clinical deterioration with physio, the physio should initiate a MET call.**

19. NEBULISER/MDI ADMINISTRATION WHILE ON NHF THERAPY

- During administration of the nebuliser/MDI reduce the flow on the AIRVO 2as indicated below:
  - **Junior Mode** - reduce to 2L/min and increase the oxygen to 95% Fi02
  - **Adult Mode** - reduce to 10L/min and increase the oxygen to 95% Fi02
- After the nebuliser /MDI is finished, return the patient to the previous AIRVO 2™/ AIRVO 3™ settings, returning both the L/min flow and reducing the Fi02 to the prescribed level.

Where clinically appropriate, inhaled medications can be administered through the high flow circuit with in-built nebulisation connector. (available from PICU and DEM)

20. WEANING OF NHF COMMENCES UNDER THE DIRECTION OF THE TREATING TEAM

Weaning of NHF therapy can commence within four (4) hours if the child's clinical condition is improving as indicated by:

- Reduction in respiratory distress including decreased work of breathing and effort.
- Respiratory rate reduced or within normal range for that infant/child's age group.
- Heart rate reduced or within normal range for that infant/child's age group.
- FiO2 required to maintain SpO2 in the target range should be ≤ 40%.

21. WEANING OF NHF STEPS

- With decreasing the FiO2 in 5% increments whilst maintaining saturations ≥ 92%.
- Once the FiO2 reaches 21% and saturations have been stable ≥ 92%, flow can be ceased.
- If infant/child desaturates ≤ 90% resume flow with FiO2 at 21%.
- If not maintaining saturations ≥ 92% increase FiO2 until saturations are 92-98%.

- Once stabilised with saturations ≥ 92% for at least two (2) hours weaning can recommence.
- The child that commences on NHF therapy in room air (21%) and maintains SpO2 ≥ 92% in 21%, is to remain on NHF therapy for two (2) hours and then cease flow. If during this time, they do not maintain SpO2 ≥ 92% titrate FiO2 to maintain SpO2 ≥ 92%.
- **CNLD infants and cardiac infants/children on long term HFNC will have individualised weaning plans managed by their treating medical team.**

ALERT

Weaning should cease if increases in respiratory rate, heart rate and work of breathing occur independent of the saturations. Reinstitute therapy to achieve stabilisation and request medical review.

22. CLEANING

The AIRVO 2™ & AIRVO 3™ Humidifier requires cleaning and disinfection between patients.

CELS collect, clean, and return machines to the appropriate areas.

DISCLAIMER

This guideline has been written under the directive of the Medical Division with the understanding that there are published random controlled studies that support the use of high flow nasal therapy in appropriate children. Use of this therapy is at the discretion of the treating physician and medical team.

SUPPORTING DOCUMENTS

- CHQ-GDL-01456 Care of the paediatric patient requiring nasal high flow therapy in Paediatric Intensive Care Unit (PICU)
- CHQ-NSS-51002 Nasal High Flow Therapy (NHFT) USING THE Airvo 2

OTHER RESOURCES:

- AIRVO™ 2 User Manual
- AIRVO™ 2 App – available free on the App store and Google play
- AIRVO™ 3 User Manual
- AIRVO™ 3 simulator App – available free on the App Store and Goole play or scan the QR code on the F&P Health care website.

CONSULTATION

Key stakeholders who reviewed this version:

• Nursing Director Medical Services	• Clinical Practice Facilitator Medical Division

• NP Respiratory • CNC Respiratory • Nurse Educator Medical • NUM 9A, 9B, 10A, 11A	• Acting Director Respiratory/Sleep Medicine • Respiratory & Sleep Physician • ED SMO • Allied Health Team, Physiotherapy, Speech Pathology

DEFINITIONS

Term	Definition
NHF	Nasal High Flow (also known as high flow nasal prong) therapy; is the delivery of humidified air at a flow rate of 2 L/kg/min up to 25kg. Paediatric patients > 25kg have maximum flows of up to 50LPM delivered via nasal cannula. Table 1 Recommended NHF flow rates by weight. High flow therapy can be delivered with or without added oxygen.
FiO_2	Fraction of inspired oxygen which is the percentage of oxygen delivered. Air is 21% (e.g., 25%).
nCPAP	Continuous positive airway pressure delivered via a nasal mask.

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GUIDELINE REVISION AND APPROVAL HISTORY

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1.0 (25/08/2016)	CNC Respiratory	EDNS	General Manager Operations	
2.0 (16/05/2017)	CNC Respiratory	EDNS		

3.0 (22/01/2019)	Clinical Nurse Consultant, Respiratory	Divisional Director Medicine	Executive Director Clinical Services (QCH)	
4.0 (30/05/2019)	Clinical Nurse Consultant, Respiratory	Divisional Director Medicine	Executive Director Clinical Services (QCH)	
5.0 25/06/2020	Clinical Nurse Consultant, Respiratory	Divisional Director Medicine	Executive Director Clinical Services (QCH)	
5.1 17/05/2024	Governance Officer (Documents)	Executive Director Nursing Services	Executive Director Nursing Services	
6.0 06/06/2025	Nurse Practitioner Respiratory	Divisional Director Medicine	Executive Director Clinical Services (QCH)	Scheduled review

Key words	Nasal High Flow, NHF, Fi02- oxygen, 70025
Accreditation references	**NSQHS Standards (1-8):** • Standard 1 - Clinical Governance • Standard 2 - Partnering with Consumers • Standard 3 - Preventing & Controlling Healthcare Associated Infection • Standard 4 - Medication Safety • Standard 6 - Communicating for Safety • Standard 8 - Recognising and Responding to Acute Deterioration **ISO 9001:2015 Quality Management Systems**