

Guideline

Nasal High Flow Therapy

Management of the paediatric patient receiving high flow therapy

Document ID	CHQ-GDL-70025	Version no.	5.0	Approval date	25/06/2020
Executive sponsor	Executive Director Nursing Services			Effective date	25/06/2020
Author/custodian	Clinical Nurse Consultant, Respiratory			Review date	25/06/2023
Supersedes	4.0				
Applicable to	All Children's Health Queensland clinical staff				
Authorisation	Executive Director Clinical Services (QCH)				

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:

- Appropriate placement in inpatient areas with trained staff.
- Support for 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 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 Manager / Team Leader / Clinical Nurse Consultant (CNC).
- Any patient who does not exhibit signs of clinical stabilisation within four (4) hours of commencement of NHF therapy should be considered for transfer to the PICU.
- 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. There is limited documented evidence available on children (excluding bronchiolitis) of all age groups treated with NHF therapy. Several multicentre trials are currently being performed, awaiting outcomes. For those hospitals involved in NHF therapy trials, please refer to the study protocol for recruitment and management of the patient on the study.

Related documents

Other

- [AIRVO™2UserManual](#)
- AIRVO™ 2 App – available free on the App store and Google play

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 $\geq 92\%$. Inspired oxygen is prescribed by clinicians as a percentage to maintain saturations $\geq 92\%$; 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 PICU / referral / retrieval service team.
- Weaning of oxygen occurs prior to weaning of NHF therapy and is directed by the treating physician.

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.

Clinical Indications for NHF therapy

- The prevention of, or relief from, respiratory distress due to diseases such as bronchiolitis or pneumonia.
- Respiratory support to infants and children with chronic lung disease.
- Continuing hypoxemia (SpO₂ < 92%) 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.

Exclusions for NHF therapy ward placement

- Critically ill with immediate need for non-invasive ventilation (NIV) or intubation.
- Apnoeas requiring NIV / intubation.
- Blocked nasal passages / choanal atresia.
- Craniofacial malformations.
- Trauma / surgery to nasopharynx.

- Pneumothorax.
- Cyanotic congenital heart disease.
- Decreased level of consciousness.
- Oncology patients.
- Tracheostomised children.
- Foreign body aspiration - suspected or confirmed.
- Any patient with known lung disease or other conditions that have not been discussed with either the Respiratory Consultant or the treating Paediatrician.

Complications from NHF therapy

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

Initiation of NHF therapy: Emergency & inpatient units

Initiation of NHF therapy in response to clinical indications must be ordered by the treating medical officer in consultation with nursing teams to ensure appropriately trained staff are available (see Placement of children receiving NHF therapy page 5).

NHF therapy via the AIRVO 2™ should be commenced as per [Table 1](#) (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 - 12 kg	2 L/kg/min	Max 25 L/min	Junior Mode
13 - 15 kg	2 L/kg/min	Max 30L/min	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

- Initial FiO₂ should be set at 0.21 (21% = room air).
- If SpO₂ < 85%, or if SpO₂ remains < 92% 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 two minutes whilst observing how the patient tolerates the flow rates.
- FiO₂ should be ordered on the Electronic medical record: FiO₂ to maintain SpO₂ ≥ 92%.

Flow rates and consumables

- 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.

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

- 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)).
- 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.
- AIRVO 2™ temperature control will automatically set to 34°C in Junior mode and 37°C in Adult mode.

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 officer.
- Children > three (3) years may require a nasogastric tube if GIT distension is an issue whilst on NHF therapy.

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). Dependent on the required FiO₂ and the flow rate specific for the patient, the wall flow meter that allows for greater flow rates up to 70 L/min must be used to achieve the desired FiO₂.

Specifically, when requiring higher FiO₂ (> 45%) on children with > 30 L/min flow or in any other circumstance when the desired FiO₂ cannot be achieved it may be necessary to use a 0-70 L/min flow meter and increase the FiO₂ with the wall flow meter until SpO₂ ≥ 92%.

Monitoring response to commencement of therapy

- 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 from therapy initiation) can be transferred to the appropriate ward from the emergency department.
- Medical review of all patients on NHF therapy outside the NHF study protocols is required ≤ 4 hours after therapy initiation.
- **Discuss and consider** review by the PICU / referral / retrieval team service if:
 - 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.

**Consultation with PICU / referral / retrieval service team and consideration of transfer to PICU should occur for these children.*

Placement of children on NHF therapy

Children who can be stabilised with an FiO_2 at $\leq 40\%$, can be transferred to the appropriate inpatient unit after consultation with the relevant Nurse Unit Manager (NUM), CNC, Safety CNC and treating medical team. Children should not be transferred from the emergency department until clinically stable.

***Please see the decision-making tool in [Appendix 1](#) at the end of the document for assistance with appropriate placement.**

Clinical stabilisation is indicated by:

- The FiO_2 required to maintain SpO_2 in the target range ($SpO_2 \geq 92\%$) is $\leq 40\%$.
- Heart rate reduced by 15 beats per minute (bpm) or to within normal range for that infant/child's age group.
- Respiratory rate reduced by 5-6 resps/min or to within normal range for that infant/child's age group.
- Signs of respiratory distress/effort have improved.

**Children who are unable to be stabilised with $FiO_2 \leq 40\%$ should be discussed and reviewed by PICU / referral / retrieval team and considered for transfer to PICU.*

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.

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 (one 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 lead for consideration for referral to PICU to ensure patient safety.

Queensland Children's Hospital specific information

When children meet criteria for inpatient ward admission/transfer they should be placed in the following areas with a minimum of two (2) trained staff available on shift.

- Emergency and Short Stay Unit.
- 9B - Infants less than 12 months.
- 9A - Overflow from 9B and children over 12 months who meet criteria for inpatient unit admission.
- 10A - Children over 12 months who meet criteria for inpatient unit admission.

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.
- NHF must be delivered by AIRVO 2™ only in PACU.
- Patients commenced on new NHF therapy postoperatively and have ongoing NHF needs must be sent to PICU post procedure.
- Patients awaiting PICU transfer on NHF therapy need to be reviewed half hourly by an Anaesthetist whilst in PACU.

Transport from emergency department to ward or other departments on NHF therapy

The AIRVO 2™ device does not allow NHF delivery during transport unless it is connected to power or an external battery. A battery for the AIRVO 2™ may be available at some hospitals (Queensland Children's Hospital in PICU and emergency department). The battery can be used for transport from one department to another if the patient needs to remain on NHF therapy and the AIRVO 2™ connected to the external battery. If the battery is not available there are two (2) options.

The older child requiring Adult Optiflow Nasal Cannula (small, medium and large) can continue oxygen therapy via 'rabbit ears' and standard oxygen tubing to wall/cylinder oxygen. If this is unavailable, then use standard sub nasal prongs or face mask to administer oxygen to the wall/cylinder oxygen.

The child requiring Junior Optiflow Nasal Cannula (green and purple prongs) or using the XXL grey Dolphin cannula can connect to the green transport oxygen tubing provided which allows the connection of Optiflow junior, infant and XXL nasal cannulas only with wall/cylinder oxygen.

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.

Nebuliser/MDI administration whilst on NHF therapy

- During administration of the nebuliser/MDI reduce the flow on the AIRVO 2™ as indicated below:
 - **Junior Mode-** reduce to 2L/min and increase the oxygen to 95% FiO₂
 - **Adult Mode-** reduce to 10L/min and increase the oxygen to 95% FiO₂
- After the nebuliser /MDI is finished, return the patient to the previous AIRVO 2™ settings, returning both the L/min flow and reducing the FiO₂ to the prescribed level.

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 be reduced to low flow humidified oxygen therapy using the AIRVO 2™ via the same nasal cannula. This is achieved by decreasing the flow on the AIRVO 2™ for maximum of up to 20 minutes as per below. On completion of orally feeding/drinking return the patient to their previous NHF therapy settings.
- Junior Mode- reduce to 2L/min and increase the oxygen to 95% FiO₂.
- Adult Mode- reduce to 10L/min and increase the oxygen to 95% FiO₂.
- 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.
- If nasogastric in place aspirate the NGT for air 2-4 hourly to de-vent the stomach.

Weaning of Nasal High Flow Therapy

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 by 5-6 resps/minute or to within normal range for that infant/child's age group.
- Heart rate should reduce by 15 bpm or to within normal range for that infant/child's age group.
- FiO₂ required to maintain SpO₂ in the target range should be ≤ 40%.

Weaning NHF therapy commences:

- 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 < 92% 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 $SpO_2 \geq 92\%$ in 21%, is to remain on NHF therapy for two (2) hours and then cease flow. If during this time, they do not maintain $SpO_2 \geq 92\%$ titrate FiO_2 to maintain $SpO_2 \geq 92\%$.



ALERT

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

Cleaning

The AIRVO 2™ Humidifier requires cleaning and disinfection between patients. Keep the orange disinfection tubing connected post disinfection cycle is complete, to ensure the AIRVO 2™ does not collect dust inside the equipment.

Follow the instructions in the Disinfection Kit Manual (900PT600) attached to each AIRVO 2™.

Disclaimer

This guideline has been written in good faith under the directive of the Medical Division with the understanding that there are limited random controlled studies (published) and therefore limited best practice evidence to support the assumptions for treatment outlined in this guideline. Use of this therapy is at the discretion of the treating physician.

Consultation

Key stakeholders who reviewed this version:

- Nursing Director Medical Services
- A/Nursing Director Clinical Support
- CNC Respiratory
- A/ CNC Sleep Services, CNC
- Study Coordinator-Paediatric Critical Care Research Group
- Medical Leader Paediatric Critical Care Research Group / PICU Consultant
- NUM 10A
- NUM 9A
- NUM Emergency
- Nurse Educator Medical
- Clinical Practice Facilitator Medical Division
- Nurse Educator Emergency
- MET CNC
- Director Respiratory/Sleep Medicine

- Respiratory/Sleep Physician
- Respiratory/Sleep Physician
- Director of Paediatric Medicine
- Paediatrician
- Director of Emergency Department

Definition of terms

Term	Definition	Source
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.	Paris II Multicentre RCT (awaiting publication in April 2019)
FiO₂	Fraction of inspired oxygen which is the percentage of oxygen delivered. Air is 21% (e.g. 25%).	FiO ₂ . (n.d.) <i>Mosby's Medical Dictionary, 8th edition.</i> (2009). Retrieved March 12 2019 from https://medical-dictionary.thefreedictionary.com/Fio2
nCPAP	Continuous positive airway pressure delivered via a nasal mask.	Australian Sleep Association.

Audit/evaluation strategy

Level of risk	Medium
Strategy	<ul style="list-style-type: none"> • Monitor implementation of procedure into ward areas. • Monitor RiskMan clinical incidents.
Audit/review tool(s) attached	N/A
Audit/Review date	Annually
Review responsibility	Clinical Nurse Consultant, Respiratory
Key elements / Indicators / Outcomes	Low reported incidents in RiskMan specifically related to NHF.

References and suggested reading

1. Franklin D, Babl F, Schlapbach L, Oakley E, Craig S, Neutze J, Furyk J, Fraser J, Jones M, Whitty J, Dalziel S, Schibler A. (2018) A Randomised Trial of High-Flow Oxygen Therapy in Infants with Bronchiolitis. *The New England Journal of Medicine*; 378:1121-31.
2. Kepreotes E, Whitehead B, Attia J, Oldmeadow C, Collison A, Searles A, Goddard B, Hilton J, Lee M, Mattes J. (2017) *The Lancet*; 369:930-39.
3. Dysart K, Miller TL, Wolfson MR, Shaffer TH. (2009) Research in high flow therapy: mechanisms of action. *Respiratory Medicine*;103:1400-5.
4. Groves N & Tobin A. (2007). High flow nasal oxygen generates positive airway pressure in adult volunteers. *Australian Critical Care*. 20, 126—131.
5. Spentzas T, Minarik M, Patters AB, Vinson B, Stidham G. (2009) Children with respiratory distress treated with high-flow nasal cannula. *J Intensive Care Med*; 24:323-8.
6. Schibler, A., Pham, T., Dunster, K., Foster, K., Barlow, A., Gibbons, K., and Hough, J. (2011) Reduced intubation rates for infants after introduction of high-flow nasal prong oxygen delivery. *Intensive Care Medicine*. May;37(5):847-52.
7. McKieman, C., Chua, L.C., Visintainer, P. and Allen, P. (2010) Nasal High Flow Therapy in Infants with Bronchiolitis. *Journal of Pediatrics* 156:634-38.
8. Mayfield, S, Jauncey-Cooke, J, and Bogossian, F. (2013) A case series of paediatric Nasal High Flow therapy. *Australian Critical Care: Official Journal of the Confederation of Australian Critical Care Nurses*. 26:189-192.
9. Mayfield, S, Bogossian, F, O'Malley, L, and Schibler, A. (2014) Nasal High Flow oxygen therapy for infants with bronchiolitis: *Pilot Study: Journal of Paediatric Child Health* 50: 373-378.

Guideline revision and approval history

Version No.	Modified by	Amendments authorised by	Approved by
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)

Keywords	Nasal High Flow, NHF, FiO ₂ - oxygen, 70025
Accreditation references	<p>NSQHS Standards (1-8):</p> <ul style="list-style-type: none"> • 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 <p>ISO 9001:2015 Quality Management Systems</p>

Appendix 1

Rapid Response System Coordination Unit

Nasal High Flow Therapy for Outlier Patients

Recognising and Responding to Acute Deterioration Committee

Situation: The scope of this document is to, at the request of the Recognising and Responding to Acute Deterioration (Standard 8) Committee, determine key decision supports and identify any opportunity for improvement in the delivery of nasal high flow therapy to outlier patients (patients who are not admitted to the preferred 'home ward'), who have or are deteriorating with or without the activation of the Medical Emergency Team.

Background: Multiple cases have been reviewed at the Medical Emergency Advisory Group (MEAG) Huddle that demonstrate a practice gap. There are occasions when, due to hospital activity, patients with respiratory symptoms such as wheeze, shortness of breath, cough, oxygen requirement, or a coryzal prodrome, are admitted to non-medical wards as outlier patients. Some of these patients deteriorate and require the administration of nasal high flow therapy. The non-medical wards are not equipped, staffed or trained to operate these devices necessitating the transfer of potentially unstable patients to medical wards already at capacity.

Action: After the decision to admit is made by the treating clinicians, the Nurse Manager-Patient Flow determines the most appropriate disposition based on the clinical needs of the patient, the capacity of the home and/or sister ward, the overall activity of the hospital, current staffing levels, and patients awaiting transfer to inpatient units.

It is proposed that a decision support tool designed to assist in identifying those patients most at risk of further deterioration will assist the Nurse Managers in deciding their disposition. This tool can also assist the Safety Clinical Nurse Consultant in providing consistent high-quality care, with an agreed escalation strategy and access to advanced therapies should they be required.

Recommendations:

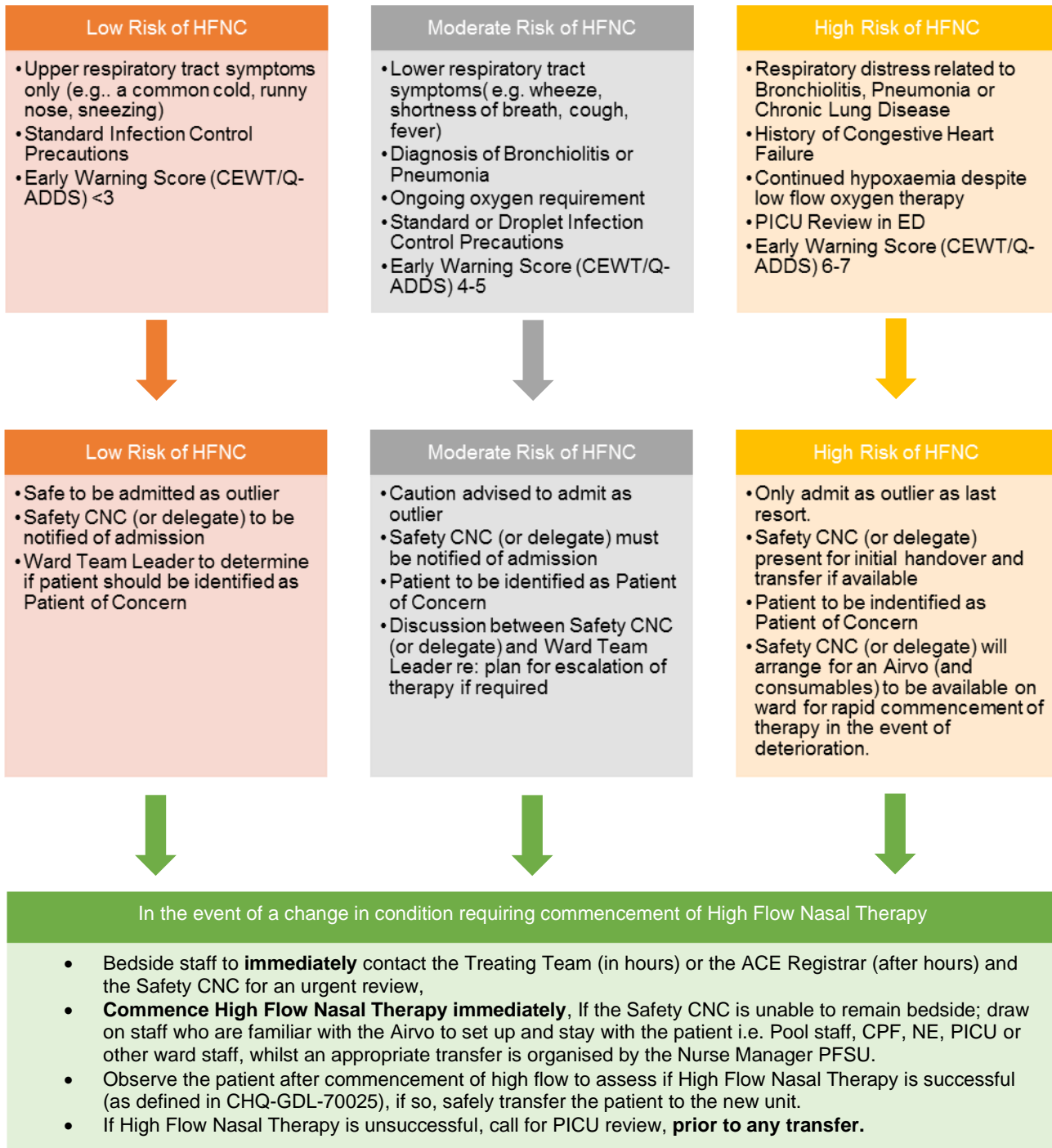
1. Trial of a decision support tool that acknowledges and respects the great work of the Nurse Managers and Safety CNC's from PFSU, whilst providing a mechanism to prevent delay in access to advanced therapies for patients who may deteriorate as an outlier patient.
2. Investigate adding this decision support tool as an appendix to the Nasal High Flow Therapy Guideline.

Related Documents:

- [CHQ-PROC-63210](#) Admission Screening and Safe Patient Placement including Cohorting
- [CHQ-GDL-70025](#) Nasal High Flow Therapy
- [CHQ-GDL-01456](#) Care of the paediatric patient requiring nasal high flow therapy in PICU

Decision Support Tool

- Patients already on high flow nasal therapy should be admitted and transferred as per existing procedures.
- Patients who meet exclusion criteria for high flow nasal therapy should be admitted and transferred as per existing procedures.
- This decision tool is for patients who are candidates for high flow therapy, who do not require it presently and who will be admitted as an outlier patient i.e. not admitted to their preferred 'home ward'.



This does not replace the MET and CODE BLUE Activation Criteria.
 In the event of deterioration that meets the criteria for MET or CODE BLUE Activation at any time, Press
EMERGENCY and call **555**