

# HUMIDIFIED HIGH FLOW NASAL CANNULA THERAPY

## PRACTICE GUIDELINE<sup>®</sup>

### DOCUMENT SUMMARY/KEY POINTS

- This guideline aims to support the safe and effective use of Humidified High Flow Nasal Cannula Therapy (HHFNC) for acute respiratory distress with moderate to severe work of breathing.
- Use in conjunction with the [HHFNC Flowchart](#) to support clinical decision making in relation to initiation, continuation, escalation and weaning.
- Commencement of HHFNC should be with 2L/kg/min gas flow & FiO<sub>2</sub> 30%.
- HHFNC 2L/kg/min may be administered on wards with appropriate consideration given to patient safety.
- Continuous monitoring of SpO<sub>2</sub> and heart rate with hourly documented observations including HHFNC settings in the Standard Paediatric Observation Chart (SPOC) are required.
- Any patient who does not exhibit signs of clinical stabilisation within 2 hours of commencement of HHFNC at 2L/kg/min and appropriate adjunct interventions are to be reviewed by ICU/NETS.
- Any clinical deterioration whereby a child is recorded in the yellow or red zones on SPOC must result in a formal CLINICAL REVIEW or RAPID RESPONSE as per local process.
- Children with chronic respiratory or cardiac failure or those who are palliative will have individual HHFNC therapy management plans documented by their medical team that may be outside the scope of this guideline.
- *Exclusion:* This guideline does not cover Post op Tonsillectomy & Adenoidectomy children receiving HHFNC Therapy.
- HHFNC **administration on Wards** should not exceed 2 L/kg/min or a maximum of 50 L/min

This document reflects what is currently regarded as safe practice. However, as in any clinical situation, there may be factors which cannot be covered by a single set of guidelines. This document does not replace the need for the application of clinical judgement to each individual presentation.

<b>Approved by:</b>	SCHN Policy Procedure and Guideline Committee	
<b>Date Effective:</b>	8 <sup>th</sup> May 2023	<b>Review Period:</b> 3 years
<b>Team Leader:</b>	General Medicine Fellow	<b>Area/Dept:</b> Medical Program

## CHANGE SUMMARY

- No major changes in practice.
- Scope updated to NSW state-wide guideline with the following inclusions:
  - included reference to NETS as part of non-tertiary escalation process.
- Removed equipment-related information and created Local Work Procedures that are linked to this Guideline. See the section on [Equipment and Set Up](#).
- **18/07/23:** Minor review to add a PPE section, update images in Local Work Procedures, standardise SpO<sub>2</sub> to  $\geq 90\%$  and include NP responsibilities
- **14/05/24:** Minor review – reworded last dot-point in *Introduction* and added a frequency for recording observations at commencement of therapy in Section 5. Replaced an image with a clearer image in the *Sizing Guide Local Work Procedure*..

## READ ACKNOWLEDGEMENT

- All clinical staff involved in the care of children where HHFNC may be delivered are to read and acknowledge having read this document

## Related Guidelines

- SCHN Nasopharyngeal And Oropharyngeal Suctioning:  
<http://webapps.schn.health.nsw.gov.au/epolicy/policy/5868>
- SCHN Between The Flags (BTF): Clinical Emergency Response System (CERS):  
<http://webapps.schn.health.nsw.gov.au/epolicy/policy/5035>
- Bronchiolitis (Paediatric Improvement Collaborative) Clinical Practice Guideline:  
[https://www.rch.org.au/clinicalguide/guideline\\_index/Bronchiolitis/](https://www.rch.org.au/clinicalguide/guideline_index/Bronchiolitis/)

This document reflects what is currently regarded as safe practice. However, as in any clinical situation, there may be factors which cannot be covered by a single set of guidelines. This document does not replace the need for the application of clinical judgement to each individual presentation.

<b>Approved by:</b>	SCHN Policy Procedure and Guideline Committee	
<b>Date Effective:</b>	8 <sup>th</sup> May 2023	<b>Review Period:</b> 3 years
<b>Team Leader:</b>	General Medicine Fellow	<b>Area/Dept:</b> Medical Program

## Equipment and Set up

Refer to the relevant **Local Work Procedure** for all equipment needs:

- [Oxygen and Air Blender \(paediatric and adult MR850 and MR950\) circuit set up, cleaning and nebulizer attachment \(for paediatric circuit only\).](#)
- [Airvo3 set up and cleaning.](#)
- [Nasal Cannula – size selection and application.](#)

## TABLE OF CONTENTS

Related Guidelines .....	2
Equipment and Set up .....	3
<b>1 Introduction.....</b>	<b>4</b>
<b>2 Indications.....</b>	<b>4</b>
<b>3 Contraindications .....</b>	<b>5</b>
<b>4 Initiation.....</b>	<b>5</b>
<b>5 Clinical Stabilisation and Care .....</b>	<b>6</b>
<b>6 Weaning.....</b>	<b>7</b>
<b>7 Escalation.....</b>	<b>7</b>
<b>8 Transfer of patients between clinical areas .....</b>	<b>8</b>
Transfer from ED to wards .....	8
Transfer to ICU (SCHN specific information) .....	8
Transfer Setup.....	8
<b>9 Infection Prevention and Control and PPE .....</b>	<b>9</b>
<b>10 Definition of Terms.....</b>	<b>9</b>
<b>11 References .....</b>	<b>10</b>
<b>Appendix: Flowchart – Humidified High Flow Nasal Cannula .....</b>	<b>11</b>

## 1 Introduction

- Respiratory distress and respiratory failure are one of the most common, life threatening presentations in childhood (40% of all paediatric presentations).
- The mainstay of treatment for children with respiratory distress are supportive therapies including oxygen delivery, hydration, assistance with secretion clearance and rest.
- Breathing cool dry gases can produce deleterious effects to the respiratory tract such as mucosal damage, reduced ciliary motility, decreased mucous production, bronchospasm and nasal discomfort.
- HHFNC therapy is used to deliver a continuous humidified flow of gas to provide respiratory support aiming to improve ventilation and oxygenation in moderate to severe respiratory distress.
- HHFNC delivery produces some positive distending pressure, aiding in preventing airway collapse, resulting in increased functional residual capacity, promotion of alveolar gas exchange and CO<sub>2</sub> elimination.
- HHFNC has been demonstrated to deliver effective oxygenation, attributed to the continuous washing of exhaled gas from the upper airways resulting in a reduction in anatomical dead space.
- HHFNC delivers a variable and low level of positive airway pressure without the complicated patient interface and potential risks such as complete airway obstruction and nasal septum necrosis associated with CPAP.

## 2 Indications

- Relief from moderate to severe respiratory distress due to diseases such as bronchiolitis or pneumonia in patients that fail to respond to nasopharyngeal suction and low flow nasal prong oxygen.
- Persistent desaturation (SpO<sub>2</sub> < 90%) in children with acute lower respiratory tract infection despite use of low flow oxygen therapy.
- Respiratory support for infants and children with respiratory distress from congestive heart failure, chronic lung disease or mucositis.



### **ALERT: HIGH RISK PATIENTS**

The following patient groups are at risk for more severe illness and rapid deterioration - consider early ICU review:

- |                            |                              |
|----------------------------|------------------------------|
| ▲ Congenital heart disease | ▲ Complex chronic conditions |
| ▲ Prematurity              | ▲ Neonates                   |

### 3 Contraindications

- Critical illness with immediate need for NIV/intubation
- Apnoeas requiring NIV/intubation
- Life threatening hypoxia
- Decreased level of consciousness
- Upper airway obstruction/nasal obstruction (e.g., choanal atresia, large polyps)
- Craniofacial malformations
- Foreign body aspiration – suspected or confirmed
- Open Chest wound / Chest trauma
- Axillofacial trauma/surgery
- Pneumothorax – use with caution
- Any patient with known lung disease or other conditions that have not been discussed with either the treating physician or respiratory consultant
- Life threatening asthma (consider NIV)

### 4 Initiation

- When considering initiation of high flow, consider the child's age, respiratory diagnosis and other co-morbidities. Consult other relevant clinical management guidelines as appropriate.
- Prior to commencement of HHFNC therapy, secretion clearance (nasopharyngeal suction) should be undertaken and may negate the need for HHFNC initiation.
- HHFNC therapy is to be ordered by the treating medical officer or senior clinical nurse in consultation with admitting officer.



#### **ALERT – NASOGASTRIC TUBE INSERTION**

Nasogastric tube placement should be encouraged in all children less than 3 years prior to initiation of HHFNC therapy (after suction for secretion clearance) for GIT decompression.

For older children, NGT may be inserted where possible and as clinically appropriate.

#### **COMMENCE FLOW RATE 2L/kg/min FiO<sub>2</sub> 30%**

Titrate FiO<sub>2</sub> to maintain SpO<sub>2</sub> ≥ 90%



#### **ALERT – ALTERED CALLING CRITERIA FOR SpO<sub>2</sub>:**

Children with complex medical backgrounds (e.g., CLD/CHD) will need individual ACC plans.

## 5 Clinical Stabilisation and Care

### Clinical stabilisation is indicated by:

- ▲  $\text{FiO}_2 < 50\%$  to maintain  $\text{SpO}_2 \geq 90\%$
- ▲ Heart rate and respiratory rate reduction,  
*e.g. from red to yellow zone or yellow to blue zone*
- ▲ Improved work of breathing/respiratory distress

- Continuous  $\text{SpO}_2$  monitoring
- At commencement of therapy, record observations (work of breathing [WOB], air entry, respiratory rate, heart rate and  $\text{SpO}_2$ ) hourly for first two hours or until deemed stable.
- Hourly recording of HHFNC settings - total flow rate,  $\text{FiO}_2$ , humidifier temperature.
- Nasopharyngeal suctioning to prevent secretions blocking airways.
- Initially children on HHFNC should be Nil by Mouth (NBM) for up to 2 hours with consideration of age/weight, last feed time and BSL check.
- If meeting stabilisation criteria as outlined above discuss feeding regimen with medical team (route, amount, frequency – initial regime continuous NGT 2/3 maintenance (initial total fluid requirement of 100-120mL/kg/day as able and can gradually increase to 150mL/kg/day for young children or full maintenance for an older child).
  - **Do not give oral feeds on 2L/kg/min.** Oral feeds can be commenced once the flow has been weaned to 1L/kg. If the child is extremely unsettled, a small feed of 10-20mL can be trialed while on 2L/kg but should be given only if necessary.
- If no improvement in WOB, remain NBM and for IV cannula and commencement of 2/3 maintenance IV fluids with NGT aspirated/on free drainage.
- Oral and nasal care 4 hourly. Monitor nasal prong position and pressure areas.
- Consultant/senior medical staff/NP review should occur at a minimum of once a day.
- **A medical review should occur if the child is deteriorating.**



### **ALERT - Seek medical/NP review if** (as per local CERS procedure):

- Patient not stabilising according to BTF chart
- Worsening respiratory distress
- Hypoxaemia persists
- $\text{FiO}_2 \geq 40\%$  required to maintain  $\text{SpO}_2 \geq 90\%$

## 6 Weaning

**Medical Officers, Nurse Practitioners or Registered Nurses can initiate weaning of HHFNC once the patient's observations and WOB are stable, evidenced by:**

- ▲ HR, RR & WOB in white or blue zones on SPOC
- ▲ **Decreased WOB and effort**
- ▲  $\text{FiO}_2 < 40\%$  to maintain  $\text{SpO}_2 \geq 90\%$

### Weaning HHFNC

- Decrease  $\text{FiO}_2$  in 5-10% increments, with flow 2L/kg/min ensure  $\text{SpO}_2 \geq 90\%$
- Once  $\text{FiO}_2$  reaches 21-25% and  $\text{SpO}_2 \geq 90\%$  are maintained for 2 hours, flow can be reduced to 1L/kg/min
- If successful weaning for at least 2 hours HHFNC can be removed and continue to monitor  $\text{SpO}_2$  for 2-4 hours

### If the patient deteriorates $\text{SpO}_2 \leq 89\%$ or increased WOB:

- For mild hypoxia without WOB consider low flow nasal prong oxygen, use a humidifier if available. (*Note: change to low flow nasal prongs*)
- For hypoxia and WOB recommence HHFNC 2L/kg/min flow and increase  $\text{FiO}_2$  until  $\text{SpO}_2 \geq 90\%$
- Once stabilised with  $\text{SpO}_2 \geq 90\%$  for at least four hours, weaning can recommence.



#### **ALERT FOR WEANING:**

WEAN  $\text{FiO}_2$  first - 21-25%  
REDUCE total flow to 1L/kg/min  
CEASE total flow

## 7 Escalation

HHFNC may be inadequate and escalation of respiratory support may be required if:

- There is an increase in respiratory distress
- Desaturation / Apnoea / Bradycardic episodes
- $\text{pCO}_2$  measured by venous or capillary blood gas  $>60\text{mmHg}$  and / or  $\text{pH} < 7.25$
- $\text{FiO}_2$  requirement  $\geq 60\%$  ( *$> 40\%$  if no on-site PICU support available*).

In hospital settings with no on-site PICU support, a discussion with NETS will be required if the child continues to deteriorate or is unable to be stabilised despite maximal therapy as appropriate for the ward.

In children  $< 8\text{kg}$ , consult with Intensive Care Outreach or NETS before further escalating treatment.



#### **ALERT - Between the Flags**

Any clinical deterioration whereby a child is recorded in the yellow or red zones on SPOC must result in a formal **CLINICAL REVIEW** or **RAPID RESPONSE**.

## 8 Transfer of patients between clinical areas

HHFNC **must NOT be disconnected** for transfer as this may lead to an acute deterioration.

### Transfer from ED to wards

- Notification of admitting teams as per local process



#### **ALERT - Between the Flags**

Patients should NOT be transferred with SPOC Observations in **RED** zone unless there is a documented plan of care and altered criteria in place by admitting team/ED Consultant or as per local process.

### Transfer to ICU (SCHN specific information)

- Medical officer or Nurse Practitioner to accompany patient with nursing staff or as per local process.

### Transfer Setup

- Child remains in bed / cot.
- Local emergency transport equipment – including extra oxygen cylinder with flow meter attached.
- 1 x FULL oxygen cylinder with regulator for connecting HHFNC O<sub>2</sub> hose.
- 1 X FULL air cylinder with regulator for connecting HHFNC air hose.
- 2 x holders for the HHFNC air and O<sub>2</sub> cylinders attached securely to the bed/cot/HHFNC pole setup.
- Connect HHFNC set up via oxygen and air hose.
- Humidifier base has no battery backup and will not operate while disconnected from mains power - disconnect immediately prior to transfer.
- Entire HHFNC set up is transferred with the patient.
- On arrival to new bed space, transfer oxygen and air hoses to wall, ensuring the blender and flow settings have not changed during transport and plug in humidifier base to recommence humidification.



## 9 Infection Prevention and Control and PPE

- Use transmission-based precautions in patients with bronchiolitis and suspected or confirmed infection or co-infection with COVID-19.
- Do not use aerosol generating procedures (AGP) on transfer.
- Staff PPE as per [CEC COVID 19 Infection Prevention and Control Manual](#).

## 10 Definition of Terms

- **HHFNC** – Humidified High Flow Nasal Cannula
- **Hypoxaemia** – Low arterial oxygen tension (in the blood)
- **Hypoxia** – Low oxygen level in the tissue
- **SpO<sub>2</sub>** – Arterial oxygen saturation measured via pulse oximetry. SpO<sub>2</sub> ≥90%
- **FiO<sub>2</sub>** – Fraction of inspired oxygen concentration (%)
- **pCO<sub>2</sub>** – Carbon dioxide in blood
- **Humidification** – The addition of heat and moisture to gas
- **NIV** – Non-invasive ventilation
- **CLD** – Chronic Lung Disease
- **CHD** – Congenital Heart Disease
- **ACC** – Altered Calling Criteria.
- **WOB** – Work of breathing
- **AGP** – aerosol generating procedure

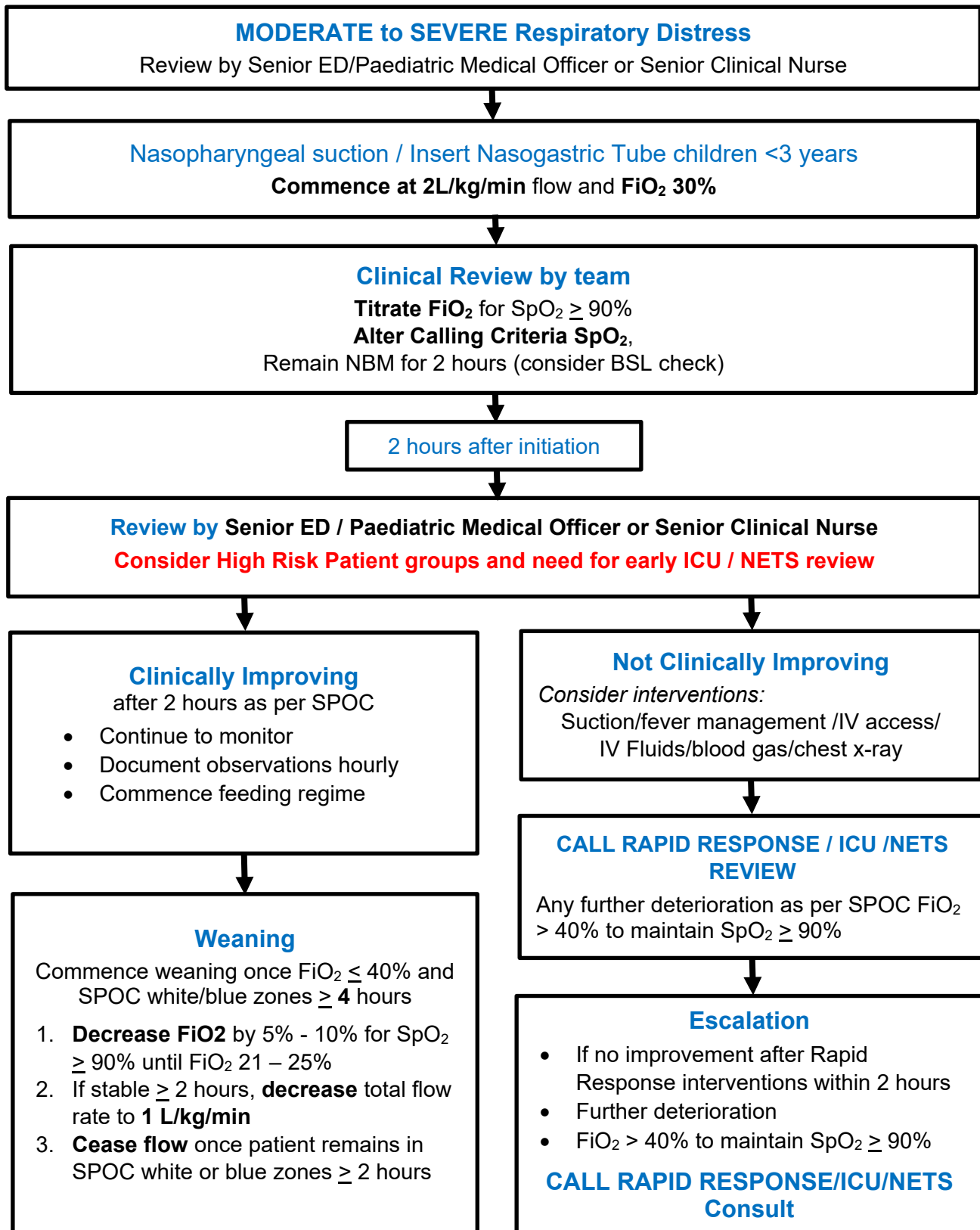
## 11 References

1. Beggs S, Wong ZH, Kaul S, Ogden KJ, Walters JAE. High-flow nasal cannula therapy for infants with bronchiolitis. *Cochrane Database of Systematic Reviews* 2014, Issue 1. Art. No: CD009609.DOI: 10.1002/14651858.CD009609.pub2
2. Bressan S, Balzani M, Krauss B, Pettenazzo A, Zanconato S, Baraldi E. High-flow nasal cannula oxygen for bronchiolitis in a pediatric ward: a pilot study. *Eur. J. Pediatr.* 2013; 172: 1649–56
3. Cambonie G, Pons-Odena M, Baleine J, Milesi C. High flow nasal cannulae for acute viral bronchiolitis in young infants: evidence based medicine is underway to define target populations and optimal flows. *Journal of Thoracic Disease* 2017 9(7): 1763-66
4. Davison M, Watson M, Wockner L, Kinnear F. Paediatric high-flow nasal cannula therapy in children with bronchiolitis: A retrospective safety and efficacy study in a non-tertiary environment. *Paediatric Emergency Medicine* 2017 29(2): 198-203
5. Franklin et al. A randomized trial of high-flow oxygen therapy in infants with bronchiolitis. *N Engl J Med* 2018; 378: 1121-31
6. Goh, CT, Kirby, LJ, Schell, DN and Egan, JR. Humidified high-flow nasal cannula oxygen in bronchiolitis reduces need for invasive ventilation but not intensive care admission. *Journal of Paediatrics and Child Health* 2017; 3(9): 897-902 doi:10.1111/jpc.13564
7. Mayfield S, Jauncey-Cooke J, Hough JL, Schibler A, Gibbons K, Bogossian F. High-flow nasal cannula therapy for respiratory support in children. *Cochrane Database of Systematic Reviews* 2014, Issue 3. Art. No.: CD009850. doi: 10.1002/14651858.CD009850.pub2
8. Schibler A, Pham TMT, Dunster KR, Foster K, Barlow A, Gibbons K, et al. Reduced intubation rates for infants after introduction of high-flow nasal prong oxygen delivery. *Intensive Care Medicine*. 2011; 37: 847-52
9. Wing R, James RC, Maranda LS, Armsby CC. Use of high-flow nasal cannula support in the emergency department reduces the need for intubation in pediatric acute respiratory insufficiency. *Pediatric Emergency Care* 2012; 28(11): 1117-1123
10. Testa G, Iodice F, Ricci Z, Vitale V, De Razza F, Halberger R, Iacoella C, Conti G, Cogo P. Comparative evaluation of high-flow nasal cannula and conventional oxygen therapy in paediatric cardiac surgical patients: a randomized controlled trial. *Interactive Cardiovascular and Thoracic Surgery* 2014; 19(3): 456-461
11. Milesi C, Baleine J, Matecki S, Durand S, Combes C, Novais ARB, Combonie G. Is treatment with a high flow nasal cannula effective in acute viral bronchiolitis? A physiologic study. *Intensive Care Medicine* 2013; 39(6): 1088-1094
12. Schibler A and Franklin D. Respiratory Support for children in the emergency department. *Journal of Paediatrics and Child Health* 2016; 52(2): 192-196
13. O'Brien S, Craig S, Babl F E et al. Rational use of high-flow therapy in infants with bronchiolitis. What do the latest trials tell us? A Paediatric Research in Emergency Departments International Collaborative perspective. *Journal of Paediatrics and Child Health*. 2019 July 55 (7) 746-752.  
<https://onlinelibrary.wiley.com/doi/full/10.1111/jpc.14496> (accessed 04/05/23)
14. Conway TP, Halaby C, Akerman M, Asuncion A. The Use of High-Flow Nasal Cannula and the Timing of Safe Feeding in Children with Bronchiolitis. *Cureus*. 2021 Jun 15;13(6):e15665. doi: 10.7759/cureus.15665. PMID: 34277257; PMCID: PMC8281783  
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8281783/> (accessed 04/05/23)

### **Copyright notice and disclaimer:**

The use of this document outside Sydney Children's Hospitals Network (SCHN), or its reproduction in whole or in part, is subject to acknowledgement that it is the property of SCHN. SCHN has done everything practicable to make this document accurate, up-to-date and in accordance with accepted legislation and standards at the date of publication. SCHN is not responsible for consequences arising from the use of this document outside SCHN. A current version of this document is only available electronically from the Hospitals. If this document is printed, it is only valid to the date of printing.

## Appendix: Flowchart – Humidified High Flow Nasal Cannula



HHFNC administration on Wards **should not exceed 2 L/kg/min or a maximum of 50 L/min**