# Nasal Cannula Respiratory Support in NICU

## Sites where Local Guideline applies
- Neonatal Intensive care Unit, JHCH & PICH JHH

## This Local Guideline applies to:
1. Adults
   - No
2. Children up to 16 years
   - Yes
3. Neonates – less than 29 days
   - Yes

## Target audience
Clinical staff that provide care to neonatal patients requiring a nasal cannula.

## Description
Guideline for the management of infants requiring nasal cannula respiratory support

## National Standard
Standard 6: Clinical Handover

## Keywords
- cannula, CPAP (continuous positive airway pressure), flow, humidified, nasal, Optiflow, oxygen

## Document registration number
JHCH_NICU_12.04

## Replaces existing document?
Yes

## Registration number and dates of superseded documents
JHCH_NICU_12.04 May 2014

## Related Legislation, Australian Standard, NSW Ministry of Health Policy Directive or Guideline, National Safety and Quality Health Service Standard (NSQHSS) and/or other, HNE Health Document, Professional Guideline, Code of Practice or Ethics:
- Aseptic Technique for medium or Higher Risk Procedures Conducted in Clinical Settings
- NSW Health Policy Directive PD2017_032 Clinical Procedure Safety
- Medication Safety in HNE Health PD2013_043:PCP31

## Prerequisites (if required)
N/A

## Local Guideline note
This document reflects what is currently regarded as safe and appropriate practice. The guideline section does not replace the need for the application of clinical judgment in respect to each individual patient but the procedure/s require mandatory compliance. If staff believe that the procedure/s should not apply in a particular clinical situation they must seek advice from their unit manager/delegate and document the variance in the patients’ health record.

## Position responsible for the Local Guideline and authorised by
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## Contact details
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- This document contains advice on therapeutics: No

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PURPOSE AND RISKS

This local clinical procedure has been developed to provide instruction to the health clinician and to ensure that the risks of harm to the child associated with application of nasal cannula respiratory support are prevented, identified and managed.

The risks are:

- Gastric distension affecting respiratory and gastro-intestinal function
- Nasal trauma and skin irritation
- Hypoxia due to displacement or blockage of cannula

The risks are minimised by:

- Clinicians having knowledge of nasal cannula respiratory support implementation and management
- Clinicians seeking assistance if caring for infants is outside their scope of practice
- Following the instructions set out in the clinical procedure
- Recognition of the common clinical signs of the complications of nasal cannula respiratory support
- Notification and management of the complications/risks to the patient

Risk Category: Clinical Care & Patient Safety

OUTCOMES

1. Provision of correct flow and oxygen/air requirements
2. Provision of humidified flow if >1L/min
3. Reduced gastric distension
4. Prevention of ongoing nasal trauma for infants < 32 weeks who still require pressure support
5. Ability for increased parental interaction e.g. commencement of sucking feeds, bathing if condition stable.

ABBREVIATIONS & GLOSSARY

<table>
<thead>
<tr>
<th>Abbreviation/Word</th>
<th>Definition</th>
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<tbody>
<tr>
<td>CGA</td>
<td>Corrected Gestational age</td>
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<tr>
<td>FiO₂</td>
<td>Fraction of inspired oxygen</td>
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<tr>
<td>HDU</td>
<td>High Dependency Unit</td>
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<tr>
<td>HHHFNC</td>
<td>Heated humidified high flow nasal cannula</td>
</tr>
<tr>
<td>HPCPAP/CPAP</td>
<td>Hudson Prong/ Continuous positive airway pressure</td>
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<tr>
<td>JHCH/NICU</td>
<td>John Hunter Children’s Hospital/Neonatal Intensive Care Unit</td>
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<tr>
<td>LFNC</td>
<td>Low flow nasal cannula</td>
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<tr>
<td>MO</td>
<td>Medical Officer</td>
</tr>
<tr>
<td>N/C &amp;NCHF</td>
<td>Nasal Cannula/Nasal Cannula High Flow</td>
</tr>
<tr>
<td>NP</td>
<td>Nurse Practitioner</td>
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</tbody>
</table>
PEEP | Positive End Expiratory Pressure
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WOB | Work of Breathing

**Guideline**

This Guideline does not replace the need for the application of clinical judgment in respect to each individual patient.

**Rationale**

Nasal Cannula respiratory support refers to the delivery of a flow of air and/or oxygen via a binasal cannulae system, commonly up to 1 L/min but may be up to 8 L/min to infants who are breathing spontaneously. Within this guideline two different procedures of delivery of nasal cannula respiratory support are described.

1. **Low Flow Nasal Cannula (LFNC):** If ≤1L/min of flow is required, a low or ultra-low flow meter is attached to the wall oxygen outlet and a Fisher & Paykel™ nasal cannula is used.

2. **Heated Humidified High Flow Nasal Cannula (HHHFNC):** If the flow of gas used is ≥2 L/min, heat and humidification is necessary using the F&P Optiflow™ nasal cannula and humidification set up, and is referred to as HHHFNC. The use of humidified gas aims to reduce the risk of nasal mucosa injury and possibly decrease the risk for nosocomial infection (De Klerk, 2008).

**LFNC**

In the NICU at John Hunter Children’s Hospital, LFNC is delivered via Fisher & Paykel nasal cannula connected to an ultra-low flow meter. The flow rate of oxygen is limited to no higher than 500mL/min.

If a flow rate >250 mL/min is required to maintain SpO₂ within desired range of 90%-95%, medical/NNP staff should be alerted and advice sought from Neonatal Fellow/Neonatologist for further respiratory management.

**Indications for LFNC:**

- Oxygen therapy not requiring pressure support or where it is desirable to avoid pressure support
- Neonates electively taken off CPAP at ≥34 weeks CGA still requiring oxygen or with SpO₂ <90% or tachypnea +/- mild-mod work of breathing after cessation of CPAP at 34 weeks CGA
- Neonates weaned off HHHFNC and requiring oxygen therapy to maintain SpO₂ in desired range
- Neonates at CGA > 32 weeks, on CPAP (PEEP ≤6 cm H₂O) and oxygen requirement ≤25% and who could be transferred to a peripheral Special Care Unit may be tried on LFNC oxygen.

**NOTE:** A minimum of 48-hours of stable LFNC O₂ (as assessed by clinical condition and histogram trace on the Phillips monitor) are necessary before the baby is transferred out of JHCH NICU. If this is not achieved, the infant requires recommencement of CPAP until the next trial off or until 34 weeks CGA as appropriate.
Application of nasal cannula for LFNC:

**Equipment requirements:**
- Fisher & Paykel nasal cannula™ - either Neonatal or Infant
- Thick Duoderm™, Hypafix™
- Flow meter – Ultra-low flow meter
- Neopuff™

**Procedure:**
1. Attach oxygen tubing connector to base and connect oxygen tubing to the ultra-low flow meter. Set the flow (in mL/min) as directed by Neonatologist.
2. Attach cannula flow end to meter.
3. Cut Duoderm™ to fit the infant’s cheeks. Position nasal cannula across infant’s upper lip ensuring the curve follows the anatomical shape of the infant- secure tubing to Duoderm™ with Hypafix™ - as pictured.
4. Position nasal cannula tubing either high overhead or low behind the neck with the clamp. To avoid pressure injury, ensure that the infant is not lying on the tubing.
5. Observe infant’s clinical condition. Titrate oxygen according to oximetry readings or MO/NNP directions.
6. Saturation screening on the histogram for 2, 4 or 8 hours should have a cumulative oxygenation saturation >90% for at least 80% of the time. Also, ensure that the saturation histogram is a bell shaped curve with peak SpO₂ around 93%.
7. Ensure a Laerdel bag™ or Neopuff™ and correct sized mask is readily available at the infant’s bed-space.

**HHHFNC**

There is widespread use both nationally and internationally for HHHFNC nasal cannula respiratory support. However, a Cochrane review in 2016 (Wilkinson et.al) generally concluded there was insufficient evidence to establish the safety or effectiveness of HFNC as a form of respiratory support in preterm infants. Also, recent trials have shown a lack of evidence to support the use of nasal cannula humidified flow as a primary non-invasive respiratory support in preterm infant’s ≥ 28 weeks or 1000g and that it is not superior to CPAP in avoiding invasive respiratory support in the first 72 hours (Murki, et.al, 2018).

**Indications for HHHFNC**

Initiation of HHHFNC should **always** be discussed with Neonatal Fellow/Neonatologist prior to commencement. It is not a nurse initiated procedure.

- Neonate with significant nasal septum abnormality / trauma from CPAP prongs (as a **temporary** relief measure ONLY)
- Neonates > 32 weeks CGA, stable on CPAP requiring <30% oxygen with no significant apnoea/bradycardic events and could otherwise be transferred to a unit which provides HHHFNC support
Failure of LFNC – oxygen flow requirement > 250mL/min OR significant work of breathing OR persistent tachypnea >80/min for >2 hours.

For neonates ≥ 34 weeks GA at birth with oxygen requirement >30% and after consultation with Neonatologist HHHFNC support may be considered.

Application of nasal cannula for HHHFNC:

The commencement flow rate for HHHFNC is usually between 6-8L/min based on the Neonatologist’s assessment of the individual infant requirement.

Equipment requirements:

- Flow meter & blender
- Optiflow™ tubing set
- Fisher & Paykel Humidifier base
- 1000ml bag of water for injection
- Oxygen tubing
- Temperature probe
- Fisher & Paykel Optiflow nasal cannula™: either XS Seahorse (blue <2.5kg), S Crab (red 1-3.5kg) or M Starfish (yellow 1-10kg) – See Appendix 2

Procedure:

- Connect the swivel connection of the Optiflow™ to the blue tubing of Optiflow™ tubing set to allow for heating/humidification immediately upon applying to face.
- Check condition of infant’s septum.

Optiflow™ Tubing set and cannula
Applying Optiflow Junior 2™ cannula

The following is a suggested procedure for applying the Optiflow™ Junior 2 Nasal Cannula (OJR410, OJR412, OJR414, OJR416, OJR418).

Fitting

1. Select cannula size
   Select appropriate cannula size; recommended nasal occlusion is approximately 50%. The sizing chart on the following page should only be used as a guide.

2. Prepare skin
   Prepare the patient’s skin according to hospital protocol.

3. Connect to gas source
   Connect the cannula to the gas source. TIP: Place hand close to nasal prongs to ensure that there is gas flow exiting the prongs.

4. Remove the first F&P Wigglepad™ 2 tabs
   Remove the first backing tabs from the F&P Wigglepads™ 2 and avoid touching the adhesive.

5. Insert cannula
   Insert the cannula into the nares. Ensure the cannula bridge rests close to the nose without touching the septum. DO NOT stretch the cannula during application. Stick the F&P Wigglepads™ 2 to the patient’s cheeks.

6. Secure cannula
   Remove the second backing tabs and stick the F&P Wigglepads™ 2 onto the cheeks.

*IMPORTANT: Always refer to the user instructions supplied with the product for full set up instructions, warnings, cautions and contraindications.
Nursing Management for infants on nasal cannula (LFNC or HHHFNC):

1. Observe infant for signs of: respiratory distress, increased work of breathing (WOB), colour change, apnoea or bradycardia. Report to the Medical Officer or Nurse Practitioner (NP), and document on flow chart and in notes. See criteria for failure of HHHFNC
2. Check and document hourly gas flow rate and FiO₂ requirement
3. Hourly check of nasal cannula position and skin integrity around nares
4. Insert an oro-gastric tube for venting for any infants on a flow ≥ 2L/min
5. Check patency of cannula and suction nares as required. Clean cannula with sterile water and sterile gauze as necessary. Only replace cannula if blocked or difficulty cleaning due to increased secretions or condensation.
6. Replace nasal cannula weekly with a new cannula and discard used one. Document date of change on a white sticker at gas wall end of tubing for clear cannula. Optiflow change can be incorporated into weekly humidifier change with appropriate sticker.
7. Oximetry monitoring / download as requested to allow for titration of FiO₂ – see Appendix 1 – ‘Oximetry Download’ guidelines
8. Depending on the infant’s condition, sucking feeds may be offered for infants with temporary reduction of flow rates to <2L/min for sucking feeds for neonates ≥34 wks or for neonates ready to be offered suck feeds. Be aware that oxygen requirements may increase with feeding. (NOTE: maximum time of 30 minutes for each feed).
9. Infants on LFNC may be bathed in the bathroom as tolerated using the Inhalo™ cylinders
10. Stable infants on LFNC or HHHFNC may be bathed at the bedside. Check with the in-charge nurse or MO/NP.
11. For infants on LFNC, parents are encouraged to participate in supervised infant care activities associated with nasal cannula, for instance changing the nasal cannula weekly until confident to change independently.
12. Infants going home on nasal cannula oxygen will be instructed on how to clean with detergent, sterile water and gauze squares.

Complications of Nasal Cannula therapy

- Possible excessive pressure from HHHFNC. There is debate about the effects of unknown end distending pressure with varied results from research studies. The Fisher & Paykel circuit™ incorporates a pressure relief valve, limiting internal circuit pressure to 40cm H₂O
- Ensure nasal cannula are the appropriate size for the infant (refer to sizing guide in Appendix 1) - there needs to be space around cannulae otherwise occlusion of the nares may cause excessive airway pressure, (Sivieri, 2012).
- Pressure related tissue damage & nasal erosion from improper positioning of tubing or infrequent changing may occur.
- Potential problems with “rainout ” resulting in lavage and increased risk of apnoea; therefore nurses need to be vigilant in clearing excess condensation and ensuring that only heated tubing is used.
- Skin irritation can result from tape used to secure the cannula.
- Hypoxia secondary to dislodgement or disconnection of nasal cannula.
• Actual FiO2 delivered may vary dependent on infant GA, RR and fit of nasal cannula
• Abdominal distention secondary to gas flow.
• Occlusion of the nasal cannula by nasal secretions.

Failure to tolerate Nasal Cannula Oxygen Therapy:

Failure of nasal cannula (either HHHFNC or Low Flow) may include one or more of the following:

1. Increase in FiO2 by >10% v/s previous FiO2 on CPAP (example: FiO2 on CPAP 35%; FiO2 on HHHFNC 45%).
2. Changes in infant condition such as persistent increased work of breathing, increasing apnoea/bradycardia/desaturation or hypercarbia on a blood gas may indicate the need for the infant to be placed on HPCPAP which is a nurse initiated treatment (refer to NICU CPG CPAP JHCH_NICU_12.2). Ex-preterm infants born <29 weeks CGA who need to go back to CPAP after >34 weeks GA from failure of LFNC or HHHFNC should always be discussed with MO/NNP/Fellow.

Important considerations

1. All neonates on HHHFNC should be deemed to be High Dependency Unit (HDU) infants for acuity of care
2. They merit appropriate nursing ratios, frequency of observations and blood gases comparative to an equivalent neonate on CPAP support.

Weaning from Nasal Cannula Therapy

Weaning from HHHFNC:

1. Wean oxygen requirements to achieve saturations in the desired band of 90-95% SpO2 and achieve cumulative oxygen saturation >90% at least 80% of the time.
2. Adjust flow rate by decrements of 1-2L/min provided oxygen requirements are <40% - usually decided on clinical rounds each morning. Changes should be made every 12-48 hours if FiO2, Histogram, clinical condition and PaCO2 on blood gases are stable or improving. Massimo oximetry download may also be used to aid the weaning process.
3. Once the flow has been weaned to <1L/min it is now considered Low-Flow NC

Weaning from Low Flow NC:

1. Reduce flow rate based on histogram and clinical condition. Massimo oximetry download should be used to assess weaning especially for infants >36 weeks CGA after consultation with Neonatologist on service.

NOTE When the flow is ceased to discontinue treatment, ensure that nasal cannula is immediately removed from the nares.
Appendix 1: Saturation Monitor Download Guidelines

Optimal Oximetry Download:

**If:**

Sampling frequency 2 secs  
Minimum sampling time 8 hours  
Validity of sampling time >90%

**And:**

Mean SaO2 ≥ 92%  
Cumulative time spent in SpO2 > 90 to be ≥ 90%  
Duration of longest apnoea to be also reviewed with nursing remarks

**Response:**

Reduce oxygen OR respiratory support as appropriate in consultation with the Neonatologist on service
Appendix 2: Optiflow Sizing Chart
References


Fisher & Paykel Healthcare: Respiratory humidification product catalogue, pp17


Zuzanna, J, Kubicka, MD, Limauro, J & Darnell, R. Heated, humidified high-flow nasal cannula therapy: Yet another way to deliver CPAP? Pediatrics 2008: 121(1) 82-88
Staff Preparation
It is mandatory for staff to follow relevant: “Five moments of hand hygiene”, infection control, moving safely/safe manual handling, documentation practices and to use HAIDET for patient/carer communication: 
- **Hand hygiene** Acknowledge, Introduce, Duration, Explanation, Thank you or closing comment.

Implementation, monitoring compliance

1. Approved clinical guideline will be uploaded to the PPG and communication of updated ‘Nasal Cannula Respiratory Support in NICU’ clinical guideline to NICU staff will be via email and message on the HUB.
2. Incident investigations associated with this Guideline and Procedure will include a review of process.
3. The Guideline and Procedure will be amended in line with the recommendations.
4. The person or leadership team who has approved the Guideline and Procedure is responsible for ensuring timely and effective review of the Guideline and Procedure.
5. Evaluation will include a review of the most current evidence as well as a consideration of the experience of Neonatal staff at JHCH in the implementation of the Guideline and Procedure.