

Local Guideline



John Hunter
Children's Hospital
CHILDREN, YOUNG PEOPLE AND FAMILIES



Health
Hunter New England
Local Health District

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

[Go to Guideline](#)

Keywords	cannula, CPAP (continuous positive airway pressure), flow, humidified, nasal, Optiflow, oxygen
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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Registration number and dates of superseded documents	JHCH_NICU_12.04 May 2014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:	
<ul style="list-style-type: none"> • Aseptic Technique for medium or Higher Risk Procedures Conducted in Clinical Settings • NSW health Policy Directive PD 2017_013 Infection Control and prevention Policy • 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.
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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

Abbreviation/Word	Definition
CGA	Corrected Gestational age
FiO ₂	Fraction of inspired oxygen
HDU	High Dependency Unit
HHHFNC	Heated humidified high flow nasal cannula
HPCPAP/CPAP	Hudson Prong/ Continuous positive airway pressure
JHCH/NICU	John Hunter Children’s Hospital/Neonatal Intensive Care Unit
LFNC	Low flow nasal cannula
MO	Medical Officer
N/C &NCHF	Nasal Cannula/Nasal Cannula High Flow
NP	Nurse Practitioner

PEEP	Positive End Expiratory Pressure
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 ≤ 1 L/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:

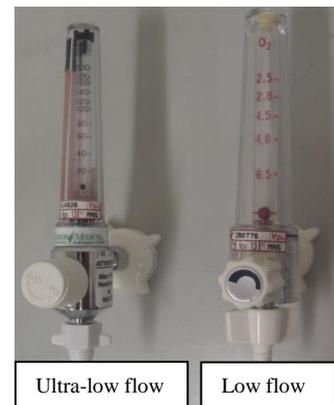
- Oxygen therapy not requiring pressure support or where it is desirable to avoid pressure support
- Neonates electively taken off CPAP at ≥ 34 weeks CGA still requiring oxygen or with SpO₂ $<90\%$ or tachypnea +/- mild-mod work of breathing after cessation of CPAP at 34 weeks CGA
- Neonates weaned off 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 $\leq 25\%$ **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

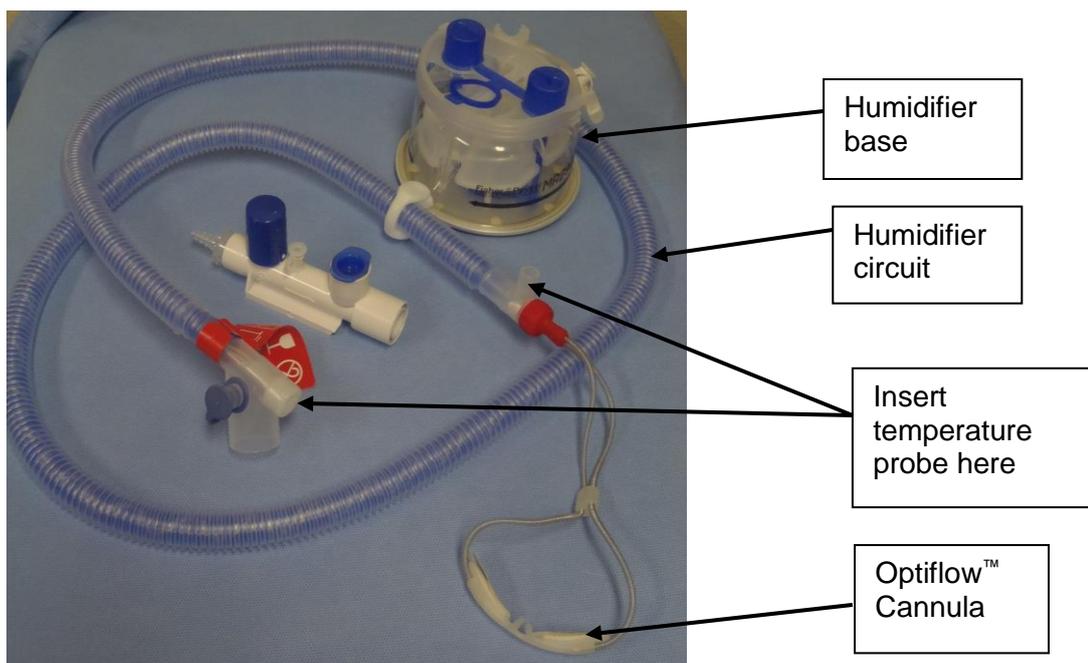
XS Seahorse (blue <2.5kg), S Crab (red 1-3.5kg) or M Starfish (yellow 1-10kg) – See Appendix 2



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

NASAL CANNULA FITTING GUIDE

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 nare 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.

1 SELECT CANNULA SIZE

SIZE RANGE		ENSURE GAP AROUND PRONGS*
XS	OJR410	
S	OJR412	
M	OJR414	
L	OJR416	
XL	OJR418	



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 \geq 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 \geq 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:

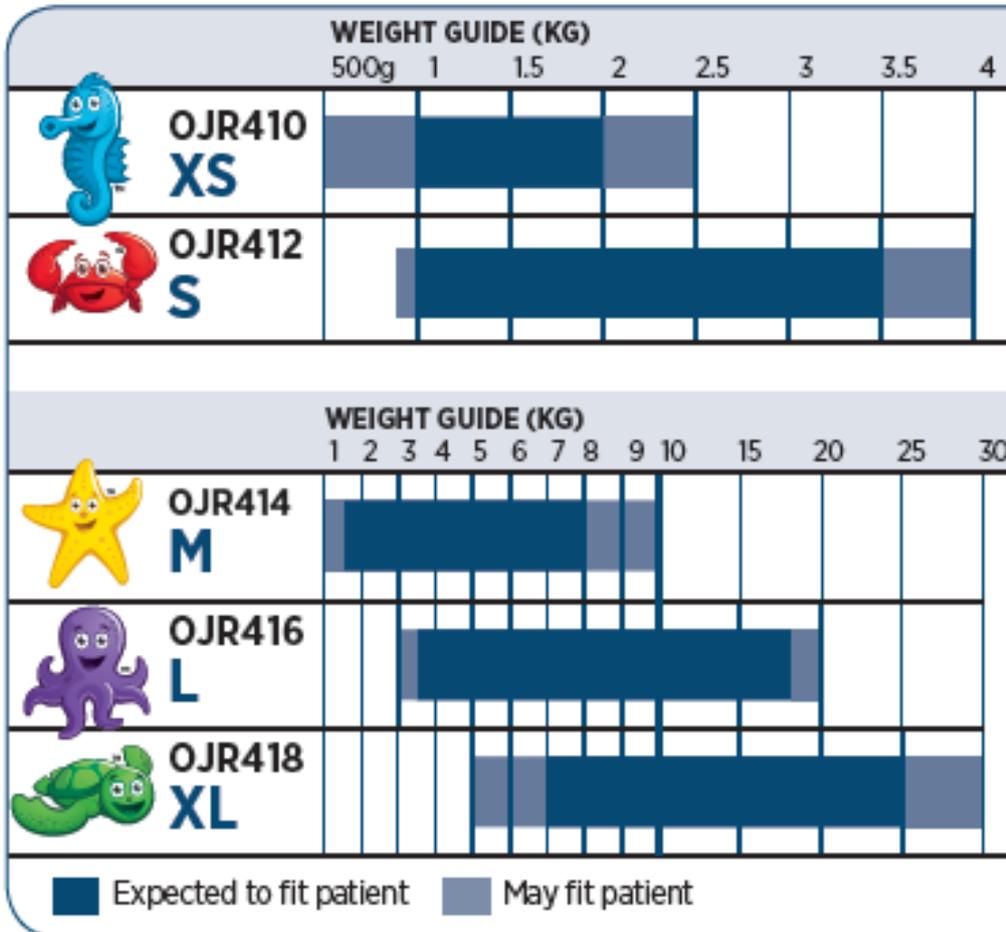
Mean SaO₂ ≥ 92%
Cumulative time spent in SpO₂ > 90 to be ≥ 90%
Duration of longest apnoea to be also reviewed with nursing remarks

Response:

Reduce oxygen OR respiratory support as appropriate in consultation with the Neonatologist on service

Appendix 2: Optiflow Sizing Chart

SIZING INFORMATION



References

- De Klerk A. Humidified high-flow nasal cannula: is it the new and improved CPAP? *Advances in Neonatal Care* 2008, Vol 8 pp. 98-106
- Fisher & Paykel Healthcare: Respiratory humidification product catalogue, pp17
- Locke, R. Wolfson, M. Shaffer, T. Rubenstein, D & Greenspan, J. Inadvertent Administration of Positive End-Distending Pressure During Nasal Cannula Flow. *Pediatrics* 1993: 91(1) 135-138
- Murki S, Singh J, Khant C, Kumar Dash S, Oleti TP, Joy P, Kabra NS High-Flow Nasal Cannula versus Nasal Continuous Positive Airway Pressure for Primary Respiratory Support in Preterm Infants with Respiratory Distress: A Randomized Controlled Trial. *Neonatology*. 2018;113(3):235-241. doi: 10.1159/000484400. Epub 2018 Jan 23.
- Saslow, J. Aghai, Z. Machala, T. Hart, J. Lawrysh, R. Stahl, G. & Pyon, K. Work of breathing using high-flow nasal cannula in pre term infants. *Journal of Perinatology* 2006: 26, 476-480
- Screenan, C. Lemke, R. Hudson-Mason, A. & Osiovicj, H. High-flow nasal Cannulae in the Management of Apnea of Prematurity: A comparison with Conventional Nasal Continuous Positive Airway Pressure. *Pediatrics* 2001: 107(5), 1081-1083
- Sivieri, E. M., Gerdes, J. S. and Abbasi, S. (2013), Effect of HFNC flow rate, cannula size, and nares diameter on generated airway pressures: An in vitro study. *Pediatr. Pulmonol.*, 48: 506–514. doi: 10.1002/ppul.2263
- Walsh, M. Engle, W. Lupton, A. Kazzi, SN. Butcher, S. Rasmussen, M et al. Oxygen delivery through nasal cannulae to pre term infants: Can practice be improved? *Pediatrics* 2005: 116, 857-861
- Wilkinson, D. Anderson, C. Smith, K. & Holberton, J. Pharyngeal pressure with high-flow nasal cannulae in premature infants. *Journal of Perinatology*. 2008: 28(1) 42-47
- Wilkinson, D. Anderson, C. & Holberton, J. Should High Flow Nasal Cannula Be Used For Respiratory Support in Preterm Infants? *Neonatology Today* 2008: 3(8)
- Wilkinson, DJ. Anderson, C. & O'Donnell, C. High Flow Nasal Cannula for Respiratory Support in Preterm Infants (Protocol) *Cochrane DSR* 2007: (1) CD006405
- Wilkinson, D. Anderson, C. O'Donnell, CPF, De Paoli, AG & Manley. B.J. High flow nasal cannula for respiratory support in preterm infants. *Cochrane Database of Systematic Reviews* 2016, Issue 2. Art No: CD006405 DOI: 10.1002/14651858.CD006405.pub3
- Yoder B.A, Stoddard.R.A, Li.M, King. J, Dirnberger, D.R & Abbasi, S.Heated, Humidified High-Flow Nasal Cannula versus Nasal CPAP for Respiratory Support in Neonates.*Pediatrics* (2013): 131;e1482-1490
- 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

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FEEDBACK: Any feedback on this document should be sent to the Contact Officer listed on the front page.

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: **H**and hygiene **A**cknowledge, **I**ntroduce, **D**uration, **E**xplanation, **T**hank 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.