F&P Optiflow Junior 2

Nasal High Flow for Infants and Children

A global overview of current literature and practice.

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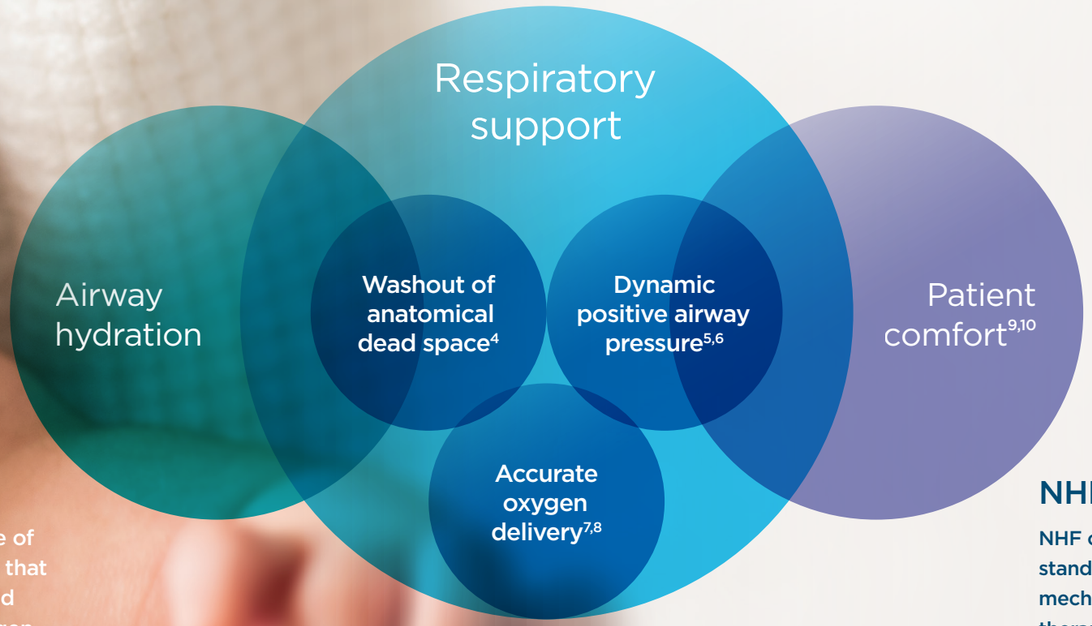
Mechanisms of action



NHF definition:[1-3]

Nasal high flow (NHF) is a mode of noninvasive respiratory support that delivers high flows of heated and humidified blended air and oxygen through an unsealed nasal interface.

NHF benefits:

NHF offers a range of benefits compared with standard oxygen therapy, and there are several mechanisms of action associated with this therapy, including airway hydration and washout of anatomical dead space.

1. Wilkinson et al. Cochrane Database Sys Rev (2016).
2. Collins et al. J Pediatr (2013).
3. Franklin et al. N Engl J Med (2018).
4. de Klerk A. Adv Neonatal Care 8, 98-106 (2008).
5. Saslow J et al. J Perinatol 26, 476-480 (2006).
6. Milési C et al. Intensive Care Med 39, 1088-1094 (2013).
7. Hough J et al. Pediatr Crit Care Med 15, e214-9 (2014).
8. Sinha I et al. Chest 148, 810-823 (2015).
9. Collins CL et al. Eur J Pediatr 173, 181-186 (2014).
10. Roberts C et al. N Engl J Med 375, 1142-1151 (2016).

Increasing evidence in the use of NHF for infants and children

2010
McKiernan et al.[1]
Australia

The use of NHF in the PICU for infants with bronchiolitis was associated with a decreased need for intubation.

2011
Schibler et al.[2]
Australia

Retrospective review showing an increased use of NHF was associated with a reduced need for intubation in children with bronchiolitis.

2012
Wing et al.[3]
USA

Retrospective review showing the early use of NHF in the ED reduced the need for intubation in the PICU.

2013
Milési et al.[4]
France

Physiological study indicating that a flow of approximately 2 L/kg/min is required to improve work of breathing in bronchiolitis patients.

2014
Rubin et al.[5]
USA

Physiological study confirming that increasing flow rate was associated with decreased effort of breathing in children post extubation.

2014
Testa et al.[6]
Italy

RCT showing NHF improved PaO_2 but had no impact on $PaCO_2$ in pediatric cardiac patients.

2014
Mayfield et al.[7]
Australia

Pilot RCT showing that improvements to heart rate and respiratory rate within one hour are predictors of NHF therapy success outside the PICU.

2014
Pham et al.[8]
Australia

Physiological study showing the use of 2 L/kg/min in bronchiolitic and cardiac infants reduced the work of breathing.

2017
Milési et al.[9]
France

RCT showing NHF did not have a failure rate similar to that of nCPAP in the PICU.

2017
Kepreotes et al.[10]
Australia

RCT showing NHF at 1 L/kg/min did not significantly reduce time on oxygen in infants with bronchiolitis compared with standard oxygen therapy.

2018
Franklin et al.[11]
Australia, New Zealand

Largest RCT including > 1400 infants with bronchiolitis in non-ICU settings, showing therapy failure rate was lower in NHF compared with standard oxygen therapy.

2022
Ramnarayan et al.[12]
UK

RCT showing NHF did not meet noninferiority criteria compared with CPAP in the time to liberation from respiratory support post extubation.

2022
Ramnarayan et al.[13]
UK

RCT showing NHF met the noninferiority criteria when compared with CPAP for time to liberation of respiratory as first-line support.

A systematic search of available literature shows there are more than 220 peer-reviewed papers investigating the use of NHF therapy in infants and children.

Of these, 23 are randomized controlled trials (RCTs) – 10 of which compared NHF with standard oxygen therapy, nine with continuous positive airway pressure (CPAP) and four with alternative treatments. A further 10 are in the form of systematic reviews.

23 RCTs

10 compare NHF vs. standard oxygen therapy

9 compare NHF vs. CPAP*

4 compare NHF vs. alternative therapies

Plus a further 10 systematic reviews

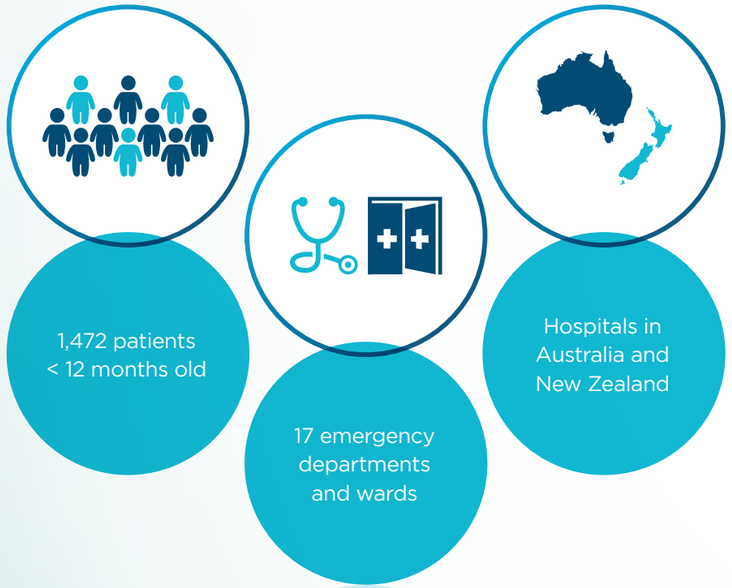
1. McKiernan et al. J Pediatr (2010).
2. Schibler et al. Intensive Care Med (2011).
3. Wing et al. Pediatr Emerg Care (2012).
4. Milési et al. Intensive Care Med (2013).
5. Rubin et al. Pediatr Crit Care Med (2014).
6. Testa et al. Interact Cardiovasc Thorac Surg (2014).
7. Mayfield et al. J Paediatr Child Health (2014).
8. Pham et al. Pediatr Pulmonol (2015).
9. Milési et al. Intensive Care Med (2017).
10. Kepreotes et al. Lancet (2017).
11. Franklin et al. N Engl J Med (2018).
12. Ramnarayan et al. JAMA (2022).
13. Ramnarayan et al. JAMA (2022).

Franklin et al. 2018.[1]

New England Journal of Medicine. 378(12), 1121-1131 (2018).

An RCT of high-flow oxygen therapy in infants with bronchiolitis.

This large multi-center RCT supports the early use of NHF in the ED and general care areas in young infants with bronchiolitis and may help reduce the escalation of therapy. This RCT used the F&P Airvo™ with an F&P Optiflow™ Junior interface.



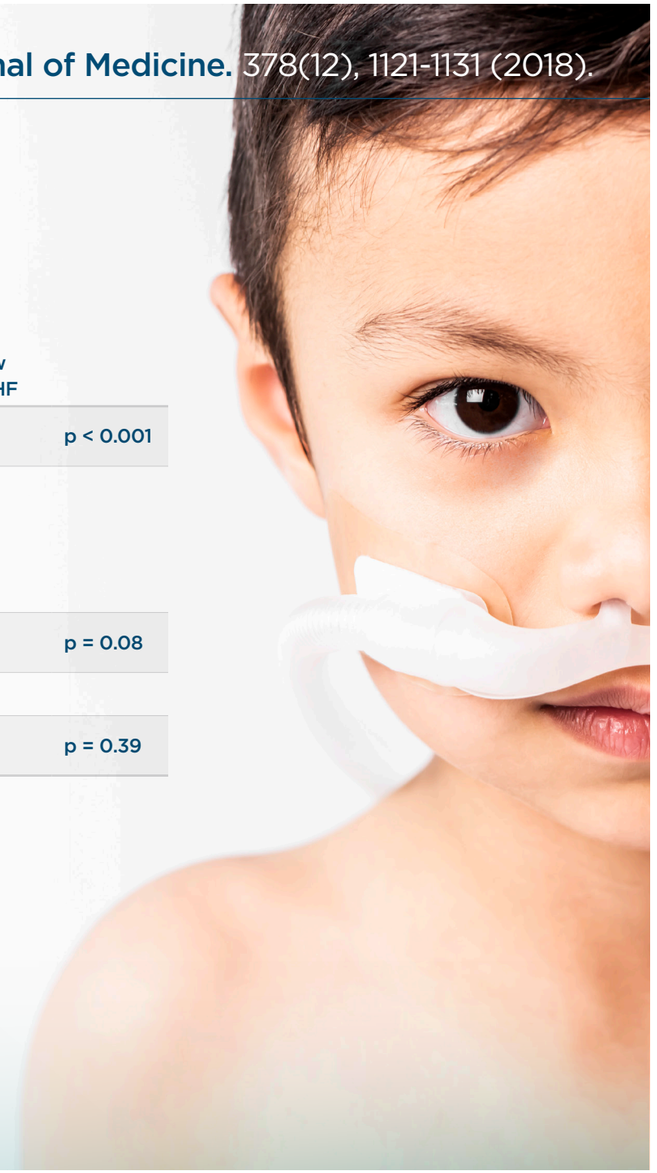
Primary Outcome

- The early use of NHF in the ED and ward resulted in a significantly lower rate of therapy failure compared with standard oxygen therapy (12% vs. 23%, p < 0.001).

	Standard O_2 therapy	Optiflow Junior NHF	
Therapy failure	167/733 (23%)	87/739 (12%)	p < 0.001
↓			
Rescue NHF therapy failure	65/167 (39%)	↓	
↓			
PICU admission	65/733 (9%)	87/739 (12%)	p = 0.08
↓	↓	↓	
Intubation	4/733 (0.5%)	8/739 (1%)	p = 0.39

Secondary Outcomes

- There were no significant differences between the secondary outcomes (PICU admissions, intubation rates and adverse events).
- 61% of patients who failed standard oxygen therapy were rescued by NHF and avoided PICU admission.



Current position of NHF in clinical practice

There are a number of possible pathways for the use of NHF for infants outside of the PICU.

Integration of NHF across the hospital environment may support standardization of care.

Humidified oxygen therapy

Heating and humidification of blended air and oxygen may avoid complications associated with cold and dry gas. It may also help assess severity of hypoxia and may help improve the standardization of equipment.

Early escalation to NHF

NHF has been shown to be an effective early escalation step following the use of standard oxygen therapy.

Primary NHF support

NHF (approx. 2 L/kg/min) can be used broadly as primary respiratory support to reduce therapy escalation compared with standard oxygen therapy.

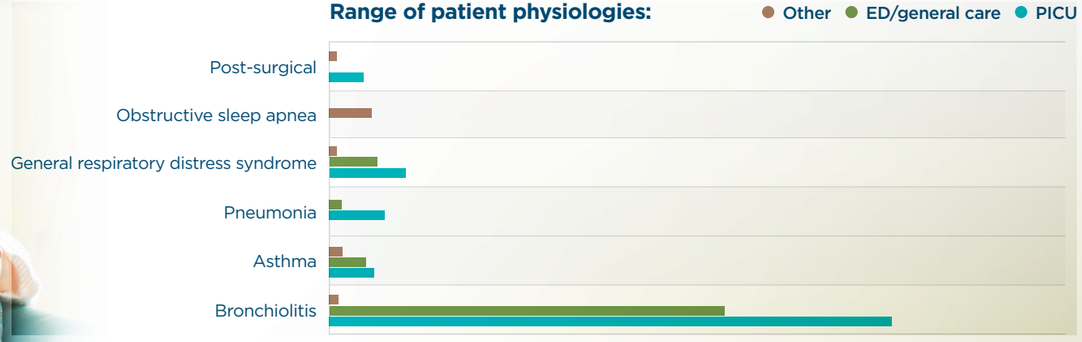
Putting NHF into practice

PICU **ED** **WARD**

Integrating the use of NHF across the PICU, ED and ward may be associated with improved standardization of care. When used cohesively across the hospital, NHF may also contribute to a change in respiratory support practice, moving towards less invasive strategies. This leads to the potential for more patients to be managed in local hospitals and lower-acuity settings.[1-4]

The current trends in literature suggest that NHF may have an increasing role across the hospital and a broad range of patient physiologies.

Range of patient physiologies:



1. Milési et al. Intensive Care Med (2013).
2. Rubin et al. Pediatr Crit Care Med (2014).
3. Pham et al. Pediatr Pulmonol (2015).
4. Franklin et al. N Engl J Med (2018).

Flow rates

Flows

- 2 L/kg/min for infants up to 12 kg in weight has been shown to produce rapid improvement in reducing respiratory distress, and a reduced need for the escalation of therapy.
- Flow rates for those over 12 kg have been protocolized by the PARIS research group.[1]

Weight	Flow rate
Up to 12 kg	2 L/kg/min
13–15 kg	30 L/min
16–30 kg	35 L/min
31–50 kg	40 L/min
> 50 kg	50 L/min

1. Franklin et al. N Eng J Med (2018).

Indicators summary

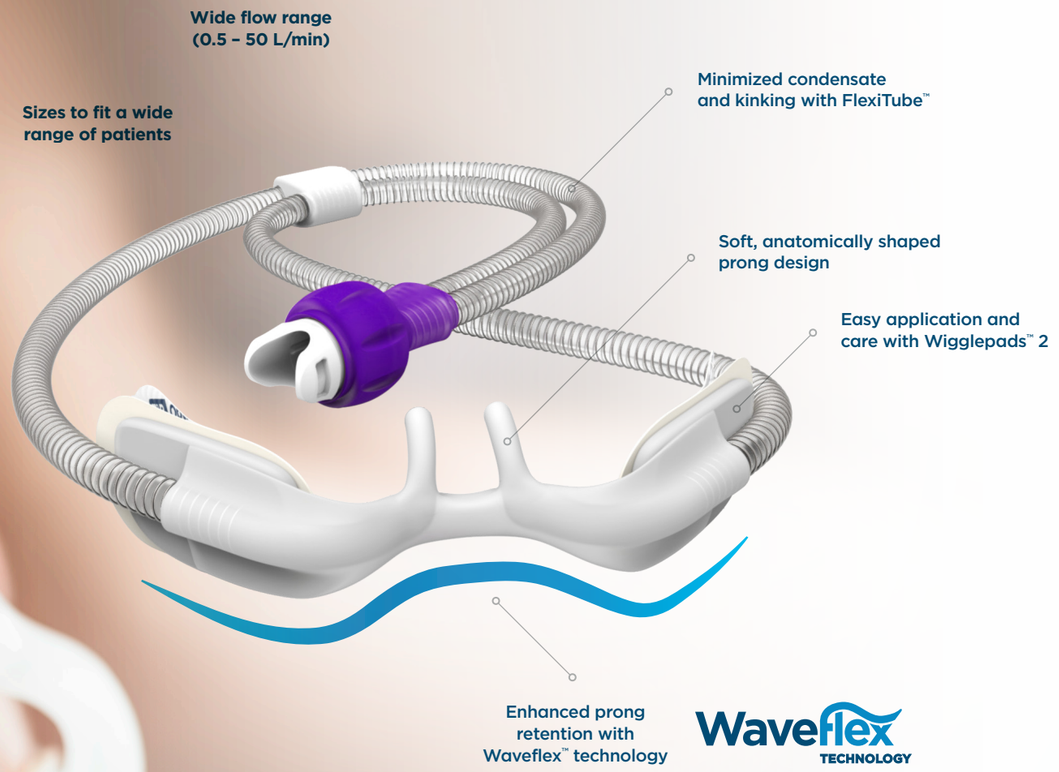
Literature suggests therapy outcome may be predicted within 60 minutes using clinical indicators.

	Likely indicators for:	
Within 60 minutes	**Success**	**Caution**
Respiratory rate	**Improvement**[1-4]	**No improvement**[1,3,4]
Heart rate	**Improvement**[1,3,4]	**No improvement**[3,4]
Work of breathing	**Improvement**[1]	Currently no data
O_2 Oxygen desaturation	Currently no data	**No improvement**[1]

The predictive quality of clinical indicators has not been assessed in definitive trials. The above information collates observational literature but does not overrule expert clinical judgement in patient management.

1. Abboud et al. Ped Crit Care Med (2012).
2. Bressan et al. Eur J Pediatr (2013).
3. Canares et al. RI Med Jour (2014).
4. Mayfield et al. J Ped & Child Health (2014).

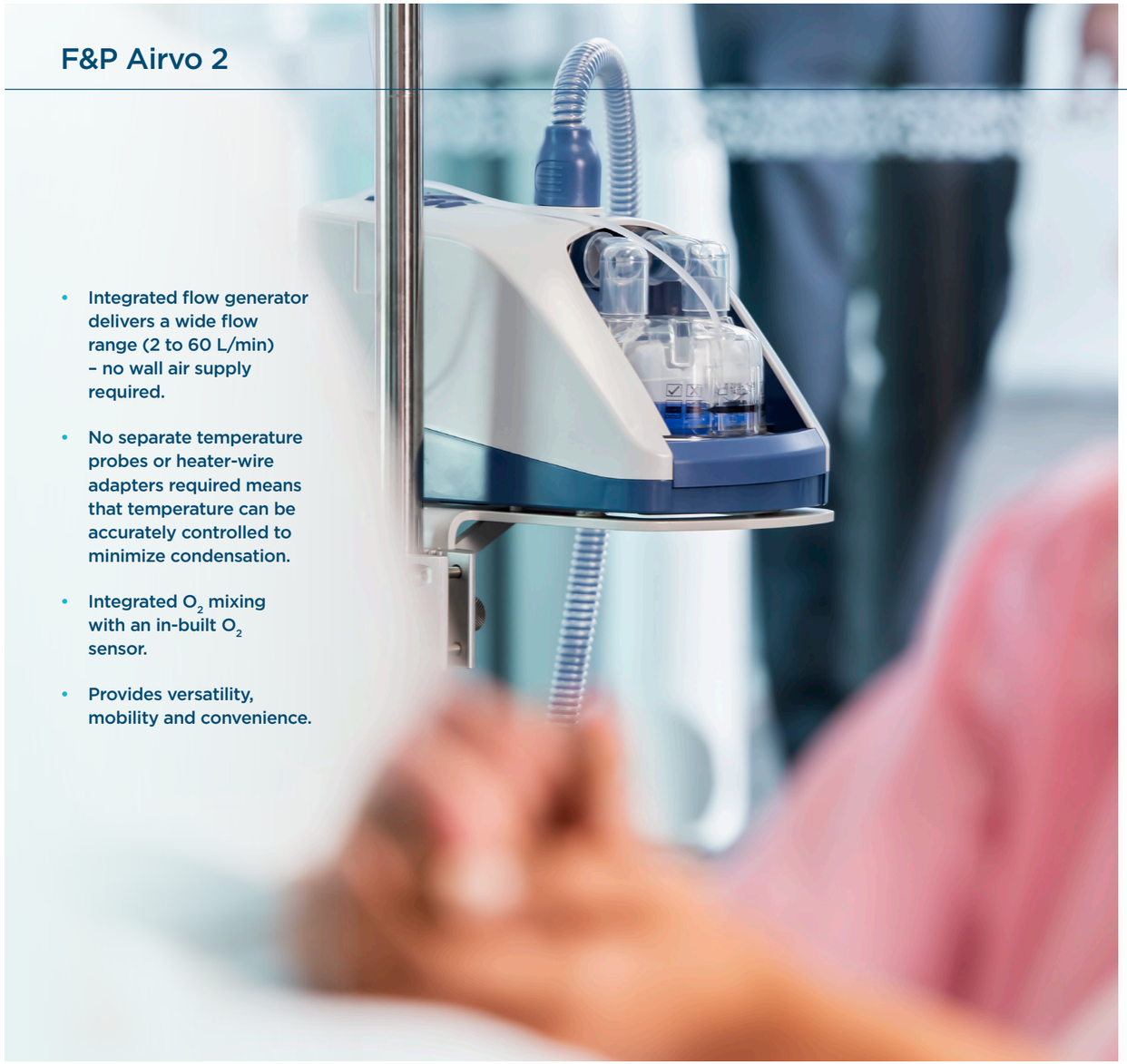
Optiflow Junior 2 interface product features



F&P WigglewiNG

The F&P WigglewiNG™ can be used in conjunction with the Optiflow Junior 2/2+ to stabilize a nasogastric (NG) tube to the patient while maintaining the ability to remove or reposition the interface if necessary.

F&P Airvo 2



- Integrated flow generator delivers a wide flow range (2 to 60 L/min) – no wall air supply required.
- No separate temperature probes or heater-wire adapters required means that temperature can be accurately controlled to minimize condensation.
- Integrated O_2 mixing with an in-built O_2 sensor.
- Provides versatility, mobility and convenience.

Size and flow rates

L

Weight (kg)*	3	3.5	18	20
Correlated age**	37.5 wkGA	40 wkGA	4.9 yr	5.6 yr
Maximum flow rate	**20 L/min**			

XL

Weight (kg)*	5	7	25	30
Correlated age**	47.5 wkGA	4.7 mo	7.6 yr	9.5 yr
Maximum flow rate	**25 L/min**			

XXL

Weight (kg)*	8	12.5	30	40
Correlated age**	6.4 mo	2.2 yr	9.5 yr	12 yr
Maximum flow rate	**50 L/min**			

wkGA = weeks of gestation; mo = months; yr = years
* Weight data is based on F&P product validation studies.
** Age data is a correlation to weight data based on a combination of Fenton, WHO and CDC growth charts.

The above flow rates can be achieved on the F&P Airvo 2 platform. Flow rates achieved on other platforms may differ.

Collins CL, Holberton J, Barfield C, Davis PG. A randomized controlled trial to compare heated humidified high-flow nasal cannulae with nasal continuous positive airway pressure postextubation in premature infants. J Pediatr 162, 949-954.e1 (2013).

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Hough J, Pham T, Schibler A. Physiologic effect of high-flow nasal cannula in infants with bronchiolitis. Pediatr Crit Care Med. 15, e214-219 (2014).

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McKiernan C, Chua L, Visintainer P, Allen H. High-flow nasal cannulae therapy in infants with bronchiolitis. The Journal of Pediatrics, 156(4), 634-638 (2010).

Milési C et al. Is treatment with a high-flow nasal cannula effective in acute viral bronchiolitis? A physiologic study. Intensive Care Med 39, 1088-1094 (2013).

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Pham T, O'Malley L, Mayfield S, Martin S, Schibler A. The effect of high-flow nasal cannula therapy on the work of breathing in infants with bronchiolitis. Pediatr Pulmonol 50, 713-720 (2015).

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Ramnarayan P et al. Effect of High-Flow Nasal Cannula Therapy vs. Continuous Positive Airway Pressure Therapy on Liberation From Respiratory Support in Acutely Ill Children Admitted to Pediatric Critical Care Units: A Randomized Clinical Trial. JAMA 328(2), 162-172 (2022).

Roberts C et al. Nasal high-flow therapy for primary respiratory support in preterm infants. N Engl J Med 375, 1142-1151 (2016).

Rubin S et al. Effort of breathing in children receiving high-flow nasal cannula. Pediatr Crit Care Med 15, 1-6 (2014).

Saslow J et al. Work of breathing using high-flow nasal cannula in preterm infants. J Perinatol 26, 476-480 (2006).

Schibler A et al. Reduced intubation rates for infants after introduction of high-flow nasal prong oxygen delivery. Intensive Care Med 37, 847-852 (2011).

Sinha I, McBride A, Smith R, Fernandes R. CPAP and High-Flow Nasal Cannula Oxygen in Bronchiolitis. Chest 148, 810-823 (2015).

Testa G et al. Comparative evaluation of high-flow nasal cannula and conventional oxygen therapy in paediatric cardiac surgical patients: a randomized controlled trial. Interact Cardiovasc Thorac Surg 19, 456-61 (2014).

Wilkinson D, Andersen C, O'Donnell CPF, De Paoli AG, Manley BJ. High-flow nasal cannula for respiratory support in preterm infants. Cochrane Database Syst Rev 2, CD006405 (2016).

Wing R, James C, Maranda L, Armsby C. Use of high-flow nasal cannula support in the emergency department reduces the need for intubation in pediatric acute respiratory insufficiency. Pediatr Emerg Care 28, 1117-1123 (2012).