

# ASPR TRACIE Technical Assistance Request

**Request Receipt Date (by ASPR TRACIE):** 3 November 2022

**Response Date:** 8 November 2022

**Type of TA Request:** Complex

## Request:

The requestor asked for information and guidance on the usage of high-flow nasal cannulas (HFNC) in pediatric patients, including the use of HFNC in non-intensive care unit (ICU) settings and during patient transport.

## Response:

ASPR TRACIE conducted a search online for relevant resources and requested input from members of the ASPR TRACIE Subject Matter Expert (SME) Cadre. Materials gathered are provided in this document. Section I provides comments from a member of the ASPR TRACIE SME Cadre. Section II includes clinical decision support tools developed by hospitals for the use of HFNC in pediatric patients. Section III includes general information on the use of HFNC for pediatric patients. Section IV includes resources on the use of HFNC in non-ICU settings for pediatrics. Section V includes resources on the use of HFNC during pediatric patient transport.

## I. ASPR TRACIE Subject Matter Expert Comments

Please note: These are direct quotes or paraphrased comments from emails and other correspondence provided by an ASPR TRACIE SME Cadre member in response to this specific request. They do not necessarily express the views of ASPR or ASPR TRACIE.

- HFNC is a proven therapy that can help children avoid more aggressive airway intervention. Nasal cannulas (including reservoir cannulas) should be used – ideally with humidifiers – prior to initiation of HFNC.
- Inpatient use of multiple HFNC units at high flow rates outside the ICU environment may exceed the oxygen flow rates possible through the piping as installed on many floor units.
- Planning may need to include disinfection and re-use of the tubing if supplies are inadequate.
- The use of HFNC during transport at high flow rates requires making sure the air or ground transport unit has adequate oxygen for the transfer, including a reserve to account for any delays.

## II. HFNC Clinical Pathways

The following section includes clinical pathways and other decision support tools developed by hospitals for the care of pediatric patients with bronchiolitis, including the potential use of HFNC.

Advocate Children's Hospital. (2021). [High Flow Nasal Cannula: ED and General Pediatric Units](#).

Cardinal Glennon Children's Hospital. (n.d.). [Inpatient Bronchiolitis Management](#).

Children's Hospital of Orange County (CHOC). (2017). [Inpatient Bronchiolitis Care Guideline](#).

Children's Hospital of Richmond at Virginia Commonwealth University. (2018). [High-flow Nasal Cannula Use in Bronchiolitis](#).

Connecticut Children's. (2022). [High Flow Nasal Cannula Use in Patients Outside of the Intensive Care Unit](#).

Dayton Children's Hospital. (2018). [Bronchiolitis Clinical Practice Guideline](#).

Dell Children's Ascension. (2019). [Bronchiolitis](#).

Dunn, M., Zorc, J., Tyler, L., et al. (2022). [Inpatient Clinical Pathway for Evaluation/Treatment of Children with Bronchiolitis](#). Children's Hospital of Philadelphia.

East Tennessee Children's Hospital. (2017). [Bronchiolitis Care Map](#).

Intermountain Healthcare. (2022). [High-Flow Nasal Cannula \(HFNC\) for Non-ICU and Non-PCH ED Use, HFNC for Non-ICU Use, Transport Guidance for HFNC, and Feeding Guidelines](#).

Johns Hopkins All Children's Hospital. (2020). [Bronchiolitis Clinical Pathway](#).

Seattle Children's. (2022). [Bronchiolitis Pathway v13.0](#).

Silver, A., Nazif, J., and Azzarone, G. (2015). [High Flow Nasal Cannula Clinical Pathway: Bronchiolitis](#). The Children's Hospital at Montefiore.

Spectrum Health. (2021). [Pediatric Bronchiolitis](#).

Texas Children's Hospital. (2016). [High Flow Nasal Cannula \(HFNC\) Therapy: Initiation and Escalation for Respiratory Distress Evidence-Informed Pathway](#).

University of California San Francisco, Northern California Pediatric Hospital Medicine Consortium. (2018). [Consensus Clinical Guidelines for Inpatient Management of Viral Bronchiolitis](#).

### III. General HFNC Resources

Fainardi, V., Abelli, L., Muscara, M., et al. (2021). [Update on the Role of High-Flow Nasal Cannula in Infants with Bronchiolitis](#). *Children*. 8(2):66.

The authors present a narrative review of scientific literature on the use of HFNC to treat infants with bronchiolitis. While they found HFNC to be safe and effective in treating infants with mild to moderate bronchiolitis who do not respond to standard oxygen therapy, they note a lack of: consistent guidelines on the initiation and discontinuation of HFNC, a precise definition of the role of HFNC in preventing respiratory failure, and evidence of greater benefit in comparison to standard oxygen therapy. They also note it has not been established when HFNC should replace continuous positive airway pressure or bi-level positive airway pressure or in which patients.

Franklin, D., Babl, F., Schlapbach, L., et al. (2018). [A Randomized Trial of High-Flow Oxygen Therapy in Infants with Bronchiolitis](#). *The New England Journal of Medicine*. 378:1121-1131.

The authors describe a multicenter, randomized, controlled trial of 1,472 infants younger than 12 months with bronchiolitis and assigned to receive either HFNC or standard oxygen therapy. Treatment failure resulting in escalation of care during admission was the primary outcome. Infants who received HFNC had a significantly lower rate of escalation of care than those who received standard oxygen therapy. Secondly, the authors found no significant differences between the two groups in duration of hospital stay, duration of ICU stay, or duration of oxygen therapy.

Hoefert, J., Molina, A., Gardner, H., et al. (2022). [De-escalation of High-flow Respiratory Support for Children Admitted with Bronchiolitis: A Quality Improvement Initiative](#). *Pediatric Quality and Safety*. 7(2):e534.

The authors examined the effect of implementing a standardized care process for weaning and discontinuing HFNC on the length of stay and resource utilization of patients aged one to 24 months hospitalized with bronchiolitis. In this single center study, they found the standardized process was associated with a shortened mean length of stay and time on supplemental oxygen without increasing adverse events.

Lodeserto, F., Lettich, T., and Rezaie, S. (2018). [High-flow Nasal Cannula: Mechanisms of Action and Adult and Pediatric Indications](#). *Cureus*. 10(11): e3639.

The authors examine the main mechanisms of action attributed to HFNC use and review the indications for its use in both adult and pediatric populations.

Nagler, J. (2022). [High-flow Nasal Cannula Oxygen Therapy in Children](#). (Subscription required.). UpToDate.

This clinical decision support resource describes the use of HFNC in pediatric patients, equipment needed, mechanisms of action, comparison with other oxygen delivery modes, indications and contraindications, patient selection, initiation, complications, and recommendations. It also includes links to other decision support resources on the use of HFNC for bronchiolitis and for premature and term neonates.

Napolitano, N., Berlinski, A., Walsh, B., et al. (2021). [AARC Clinical Practice Guideline: Management of Pediatric Patients with Oxygen in the Acute Care Setting](#). *Respiratory Care*. 66(7):1214-1223.

These clinical practice guidelines are based on a systematic literature review on the management of pediatric patients with oxygen in the acute care setting.

Sharma, S., Danckers, M., Sanghavi, D., et al. (2020). [High Flow Nasal Cannula](#). StatPearls.

The authors assess the use of HFNC and the physiological mechanisms of action. They also identify limitations and challenges to HFNC.

#### IV. Use of HFNC in Intensive Care Unit Versus Other Settings

Coon, E., Stoddard, G., and Brady, P. (2020). [Intensive Care Unit Utilization After Adoption of a Ward-Based High-Flow Nasal Cannula Protocol](#). *Journal of Hospital Medicine*. 15(6):325-330.

The authors studied a retrospective cohort of 26,253 infants ages three to 24 months hospitalized with bronchiolitis before and after adoption of HFNC treatment outside of the ICU. The authors found that initial implementation of ward-based HFNC increased rather than decreased ICU utilization, though they noted their finding contradicted existing literature. They recommended future research on the effects of using more evolved HFNC protocols with higher flow rates, more generous transfer criteria, and more rapid weaning criteria.

Dadlez, N., Esteban-Cruciani, N., Khan, A., et al. (2019). [Safety of High-Flow Nasal Cannula Outside the ICU for Previously Healthy Children with Bronchiolitis](#). *Respiratory Care*. 64(11):1410-1415.

The authors conducted a retrospective cohort study on 80 patients up to 24 months old admitted to a pediatric floor in a tertiary care center for bronchiolitis who received HFNC. They found HFNC may be a safe modality of respiratory support for previously healthy children with bronchiolitis outside of an ICU setting. They also noted that 41% of the patients required transfer to a PICU, mostly within the first 24 hours after HFNC treatment was initiated and indicating a need to closely monitor patients during early treatment.

Kugelman, A. (2020). [High-flow Nasal Cannula Therapy: Can it be Recommended as Initial or Rescue Care for Infants with Moderate Bronchiolitis in the Paediatric Ward?](#) *European Respiratory Journal*. 56(1):2001020.

The author reviewed current literature on the use of HFNC in infants with moderate bronchiolitis outside of the PICU. The review suggested routine or initial use of HFNC outside the PICU is not supported unless more selective criteria for use are in place, but rescue use may be justified with a better delineated threshold for standard care failure. However, the review also suggested that HFNC can be used safely in pediatric wards.

Van Winkle, P., Castro, A., Salvador-Lloyd, S., et al. (2021). [High-Flow Nasal Cannula Use in Children with Bronchiolitis in a Community Hospital Setting: Evaluation of Safety, Flow Limits, and Intensive Care Unit Transfers](#). *The Permanente Journal*. 25(3).

The authors describe a single center retrospective cohort study of 157 patients from birth to 24 months treated for bronchiolitis using HFNC in the pediatric ward of a community hospital. They found HFNC could be used safely in a community hospital without pediatric intensive care unit (PICU) expertise or capability. Thirty-four patients required transfer to a PICU, which was accomplished without interruption of HFNC.

## V. Use of HFNC During Patient Transport

McCoy, A., Morris, D., Tanaka, K., et al. (2021). [Prehospital Noninvasive Ventilation: An NAEMSP Position Statement and Resource Document](#). *Prehospital Emergency Care*. 26(sup1):80-87.

This position statement and resource document reviews the rationale and data supporting use of noninvasive ventilation in the prehospital setting for the management of respiratory distress. It includes a discussion of studies on novel noninvasive ventilation methods, including HFNC, that suggest HFNC can be used safely and effectively in the out-of-hospital environment and for interfacility pediatric transports, though additional research is needed in the pre-hospital setting.

Miura, S., Yamaoka, K., Miyata, S., et al. (2021). [Clinical Impact of Implementing Humidified High-Flow Nasal Cannula on Interhospital Transport Among Children Admitted to a PICU with Respiratory Distress: A Cohort Study](#). *Critical Care*. 25(194).

The authors conducted a retrospective cohort study to assess the clinical impact of humidified HFNC on interhospital transport of children in Australia. They found the implementation of humidified HFNC on interhospital transport was associated with a reduction in PICU length of stay, reduction in duration of invasive and non-invasive ventilation use and hospital stay, and safety of humidified HFNC use on retrieval.

Reimer, A., Simpson, B., Brown, A., et al. (2021). [High-Flow Nasal Cannula in Transport: Process, Results, and Considerations](#). *Air Medical Journal*. 41(1):42-46.

The authors outlined the clinical workflow of using HFNC in transport and conducted a retrospective chart review of patient transfers using HFNC, including 148 pediatric and 72 adult patients. They found the use of HFNC in patient transport to be feasible and demonstrated statistically significant improvements in pre- and post-transport heart rate and blood pressure in pediatric patients.