

Enough Is Enough: Quality Improvement to Deimplement High-Flow Nasal Cannula in Bronchiolitis

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High-flow nasal cannula (HFNC): nobody seems to like it, but everyone seems to be using it as the newest treatment of bronchiolitis. Although supportive care is the mainstay of treatment,¹ we as a medical community continue to seek interventions for this self-limited viral disease process, with the good intentions to minimize suffering and limit time families spend in the hospital. As hospitalists, we strive to provide efficient care and were quick to partner with our critical care colleagues to make HFNC therapy available on the acute care wards, in an attempt to avoid costly ICU stays. In the last several years, in 2 randomized controlled trials, researchers found that early initiation of HFNC reduces the need for later rescue therapy^{2,3} (notably, most often to HFNC), but that HFNC does little to mitigate the disease process and does not reduce the length of time oxygen therapy is needed nor the frequency of ICU transfers.⁴ Despite this, the use of HFNC nationally has risen.⁵ In this issue of *Hospital Pediatrics*, Charvat et al⁶ and Noelck et al⁷ share 2 quality improvement (QI) studies to implement standardized weaning protocols as a first step toward establishing appropriate HFNC therapy use.

Both Charvat et al⁶ and Noelck et al⁷ used QI methodology to address the discontinuation of HFNC, one aspect of mitigating its overuse. Both studies were conducted at medium-sized academic centers and spanned several bronchiolitis seasons. Charvat et al⁶ aimed to decrease both HFNC length of treatment, as well as overall length of stay (LOS). Noelck et al⁷ aimed to reduce the time patients spent on lower flow rates of HFNC, which the literature suggests is ineffective.⁸ Through the use of QI interventions, both groups were successful in their aims, with Noelck et al⁷ decreasing the time patients spent on ≤ 8 L/minute of HFNC by $>50\%$ and Charvat et al⁶ decreasing HFNC length of treatment by 17 hours and LOS by 23 hours. Although the authors focused on 2 different approaches to weaning HFNC, their overall conclusions were similar: rapid discontinuation of HFNC appears to be feasible, safe, and effective in shortening LOS.

Although the authors' results are certainly compelling, there are limitations to their work, some of which are inherent to QI initiatives. One such limitation is the studies' generalizability. Charvat et al,⁶ for example, use relatively low flow rates at their institution, raising the question of whether their weaning protocol would lead to similar successes at institutions who are using higher rates of up to 2 L/kg per minute of HFNC. Similarly, the exclusion of

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older infants (>18 months of age) because of a desire to avoid those being treated for airway reactivity also raises the question of the protocol being applicable to a subset of patients who many pediatric hospitalists are likely to encounter (ie, patients with bronchiolitis who are also treated with bronchodilators, despite a lack of evidence for their efficacy).¹ Additionally, both studies were conducted at single centers, and the upcoming initiative to spread HFNC deimplementation nationally through the American Academy of Pediatrics' Value in Inpatient Pediatrics Network will surely lead to additional learning. In the study by Noelck et al,⁷ it is not clear how much of the improvement seen was due to the authors' interventions versus the simultaneous change in their institutional bronchiolitis guidelines. The overall decreased LOS after the implementation of their interventions is impressive, nonetheless.

Because HFNC use outside of the ICU has increased,⁵ studies specifically evaluating its use on the acute care floors are necessary, particularly as providers look to safely deimplement this costly therapy. Charvat et al⁶ and Noelck et al⁷ demonstrate that HFNC can be safely and rapidly discontinued on the acute care floors, a finding that Betters et al⁹ previously demonstrated in the ICU setting. The authors also demonstrate the successful use of QI methods to drive practice change. QI has become an important tool in health care optimization over recent years, and its use to address overused testing and treatments has become increasingly common.¹⁰ Bronchiolitis, in particular, is a diagnosis frequently addressed in QI studies¹¹ because providers aim to deimplement therapies that have been shown to be ineffective in improving patient outcomes. In such QI studies, researchers have successfully decreased the use of antibiotics, steroids, bronchodilators, and chest radiographs in patients diagnosed with bronchiolitis.¹¹ Given that research on the limitations of HFNC has become more abundant^{2,3,12} and its increasing use is clear,⁵ HFNC is certainly an overused therapy and is a particularly important one to address given its potential negative impact on patient outcomes and its

significant cost.^{4,13} The question then becomes the following: how do we deimplement a therapy whose use outside of the ICU setting was established with limited evidence? Although 2 randomized controlled trials provide high-quality evidence on how, when, and where HFNC may be initiated safely, the weaning of HFNC is informed by scant evidence. Instead, weaning protocols were adapted from the weaning of supplemental oxygen, a seemingly similar therapy, but one that has pulse oximetry as a much more direct and measurable marker of wean success. With no proximal marker of HFNC wean success, it is not surprising that weans have been slow and inefficient. Charvat et al⁶ and Noelck et al⁷ present a potential solution to that problem in their use of scholarly QI methods to demonstrate the safe and efficient rapid discontinuation of HFNC.

However, although the authors provide successful models for weaning HFNC, rapid discontinuation only addresses a small piece of HFNC overuse because the therapy continues to be used on a significant proportion of patients admitted with bronchiolitis.⁵ Without better guidance on which patient population benefits from HFNC, decreasing its use remains a significant obstacle. Perhaps the use of rigorous QI methodology can offer a solution not only to successfully discontinuing HFNC, but also to decreasing its initiation as well.

When it comes to the management of bronchiolitis, we as providers are no strangers to the necessity of deimplementation because nearly all the previously suggested treatments, outside of supportive care, have been shown to be ineffective.^{1,14} Deimplementation is difficult work to do, however because providers may perceive a benefit from the therapy in question, and in the face of uncertainty, the desire to intervene may compete with scientific reasoning or lack of efficacy.¹⁵ In regards to HFNC, there is sufficient evidence to suggest its use is largely unwarranted, and it is time for us to start aggressively addressing its deimplementation. By using Charvat et al⁶ and Noelck et al's⁷ studies as models, perhaps the best way to do this is through scholarly QI, with the next step

hopefully addressing which patients to start on this costly, often misunderstood therapy.

REFERENCES

1. Ralston SL, Lieberthal AS, Meissner HC, et al; American Academy of Pediatrics. Clinical practice guideline: the diagnosis, management, and prevention of bronchiolitis. [published correction appears in *Pediatrics*. 2015;136(4):782]. *Pediatrics*. 2014;134(5). Available at: www.pediatrics.org/cgi/content/full/134/5/e1474
2. Kepreotes E, Whitehead B, Attia J, et al. High-flow warm humidified oxygen versus standard low-flow nasal cannula oxygen for moderate bronchiolitis (HFWHO RCT): an open, phase 4, randomised controlled trial. *Lancet*. 2017;389(10072):930–939
3. Franklin D, Babl FE, Schlapbach LJ, et al. A randomized trial of high-flow oxygen therapy in infants with bronchiolitis. *N Engl J Med*. 2018;378(12):1121–1131
4. Coon ER, Stoddard G, Brady PW. Intensive care unit utilization after adoption of a ward-based high-flow nasal cannula protocol. *J Hosp Med*. 2020;15(6):325–330
5. Kalburgi S, Halley T. High-flow nasal cannula use outside of the ICU setting. *Pediatrics*. 2020;146(5):e20194083
6. Charvat C, Jain S, Orenstein EW, Miller L, Edmond M, Sanders R. Quality initiative to reduce high-flow nasal cannula duration and length of stay in bronchiolitis. *Hosp Pediatr*. 2021;11(4):e2020005306
7. Noelck M, Foster A, Kelly S, et al. SCRATCH trial: an initiative to reduce excess use of high-flow nasal cannula. *Hosp Pediatr*. 2021;11(4):e2020003913
8. Hough JL, Pham TMT, Schibler A. Physiologic effect of high-flow nasal cannula in infants with bronchiolitis. *Pediatr Crit Care Med*. 2014;15(5):e214–e219
9. Betters KA, Gillespie SE, Miller J, Kotzbauer D, Hebbar KB. High flow nasal cannula use outside of the ICU; factors

- associated with failure. *Pediatr Pulmonol.* 2017;52(6):806–812
10. Sun GH, MacEachern MP, Perla RJ, Gaines JM, Davis MM, Shrank WH. Health care quality improvement publication trends. *Am J Med Qual.* 2014;29(5):403–407
11. Ralston S, Comick A, Nichols E, Parker D, Lanter P. Effectiveness of quality improvement in hospitalization for bronchiolitis: a systematic review. *Pediatrics.* 2014;134(3):571–581
12. Luo J, Duke T, Chisti MJ, Kepreotes E, Kalinowski V, Li J. Efficacy of high-flow nasal cannula vs standard oxygen therapy or nasal continuous positive airway pressure in children with respiratory distress: a meta-analysis. *J Pediatr.* 2019;215:199.e8–208.e8
13. Ralston SL. High-flow nasal cannula therapy for pediatric patients with bronchiolitis: time to put the horse back in the barn. *JAMA Pediatr.* 2020;174(7):635–636
14. Leyenaar JK, Ralston SL. Widespread adoption of low-value therapy: the case of bronchiolitis and high-flow oxygen. *Pediatrics.* 2020;146(5):e2020021188
15. Wolk CB, Schondelmeyer AC, Barg FK, et al; Pediatric Research in Inpatient Settings (PRIS) Network. Barriers and facilitators to guideline-adherent pulse oximetry use in bronchiolitis. *J Hosp Med.* 2021;16(1):23–30

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