

Chasing the Latest Rabbit: High Flow Nasal Cannula and Bronchiolitis

Brent A. Mothner, MD, Ricardo A. Quinonez, MD

The search for effective evidence-based management strategies for children hospitalized with acute viral bronchiolitis is filled with dark rabbit holes of potential benefit that, for the most part, have led right back to the beginning. Such has been the case for antiviral agents, bronchodilators, systemic and inhaled corticosteroids, and, most recently, nebulized hypertonic saline.¹ A new tool in the ever-changing toolbox of bronchiolitis that has gathered recent enthusiasm is high-flow nasal cannula (HFNC). HFNC is an oxygen delivery strategy that uses heated and humidified air that allows for higher flows than typical oxygen delivery methods such as simple nasal cannula or a face mask.² This enthusiasm is mostly based on retrospective data showing decreased intubation rates in the emergency department and intensive care setting, as well as some limited data that argue for its safety in the general inpatient wards.³⁻⁵ The enthusiasm regarding HFNC is tempered by the fact that the studies arguing for decreased intubation rates were retrospective and observational in nature and used historical cohorts to compare outcomes after HFNC implementation. Historical cohorts may have biased these initial studies by failing to take into account secular trends in practice.

In this issue of *Hospital Pediatrics*, Riese et al⁶ build on previous research⁷ and review outcomes of HFNC initiation in the general pediatric ward setting. In this single-center study, the investigators retrospectively reviewed 936 preimplementation cases and 1001 postimplementation cases of an HFNC protocol over a 4-year period. The primary outcome assessed was length of stay. Secondary outcomes included transfer to higher level of care, intubation, and 30-day readmission rates. To mitigate the issue of historical comparison groups, they used an interrupted time series analysis to adjust and account for secular trends. Their adjusted analysis found no improvement in overall or intensive care length of stay, no decrease in transfer to higher level of care, and no changes in 30-day readmission rates. Most surprisingly, this study found no difference in intubation rates for patients admitted to the general inpatient wards.

The strengths of the study⁶ are the large number of patients in the preintervention and postintervention cohorts and the use of interrupted time series as an analysis strategy to account for temporal changes in practice that, as previously mentioned, may have potentially biased previous studies. One limitation is its single-centered nature, given the influence that local culture and protocols may have over some of the results. However, the most significant drawback is that despite the authors' use of a better adjustment strategy to limit the influence of secular trends, the study was still observational in design and unable to account for all confounding variables.

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Nevertheless, the results are sobering and familiar.⁶ The history of bronchiolitis, particularly in the inpatient setting, is one of adoption before reflection. Most treatments are widely implemented before strong evidence supports their use. The case of hypertonic saline is informative because even higher level evidence in the form of randomized controlled trials reported benefit, but later randomized controlled trials more applicable to US practice and a meta-analysis contradicted this finding.^{8–10} As is the case with HFNC, the use of hypertonic saline was widely adopted given the initial enthusiasm of early results.

These early adoptions come at a high price. As with any change in practice, the process of investment and initiation into the system is complex. Each iteration of potential improvement includes preparation time, educational efforts, supply costs, and culture acceptance. Implementation of effective evidence into practice is difficult because of multiple factors, such as system complexities, time commitment, and selection bias that can reinforce established practice. Conversely, when the evidence suggests a treatment to be ineffective, the discontinuation of a now standard practice can be met with even stronger resistance and skepticism. In bronchiolitis, the cycle of early adoption followed by practice reversal is likely to be a continuous one; thus, a question to consider is what do we do when better evidence reveals that what was initially believed to be beneficial is actually ineffective? Because the decision itself to abandon use of a medical practice is multifactorial, the key may be to position the evidence of the decision in an instructive and influential manner. For this dilemma, the science of de-implementation may be informative.

In an editorial published in 2014, Prasad and Ioannidis¹¹ provided an evidence-based framework to consider as guidance for decisions to stop an ineffective practice. They divided practices in need of de-implementation into 3 wide categories: contradicted practices, practices where evidence is uncertain, and practices in development. They also provide a framework

for prioritizing such practices for de-implementation that takes into account several factors, including evidence basis, costs, and availability of alternatives, among others. The use of HFNC for bronchiolitis is currently at the uncertain evidence stage. For practices in this stage, Prasad and Ioannidis advocate testing the practice in a rigorous fashion, preferably by nonconflicted investigators. HFNC also fits many of the characteristics of practices that should be prioritized, including costs, ubiquity, and strength (or lack thereof) of the evidence basis that supports it. Therefore, although it may be cliché to call for further study of a particular intervention, the use of HFNC is certainly in dire need of randomized controlled data, and according to the prioritization framework of Prasad and Ioannidis, the sooner the better.

If higher level evidence suggests that HFNC is ineffective at improving meaningful outcomes, de-implementation will pose a significant challenge. Traditional components of educational outreach (provider education, e-mail reminders, and electronic alerts) are unlikely to be effective. With an approximate cost of \$2600 per HFNC device,¹² the system/hospital impact of abandoning the use of this device will be extensive. Rationale for exclusions to the evidence will emerge and need to be debated and thoughtfully discussed. The basis for such discussion must be patient-centric, with an emphasis on value and patient outcomes. However, what is clear is that the research of Riese et al⁶ should give us pause to continue wide-scale adoption of HFNC and avoid falling into the ever-deepening rabbit hole of contradicted practices for bronchiolitis.

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