

Establishing paediatric ward high-flow nasal cannula usage for infants with bronchiolitis

Bronchiolitis is a common cause for hospital admissions.¹ Trends in paediatric ward admission rates have been increasing, whereas paediatric intensive care unit (PICU) admission rates remain static.² It has been suggested that High Flow Nasal cannula Oxygen (HFNO) may reduce the need for escalation of care. RCTs showed HFNO usage was safe on paediatric wards including those without direct access to PICU and could be used in place of standard oxygen without additional staffing.^{3,4} They suggested a reduction in admission rates to PICU but failed to show differences in length of hospital stay. A meta-analysis reported HFNO was safe, but showed no benefits in bronchiolitis outcomes.⁵

The Children's Hospital for Wales (CHfW) introduced HFNO on the wards in October 2016. We provided staff with training on HFNO and a guideline for the use of high-flow oxygen in bronchiolitis (Appendix S1). We aimed to investigate whether HFNO could be a rescue therapy to reduce escalation rates to PICU. We performed a retrospective study of discharge letters for bronchiolitis in 2014-2019. A consultant gave permission for notes to be reviewed, patients were not contacted and data was coded, so no consent was required.

Data were collected for all discharges from hospital with a diagnosis of bronchiolitis during the period 1st October to 31st March of 2014-2019. Inclusion criteria were a discharge clinical diagnosis coding of 'Bronchiolitis' and less than 1 year of age at admission. Exclusion criteria included incomplete discharge letters, diagnosis coding errors, transfers to PICU from another hospital, and complex comorbidities. Data were collected on admission, level of care, supplemental oxygen use, HFNO use and duration of inpatient stay.

Statistics were generated using Excel on admission numbers, levels of escalation to HDU/PICU, length of stay and HFNO usage were calculated and compared before and after the introduction of HFNO on wards.

During the 5 years, 3080 patients presented with bronchiolitis, 1512 did not require hospitalisation and 427 were excluded (comorbidities or very preterm infants [<32 weeks of gestation]). There were 1135 admitted for treatment, 698 males and 437 (38%) females. Premature infants (<37 weeks of gestation) accounted for 182. Average admission age was 138 days (interquartile range 118 and 161 days between years).

The number of patients escalated to PICU varied between years (Table S1). In pre-high-flow years, 16 (9.1%) and 17 (7.9%) infants in 2014/2015 and 2015/2016, respectively, of those admitted were escalated. In the first year, after high-flow introduction (2016/2017) 40 (15.6%) infants were admitted to PICU. This reduced to 26 (9.9%) infants in 2017/2018; further reduced in 2018/2019 to 15 (6.5%) infants. Comparing the years, there is a significant difference between the numbers admitted to PICU. However, when pre-high-flow years are combined and compared to post-high-flow years there was no significant difference, between numbers admitted to PICU.

The average length of stay varied over the years between 3.9 and 2.8 days. When PICU patients were analysed separately, their length of overall admission varied between 8.2 days in 2016/2017 to 6.5 in 2015/2016. There was no statistical difference between the years or between the pre and post-high-flow years.

In the 3 years, after high flow was introduced a total of 206 infants received high flow, 56 in 2016/2017 and 75 in both 2017/2018 and 2018/2019. Of the infants treated with high flow in 2016/2017 46.4% did not need any further escalation, increasing in 2017/2018 to 77.3% and again in 2018/2019 to 84.0%. Bronchiolitis PICU admission rates per 1000 infants were 3.75/1000 in 2014/15; 2.86/1000 in 2015/16; 6.9/1000 in 2016/17; 4.65/1000 in 2017/18; 2.79/1000 in 2018/19. There were two recorded episodes of pneumothoraxes most likely unrelated to the use of HFNO.

The results appear to demonstrate a reduction in PICU admissions in the third year of using HFNO on the wards in a tertiary teaching hospital. This is important as bronchiolitis is a common respiratory disease resulting in a large number of PICU admissions. There were no significant adverse events when HFNO was in use on the wards. It appears that over the 5 years studied admission rates for bronchiolitis continued to climb and the acuity level of patients appeared to worsen. The data have not demonstrated a significant difference in escalation of care possibly due to variability in severity of bronchiolitis over the 5 years. This probably accounts for the increased admissions to PICU in the year that HFNO was introduced.

A study strength is it reported complete data over a number of bronchiolitis seasons for all discharges for infants with bronchiolitis who met inclusion criteria. The audit covered more than one bronchiolitis season

The copyright line for this article was changed on 25 September 2020 after original online publication.

This is an open access article under the terms of the Creative Commons Attribution-NonCommercial License, which permits use, distribution and reproduction in any medium, provided the original work is properly cited and is not used for commercial purposes.

© 2020 The Authors. *Acta Paediatrica* published by John Wiley & Sons Ltd on behalf of Foundation Acta Paediatrica

after the implementation of HFNO on the wards which is important as bronchiolitis seasons vary in severity. 2015/16 was the quietest season and this may partly account for us not demonstrating a statistical significant reduction in PICU admissions. Also there were some anxieties associated with the introduction of HFNO in 2016/17 which may account for the increase in PICU/HDU admissions that season. A limitation is we excluded children with complex comorbidities, although only excluded 14% of patient episodes. Also, we have not been able to perform a cost analysis and it should be noted that the use of HFNO is considerably more expensive than standard oxygen therapy.

Further research is needed to study the optimal management of infants with bronchiolitis treated with HFNO on wards and develop evidence based guidelines. Current research suggests that the usage is safe and may reduce admissions to PICU. The evidence for the use of HFNO outside of PICU is increasing and needs to be collated in a systematic review and meta-analysis.

ACKNOWLEDGEMENTS

Thank you to the nursing and medical staff at the Children's Hospital for Wales, Cardiff for supporting the use of high flow on the paediatric wards, especially Siwan Lloyd and Matt Roche.

CONFLICT OF INTEREST

MOE declares payment from Abbvie to attend an RSV discussion panel.

Sarah J. Kotecha¹

David Vick²

Margarita Delgado-Thompson²

Jack West²

Martin O. Edwards^{1,2} 

¹Department of Child Health, School of Medicine, Cardiff University, Cardiff, UK

²Children's Hospital for Wales, Cardiff and Vale University Health Board, Cardiff, UK

Correspondence

Martin Edwards, Children's Hospital for Wales, University Hospital of Wales, Heath Park, CF14 4XW Cardiff, UK.

Email: EdwardsMO@cardiff.ac.uk

ORCID

Martin O. Edwards  <https://orcid.org/0000-0002-7243-7039>

REFERENCES

1. Hasegawa K, Tsugawa Y, Brown DF, Mansbach JM, Camargo CA. Trends in bronchiolitis hospitalizations in the United States, 2000–2009. *Pediatrics*. 2013;132(1):28–36.
2. Green CA, Yeates D, Goldacre A, et al. Admission to hospital for bronchiolitis in England: trends over five decades, geographical variation and association with perinatal characteristics and subsequent asthma. *Arch Dis Child*. 2016;101(2):140–146.
3. 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.
4. 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.
5. Lin J, Zhang Y, Xiong L, Liu S, Gong C, Dai J. High-flow nasal cannula therapy for children with bronchiolitis: a systematic review and meta-analysis. *Arch Dis Child*. 2019;104(6):564–576.

SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.