

Northumbria Research Link

Citation: Stephenson, Mike (2021) When and how should you ventilate a child? Nursing Children and Young People, 33 (1). p. 10. ISSN 2046-2336

Published by: RCN Publishing Company Ltd

URL: <https://doi.org/10.7748/ncyp.33.1.10.s5> <<https://doi.org/10.7748/ncyp.33.1.10.s5>>

This version was downloaded from Northumbria Research Link:
<http://nrl.northumbria.ac.uk/id/eprint/45436/>

Northumbria University has developed Northumbria Research Link (NRL) to enable users to access the University's research output. Copyright © and moral rights for items on NRL are retained by the individual author(s) and/or other copyright owners. Single copies of full items can be reproduced, displayed or performed, and given to third parties in any format or medium for personal research or study, educational, or not-for-profit purposes without prior permission or charge, provided the authors, title and full bibliographic details are given, as well as a hyperlink and/or URL to the original metadata page. The content must not be changed in any way. Full items must not be sold commercially in any format or medium without formal permission of the copyright holder. The full policy is available online: <http://nrl.northumbria.ac.uk/policies.html>

This document may differ from the final, published version of the research and has been made available online in accordance with publisher policies. To read and/or cite from the published version of the research, please visit the publisher's website (a subscription may be required.)

When should you use mechanical ventilation in children's respiratory care?

Examining the importance of mechanical ventilation and why there is a move to non-invasive treatment

Examining the importance of mechanical ventilation and why there is a move to non-invasive treatment

Picture: Alamy

Ventilators play an essential role to support the respiratory system and breathing at several stages in a child's life.

The purpose of a ventilator is to ensure a child's lungs receive sufficient air flow for gaseous exchange, to deliver oxygen and remove carbon dioxide, while reducing the effort required by the child to move air in and out of their lungs ([Tobin and Manthous 2017](#)).

In premature infants, for example, [Schmalisch \(2016\)](#) explains that respiratory failure is common due to the structural and functional immaturity of their respiratory systems, so ventilation allows time for immature lungs to develop and grow.

Ventilation in childhood presents many challenges not seen in adult care

Ventilation also supports children with long-term conditions who are unable to breathe effectively or independently ([Nawaz et al 2020](#)), such as Duchenne muscular dystrophy and similar diseases affecting children's muscles. Most ventilators, however, are used as a temporary measure in paediatric intensive care units to support children due to disease, injury or surgery.

Ventilation in childhood presents many challenges not seen in adult care, due to continued lung development and growth. From infancy to about eight years, ongoing respiratory development results in smaller airways and a flexible chest wall lacking muscle mass ([Rimensberger et al 2018](#)).

- **RELATED:** [Debunking myths: can you over-oxygenate a child?](#)

This influences the approach taken to ventilate children. Ventilators have many settings to control the pressure, volume and flow of air the child receives. They also control the temperature, humidity and concentration of oxygen given.

'Using positive pressure to push air into a child's lungs can damage the lungs'

In general, settings fall into two distinct approaches, depending on illness and lung development.

In invasive mechanical ventilation the child is sedated, allowing the ventilator to deliver all breaths through a tube placed in the child's airway. The concern with this approach is that using positive pressure to push air into a child's lungs can damage the lungs ([Tobin and Manthous 2017](#)).

- **RELATED:** [Long-term ventilation: best practice in caring for children and young people](#)

Alternatively, the child remains awake and supported to breathe independently with no invasive tube. The difference between these approaches is important.

In normal breathing, children pull air into their lungs by generating negative pressure in their chest and the chest muscles drive respiration. In invasive mechanical ventilation the opposite happens – air is pushed into the child's lungs using positive pressure and chest muscles offer no support.

Non-invasive ventilation can provide positive pressure to assist a child's breathing

For this reason, the preferred approach – if the child's condition allows – is to avoid mechanical ventilation and use non-invasive ventilation to mirror normal breathing ([Russell 2016](#)).

Non-invasive ventilation, delivered through nasal prongs or a face mask, refers to assisted ventilation without the need for a tube in the child's airway.

- **RELATED: [Biological basis of child health: development of the respiratory system and elements of respiratory assessment](#)**

Commonly, non-invasive ventilation provides positive pressure to assist a child's breathing. This pressure can be continuous support, as with continuous positive airway pressure, or tailored to provide additional pressure, or volume of air, to complete a breath the child initiates ([Wickham et al 2010](#)).

' If the child becomes tired and cannot initiate a breath, invasive mechanical ventilation is used'

The flow of air reduces the effort the child uses to breathe, but importantly removes the need to sedate. Non-invasive ventilation cannot breathe for the child like invasive mechanical ventilation. If the child becomes tired and cannot initiate a breath, invasive mechanical ventilation is used.

Early application of non-invasive positive pressure ventilation improves the child's breathing pattern, eases the work of respiratory muscles and improves gaseous exchange. [Mikalsen et al \(2016\)](#) maintain that non-invasive ventilation in children is a relatively safe, well-tolerated and feasible method for delivering oxygen.

During COVID- 19, [Privitera et al \(2020\)](#) have reported that non-invasive ventilation has successfully supported adult patients, removing the need for invasive mechanical ventilation in many cases.

Mike Stephenson is a senior lecturer at Northumbria University, Newcastle upon Tyne

References

- [Mikalsen IB, Davis P, Øymar K \(2016\) High flow nasal cannula in children: a literature review. Scandinavian Journal of Trauma Resuscitation and Emergency Medicine. 24, 93. doi.org/10.1186/s13049-016-0278-4](#)

- [Nawaz RF, Page B, Harrop, E et al \(2020\). Analysis of paediatric long-term ventilation incidents in the community. Archives of Disease in Childhood. 105: 446–451. dx.doi.org/10.1136/archdischild-2019-317965](#)
- [Privitera D, Angaroni L, Capsoni N et al \(2020\) Flowchart for non-invasive ventilation support in COVID-19 patients from a northern Italy emergency department. Internal and Emergency Medicine. 20, 767-771. doi.org/10.1007/s11739-020-02370-8](#)
- [Rimensberger PC, Cheifetz IM, Kneyber MCJ \(2018\) The top ten unknowns in paediatric mechanical ventilation. Intensive Care Medicine. 44, 366–370. doi.org/10.1007/s00134-017-4847-4](#)
- [Russell RR \(2016\). Paediatric ventilation – the mini series. Paediatric Respiratory Reviews. 20, 1–2. doi: 10.1016/j.prrv.2016.01.001](#)
- [Schmalisch G \(2016\) Basic principles of respiratory function monitoring in ventilated newborns: a review. Paediatric Respiratory Reviews. 20: 76–82. doi: 10.1016/j.prrv.2016.01.004](#)
- [Tobin M, Manthous C \(2017\) Mechanical ventilation. American Journal of Respiratory and Critical Care Medicine. 196, 3-4. doi.org/10.1164/rccm.1962P3](#)
- [Wickham A, Harley M, Leach R \(2010\). Non-invasive ventilation. Student BMJ. 18, 341:c6257. doi: 10.1136/bmjspcare-2015-000908](#)