

Early-life lower respiratory tract infection: Addressing Long-Term Health Risks through Nutritional Interventions and Public Awareness

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Pills from the literature

INTRODUCTION

The article "Early-life respiratory infection: How do we react to this red flag?" by Bush et al. examines the lasting impact of early-life lower respiratory tract infections (LRTIs), with a focus on respiratory syncytial virus (RSV) bronchiolitis¹. The authors emphasize the significant correlation between early LRTIs and an increased risk of premature adult death, calling for the medical community to view these infections as more than temporary health issues. Current guidelines for these pathologies do not address the associated long-term risks, and to tackle this, the paper suggests a proactive approach based on a public health campaign to raise awareness about the enduring effects of LRTIs, the need for further research to understand the mechanisms connecting early respiratory infections with later health outcomes, and measuring and correcting micronutrient deficiencies in high-risk groups, such as preterm infants and hospitalized children. Critical nutrients like oligo-elements and vitamins are noted for their roles in reducing oxidative stress and inflammation linked to severe LRTIs¹. Thus, a holistic approach to improve pediatric respiratory health is recommended, combining nutritional strategies with existing public health measures, including vaccination programs. This dual strategy aims to protect children from specific pathogens while strengthening their immune systems for a more robust response to infections. Hence, it is essential to consider these critical factors to achieve this goal, and examined in detail below.

ASSOCIATION BETWEEN EARLY LRTI AND LONG-TERM RISKS

The authors underscore the long-term effects associated with early childhood LRTIs: the progressive reduction of lung function²; an increased risk of allergic diseases and chronic respiratory diseases such as non-allergic asthma and chronic obstructive pulmonary disease (COPD)³, due to inflammation and remodeling resulting in permanent and structural alterations of the lung, increased hospitalization rates throughout childhood and possibly into adulthood end, later in the life, the nearly two-fold increased risk of premature adult death associated with cardiovascular diseases and metabolic disorders^{4,5}. All these data should be a warning for healthcare workers in managing respiratory infections in young children.

NUTRITIONAL INTERVENTIONS

Bush et al. propose several practical recommendations to address early-life LRTIs by focusing on nutritional interventions, particularly in high-risk infants. They emphasize the importance of measuring and supplementing micronutrient levels, supported by evidence that simple, low-cost measures can provide significant benefit. While the proposed strategies are feasible and particularly beneficial for high-risk groups like preterm infants, the article ac-

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knowledges the limitations of current knowledge, highlighting the need for more long-term studies to better understand the benefits of these interventions. Several essential micronutrients have been identified to support the immune system and enhance the body's ability against respiratory pathogens. Among these, vitamin D is particularly noteworthy for its pivotal role in the immune system by strengthening the pathogen-fighting capacity of monocytes and macrophages, decreasing inflammation, and reducing the severity of respiratory infections. Supplementation with vitamin D has been recommended, especially for infants at high risk of deficiency, such as those born prematurely or living in areas with limited sunlight exposure ⁶. Zinc is another essential micronutrient that supports normal development and function of cells mediating innate immunity, such as neutrophils and natural killer cells. Zinc deficiency impairs the immune response and has been associated with an increased susceptibility to infections, including respiratory infections, and zinc supplementation can reduce the incidence of pneumonia and other respiratory infections in children ⁷.

Magnesium also significantly supports overall immune function and helps maintain normal muscle function, including those involved in breathing. Magnesium deficiency seems to exacerbate respiratory conditions such as asthma, and supplementation to improve respiratory health ⁸.

Lastly, phytochemicals, such as flavonoids, carotenoids, and polyphenols, have potent antioxidant and anti-inflammatory effects. Diets enriched in these compounds have been shown to reduce the incidence and severity of respiratory infections. Encouraging the consumption of a diverse range of these compounds can thus be a practical approach to enhance the immune defenses of infants ⁹. Oxidative stress plays a crucial role in the progression of respiratory diseases, acting as both a trigger and a consequence of inflammation and tissue damage in the lungs. ROS production is intended to destroy invading pathogens, but excessive or prolonged production can damage host tissues, including the delicate epithelium of the respiratory tract. For instance, infants with severe RSV bronchiolitis have been shown to have higher levels of oxidative biomarkers and lower levels of antioxidants like glutathione and selenium in their blood. This oxidative imbalance can lead to further lung damage and exacerbate symptoms, prolonging recovery and increasing the risk of complications ¹⁰. Antioxidants such as vitamins C and E, selenium, and other micronutrients can neutralize ROS, reducing oxidative damage and inflammation. For instance, selenium deficiency promotes mutations, replication and virulence of RNA viruses, and its supplementation is beneficial not only via restoration of host antioxidant capacity but also by reducing apoptosis and endothelial cell damage as well as platelet aggregation. Vitamins, oligo-elements and polyphenols play vital and synergistic roles at every stage of the immune response. Since micronutrient deficiencies do not occur in isolation, supplementation with multiple micronutrients is essential to reduce the risk of infection ⁹.

PUBLIC AWARENESS CAMPAIGNS AND MULTIDISCIPLINARY APPROACH

Public awareness campaigns, vital to educating parents and caregivers about the long-term risks associated with early-life respiratory infections, must emphasize the importance of vaccination and nutrition in maintaining respiratory health, alongside encouraging healthy practices, such as hand hygiene and avoiding exposure to tobacco smoke ¹¹. These can help build a foundation of preventive healthcare from infancy. Pediatricians, Nutritionists, and Public Health Officials must work together to build a multidisciplinary approach to children, especially those at high risk of respiratory infections.

In conclusion, effective preventive intervention for respiratory infections in pediatric populations must integrate nutritional interventions, vaccination programs, and public awareness campaigns with a multidisciplinary strategy. This holistic strategy addresses immediate health concerns and contributes to preventing chronic conditions in adulthood, ensuring a healthier future for children. Regular health check-ups should include nutritional status and vaccination history assessments. Equal access to healthcare should be ensured, particularly in underserved communities where the prevalence of respiratory infections may be higher.

CONCLUSION

The authors then design what could be an effective preventive program for the long-term effects of respiratory infections in pediatric populations. A program that must integrate nutritional interventions, vaccination programs, and public awareness campaigns in a multidisciplinary strategy. This holistic approach, while addressing immediate health concerns, may contribute to preventing chronic conditions in adulthood and ensure a healthier future for children.

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Author's contribution

AG: drafted and revised the manuscript for important intellectual content; AMZ: revised the manuscript for important intellectual content.

References

- ¹ Bush A, Buonsenso D, Peroni D, et al. Early-life Respiratory Infection: How Do We React to This Red Flag? *Pediatric Pulmonology* 2024;59:1817-1819. <https://doi.org/10.1002/ppul.26963>
- ² Meel E. R. van; Mensink-Bout, S. M.; Dekker, et al. Early-life respiratory tract infections and the risk of school-age lower lung function and asthma: a meta-analysis of 150000 European children. *Eur Respir J* 2022;60:2102395. <https://doi.org/10.1183/13993003.02395-2021>
- ³ Martinez FD. Early-Life Origins of Chronic Obstructive Pulmonary Disease. *N Engl J Med* 2016;375:871-878. <https://doi.org/10.1056/NEJMr1603287>
- ⁴ Allinson JP, Chaturvedi N, Wong A, et al. Early Childhood Lower Respiratory Tract Infection and Premature Adult Death from Respiratory Disease in Great Britain: A National Birth Cohort Study. *Lancet* 2023;401:1183-1193. [https://doi.org/10.1016/S0140-6736\(23\)00131-9](https://doi.org/10.1016/S0140-6736(23)00131-9)
- ⁵ Harris E. Early Respiratory Infections Tied to Premature Death Later in Life. *JAMA* 2023;329:1053. <https://doi.org/10.1001/jama.2023.3307>
- ⁶ Nurmatov U, Devereux G, Sheikh A. Nutrients and Foods for the Primary Prevention of Asthma and Allergy: Systematic Review and Meta-Analysis. *J Allergy Clin Immunol* 2011;127:724-733.e30. <https://doi.org/10.1016/j.jaci.2010.11.001>
- ⁷ Sadeghsoltani F, Mohammadzadeh I, Safari MM, et al. Zinc and Respiratory Viral Infections: Important Trace Element in Anti-Viral Response and Immune Regulation. *Biol Trace Elem Res* 2022;200:2556-2571. <https://doi.org/10.1007/s12011-021-02859-z>
- ⁸ Gilliland FD, Berhane KT, Li YF, et al. Dietary Magnesium, Potassium, Sodium, and Children's Lung Function. *Am J Epidemiol* 2002;155:125-131. <https://doi.org/10.1093/aje/155.2.125>
- ⁹ Gombart AF, Pierre A, Maggini S. A Review of Micronutrients and the Immune System-Working in Harmony to Reduce the Risk of Infection. *Nutrients* 2020;12:236. <https://doi.org/10.3390/nu12010236>
- ¹⁰ Albano GD, Gagliardo RP, Montalbano AM, et al. Overview of the Mechanisms of Oxidative Stress: Impact in Inflammation of the Airway Diseases. *Antioxidants* 2022;11:2237. <https://doi.org/10.3390/antiox11112237>
- ¹¹ Loffredo L, Carnevale R, Pannunzio A, et al. Children smoke prevention group*. Impact of heat-not-burn cigarette passive smoking on children's oxidative stress, endothelial and platelet function. *Environ Pollut* 2024;345:123304. <https://doi.org/10.1016/j.envpol.2024.123304>