

THE INCREASING PREVALENCE OF ACUTE RESPIRATORY INFECTIONS AMONG INFANTS AND CHILDREN AND SUGGESTED NUTRITIONAL PREVENTION AND PRESCRIPTION: A LITERATURE REVIEW

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Abstract

Background: Acute respiratory infections (ARI) are a significant cause of illness and death in infants and children under five. Infants' nutritional status and feeding patterns are factors that affect their vulnerability to ARI. This literature review aimed to summarize the incidence of ARI, the risk factors, and the evaluation of nutritional strategies. **Methods:** The literature review was conducted using articles published between January 2020 and December 2025. A search was conducted in PubMed and Scopus using keywords related to ARI. **Results:** ARI is very common among children under 5 years old. Malnutrition and low birth weight correlate with heightened risk and severity of ARI. Insufficient exclusive breastfeeding practices are associated with an increased risk of ARI, while exclusive breastfeeding has a protective effect. Environmental factors affect the likelihood of ARI. Evidence on micronutrient supplementation is varied and not ideal. **Conclusion:** Interventions for ARI in children require an integrated strategy that focuses on exclusive breastfeeding, improved nutritional status, and a healthier household environment.

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Keywords: Acute respiratory infection, Nutrition, Exclusive breastfeeding, Environmental, Children under five.

Introduction

Acute respiratory infections (ARIs) are still a big problem for public health around the world, especially for infants and children under five years of age¹ For policymakers, the fact that ARIs are still a significant cause of illness and death in children in low- and middle-income countries shows how important it is to take specific steps.² Recent large-scale epidemiological studies have indicated substantial disparities in the incidence of ARIs. Caregivers report symptoms in up to 38.5% of particular population groups, and many tertiary health centers have a lot of clinical burden.³

Newborns and young infants are vulnerable to ARIs for multiple reasons. Immature immune system development and recurrent exposure to respiratory infections both elevate susceptibility. Socio-environmental factors, such as congested housing, exposure to indoor air pollution from solid fuel use, inadequate sanitation, and limited access to healthcare, intensify this biological susceptibility. The national demographic and health survey indicated that ARIs are significantly more prevalent among households with lower incomes. Infants less than six months of age are at the most significant risk of experiencing severe illness and adverse outcomes.⁴

Understanding how malnutrition affects the frequency and severity of ARIs in children highlights the importance of nutritional status, which allows pediatric healthcare workers to improve ARI outcomes.⁵ Micronutrient deficits and undernutrition, resulting from inadequate breastfeeding practices, impair immune function and are often associated with heightened susceptibility to respiratory infections. Several studies have established a significant correlation between poor nutritional status and a heightened prevalence of ARIs, indicating

that dietary deficits may undermine children's immune function and mucosal integrity.⁶

Breastfeeding practices are associated with nutritional intake and the likelihood of ARIs.⁷ Emphasizing the importance of exclusive breastfeeding in the first six months of life can increase health professionals' confidence in their responsibility to strengthen the immune system. Exclusive breastfeeding provides significant health benefits, particularly in providing protective antibodies that can prevent respiratory infections and promote the development of the gut as well as the immune system.^{8,9} In addition to breastfeeding, micronutrients like vitamin A, zinc, and vitamin D have been examined for their immunomodulatory effects, with sufficient consumption potentially affecting disease risk and development.^{10,11}

Due to the consistently elevated incidence of ARIs in infants and children and the intricate link between ARIs and many nutritional factors, a thorough, evidence-based understanding of nutrition's role in ARI prevention and management is essential. The objectives of this review are to aggregate recent data on ARI frequency patterns, identify nutritional risk factors that influence susceptibility to infection, and assess nutritional strategies and interventions that may mitigate the incidence and severity of ARI.

Method

This study was a literature review to summarize the latest evidence on the increasing prevalence of ARI in infants and children and to explore nutritional prevention strategies and appropriate dietary recommendations for this population. This review will focus on peer-reviewed articles published between January 2020 and December 2025. The literature search and integration are based on the Population–Problem–Measure (PPM) framework, which

focuses on infants and children (0–5 years) as the studied group, the increasing prevalence of ARI as the issue, and nutritional prevention approaches and dietary management as the measures.

A comprehensive literature review was performed across various electronic databases, including PubMed and Scopus. The search methodology integrated Medical Subject Headings (MeSH) terms and keywords related to ARIs, pediatric populations, and nutrition. Key search terms included “acute respiratory infections” OR “ARI,” “infant” OR “child” OR “children” OR “pediatrics” OR “children under five years of age,” and “nutrition” OR “nutritional conditions” OR “breastfeeding” OR “micronutrients” OR “dietary interventions” OR “nutritional prevention” and “prevalence” OR “incidence.” Boolean operators (AND/OR) were used to refine the search parameters. Studies were considered eligible if they were original research papers, systematic reviews, or meta-analyses, and a Random Controlled Trial (RCT) that examined the prevalence of ARI, associated risk factors, or nutrition-related interventions in children. Articles that addressed only adults, non-respiratory infections, animal studies, or lacked full text were excluded.

Titles and abstracts were evaluated for suitability, followed by a comprehensive examination of the complete texts of articles that met the criteria. Data related to ARI prevalence, nutritional risk factors, breastfeeding and feeding practices, the significance of micronutrients, and nutritional interventions during ARI were extracted. The results of the review are presented in narrative format to offer a thorough comprehension of the most recent evidence, identify knowledge gaps, and underscore the implications for child nutrition practices and public health.

Results and Discussion

A total of 13 articles met the inclusion criteria and were summarized in **Table 1**. Of these, 10 were cross-sectional studies, 2 were systematic reviews/meta-analyses, and 1 was a case–control study. Across the included studies, the reported prevalence of ARI among children under five varied substantially across settings. Community-based studies reported prevalence ranging from 5.7% in large national datasets in Indonesia to as high as 64.7% in localized high-risk populations in Bangladesh.¹² Two-week prevalence in Ethiopia was reported at 16.1%, while urban Indonesian settings showed prevalence around 35%.⁹ These variations suggest that ARI frequency patterns differ considerably by geographical location, socioeconomic status, environmental exposure, and study design. Infants under six months consistently appeared as one of the most vulnerable groups, particularly in low- and middle-income households.^{4,13} Overall, current findings indicate that ARI remains highly prevalent in under-five populations, although magnitude varies widely across contexts.

ARI is a significant public health problem across regions, particularly among children under 5 years of age in low- and middle-income countries. These data indicate that poor nutritional status, inappropriate infant feeding practices, and micronutrient deficiencies can weaken the immune system, further increasing the risk and severity of ARI. These results are consistent with global literature by Swain et al (2025) and Masi et al (2024), which shows that nutritional intake and living conditions play a significant role in a child's risk of ARI infection.^{2,7}

Nutritional status and household environmental conditions are two major factors that significantly influence a child's susceptibility to ARI. This is due to the interaction of the two, which affects immune system function and exposure to pathogens from an early age. Children

with malnutrition and micronutrient deficiencies were reported to have a higher likelihood of ARI in several included studies. However, most of these findings were derived from cross-sectional analyses, which limit causal inference. Biologically, this observed association may be explained by impaired immune cell function, decreased integrity of the respiratory epithelium, and increased systemic inflammation, which together could increase susceptibility to respiratory pathogens.¹⁴ This is demonstrated by the findings of Agrarina et al (2025), who reported a significant association between poor nutritional status and the incidence of ARI in toddlers. Children with poor nutritional status or malnutrition have a higher risk of experiencing ARI compared to children with good nutritional status.⁶

Meanwhile, evidence from Farrag et al (2024) and Roshan et al (2025) shows that poor feeding practices, especially insufficient exclusive breastfeeding, are closely associated with an increased incidence of ARI. It emphasizes the critical role of nutrition in immune maturation and highlights it as the strongest determinant of protection against ARI. A study by Roshan et al. (2025) reported that infants who were exclusively formula-fed had nearly 17-fold higher odds of developing ARI compared with those who were exclusively breastfed. Similarly, Farrag et al. (2024) found that exclusive breastfeeding was associated with a 55% reduction in the odds of ARI among infants under six months. However, both studies employed observational designs (case–control and cross-sectional), which limit causal inference. The reported effect sizes may have been influenced by recall bias, selection bias, and residual confounding factors such as maternal education, household hygiene, and access to healthcare. Therefore, these findings should be interpreted as associations rather than definitive causal relationships.^{15,16} From a biological perspective, the observed protective association of exclusive breastfeeding

is plausible, as breast milk contains immunoglobulins, anti-inflammatory factors, and other bioactive components that contribute to immune system maturation and may enhance protection against respiratory pathogens in early life.¹⁷ Studied by Irma et al (2023), the study also found significant relationships between exclusive breastfeeding and nutritional status, and the incidence of ARI in toddlers.¹⁸ These findings suggest that exclusive breastfeeding may play an important protective role against ARI. Nevertheless, because most included studies were observational, residual confounding factors such as maternal education, household hygiene, and access to healthcare may partly explain the observed associations.¹⁹

Nutritional status and a history of low birth weight (LBW) are significant factors influencing a child's vulnerability to ARI. Studies by Akter et al (2025), Sitanggang et al (2025), and Haryanto et al (2025) found that malnutrition, both underweight and stunting, as well as low birth weight, have a strong association with a high incidence of ARI.^{9,12,13} Children with malnutrition show impaired immune system function and have insufficient nutritional reserves, resulting in a weakened immune response to respiratory tract pathogens. As a result, the frequency of ARI tends to be higher than in children with good nutritional status.^{4,20} Furthermore, LBW children have a higher likelihood of experiencing stunting or poor nutritional conditions during toddlerhood. Several studies have shown that the risk of stunting in children born with low birth weight (LBW) increases severalfold compared to children born with normal weight.²¹ This condition does not increase the risk of ARI because it can weaken the respiratory mucosa and impair the cellular immune response, thereby facilitating pathogen invasion.²² However, Mubarokah et al (2024) reported different results, finding no significant relationship between nutritional status and ARI. It indicates that the existence of

this relationship may vary depending on environmental context, measurement methods for nutritional intake, and unanalyzed confounding factors such as household air pollution, ventilation, and residential density.²³

Table 1. Summary of the included studies

Authors	Title Article	Journal	Publication Year	Study Design	Population	Nutritional Exposure / Intervention	Results	Summary of Finding
Akter, et al ¹²	Prevalence of ARI, fever, and diarrhea among under-five children and the influencing factors in southwestern coastal region of Bangladesh	BMC Public Health	2025	Cross-sectional	Children aged 6–59 months (n=348)	Infant and young child feeding (IYCF) practices, particularly daily feeding frequency, and early-life nutritional status as reflected by birth weight.	ARI prevalence: 64.7%; feeding frequency & birth weight significantly associated (p<0.05).	Suboptimal feeding practices and low birth weight were associated with higher ARI prevalence.
Purnama, et al ⁴	Prevalence and risk factors of acute respiratory infection and diarrhea among children under 5 years old in low-middle wealth household, Indonesia	Infectious Diseases of Poverty	2025	Cross-sectional	Children under five years from low- and middle-wealth households in Indonesia, including infants under six months, drawn from 514 districts/cities	Nutritional status indicators (malnutrition, stunting, underweight), household cooking fuel type as a nutrition-sensitive exposure, sanitation access (shared vs. private toilets), and social	ARI prevalence: 5.7%; unclean fuel (AOR=1.53), shared sanitation (AOR=1.45)	Nutrition-sensitive environmental factors increased ARI risk.

Authors	Title Article	Journal	Publication Year	Study Design	Population	Nutritional Exposure / Intervention	Results	Summary of Finding
Purnama, et al ²⁴	Effects of the Local Environment and Nutritional Status on the Incidence of Acute Respiratory Infections Among Children Under 5 Years Old in Indonesia	Journal of Preventive Medicine & Public Health	2025	Ecoogical study	nationwide (n = 289,631 children). Children under five years of age (n = 334,878) across 33 provinces and 486 districts/cities in Indonesia, based on the Indonesia Nutrition Survey 2022.	protection coverage. Malnutrition indicators representing the triple burden of malnutrition, including stunting, wasting, and underweight; wealth index and environmental conditions as upstream determinants affecting nutritional status and ARI risk.	Malnutrition negatively associated with ARI (path coef -0.072; p<0.01)	Socioeconomic disparities influenced ARI distribution.
Sitanggang, et al ⁹	Epidemiology of acute respiratory infection among children under five in Kenali Asam Bawah, Jambi city	Proceedings Academic Universitas Jambi	2025	Cross-sectional	Children aged 6–59 months living in Kenali Asam Bawah Urban Village, Jambi City,	Child nutrition–related factors including exclusive breastfeeding status, vitamin A supplementation,	ARI prevalence: 35%; ARI associated with breastfeeding & nutritional status	Nutrition-related factors associated with ARI occurrence.

Authors	Title Article	Journal	Publication Year	Study Design	Population	Nutritional Exposure / Intervention	Results	Summary of Finding
Roshan, et al ¹⁶	Association between Acute Respiratory Infection and Type of Feeding in Children up to 2 Years of Age: A Comparative Study of Breast Feeding, Formula Feeding and Mixed Feeding in CMH Abbottabad	Indus Journal of Bioscience Research	2025	Case control study	Indonesia (n = 180). Children aged ≤2 years attending the pediatric outpatient department at CMH Abbottabad, including 50 ARI cases and 50 age-matched controls without infection.	birth weight, and current nutritional status (underweight, normal, risk of overweight). Type of infant feeding during the first six months of life, categorized as exclusive breastfeeding, exclusive formula feeding, or mixed feeding according to WHO classification.	A significant association was observed between feeding type and the incidence of acute respiratory infection (p < 0.0001). Exclusive formula feeding was predominant among ARI cases (60%) and was associated with markedly higher odds of ARI (OR = 16.8)	Exclusive breastfeeding showed protective association against ARI.
Lisnawati ²⁵	Effect of Vitamin A Supplementation on Acute	Poltekita : Jurnal Ilmu Kesehatan	2025	Cross-sectional	Children under five years diagnosed	Vitamin A supplementation frequency, categorized as	Vitamin A status associated with ARI severity (p=0.007)	Vitamin A supplementation related to ARI severity.

Authors	Title Article	Journal	Publication Year	Study Design	Population	Nutritional Exposure / Intervention	Results	Summary of Finding
	Respiratory Infections among Children Under Five in Konawe District				with acute respiratory infections attending Morosi Community Health Center, Konawe District, Indonesia (n = 67).	low (≤ 1 dose/year) and adequate (≥ 2 doses/year).		
Haryanto, et al ²⁶	Correlation Between Nutritional Status With Acute Respiratory Infection Frequency On 3-5 Years Old Children At Gotong Royong Hospital Surabaya	Journal of Widya Medika Junior	2025	Cross-sectional	Children aged 3–5 years treated at Gotong Royong Hospital, Surabaya, Indonesia (n=53)	Nutritional status based on Weight-for-Age (BB/U): severely underweight, underweight, normal, overweight.	A significant negative correlation between nutritional status and ARI frequency (p = 0.031; r = -0.2706).	Poor nutritional status associated with more frequent ARI.

Authors	Title Article	Journal	Publication Year	Study Design	Population	Nutritional Exposure / Intervention	Results	Summary of Finding
Tanase, et al ²⁷	Assessing the Impact of Vitamin D Supplementation on Respiratory Infections in Children and Adolescents: A Cross-Sectional Study	Nutrients	2025	Cross-Sectional Study	Children and adolescents aged 1–18 years (n = 194) Children <6 years (n = 36)	Vitamin D supplementation (weekly doses: <400 IU, 400–800 IU, >800 IU) and serum 25-hydroxyvitamin D (25-OHD) concentrations (<20 ng/mL, 20–30 ng/mL, >30 ng/mL)	Higher vitamin D (>800 IU/week) associated with lower ARI incidence	Adequate vitamin D status associated with reduced ARI risk.
Farrag, et al ¹⁵	Association Between Exclusive Breastfeeding and Acute Respiratory Infections Among Infants Under the Age of 6 Months	Breastfeeding Medicine	2024	Cross-sectional	Infants aged <6 months and their mothers in Egypt (n = 1,340).	Exclusive breastfeeding during the first six months of life, defined as provision of only breast milk.	Exclusive breastfeeding was significantly associated with reduced odds of ARI symptoms (AOR = 0.450; 95% CI: 0.243–0.832)..	Exclusive breastfeeding independently associated with lower ARI risk.
Mubarokah, et al ²³	The relationship between nutritional status and the	World Journal of Advanced	2024	Cross-sectional	100 toddlers aged 1–5 years attending	Nutritional status (W/H): malnutrition, wasted, normal,	No significant association between nutritional status and the	Nutritional status was not significantly associated with ARI incidence among

Authors	Title Article	Journal	Publication Year	Study Design	Population	Nutritional Exposure / Intervention	Results	Summary of Finding
	incidence of ARI In toddlers aged 1-5 years	Reseach and Reviews			Mulyorejo Community Health Center, Surabaya	risk of overweight, overweight, obesity.	incidence of ARI (p = 0.492).	toddlers aged 1–5 years in this study setting.
Milani, et al ¹¹	A systematic review and meta-analysis on nutritional and dietary interventions in pediatric ARI patients	Allergy	2023	Systematic review & meta-analysis	Children diagnosed with acute respiratory tract infections across low-, lower-middle-, upper-middle-, and high-income countries (total 50 clinical trials included).	Dietary and nutritional interventions, including supplementation with zinc, vitamin A, vitamin D, vitamin E, and probiotics, administered as treatment for acute respiratory tract infections.	Nutritional status not associated with ARI in this setting.	Evidence for micronutrient therapy in ARI remains inconsistent.
Irma et al ¹⁸	Nutrition and Breastfeeding in the View of Islam to Prevent Acute Respiratory	Diversity: Disease Preventive of Research Integrity	2023	Case–control study	136 toddlers (68 ARI cases; 68 controls) in rural Indonesia	Nutritional status of toddlers and exclusive breastfeeding practices,	A significant associations between nutritional status and ARI incidence (p =	Both nutritional status and exclusive breastfeeding were significantly associated with ARI incidence

Authors	Title Article	Journal	Publication Year	Study Design	Population	Nutritional Exposure / Intervention	Results	Summary of Finding
	Infections in Toddlers					assessed using questionnaires and child health cards (KMS).	0.001) as well as between exclusive breastfeeding and ARI incidence ($p = 0.001$).	among toddlers in rural areas.
Marusca, et al ²⁸	The Effects of Vitamin D Supplementation on Respiratory Infections in Children under 6 Years Old: A Systematic Review	Diseases	2023	Systematic Review (5 RCTs, 2 Case–Control, 1 Prospective Cohort)	Children aged 0–5 years ($n = 2189$) from Canada, India, and China	Vitamin D supplementation (400–2000 IU/day; bolus doses up to 300,000 IU; duration 3–12 months)	Findings were inconsistent: low vitamin D levels were associated with higher RTI risk (OR 4.90–6.97), and 800 IU/day reduced episodes in one study (RR = 0.55). However, most studies reported no significant effect on RTI incidence or severity.	Evidence for vitamin D supplementation in preventing or treating RTIs in children under six remains limited and inconsistent, with no clear reduction in incidence or severity across studies.
Gebrerufael, et al ¹³	Prevalence and predictors of acute respiratory infection among children under-five years in	BMC Infectious Diseases	2023	A retrospective cross-sectional study	Children under five years (0–59 months) in Tigray region,	Household wealth index as a nutrition-sensitive indicator and child diarrhea status as a	Two-week ARI prevalence was 16.1% (95% CI: 13.8–18.4). Significant predictors included	ARI prevalence was associated with household socioeconomic status and comorbid diarrhea, indicating the role of

Authors	Title Article	Journal	Publication Year	Study Design	Population	Nutritional Exposure / Intervention	Results	Summary of Finding
	Tigray regional state, northern Ethiopia: a cross sectional study				Ethiopia (n=986)	nutrition–infection-related condition; no direct nutritional intervention was implemented.	diarrhea (AOR = 3.0), maternal smoking (AOR = 4.0), younger age, and lower household wealth (protective effect for higher wealth: AOR = 0.60).	nutrition-sensitive and health-related factors in ARI risk.

These differences in results indicate that the relationship between nutritional status and ARI cannot be observed in isolation; the broader environmental context influences it. When dietary factors yield inconsistent results, it is highly likely that other factors, such as nutrition-sensitive household factors, contribute to increased risk of ARI in children. Unhealthy household environments, such as the use of solid fuels for cooking, poor ventilation, inadequate sanitation and clean water availability, overcrowding, and exposure to cigarette smoke, are consistently associated with increased exposure to infectious agents that may compromise children's respiratory health and elevate the risk of ARI.^{4,29,30} This is reinforced by a follow-up study by Purnama et al (2025b), which showed that children from families who use unclean cooking fuels and have access to shared sanitation facilities are at higher risk of experiencing ARI, thus re-emphasizing that environmental factors are an essential component of nutrition that greatly influences children's respiratory health.²⁴ This is in line with the studies by Akter et al (2025) and Gebrerufael & Hagos (2023), which found that children in households with low socioeconomic status and those exposed to comorbidities such as diarrhea were more susceptible to ARI. These results support the view that environmental and nutritional factors play a complex role in reducing disease risk.^{12,13}

As the influence of environmental factors on the risk of ARI becomes clearer, there is a need to re-evaluate the roles of other nutritional components, including micronutrients, that may influence disease susceptibility and progression. However, unlike the stable results for macronutrients and environmental factors, the evidence for micronutrient interventions is much more variable and has not yet provided clinical

certainty. Recent observational evidence from Indonesia also suggests that regular consumption of fortified growing-up milk may reduce the incidence of upper respiratory tract infections among young children, highlighting the potential role of fortified nutritional products in respiratory infection prevention.³¹ Milani et al (2023) found that zinc provided only a limited benefit, reducing hospitalization duration, but had no significant effect on recovery time from pneumonia.¹¹ Marusca et al (2023) also reported mixed results, with vitamin D showing effectiveness only under certain conditions and not consistently reducing the incidence or severity of ARI.²⁸ In contrast, Tanase et al (2025) demonstrated that high-dose vitamin D supplementation (>800 IU/week) was associated with a significantly lower incidence of ARI among under-five children, suggesting that the effectiveness of micronutrient interventions may depend on dosage, baseline nutritional status, and contextual factors.²⁷ Lisnawati (2025) further reported an atypical pattern: children receiving adequate vitamin A supplementation were more likely to experience moderate ARIs.²⁵ It confirms that without improvements in nutritional status and household environmental conditions, micronutrient interventions alone cannot consistently reduce the incidence or severity of ARI.

In addition to vitamin D and zinc, iron status may also influence susceptibility to respiratory infections in children. Iron deficiency anemia has been linked to impaired immune mechanisms and an increased incidence of respiratory tract infections, with children suffering IDA exhibiting higher risk of acute lower respiratory tract infections compared with non-anemic peers. Iron deficiency has been associated with altered immune responses, reduced lymphocyte proliferation, and increased likelihood of

infection episodes. However, evidence specific to iron supplementation for ARI prevention is limited and heterogeneous, with some studies suggesting a higher susceptibility to respiratory infections among children with IDA and others indicating complex interactions between iron metabolism and infectious risk. Therefore, iron interventions should be carefully targeted based on documented deficiency, and further well-designed pediatric studies are needed to clarify its role in ARI outcomes.^{32,33}

It is important to interpret the reported effect sizes with caution. The majority of included studies employed cross-sectional designs, which cannot establish temporal relationships or causality. Reported odds ratios and adjusted odds ratios may overestimate associations in high-prevalence settings, and residual confounding from unmeasured socioeconomic and environmental variables cannot be ruled out. Therefore, the observed associations should be understood as correlations rather than definitive causal relationships.

Conclusion

Based on currently available evidence, poor nutritional status, low birth weight, and inadequate exclusive breastfeeding practices are consistently associated with increased ARI risk in children under five. However, because much of the evidence derives from observational studies, causality cannot be definitively established. Exclusive breastfeeding appears to confer protective benefits, although contextual socioeconomic and environmental factors likely modify this relationship. Although evidence regarding micronutrient interventions remains heterogeneous and insufficient to support uniform

recommendations, emerging findings suggest that vitamin D may represent a promising exception. Several recent studies indicate that adequate vitamin D status or higher-dose supplementation is associated with a reduced incidence of ARI, particularly among young children with low baseline levels. Nevertheless, current evidence remains inconsistent across settings and populations, underscoring the need for an integrated prevention strategy that combines optimal infant feeding practices, improved overall nutritional status, targeted micronutrient supplementation when appropriate, and healthier household environments to reduce the burden of ARI in children effectively.

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Conflict of Interest

There are no conflict interest of this publication.

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