

## Review

# Epidemiology of Asthma, Rhinitis, Eczema, and Atopy Among Children

Alaa Alzahrani<sup>1</sup>, Saeed Alghamdi<sup>2</sup>, Rawan Abdulrahman<sup>3</sup>, Mustafa Zaytuni<sup>4</sup>, Ethar Alsaedi<sup>5</sup>, Ali Artam Alajmi<sup>6</sup>, Aziz Alsubaie<sup>7</sup>, Alaa Ghawas<sup>8</sup>, Fatima Mohamed<sup>9</sup>, Layaly Safi<sup>8</sup>, Yousef AlAli<sup>3</sup>, Abdulghani Alzamzami<sup>1</sup>, Sultan Alsharif<sup>10</sup>

<sup>1</sup> Department of Pediatrics, Aziziyah Children Hospital, Jeddah, Saudi Arabia

<sup>2</sup> Department of Psychiatry, King Fahad General Hospital, Jeddah, Saudi Arabia

<sup>3</sup> College of Medicine, Royal College of Surgeons in Ireland – Medical University of Bahrain, Muharraq, Bahrain

<sup>4</sup> Department of Dermatology, Ohud Hospital, Medina, Saudi Arabia

<sup>5</sup> College of Medicine, Umm Al-Qura University, Mecca, Saudi Arabia

<sup>6</sup> College of Medicine, Arabian Gulf University, Manama, Bahrain

<sup>7</sup> College of Medicine, University of Bisha, Bisha, Saudi Arabia

<sup>8</sup> College of Medicine, Dar Al Uloom University, Riyadh, Saudi Arabia

<sup>9</sup> Department of Dermatology, 360 Clinics, Manama, Bahrain

<sup>10</sup> Department of Pediatrics, Al Thager Hospital, Jeddah, Saudi Arabia

**Correspondence** should be addressed to **Alaa Alzahrani**, Department of Pediatrics, Aziziyah Children Hospital, Jeddah, Saudi Arabia. Email: [dr.alaa\\_hayas@hotmail.com](mailto:dr.alaa_hayas@hotmail.com)

Copyright © 2022 **Alzahrani**, this is an open-access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Received: 13 June 2022, Accepted: 19 June 2022, Published: 22 June 2022

### Abstract

Atopic disorders are a spectrum of diseases that share an underlying immune system issue. Atopic diseases such as eczema, asthma, and allergic rhinitis are frequent among children, making them a major public health concern around the world. Both genetic and environmental variables have a significant role in the development of these disorders. Despite the diversity, there appears to be a strong link between these conditions. While many diseases overlap risk factors, the nature and progression of disease differs from person to person. For children in the general population globally, the estimated prevalence of asthma, eczema, and allergic rhinitis is 12.0%, 7.9%, and 12.7%, respectively. The purpose of this research is to review the available information about the epidemiology of asthma, rhinitis and eczema among children. Due to their high frequency and related clinical and social cost, allergic disorders such as asthma, rhinitis, and eczema have turned into a worldwide public health challenge. Despite the fact that allergic disorders can be considered as separate entities, multimorbidity which is coexistence and cooccurrence is a common event. Over the last two decades, the incidence of asthma, rhinitis, and eczema has increased globally and varies across different geographical regions hence, effective prevention and management approach is need of time. More epidemiological population-based surveys in future can contribute to generation of evidence-based strategies for the prevention and management of these diseases and will also play a pivotal role in creating awareness among parents.

**Keywords:** *epidemiology, atopic, disease, eczema, rhinitis, asthma*

## Introduction

Atopic disorders are a spectrum of diseases that share an underlying immune system issue. The formation of a specific immunoglobulin mainly immunoglobulin-E aimed against normally harmless allergens is the major feature. Atopic dermatitis, allergic rhinitis, asthma, and food allergies are all examples of childhood atopic illness. The term atopic march refers to the prevalent condition that children who experience one of these ailments are at high risk of having the other at some point throughout childhood since the diseases implicated in atopic disease are related by shared causes. Around 75% of children with atopic dermatitis develop allergic rhinitis, and more than 50% acquire asthma (1).

Atopic diseases such as eczema, asthma, and allergic rhinitis are frequent among children, making them a major public health concern around the world. The prevalence of these three illnesses varies significantly by location and even country. Despite this diversity, there appears to be a strong link between these conditions. Eczema is frequently the first condition to develop in a triumvirate of events that includes eczema, asthma, and allergic rhinitis. For children in the general population globally, the estimated prevalence of asthma, eczema, and allergic rhinitis is 12.0%, 7.9%, and 12.7%, respectively. A lot of emphasis has been paid to the wide diversity in the incidence of atopic illnesses (2). The likelihood of acquiring atopic disorders is complicated, and the atopic march's temporal pattern may not be a straightforward progression. Both genetic and environmental variables have a significant role in the development of these disorders. While many diseases overlap risk factors, the nature and progression of disease differs from person to person. There may be a significant correlation between eczema and the later-onset atopic respiratory disorders, or atopic diseases can be independent conditions that develop sequentially along an atopic pathway (3).

The most frequent chronic disorders in children are atopic diseases. Notably, asthma affects over 300 million children worldwide, and the incidence of the disease is rising in many countries. In most Western nations, asthma and allergies have reached pandemic proportions in recent decades. These disorders are described as rare in early twentieth-century descriptions, affecting only a few families. However, atopic disorders have become far more common in recent decades, not just in Western nations as well as in several developing countries. Since

genetic makeup is unlikely to have altered over the decades, external factors must be addressed when understanding the rapid rise in asthma and allergy prevalence (4). Many young children experience frequent spells of wheezing and cough, which are often a consequence of acute respiratory infections hence, diagnosing asthma in children under the age of three is difficult. Furthermore, measuring lung function, airway inflammation, and hyperresponsiveness in this age range is difficult. Some factors, however, suggest that increased risk of persistent respiratory or asthmatic symptoms beyond childhood, and children with these characteristics are more likely to develop true asthma, which is less relevant to respiratory infections and occurs in the absence of infections and in response to a wide range of specific and nonspecific stimuli. Persistent asthma in childhood and adult life is predicted by a positive family history of atopic disease, the presence of atopic dermatitis, and sensitivity to food and aeroallergens (5).

Eczema is an allergic skin condition marked by damage to the skin, swelling, itching, and recurrent rashes. Children's symptoms have a complicated etiology, which is usually attributed to a combination of environmental and hereditary causes. Eczema produces itching, which can disrupt sleep in children and, in extreme cases, hinder physical and mental development. Eczema can develop into asthma or rhinitis, and the management of eczema and its aggravating factors can be costly for the patient (6). Allergic rhinitis is an immunoglobulin E-mediated disease caused by allergen exposure to the nasal mucosa. This causes rhinorrhoea, itching, sneezing, and sleep disturbances, which parents or guardians might easily notice and report. However, the most prevalent symptom of allergic rhinitis, nasal congestion, is more difficult to provoke in young children. Rhinitis and other allergy illnesses have become more common worldwide in the previous three decades, with prevalence rates ranging from 10% to 45% depending on geographical location (7). The purpose of this research is to review the available information about the epidemiology of asthma, rhinitis and eczema among children.

## Methodology

This study is based on a comprehensive literature search conducted on April 25, 2022, in the Medline and Cochrane databases, utilizing the medical topic headings (MeSH) and a combination of all available related terms,

according to the database. To prevent missing any possible research, a manual search for publications was conducted through Google Scholar, using the reference lists of the previously listed papers as a starting point. We looked for valuable information in papers that discussed the information about the epidemiology of asthma, rhinitis and eczema among children. There were no restrictions on date, language, participant age, or type of publication.

## Discussion

Atopic disorders have become far more common in both industrialized and developing countries, particularly among children and young adults. Atopic illnesses are intertwined. The symptoms may appear in a predictable pattern in youngsters known as the atopic march or allergic march. Symptoms can last for years or even decades and often fade away on their own as people get older. The presence of one atopic disorder is linked with the development of a second atopic disorder. Sequential occurrence of atopic disorders, on the other hand, is more likely to occur because certain individuals have atopic disorders that are impacted by successive exposure to environmental stimuli (8). Due to their high frequency and related clinical and social cost, allergic disorders such as asthma, rhinitis, and eczema have turned into a worldwide public health challenge. The International Study of Asthma and Allergies in Children provides a once-in-a-lifetime chance to investigate trends in the prevalence of allergic disorders and related risk factors in children across time. According to reports based on the International Study of Asthma and Allergies in Children survey, there are differences in the distribution of allergy disorders both between and within nations. For example, the 12-month prevalence of eczema, asthma, and rhinitis symptoms in children aged 13 to 14 years ranged from 0.2% to 24.6%, 3.4% to 31.2%, and 4.5% to 45.1%, respectively. Despite the fact that allergic disorders can be considered as separate entities, multimorbidity which is coexistence and cooccurrence is a common event (9).

### *Global prevalence of asthma, rhinitis and eczema*

Over the last two decades, the incidence of asthma, rhinitis, and eczema has increased globally. Results of a nation-wide survey in Taiwan in 2010 reported that atopic dermatitis, allergic rhinitis, and asthma were shown to be prevalent in 6.7%, 26.3%, and 11.9% of the population, respectively, across an eight-year period. Atopic dermatitis patients were more likely to suffer from allergic rhinitis and asthma. Those who

had both atopic dermatitis and allergic rhinitis were more likely to develop asthma odds ratio (OR) 9.04 (10). Results of another nation-wide survey conducted in Korea in 2022 showed that asthma was shown to be prevalent in 0.9% of infants, 2.3% of pre-schoolers, 4.1% of school-aged children, 2.3% of adults, and 4.1% of the elderly. Allergic rhinitis was projected to affect 9.0%, 20.2%, 27.6%, 17.1%, and 6.9% of the population, correspondingly. Atopic dermatitis was projected to affect 5.9%, 11.3%, 14.6%, 3.9%, and 1.6% of the population, respectively. The prevalence of asthma in infants, preschool children, and the elderly has decreased significantly during the last ten years. increase in the frequency of atopic dermatitis in infants and pre-schoolers ( $P=0.05$  for all trends). Furthermore, 10-year trends revealed a substantial increase in the prevalence of allergic rhinitis in school-aged children, adults, and the geriatric population, as well as atopic dermatitis in school-aged children and the elderly ( $P=0.05$  for all trends) (11). Results of a population-based survey conducted in Bangladesh in 2021 revealed that children aged 2 years old had the highest frequency of 20.1%. for asthma. The prevalence then fell to 2.2% in the 15–19-year age groups. For rhinitis, the frequency of under-5 children was high in the 2-year and 4-year age groups contributing to 4.8% (12).

Findings of a cross-sectional study conducted in Andean city in 2020 among children aged 3-5 years revealed that asthma symptoms were reported by 18% of children, rhinitis by 48%, and eczema by 28%, with skin prick test reactivity by 33%. Asthma, rhinitis, and eczema population fractions attributable to skin prick test were 3.4%, 7.9%, and 2.9%, respectively. In multivariable models, children with a maternal history of rhinitis OR 1.85, rhinitis was significantly increased in children of high socioeconomic status compared to children of low socioeconomic status (OR 2.09), among several children with a maternal history of rhinitis (OR 2.29) or paternal history of eczema (OR 2.07), but was reduced in children attending day-care (OR 0.64); eczema was associated with a paternal history (OR 3.73) (13). Results of another cross-sectional study conducted in Bolivia in 2014 showed that the average age of the children was eleven years. In urban regions, 16.4% of people had asthma symptoms after a year, compared to 21.7% in rural areas. The frequency of rhinitis symptoms was significant, with 22% of children in urban schools and 24% of children in rural schools experiencing rhino conjunctivitis symptoms in the previous 12 months. In urban schools, the prevalence of eczema was higher than in rural schools after a year 12% vs. 9%. The prevalence

of severe eczema over a 12-month period was extremely low 1.6% in children from urban schools, 0.5% in children from rural schools (14).

Results of a survey conducted in India in 2017 among children of age 3-15 years showed that allergic rhinitis was observed in 29.04% of children, atopic dermatitis in 9.84%, and asthma in 8.5% (15). Results of another cross-sectional survey conducted in 2012 in Seoul revealed that among the 31,201 children studied, the frequency of atopic dermatitis manifestations in the previous 12 months was 19.3% in children aged 0 to 3, 19.7% in children aged 4 to 6, 16.7% in children aged 7 to 9, and 14.5% in children aged 10 to 13 (p for trend 0.001). Asthma prevalence was 16.5%, 9.8%, 6.5%, and 5.4% in these age categories, respectively (p for trend 0.001). Allergic rhinitis was seen in 28.5%, 38.0%, 38.5%, and 35.9% of these age groups, correspondingly (p for trend = 0.043). 2.5% had both atopic dermatitis, while both asthma and allergic rhinitis contributed to 4.7%, and 8.7% of participants suffered from both atopic dermatitis and allergic rhinitis, respectively. With increasing age, the prevalence of concomitant allergy illnesses reduced (p for trend 0.001) (16). Results of a cross-sectional survey from Denmark in 2013 showed that asthma and hay fever prevalence increased with age; asthma prevalence climbed from 3.2% among children aged 3 to 15.4 % among children aged 15; hay fever prevalence increased from 3.1% among children aged 3 to 21.3 % among children aged 15 years. Atopic eczema prevalence did not differ by age, ranging from 15.5 % to 17.8 % (17).

#### ***Prevalence of asthma, rhinitis and eczema in Gulf Cooperation Council Countries***

Findings of a systematic review assessing the prevalence among children on Arabian peninsula in 2018 exhibited that the overall incidence rate for asthma varied from 8% to 23%, whereas the prevalence of eczema was reported to be between 7.5% and 22.5 %. The prevalence estimates of rhinoconjunctivitis, ranging from 6.3% to 30.5 %, was highly variable (8). Results of a cross-sectional study conducted in United Arab Emirates in 2021 showed that among the 6 to 7-year-old cohort, asthma contributed to 11.9%, wheezing (44.2%), allergic rhinitis (46.5%), hay fever (22.1%), and atopic dermatitis was observed in 12.9% of the participants while the frequency for asthma (9.8%), wheezing (33.1%), allergic rhinitis (51.3%), hay fever (19.9%), and atopic dermatitis was (14.6%) in the 13- to 14-year-old age group, respectively (18). Results of another study in 2022 among pre-school children in United Arab

Emirates reported that 26.5% participants suffered from asthma, the prevalence estimate for rhinitis was 40.5% and for eczema experienced ever was 58% (19). A cross-sectional study conducted in Bahrain in 2014 among 6–7-year-old children showed that the frequency of asthma was 10.8%, allergic rhinitis contributed to 16.5% while eczema was reported in 9.8% participants (20). Results of a cross-sectional study from Qatar in 2022 reported the prevalence of 34.6% for asthma, 30.9% for rhinitis and 37.4% for eczema among study participants (21). Findings of a cross-sectional study conducted in Saudi Arabia in 2016 revealed that the frequency of asthma was 27.5%, 6.3% for rhinitis and 12.5% for eczema (22). Another cross-sectional study from Madinah in 2012 showed that eczema was prevalent in 10.3%, rhinitis in 24.2% and asthma in 23.6% of the study participants (23). Results of a review in 2016 stated that asthma prevalence in the gulf region ranged from 10% to 30%, with Saudi Arabia having the highest prevalence of 23%. In Morocco and Qatar, allergic rhinitis and eczema were the most common, affecting 38% and 23%, respectively (24). A better knowledge of the incidence of atopic diseases in children has been aided by research on the epidemiology of these disorders and literature is also well-established however there is shortfall in research and data regarding prevalence of atopic diseases among children in Gulf countries, more epidemiological, population-based studies are needed to be conducted that will help in designing better prevention and management strategies

#### **Conclusion**

The prevalence of asthma, rhinitis and eczema among children is high and varies across different geographical regions hence, effective prevention and management approach is need of time. More epidemiological population-based surveys in future can contribute to generation of evidence-based strategies for the prevention and management of these diseases and will also play a pivotal role in creating awareness among parents.

#### **Disclosure**

##### ***Statement:***

The authors declare no conflict of interest.

##### ***Funding:***

No funding.

##### ***Ethical consideration:***

Non-applicable.

**Data availability:**

Data that support the findings of this study are embedded within the manuscript.

**Authors' contribution:**

All authors contributed equally to the drafting, writing, sourcing, article screening and final proofreading of the manuscript.

**References**

1. Moreno MA. Atopic Diseases in Children. *JAMA PEDIATRICS*. 2016;170(1):96.
2. Pols DH, Wartna JB, van Alphen EI, Moed H, Rasenberg N, Bindels PJ, et al. Interrelationships between Atopic Disorders in Children: A Meta-Analysis Based on ISAAC Questionnaires. *PloS one*. 2015;10(7):e0131869.
3. Bantz SK, Zhu Z, Zheng T. The Atopic March: Progression from Atopic Dermatitis to Allergic Rhinitis and Asthma. *Journal of clinical & cellular immunology*. 2014;5(2).
4. Thomsen SF. Epidemiology and natural history of atopic diseases. *European clinical respiratory journal*. 2015;2.
5. Grad R, Morgan WJ. Long-term outcomes of early-onset wheeze and asthma. *The Journal of allergy and clinical immunology*. 2012;130(2):299-307.
6. Shi H, Wan G, Wang T, Zhu J, Jiang L, Ma S, et al. Prevalence and influencing risk factors of eczema among preschool children in Urumqi city: a cross-sectional survey. *BMC Pediatrics*. 2021;21(1):347.
7. Mahnashi TA, Faqihi MA, Moafa AN, Basudan AA, Alhazmi MN, Khawaji AF, et al. Severity and prevalence of allergic rhinitis among school children, Jazan Region Saudi Arabia. *Journal of family medicine and primary care*. 2019;8(2):663-8.
8. Al-Herz W. A Systematic Review of the Prevalence of Atopic Diseases in Children on the Arabian Peninsula. *Medical Principles and Practice*. 2018;27(5):436-42.
9. Ziyab AH. Prevalence and Risk Factors of Asthma, Rhinitis, and Eczema and Their Multimorbidity among Young Adults in Kuwait: A Cross-Sectional Study. *BioMed Research International*. 2017;2017:2184193.
10. Hwang CY, Chen YJ, Lin MW, Chen TJ, Chu SY, Chen CC, et al. Prevalence of atopic dermatitis, allergic rhinitis and asthma in Taiwan: a national study 2000 to 2007. *Acta dermato-venereologica*. 2010;90(6):589-94.
11. Ha J, Lee SW, Yon DK. Ten-year trends and prevalence of asthma, allergic rhinitis, and atopic dermatitis among the Korean population, 2008-2017. *Clinical and experimental pediatrics*. 2020;63(7):278-83.
12. Pedersen CJ, Uddin MJ, Saha SK, Darmstadt GL. Prevalence of atopic dermatitis, asthma and rhinitis from infancy through adulthood in rural Bangladesh: a population-based, cross-sectional survey. *BMJ Open*. 2020;10(11):e042380.
13. Ochoa-Avilés C, Morillo D, Rodriguez A, Cooper PJ, Andrade S, Molina M, et al. Prevalence and risk factors for asthma, rhinitis, eczema, and atopy among preschool children in an Andean city. *PloS one*. 2020;15(7):e0234633.
14. Solis Soto MT, Patiño A, Nowak D, Radon K. Prevalence of asthma, rhinitis and eczema symptoms in rural and urban school-aged children from Oropeza Province - Bolivia: a cross-sectional study. *BMC Pulmonary Medicine*. 2014;14(1):40.
15. Veerapaneni V, Jayaraj B, K S L, Chaya S, Veerapaneni V, Holla A, et al. Prevalence of Allergic Rhinitis, Atopic Dermatitis and Asthma among school children in Hyderabad, India 2017. AB205 p.
16. Hong S, Son DK, Lim WR, Kim SH, Kim H, Yum HY, et al. The prevalence of atopic dermatitis, asthma, and allergic rhinitis and the comorbidity of allergic diseases in children. *Environmental health and toxicology*. 2012;27:e2012006.
17. Hammer-Helmich L, Linneberg A, Thomsen SF, Glümer C. Association between parental socioeconomic position and prevalence of asthma, atopic eczema and hay fever in children. *Scandinavian journal of public health*. 2013;42(2):120-7.
18. Ibrahim NM, Almarzouqi FI, Al Melaih FA, Farouk H, Alsayed M, AlJassim FM. Prevalence of asthma and allergies among children in the United Arab Emirates: A cross-sectional study. *The World Allergy Organization journal*. 2021;14(10):100588.
19. Shamssain M, Alhamadi A, Nezar Al Afandi S, Naeem Awadallah T, Naeem Awadallah S. Prevalence and Severity of Asthma, Rhinitis and Eczema in Pre-School Children in the United Arab Emirates. *Athens Journal of Health and Medical Sciences*. 2022.

20. Al-Sindi H, Malla M, Bu-Saibaa A, Sharaf B, Jawad JS, Karim OA. Prevalence of asthma and allergic diseases in children aged 6-7 in the Kingdom of Bahrain. *Journal of the Bahrain Medical Society*. 2014;25:71-4.

21. Hammoudeh S, Hani Y, Alfaki M, Omar N, El Dimassi D, Nowir K, et al. The prevalence of asthma, allergic rhinitis, and eczema among school-aged children in Qatar: A Global Asthma Network Study. *Pediatric pulmonology*. 2022.

22. Alqahtani JM. Asthma and other allergic diseases among Saudi schoolchildren in Najran: the need for a