ORIGINAL RESEARCH ARTICLE

Evaluation of Demographic Characteristics, Clinical Symptoms, and Complications of Allergic Rhinitis in Patients Visiting Allergy Clinics

Amirhossein Ebrahimdokht[1], Mir Reza Ghaemi[1], Hamidreza Houshmand[1]

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Abstract

Background Rhinitis is a disorder of the upper respiratory tract that is characterized by symptoms such as rhinorrhea, itching, sneezing, and nasal congestion. Given the high prevalence of allergic rhinitis among children and adolescents reported in previous studies and its clinical importance, this study was conducted to assess the demographic characteristics, clinical signs, and complications of allergic rhinitis in patients referred to the allergy clinics of Urmia University of Medical Sciences during 2022-2023.

Methods This cross-sectional study was conducted on all children and adolescents under the age of 18 who visited the allergy clinics of Urmia University of Medical Sciences in 1401 and were diagnosed with allergic rhinitis. Demographic information, complications, and any diagnosis of asthma were reviewed and recorded. Data were analyzed using SPSS software version 22.

Results A total of 193 children (mean age: 9.9 ± 3.8 years, 64.8% male) diagnosed with allergic rhinitis participated in the study. Sneezing was reported as the most common clinical complaint. In addition, sleep disturbances (60.1%) and sinusitis (47.2%) were identified as the two most frequent complications. Asthma was also concurrently diagnosed in 15.5% of the patients.

Conclusion Sinusitis and asthma were found to be relatively prevalent as complications and coexisting conditions in children and adolescents with allergic rhinitis. Simultaneous management and control of these conditions can significantly improve the quality of life in affected children.

Keywords Adolescents, Allergic rhinitis, Asthma, Atopy, Child, Sinusitis

✉ Mir Reza Ghaemi
ghaemi.m@umsu.ac.ir

1. Department of Pediatric Disease, School of Medicine, Urmia University of Medical Sciences, Urmia, Iran

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1 Introduction

Rhinitis is a respiratory disorder of the upper airway, characterized by rhinorrhea, itching, sneezing, and nasal congestion. Allergic rhinitis (AR) and non-allergic rhinitis are classifications based on clinical manifestations and sensitivity to common allergens. In another classification, rhinitis is divided into two types: intermittent and persistent. Patients with intermittent rhinitis experience symptoms fewer than four days per week or for less than four weeks per year, while those with persistent rhinitis have symptoms for more than four days per week and more than four weeks per year.[1] Atopic dermatitis is a chronic skin disorder that leads to dryness, itching, and inflammation. It is frequently seen in young children but can develop at any age. In many cases, symptoms of atopic dermatitis flare up periodically, during which patients often scratch their skin.[2-4]

Allergic rhinitis or allergic rhinosinusitis typically presents with sneezing, nasal discharge, and congestion, and is often accompanied by itching of the eyes, nose, and palate. Postnasal drip, coughing, irritability, and fatigue are also among the common symptoms.[3] This condition develops as a result of a hypersensitivity reaction caused by inhaled particles contacting the nasal mucosa, triggering an inflammatory response mediated by immunoglobulin E (IgE).[2] IgE-mediated immune mechanisms play a key role by releasing mediators that are responsible for allergic symptoms.[4]

AR is often underdiagnosed for several reasons, including the similarity of its symptoms to the common cold, the lack of physician consultation by parents, and the use of over-the-counter medications.[5]

Although allergic rhinitis is not life-threatening by itself, it is associated with various morbidities and comorbid conditions. These can significantly affect a patient's quality of life, disrupting daily activities both socially and financially.

Risk factors for allergic rhinitis may range from smoking and alcohol use, pet ownership, and living in polluted environments, to a family history of the condition.

Numerous studies have shown that the Middle East has a high presence of allergens and a greater incidence of allergic diseases, which may contribute to the elevated prevalence of allergic rhinitis in the region.[6]

Several studies have reported that allergic rhinitis coexists with asthma in approximately 50–60% of cases.[7] Managing AR in adults and children with concurrent asthma can enhance asthma control and reduce hospital admissions.[8] Untreated allergic rhinitis may predispose children to sinusitis, otitis media, and hearing loss (due to Eustachian tube dysfunction), adenoid hypertrophy, and sleep disorders, negatively impacting school performance.[9,10] A strong association between nasal allergy and these conditions has been confirmed by extensive epidemiological evidence. Comparable models have been suggested to explain the pathophysiological links between allergic rhinitis, sinusitis, and otitis media. In such models, inflammation from nasal allergy or viral infection results in blockage, fluid buildup, bacterial infection, and acute illness.[11]

Allergic rhinitis is widespread, affecting 10–30% of children and adults in the United States and other industrialized nations.[12] It may be less common in some parts of the world, though even developing countries report significant prevalence rates.[13,14] In the ISAAC (International Study of Asthma and Allergies in Childhood), the prevalence of asthma, rhinoconjunctivitis, and eczema was systematically assessed in around 1.2 million children across 98 countries, with rhinoconjunctivitis rates of 8.5% and 14.6% in children aged 6–7 and 13–14, respectively.[15] In Iran, the prevalence of allergic rhinitis has also been reported as 18% in children and 25% in adults.[16]

The prevalence of these allergy-based diseases is increasing worldwide, especially in industrialized countries and urban areas.[17] It is unlikely that changes in genetic factors are the main cause of the rise in allergic diseases since the increase in allergic rhinitis and asthma has occurred rapidly. Instead, multiple environmental factors may play a role. These include improvements in hygiene, eradication of most parasitic infections, changes in home heating and ventilation, reduced physical activity, and dietary changes due to lifestyle shifts. Although a complete understanding of the potential role of epigenetic changes in the rise of allergic diseases is lacking, several studies suggest that exposure to environmental factors related to specific epigenetic changes can lead to allergic phenotypes.[18]

Various national studies have examined the clinical and demographic characteristics of children with allergic rhinitis and the prevalence of the disease.[19-35] A recent study conducted in Sanandaj aimed to investigate the prevalence of allergic rhinitis in children and adolescents by distributing 4,000 questionnaires in elementary and middle schools. The results showed that 29.7% of respondents reported sneezing and runny nose in the past twelve months, with the highest frequency among boys aged 13–14. Additionally, based on clinical diagnosis by physicians, 37.9% of the children studied had allergic rhinitis, with a higher prevalence among boys in elementary and middle school compared to girls.[31] Another study conducted in Ahvaz reported the prevalence of asthma symptoms, allergic rhinitis, and eczema in children and adolescents as 14.1%, 18.2%, and 8.4%, respectively. No significant gender differences were reported, but the prevalence of these conditions was significantly higher among middle school students than

elementary school students.[10]

Given the high prevalence of allergic rhinitis among children and adolescents based on previous studies and the importance of obtaining a comprehensive overview of the clinical status, symptoms, and complications, as well as the lack of similar studies in West Azerbaijan province, the present study was designed and conducted to determine the demographic findings, clinical symptoms, and complications of allergic rhinitis in patients referred to allergy clinics of Urmia University of Medical Sciences in 2022-2023.

2 Methods

This study is cross-sectional. After obtaining ethical approval from the Ethics and Research Committee of Urmia University of Medical Sciences, all children and adolescents under 18 years old who visited the allergy clinics of Urmia University of Medical Sciences during 2022-2023 and were diagnosed with allergic rhinitis were enrolled in the study. The diagnosis of allergic rhinitis was based on clinical complaints and symptoms such as sneezing, itching, rhinorrhea, nasal congestion, the Salute sign, and Dennie Morgan line, as assessed by the collaborating allergy subspecialist. After the initial evaluation for eligibility criteria and obtaining informed consent from their parents, patients were included in the study. The Dennie Morgan line is defined as a narrow crease or fold beneath the lower eyelid (infraorbital) commonly seen in individuals with allergic conditions including eczema and allergic rhinitis. The Salute sign refers to the repeated upward rubbing of the nose with the palm, frequently observed in allergic rhinitis patients. In this study, allergic rhinitis was classified according to symptom duration into seasonal or intermittent allergic rhinitis (symptoms fewer than four days per week and less than four weeks per year) and perennial allergic rhinitis (symptoms more than four days per week and more than four weeks per year). Asthma diagnosis concurrent with allergic rhinitis was determined by clinical findings (wheezing, chest tightness, auscultation of wheezing) along with spirometry results in children older than five years and symptom response to salbutamol spray in children younger than five years, assessed and recorded by the allergy subspecialist collaborator. Demographic data were collected through parental questionnaires using a checklist designed by the researcher. Patients were also examined for secondary complications of allergic rhinitis including sinusitis, adenoid hypertrophy, and sleep disturbances, with findings recorded in the checklist.

Sinusitis diagnosis was based on clinical signs such as headache, facial fullness, and clear postnasal drip (PND); confirmation required at least two symptoms plus either paranasal sinus CT imaging (if available) or anterior rhinoscopy.

In this study, the inclusion criteria were age under 18 years and diagnosis of allergic rhinitis according to existing criteria and the opinion of the asthma and allergy specialist collaborating in the project. The exclusion criteria were incompleteness of the required information, lack of consent to participate in the project by the parents or patient, the presence of underlying diseases such as cystic fibrosis, cerebral palsy, immunodeficiency, and the presence of other differential diagnoses such as infectious rhinosinusitis and non-allergic rhinitis.

Finally, the collected data were properly coded and entered into SPSS version 22 software and analyzed according to the study objectives.

3 Results

Figure 1 shows the patient enrollment process for the study. During the study period (2022-2023), 214 children diagnosed with allergic rhinitis (based on clinical symptoms and the opinion of the asthma and allergy subspecialist) were referred to the allergy clinics of Urmia University of Medical Sciences and underwent initial evaluation. Among them, 15 children were excluded due to inflammatory underlying diseases. Additionally, six children were excluded because of incomplete information or lack of cooperation from parents in providing the required data. Ultimately, 193 children with allergic rhinitis were enrolled in the study.

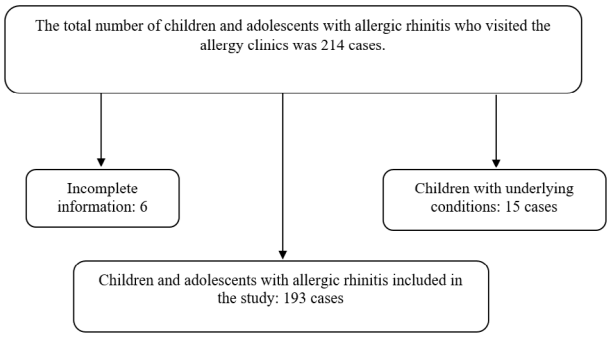

Figure 1 Flowchart of patient enrollment in the study

The mean age of the patients in the study was 9.9 ± 3.8 years, ranging from 3 to 17 years. Table 1 shows the demographic characteristics of the children and adolescents with allergic rhinitis included in the study. About half of the children (56%) were of school age, with 31.6% over 12 years old and 12.4% under 6 years old. Additionally, more than half of the children and adolescents were boys (64.8%). Most patients (83.4%) lived in urban areas, while only 32 children resided in rural regions.

Table 1 Demographic characteristics of the patients studied

Variable		Frequency (percentage)
Age Group	Before school[1]	24 (12.4%)
	School ages[2]	108 (56%)
	Adolescence[3]	61 (31.6%)
Gender	Boy	125 (64.8%)
	Girl	68 (35.2%)
Place of Residence	City	161 (83.4%)
	Village	32 (16.6%)

(1): Under 6 years old, (2): Between 6 and 12 years old, (3): Over 12 years old

Table 2 shows the basic birth and growth characteristics of the patients studied. More than half of the patients were born via natural delivery (57%), and during infancy, 64.2% were breastfed. Additionally, 16.1% and 17.6% of the patients were fed with a combination of breast milk and formula, and formula alone, respectively, during childhood. The average birth weight of the patients was 3449.7 ± 592.7 grams, ranging from 2300 g to 5000 g. Furthermore, the average height and weight of the patients were 144.3 ± 7.2 cm and 40.10 ± 12.18 kg, respectively.

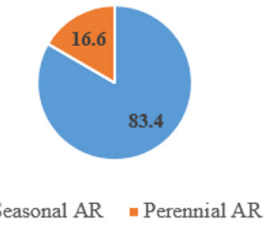

Figure 2 Frequency of allergic rhinitis types in the studied patients

Figure 3 shows the frequency of seasonal allergic rhinitis distributed by seasons of the year. Among 161 children with seasonal allergic rhinitis, symptoms were most commonly present in the spring (72 cases, 44.7%), followed by autumn (40 cases, 24.8%) and spring–summer (23 cases, 14.3%).

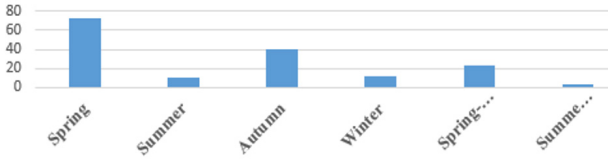

Figure 3 Frequency of seasonal allergic rhinitis in the studied patients

Table 2 Basic birth and growth characteristics of the patients studied

Variable		Frequency (percentage)
Infant feeding*	Breastfeeding	124 (64.2%)
	Formula feeding	34 (17.6%)
	Combination of breastfeeding and formula feeding	31 (16.1%)
Type of birth*	Natural delivery (Vaginal birth)	110 (57%)
	Cesarean section (C-section)	79 (40.9%)
variable		Mean ± Standard deviation (range)
Birth weight (grams)		(2300-5000) 3449.4 ± 592.7
Current weight (kilograms)		(14-90) 14.01 ± 18.12
Current height (centimeters)		(95-185) 144.3 ± 21.7
Body Mass Index (Kg/m²)		(31.1-12.3) 17.7 ± 4.3

* For four patients in the study, information on the type of feeding and delivery method was not available

Regarding the frequency of clinical symptoms in children and adolescents with allergic rhinitis under study, sneezing, with a frequency of 95.9%, was the most common symptom among the patients. Additionally, nasal discharge and nasal itching were reported in 88.6% and 87.6% of patients, respectively. The clinical signs Dannie Morgan line and Salute sign were observed in 83.9% and 64.8% of patients, respectively.

Figure 2 shows the frequency of types of allergic rhinitis (seasonal or perennial) based on the duration of symptoms throughout the year. Most patients in the study had seasonal allergic rhinitis, while only 32 cases (16.6%) exhibited longer-lasting symptoms consistent with perennial allergic rhinitis.

Figure 4 presents the frequency of secondary complications associated with allergic rhinitis in the patients. Sleep disturbance and sinusitis were the two most common complications, reported in 60.1% and 47.2% of patients, respectively. Additionally, otitis media and adenoid hypertrophy were observed in 9.3% and 18.7% of patients, respectively.

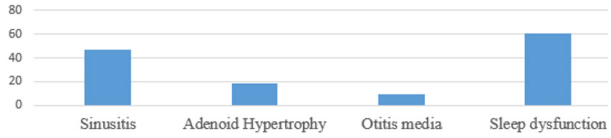

Figure 4 Frequency of secondary complications of allergic rhinitis in the studied patients

Illustrates the frequency of asthma, atopy, and positive family history of allergic rhinitis in the studied patients. Asthma was diagnosed concurrently in 15.5% of patients with allergic rhinitis. Atopy was present in 3.9% of patients. A positive family history of allergic rhinitis was reported in 7.48% of the cases.

4 Discussion

Allergic rhinitis is a type I allergic disease of the nasal mucosa, characterized by recurrent sneezing attacks, watery rhinorrhea, and nasal congestion. It is a highly prevalent disorder affecting individuals of all ages, reaching its peak during adolescence. This condition is often overlooked and underdiagnosed for various reasons, which leads to significant social and functional costs. It predisposes individuals to numerous complications, such as chronic sinusitis, and when associated with asthma, it can disrupt asthma symptom control and severely reduce patients' quality of life. Given the critical importance of accurate diagnosis of allergic rhinitis—especially in children and adolescents—to prevent secondary complications and improve their functional status, the present study was designed and conducted in 2022-2023 at the allergy clinics of Urmia University of Medical Sciences. The study aimed to identify the demographic characteristics, clinical symptoms, and complications of allergic rhinitis in patients attending these clinics to develop a clearer picture of allergic rhinitis cases in the province and to use these findings to facilitate earlier diagnosis and better management of patients.

The results showed that most children with allergic rhinitis were school-aged, with an average age of about 10 years. The frequency of boys affected was higher than that of girls, and children living in urban areas were more frequently affected than those in rural areas. Consistent with these findings, epidemiological studies indicate that nearly half of adult patients with allergic rhinitis report initial symptoms between the ages of six and 10.[33] A study by Sedaghat et al. also aligns with the current findings, showing the average age of children diagnosed with allergic rhinitis to be approximately 8.9 years, with a higher prevalence among boys than girls.[34] Furthermore, a meta-analysis conducted in Iran found a higher prevalence of allergic rhinitis in boys compared to girls, consistent with our results.[32] Two other studies conducted in Syria.[1] and Iran's Kurdistan province.[31] also reported a significantly higher prevalence of allergic rhinitis among boys compared to girls, echoing our findings. This gender difference may be rooted in cultural factors, where boys tend to spend more time outdoors and play in various environments, possibly leading to greater exposure to allergens. Previous research similarly supports these observations, indicating that allergic diseases such as asthma, eczema, and allergic rhinitis are more prevalent in males during childhood; however, as age increases, the prevalence rises among females relative to males. Despite this, the prevalence of allergic rhinitis remains higher in adult males compared to females.[23] Although some studies, such as Çobanoğluet al.'s research in Turkey, present contrasting results—identifying female gender as a risk factor for allergic rhinitis among adolescents aged 12 to 15 (22)—such differences highlight the importance of detailed regional epidemiological assessments based on gender and age for designing effective therapeutic and preventive strategies. Moreover, consistent with our findings, comprehensive studies have shown that urban residents are at greater risk of developing allergic rhinitis compared to rural inhabitants, possibly due to higher exposure to air pollution. For instance, a study in Turkey found that atopy and positive Prick test results were approximately twice as common in urban populations compared to rural ones.[21] Similarly, research on adults indicates that the risk of allergic rhinitis correlates with the level of urbanization throughout life, especially during early life stages. The hygiene hypothesis and the beneficial effects of sustained exposure to microbial diversity during early childhood might explain these observations.[20] Additionally, differences in lifestyle and diet between rural and urban children may influence the occurrence of atopic and allergic symptoms, especially in adulthood.[35] According to our study, most children with allergic rhinitis experienced seasonal symptoms rather than perennial ones, with the highest symptom prevalence occurring in spring and autumn. This aligns with the study by Mohammadpour et al. (2017, Babol), which also reported the highest frequency of allergic rhinitis symptoms in spring.[28] Similarly, a study in Spain showed two seasonal peaks in allergic rhinitis symptoms among children: spring–summer and summer–autumn, supporting our findings.[19] In the 2014 study by Mahboub et al. in the United Arab Emirates, seasonal allergic rhinitis symptoms peaked in spring; however, unlike our findings, a relatively high prevalence was also noted in winter, likely due to geographic and climatic differences. The present study also identified sleep disorders and sinusitis as common complications in patients with allergic rhinitis. Additionally, otitis media and adenoid hypertrophy were reported at frequencies of 9.3% and 18.7%, respectively. Asthma was concurrently diagnosed in 15.5% of the patients. Jalali et al.'s study similarly reported a significant association between sinusitis and allergic rhinitis.[24] Conversely, Masoumi et al.'s research on children undergoing adenoid hypertrophy surgery found no significant difference in allergic rhinitis prevalence between those with and without hypertrophy, which is consistent with the relatively low prevalence of

adenoid hypertrophy observed in our study.[36] Higuchi et al. also reported a close relationship between asthma and allergic rhinitis in children, indicating that simultaneous evaluation of asthma in children with allergic rhinitis symptoms could improve management of both conditions.[37] Studies on children with asthma further suggest that allergic rhinitis is likely the most important risk factor for asthma onset and the most influential extrabronchial factor in asthma control.[38] Regarding otitis media, Norhafizah et al. showed that allergic rhinitis is a key risk factor for otitis media with effusion in children, where significant hearing loss was observed in children suffering from both conditions. With appropriate simultaneous treatment of otitis media and allergic rhinitis, hearing thresholds significantly improved.[39]

5 Conclusion

The results of the present study showed that the most common age for children with allergic rhinitis symptoms to visit healthcare centers is the school-entry age. This may be due to the increased importance of symptoms that disrupt quality of life at this age, particularly because of their negative impact on the child's sleep and academic performance. On the other hand, sinusitis and asthma were relatively common as complications and comorbidities in children and adolescents with allergic rhinitis. Simultaneous control and management of these conditions can significantly improve children's quality of life.

It is recommended that future prospective studies include a control group of children without allergic rhinitis symptoms to more accurately determine the relationship between underlying factors, complications, and comorbidities associated with allergic rhinitis in children, thereby aiding in better management of these patients. Furthermore, given the relatively high prevalence of sinusitis and asthma in children with seasonal allergic rhinitis symptoms, it is suggested that these two conditions be carefully evaluated simultaneously.

Declarations

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The above article is taken from Amirhossein Ebrahimdokht's medical thesis. Special thanks and appreciation are extended to the Research Department of Motahari Hospital, Urmia, for their valuable cooperation in this study.

Artificial Intelligence Disclosure
The authors declare that no artificial intelligence (AI) tools were used in the preparation or writing of this manuscript.

Authors' Contributions
Mir Reza Ghaemi conducted the methodology, sampling, data curation, and statistical analysis. Amirhossein Ebrahimdokht wrote the original draft. Mir Reza Ghaemi conducted investigation and resources.

Availability of Data and Materials
All the data obtained from this study are included in the text of the article.

Conflict of Interest
The authors have no conflicts of interest associated with the material presented in this paper.

Consent for Publication
Not applicable.

Ethical Considerations
The study protocol was approved by the institutional ethics committee of Urmia University of Medical Sciences, Urmia, Iran with the Code of Ethics IR.UMSU.REC.1401.174.

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References

1. Kakaje A, Alhalabi MM, Alyousbashi A, Hamid A, Hosam Aldeen O. Allergic Rhinitis and Its Epidemiological Distribution in Syria: A High Prevalence and Additional Risks in War Time. Biomed Res Int. 2020; 2020: 7212037. doi:10.1155/2020/7212037.
2. Bousquet J, Khaltaev N, Cruz AA, Denburg J, Fokkens W, Togias A, et al. Allergic rhinitis and its impact on asthma (ARIA) 2008. Allergy. 2008; 63: 8-160. doi:10.1111/j.1398-9995.2007.01620.x.
3. Dykewicz MS, Wallace DV, Amrol DJ, Baroody FM, Bernstein JA, Craig TJ, et al. Rhinitis 2020: a practice parameter update. J Allergy Clin Immunol. 2020; 146(4): 721-767. doi:10.1016/j.jaci.2020.07.007.
4. Wang D-Y. Risk factors of allergic rhinitis: genetic or environmental? Ther Clin Risk Manag. 2005; 1(2): 115-123. doi:10.2147/tcrm.1.2.115.62907.
5. Turner PJ, Kemp AS. Allergic rhinitis in children. J Paediatr Child Health. 2012; 48(4): 302-310. doi:10.1111/j.1440-

1754.2010.01779.x.

6. Chong SN, Chew FT. Epidemiology of allergic rhinitis and associated risk factors in Asia. World Allergy Organ J. 2018; 11: 17. doi:10.1186/s40413-018-0198-z.
7. Hamouda S, Karila C, Connault T, Scheinmann P, De Blic J. Allergic rhinitis in children with asthma: a questionnaire-based study. Clinical & Experimental Allergy. 2008; 38(5): 761-766. doi:10.1111/j.1365-2222.2008.02953.x.
8. Taramarcaz P, Gibson P. The effectiveness of intranasal corticosteroids in combined allergic rhinitis and asthma syndrome. Clin Exp Allergy. 2004; 34(12): 1883-1889. doi:10.1111/j.1365-2222.2004.02130.x.
9. Adegbiji WA, Olajide GT, Olajuyin AO, Aremu SK, Olusola AG. Pattern of allergic rhinitis among children in Ekiti, Nigeria. Int J Pediatr Otorhinolaryngol. 2018; 106: 75-79. doi:10.1016/j.ijporl.2018.01.014.
10. Yuksel H, Sogut A, Yilmaz H, Yilmaz O, Dinc G. Sleep actigraphy evidence of improved sleep after treatment of allergic rhinitis. Ann Allergy Asthma Immunol. 2009; 103(4): 290-294. doi:10.1016/S1081-1206(10)60527-3.
11. Meltzer EO. Allergic rhinitis: burden of illness, quality of life, comorbidities, and control. Immunol Allergy Clin North Am. 2016; 36(2): 235-248. doi:10.1016/j.iac.2015.12.002.
12. Meltzer EO, Blaiss MS, Derebery MJ, Mahr TA, Gordon BR, Sheth KK, et al. Burden of allergic rhinitis: results from the Pediatric Allergies in America survey. J Allergy Clin Immunol. 2009; 124(3): S43-S70. doi:10.1016/j.jaci.2009.05.013.
13. Kong WJ, Chen JJ, Zheng ZY, Shi QM, Zhou Y. Prevalence of allergic rhinitis in 3–6-year-old children in Wuhan of China. Clin Exp Allergy. 2009; 39(6): 869-874. doi:10.1111/j.1365-2222.2009.03206.x.
14. Lima RG, Pastorino A, Casagrande R, Sole D, Leone C, Jacob C. Prevalence of asthma, rhinitis and eczema in 6-7 years old students from the western districts of São Paulo City, using the standardized questionnaire of the "International Study of Asthma and Allergies in Childhood"(ISAAC)-phase IIIB. Clinics (Sao Paulo). 2007; 62(3): 225-234. doi:10.1590/S1807-59322007000300005.
15. Mallol J, Crane J, von Mutius E, Odhiambo J, Keil U, Stewart A, et al. The International Study of Asthma and Allergies in Childhood (ISAAC) phase three: a global synthesis. Allergol Immunopathol (Madr). 2013; 41(2): 73-85. doi:10.1016/j.aller.2012.03.001.
16. Kalmarzi RN, Ataee P, Fathollahpour A, Behzadifar M, Moradi M, Sharifian F, et al. The prevalence of allergic rhinitis among iranian children: A systematic review and meta-analysis. Endocr Metab Immune Disord Drug Targets. 2020; 20(2): 189-197. doi:10.2174/1871530319666190515100735.
17. Solé D, Cassol V, Silva A, Teche S, Rizzato T, Bandim L, et al. Prevalence of symptoms of asthma, rhinitis, and atopic eczema among adolescents living in urban and rural areas in different regions of Brazil. Allergologia et immunopathologia. 2007; 35(6): 248-253. doi:10.1157/13112991.
18. Bégin P, Nadeau KC. Epigenetic regulation of asthma and allergic disease. Allergy Asthma Clin Immunol. 2014; 10(1): 27. doi:10.1186/1710-1492-10-27.
19. Batlles-Garrido J, Torres-Borrego J, Rubi-Ruiz T, Bonillo-Perales A, Gonzalez-Jimenez Y, Momblan-De Cabo J, et al. Prevalence and factors linked to allergic rhinitis in 10 and 11-year-old children in Almeria. Isaac Phase II, Spain. Allergol Immunopathol. 2010; 38(3): 135-141. doi:10.1016/j.aller.2009.09.005.
20. Christensen SH, Timm S, Janson C, Benediktsdóttir B, Forsberg B, Holm M, et al. A clear urban–rural gradient of allergic rhinitis in a population-based study in Northern Europe. Eur Clin Respir J. 2016; 3(1): 33463. doi:10.3402/ecrj.v3.33463.
21. Cingi C, Cakli H, Us T, Akgün Y, Kezban M, Özudogru E, et al. The prevalence of allergic rhinitis in urban and rural areas of Eskişehir-Turkey. Allergologia et immunopathologia. 2005; 33(3): 151-156. doi:10.1157/13075698.
22. Çobanoğlu HB, Işık AÜ, Topbaş M, Ural A. Prevalence of allergic rhinitis in children in the Trabzon province of the black sea region of Turkey. Turkish archives of otorhinolaryngology. 2016; 54(1): 21. doi:10.5152/tao.2016.1089.
23. Fröhlich M, Pinart M, Keller T, Reich A, Cabieses B, Hohmann C, et al. Is there a sex-shift in prevalence of allergic rhinitis and comorbid asthma from childhood to adulthood? A meta-analysis. Clinical and translational allergy. 2017; 7(1): 44. doi:10.1186/s13601-017-0176-5.
24. Jalali MM, Nemati S, Nezamdoust F, Ramezani H. Frequency of allergic rhinitis and its comorbidities in patients attending Rasht Amiralmomenin Hospital in Rasht. Journal of Mazandaran University of Medical Sciences. 2019; 28(170): 194-199.
25. Karimi M, Mirzaei M, Ahmadieh M. Prevalence of Asthma, Allergic rhinitis and Eczema symptoms among 13-14 year-old school children in Yazd in 2003. 2007.
26. Katelaris CH, Lee BW, Potter PC, Maspero JF, Cingi C, Lopatin A, et al. Prevalence and diversity of allergic rhinitis in regions of the world beyond E urope and N orth A merica. Clinical & Experimental Allergy. 2012; 42(2): 186-207. doi:10.1111/j.1365-2222.2011.03891.x.
27. Mahboub B, Al-Hammadi S, Prakash VP, Sulaiman N, Blaiss MS, Redha AA, et al. Prevalence and triggers of allergic rhinitis in the United Arab Emirates. World Allergy Organization Journal. 2014; 7(1): 1-5. doi:10.1186/1939-4551-7-19.
28. Mohammadpour M, Mohammadi M, Dehestani A, Mohammadzadeh I. The survey of prevalence of allergic disorders in chronic sinusitis of children referred to infectious, immunologic and allergic diseases' clinic of Amirkola children's hospital in 2011-2012. 2017.
29. Mohammadzadeh I, Barari-Savadkoohi R, Alizadeh-Navaei R. The prevalence of allergic rhinitis in Iranian children: A systematic review and descriptive meta-analysis. Journal of Pediatrics Review. 2013; 1(2): 19-24.
30. Molatefi R, Ahadi A, Salehzadeh H, Safarzadeh E, Abbasi H. The prevalence of respiratory allergens in patients with asthma and allergic rhinitis in Ardabil province. 2020.
31. Nasiri R, Homagostar G, Tajik M, Shekari A, Roshani D, Ataei P, et al. Evaluation of prevalence of allergic rhinitis symptoms in Kurdistan, a Western Province in Iran. Journal of Pediatric Perspectives. 2015; 3(6.1): 1039-1046.
32. Rahimian N, Aghajanpour M, Jouybari L, Ataee P, Fathollahpour A, Lamuch-Deli N, et al. The Prevalence of Asthma Among Iranian Children and Adolescent: A Systematic Review and Meta-Analysis. Oxid Med Cell Longev. 2021; 2021(1): 6671870. doi:10.1155/2021/6671870.
33. Schuler IV CF, Montejo JM. Allergic rhinitis in children and adolescents. Immunol Allergy Clin North Am. 2021; 41(4): 613-625. doi:10.1016/j.iac.2021.07.010.
34. Sedaghat AR, Phipatanakul W, Cunningham MJ. Prevalence of and associations with allergic rhinitis in children with chronic rhinosinusitis. Int J Pediatr Otorhinolaryngol. 2014; 78(2): 343-347. doi:10.1016/j.ijporl.2013.12.006.
35. Tamay Z, Akcay A, Ergin A, Güler N. Dietary habits and

prevalence of allergic rhinitis in 6 to 7-year-old schoolchildren in Turkey. Allergol Int. 2014; 63(4): 553-562. doi:10.2332/allergolint.13-OA-0661.

36. Davari R, Pirzadeh A, Amani F, A SM. International Journal of Otorhinolaryngology and Head and Neck Surgery. Int J Otorhinolaryngol Head Neck Surg. 2022; 8(11): 879-882. doi:10.18203/issn.2454-5929.ijohns20222676.

37. Higuchi O, Adachi Y, Itazawa T, Ito Y, Yoshida K, Ohya Y, et al. Rhinitis has an association with asthma in school children. Am J Rhinol Allergy. 2013; 27(1): e22-e25. doi: 10.2500/ajra.2013.27.3846.

38. Tenero L, Vaia R, Ferrante G, Maule M, Venditto L, Piacentini G, et al. Diagnosis and management of allergic rhinitis in asthmatic children. J Asthma Allergy. 2023: 45-57. doi:10.2147/JAA.S281439.

39. Norhafizah S, Salina H, Goh B. Prevalence of allergic rhinitis in children with otitis media with effusion. Eur Ann Allergy Clin Immunol. 2020; 52(3): 121-130. doi:10.23822/EurAnnACI.1764-1489.119.