

ORIGINAL ARTICLE

Iran J Allergy Asthma Immunol

June 2021; 20(3):263-270.

Doi: 10.18502/ijaa.v20i3.6342

The Prevalence of Allergic Rhinitis in Southwestern Iran and Its Association with Chronic Rhinosinusitis: A GA²LEN Study

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Received: 14 October 2020; Received in revised form: 23 April 2021; Accepted: 27 April 2021

ABSTRACT

Allergic rhinitis (AR) is a prevalent disease affecting the quality of life of patients throughout the world. This study aimed to assess the prevalence of AR and its association with chronic rhinosinusitis (CRS) in the adult population living in Bushehr, southwestern part of Iran.

In this population-based study, a total of 5420 individuals aged 15-65 years were selected through a multi-stage, cluster, random sampling method from which 5201 of them completed the Global Allergy and Asthma Network of Excellence (GA²LEN) questionnaire (Response rate=96.1%). The prevalence of AR, based on Allergic Rhinitis and Its Impact on Asthma (ARIA) classification (mild or moderate; intermittent or persistent) was calculated and the association of AR and CRS was evaluated using a multiple logistic regression model.

The overall prevalence of AR was 28.8%, and for the intermittent and persistent AR were 25.9% (out of which 81.34% were moderate to severe) and 74.1% respectively. Moreover, the prevalence of AR was significantly higher in health workers and smokers ($p=0.002$ and $p<0.001$, respectively). Furthermore, an association was found between AR and CRS ($p<0.001$, aOR: 4.68, 95%CI: 4.07-5.39), and also, between the persistent AR and CRS as compared with the intermittent ($p<0.001$, aOR: 4.21, 95%CI: 3.40-5.22).

The present study showed that the prevalence of AR in Bushehr (Southwestern part of Iran) was significantly high. In addition, the results indicated a strong association between AR and CRS, especially in individuals with moderate to severe persistent AR.

Keywords: Allergic rhinitis; Asthma; Nasal polyps; Prevalence; Sinusitis

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INTRODUCTION

Allergic rhinitis (AR) is defined as a chronic inflammatory disease involving the nose and it is characterized by symptoms including sneezing, itching, runny or stuffy nose, which occurs when the immune system over-responds to aeroallergens.¹ The symptoms of AR are substantially important and certainly affect the quality of life (QOL) of patients.² The reports from the world health organization (WHO) have indicated that AR is the most common form of rhinitis affecting over 400 million adult populations throughout the world and its prevalence is on the rise.³

The recent studies reported the prevalence of AR in adults as 10- 30%.⁴⁻⁸ Moreover, the prevalence of AR in Europe has been reported by the European Community Respiratory Health Survey to be as 4 to 32 %.³ In Asian countries, there have been different rates of prevalence of AR which are on the rise.⁹ Additionally, the results of an investigation conducted in Iran by using a telephone interview survey reported the prevalence of AR as 26.7%.¹⁰

Chronic rhinosinusitis (CRS) is defined as an inflammation of nasal and paranasal sinuses mucosa lasting for 12 weeks or longer,¹¹ having two subtypes, with or without nasal polyposis().¹² Interestingly, the result of some investigations has shown a relationship between AR and CRS.¹³⁻¹⁵

For the epidemiological assessment of allergic diseases, a questionnaire has been developed by the Global Allergy and Asthma European Network (GA²LEN), which was funded by the European Union, and covers socio-demographic characteristics and allergic-related symptoms.¹⁶

Epidemiological studies have been used to identify the risk factors that may represent critical control points of the diseases. About the hot and humid climates of Bushehr province and the high prevalence of indoor and outdoor regional allergens and the lack of statistical data on the prevalence of AR, this study seems to be essential. Up to date, no reports have been given about the prevalence of AR in adults based on the standardized GA²LEN questionnaires in Iran. Therefore, the present study was designed to assess the prevalence of AR and its association with CRS in adults living in Bushehr (southwestern Iran), by using a standardized GA²LEN questionnaire.

MATERIALS AND METHODS

Study Design and Sampling

This study was a cross-sectional survey carried out in Bushehr city, the capital of Bushehr province (Southwestern Iran), and it was approved by the Ethics Committee of the Bushehr University of Medical Sciences in Bushehr, Iran (ethical approval code: IR.BPUMS.REC.1395.123).

We used a multistage, cluster, random sampling method to select 5420 individuals aged 15-65 years living in Bushehr to participate in the study. Based on the urban divisions of the municipality; the city has 75 distinct areas with different population densities. We selected the participants proportional to the households living in the area (Figure 1). The data for this study was obtained using the GA²LEN questionnaire¹⁴, which consisted of 23 questions, comprising upper and lower respiratory diseases, eczema, age, gender, education level, and the history of smoking. The questionnaire was translated to Persian and back-translated to English by a native translator. The face validity of the translated questionnaire was evaluated by experts to ensure that the questions were clear and understandable. The questionnaires were self-administered. They were personally delivered to the selected individuals to be completed, or their relatives in case they could not read and write. For the evaluation of validity and reliability, the content validity ratio (CVR), and content validity index (CVI) were determined; for doing so, 10 specialists reviewed the tool and scored each item based on the provided checklist. The mean of CVR and CVI for the questionnaire were 0.88 and 0.91, respectively, which were satisfactory. Cronbach's alpha coefficient was calculated in 30 participants to determine the reliability of the questionnaire. The Cronbach's alpha was 0.73, which showed acceptable reliability.

Relevant Epidemiologically Definitions According to the Questions in the GA²LEN Questionnaire

AR: epidemiologically positive answer to the question as having two or more of the symptoms for more than 1 hour per day: nasal running, blocking, itching, or sneezing.

Intermittent AR: having AR symptoms for less than 4 days in any one week.

Persistent AR: having AR symptoms for more than 4 days in any one week

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CRS: an inflammation of the nose and the paranasal sinuses, in adults, is characterized by the presence of two or more symptoms including nasal blockage (obstruction or congestion), anterior or posterior nasal discharge with or without facial pain (or pressure) and reduction or loss of smell for more than 12 weeks.

The Allergic Rhinitis and its Impact on Asthma (ARIA) categorized AR to intermittent or persistent, based on duration and mild or moderate/severe.¹⁷ The classification and definition of AR were improved after the cooperation between ARIA, the world allergy organization (WAO), and GA²LEN.⁸ Further, the questions set up for the diagnosis of CRS in the GA²LEN questionnaire are based on the European Position Paper on Rhinosinusitis and Nasal Polyps (EPOS) criteria.¹⁶

Statistical Analysis

The categorical variables were described using frequencies and percentages and continuous variables were described using mean and standard deviation. Independent T-tests were used to compare the categorical and continuous variables, respectively, between the two groups. Multivariable logistic regression models were used to investigate the association between AR and the comorbidities (CRS and asthma) adjusted for potential confounders (sex and age groups). The adjusted odds ratio (aOR) and the corresponding 95% confidence intervals (95%CI) were presented as the measure of association. The p-values less than 0.05 were considered significant. Statistical analyses were performed using SPSS version 21.0 statistical software (IBM; USA).

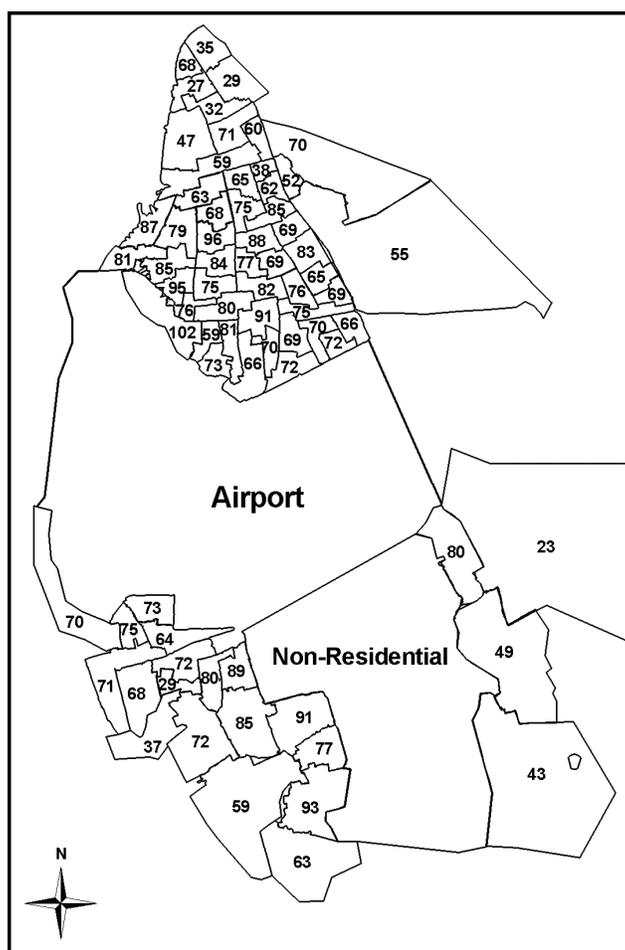


Figure 1. Map of Bushehr and distribution of participants in the strata

RESULTS

In this cross-sectional study, 5420 individuals participated, out of which 5201 (49% men and 51% women) completed the questionnaire (the response rate=96.1%). The mean age of the participants was 36.1 ± 13.5 years old (for the men and women 37.3 ± 13.4 and 35.0 ± 13 , respectively) ($t_{(4,890)} = 5.973$, $p=0.40$). The prevalence of AR was 28.8%. The frequencies were 680 (27.4%) and 765 (29.6%) among men and women, respectively (Chi-square: 2.9 $p=0.08$). In addition, AR was also more frequent significantly among 25- 34 year old group, health workers and smokers, (Chi-square: 11.5 $p=0.04$; Chi-square: 9.5 $p=0.002$; Chi-square: 59.04 $p<0.001$, respectively) (Table 1). The prevalence of intermittent and persistent AR were 367 (25.9%) and 1106 (74.1%) respectively, out of which 899 (81.34%) was moderate to severe

(Figure 2). In addition, the prevalence of AR symptoms reported by the participant was shown in Table 2.

Of the total individuals with AR, 748 (53.4%) had CRS comorbidity. There was a strong association between CRS and AR (aOR: 4.68, 95%CI: 4.07-5.39, $p<0.001$). The association between CRS and AR was stronger in the participants with persistent as compared to intermittent AR (aOR: 7.68, 95%CI: 6.34-9.30, $p<0.001$, aOR: 3.17, 95%CI: 2.66-3.77, $p<0.001$, respectively) (Figure 3A).

Furthermore, among the patients with AR (1473), 271 (18.3%) reported current asthma. Therefore, our data showed that there was an association between AR and current asthma (aOR: 4.21, 95%CI: 3.40-5.22, $p<0.001$). And, this association was stronger in those reporting persistent AR in comparison with intermittent AR (aOR: 5.14, 95%CI: 3.98-6.65, $p<0.001$, aOR: 3.52, 95%CI: 2.72-4.55, $p<0.001$, respectively) (Figure 3B).

Table1. Characteristics of the participants

Characteristic; N (%)	Allergic Rhinitis (N= 1473)	No Allergic Rhinitis (N= 3728)	<i>p</i>
Gender			
Male	680 (46.1)	1797 (48.2)	0.08
Female	765 (53.9)	1815 (51.8)	
10 year-age group (n %)			
15-24	301 (25.5)	877 (74.45)	
25-34	359 (35.30)	824 (69.65)	0.04
35-44	310 (30.72)	699 (69.28)	
45-54	257 (29.07)	627 (70.93)	
55-65	157 (26.21)	442 (73.79)	
Smoking (n %)	223 (42.80)	298 (57.20)	<0.001
Health worker (n %)	37 (43.02)	49 (56.59)	0.002

Table 2. The prevalence of allergic rhinitis (intermittent and persistent) symptoms in the participants

	Allergic Rhinitis	Intermittent Allergic Rhinitis	Persistent Allergic Rhinitis	<i>p</i>
Watery rhinorrhea	888 (60.2%)	212 (23.8%)	676 (76.2%)	<0.001
Nasal blockage (Congestion)	572 (38.8%)	121 (21.1%)	451 (78.9%)	<0.001
Sneezing	754 (51.1)	334 (44.2%)	420 (45.8)	0.09
Itchy nose	453 (30.7)	273 (60.2)	180 (39.8)	0.06

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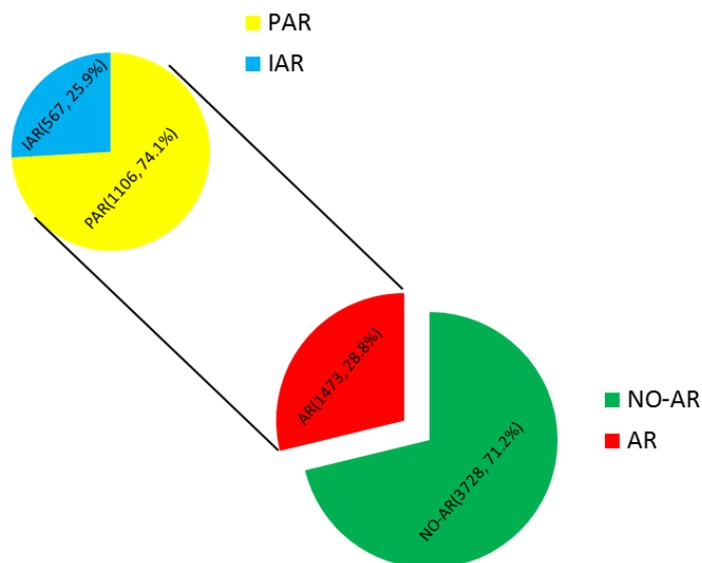


Figure 2. The total prevalence of allergic rhinitis and the prevalence of intermittent and persistent allergic rhinitis in patients. Red=Patients with AR, Green=Patients without AR, Yellow=Patients with persistent AR, Blue=Patients with intermittent AR. AR: Allergic rhinitis, IAR: Intermittent allergic rhinitis, PAR: Persistent allergic rhinitis

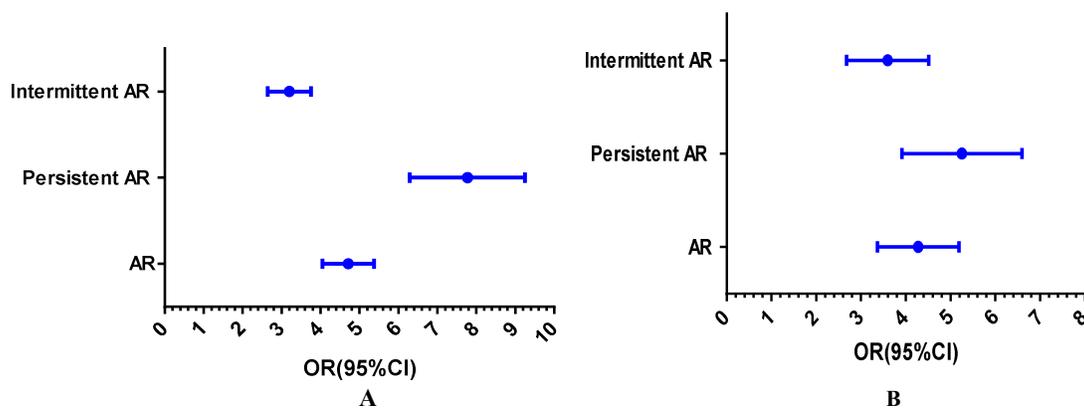


Figure3. A: The association (adjusted OR and 95% CI) of allergic rhinitis, persistent and intermittent allergic rhinitis with CRS; B: The association (adjusted OR and 95% CI) of allergic rhinitis, persistent and intermittent allergic rhinitis with Asthma; AR: Allergic rhinitis, IAR: Intermittent allergic rhinitis, PAR: Persistent allergic rhinitis

DISCUSSION

The results of this large-scale study on the adult population from the southwestern part of Iran showed that the prevalence of AR was high (28.8%). Moreover, a significant association was found between AR and CRS.

Importantly, the prevalence of AR is continuously increasing throughout the world,¹⁸ and it has been increased by three times from 8.0% in 1980 to 26.7% in 2017.^{10,19} Studies reported that the prevalence of intermittent and persistent AR was varied as 1- 40% and 1- 13%, respectively.^{19, 20} Further, only a few studies have been conducted regarding the prevalence

of AR among adults in Iran. The reports from a telephone interview study using a modified European Community Respiratory Health Survey (ECRHS) questionnaire showed the prevalence of AR 26.7% in Tehran and 22.4% in Mashhad, Iran.^{10, 21}

Moreover, the prevalence of AR has been estimated to be in the range of 10- 20% in the USA and some European countries.²⁰ Another telephone interview study conducted by Zhang et al. reported that the prevalence of AR is 26% in eleven major cities in China.²² Therefore, the present study showed that the prevalence of AR in Bushehr was slightly higher than in other cities in the world. Multiple factors may be involved in the discrepancies or differences in the results about the prevalence of AR including the criteria used for the diagnosis, differences in survey methodology, varied geographic locations, and socioeconomic status.²⁰

Environmental allergens including inhaled outdoor and indoor, induce allergic reactions and the development of AR. Therefore, the existence of these factors in the area impacts the prevalence of AR in the region.²³ Our previous study revealed that the highest rate of skin prick tests reactivity in AR patients in Bushehr was seen with house dust mite (88.5%), molds (82.9%), animal dander (79.5%), weeds (77.6%), trees (75.5%) and grass pollen (71.5%), respectively.²⁴ Furthermore, we confirmed the impact of long-term exposure to aromatic or dusty air pollutions on respiratory allergic diseases.²⁰ Additionally, the result of our previous study on the population living in Bushehr has shown that long exposure to dusty air pollution could have an impact on the immune system leading to allergic diseases.²⁵ Further, the present study indicated that the prevalence of AR was significantly higher among health workers and smokers. Many occupations are at risk of allergic diseases such as occupational AR and asthma. These occupational groups comprise health care workers, painters, bakers, and laboratory technicians, and more than 250 agents have been identified to be the causes of occupational allergic diseases.²⁶ Therefore, the above-mentioned risk factors may be the main causes of the higher prevalence of AR in Bushehr.

Interestingly, our results showed a significant association between AR and CRS, and the probability of comorbidity of AR and CRS was seen in individuals who reported persistent rather than intermittent AR. The paranasal sinuses are closely related to the nasal

airways, so AR and CRS are considered to be a single disease in the united airway.^{20, 27} These diseases are IgE mediated and can be triggered by similar aeroallergens including house-dust mites, mold, pollens, and animal dander.¹⁷ Moreover, the radiographic findings approved the association of peripheral eosinophilia and the presence of atopy with the severity of CRS.^{19, 28-30} Further, Berrettini et al. reported that 60% of the patients with CRS had IgE-mediated allergic reactions to aeroallergens.³¹ Additionally, studies have shown that allergic reactions including mucosal Th2 lymphocytes infiltration with the production of Th2 related cytokines including interleukin (IL)-4, IL-5, and IL-13 occurred in patients having CRS, especially with nasal polyposis.^{32, 33} Despite the reports discussed above, the entire mechanism for the association between AR and CRS remained to be unclear and further investigations are needed.

One of the limitations of this study was that we defined AR according to the epidemiological criteria, but, which is a condition that should be clinically approved. The second limitation was that some of the questions were not answered by the participants, however, the analyses showed no influential impact on the study.

In summary, our findings indicated a high prevalence of AR in the port of Bushehr, Iran. In addition, we showed that AR and CRS were clinically considered as comorbid conditions of asthma. Finally, there is insufficient epidemiologic data about AR and CRS in Iran and more data are needed about their etiologic risk factors.

CONFLICT OF INTEREST

There was no conflict of interest in the study.

ACKNOWLEDGEMENTS

This study was funded by Bushehr University of Medical Sciences (BPUMS), Iran.

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