

An Indian Cross-Sectional Study to Evaluate In-Clinic Allergic Rhinitis Prevalence in Patients Having Nasal Symptoms Using the SFAR Questionnaire

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Purpose: Allergic rhinitis (AR) is a global health concern caused by allergen exposure. This Indian study utilized the Score for Allergic Rhinitis (SFAR) questionnaire to estimate the prevalence of AR among patients with nasal symptoms visiting doctors' clinics/hospitals.

Patients and Methods: This multicenter, cross-sectional study assessed AR using the SFAR questionnaire in patients with nasal symptoms visiting doctors' clinics/hospitals. It included patients aged ≥ 11 years across 19 states/union territories of India from September 2022 to April 2023. The score was digitally calculated using the Kribado™ device, with a score of ≥ 7 indicating the presence of AR. Patient-reported data covered demographics, seasonal patterns, symptoms, allergens/triggers, and prevalence. Associations among various risk factors were analyzed.

Results: This study involved 3358 doctors, including ENT surgeons and chest physicians, and 40,001 patients across India. Among all patients, 53.7% ($n=21,480$) had SFAR scores ≥ 7 . Sneezing was the most common symptom, reported by 69.1% of patients overall and 86.8% in the AR+ subgroup. House dust mites were the most prevalent allergens, affecting 73.8% of patients. Nose-related issues peaked from October to January. Half of the patients had a family history of asthma, eczema, or AR. In the AR+ subgroup, only 46% were diagnosed with allergies by a doctor, and 31.5% underwent allergy testing. After adjusting for variables, AR was significantly linked to nasal symptoms, including itchy and watery eyes, and a history of doctor-diagnosed allergies.

Conclusion: The in-clinic prevalence of AR in patients with nasal symptoms, as indicated by the SFAR questionnaire, is substantially high in India. A positive family history, indoor dust exposure, nasal symptoms, the months of October to January, and females were strongly linked to AR in Indian patients. The SFAR score is an effective in-clinic screening tool to support early AR diagnosis and management in India.

Keywords: allergic rhinitis, India, prevalence

Introduction

Allergic rhinitis (AR) is an allergen-triggered inflammation of the nose,¹ characterized by nasal and adnexal symptoms resulting from an immunoglobulin E (IgE)-mediated response to allergen exposure.^{2–4} Clinical manifestations of AR include nasal congestion, nasal pruritus, sneezing, and a clear, runny nose.⁵ According to the Allergic Rhinitis and its Impact on Asthma (ARIA) guidelines, allergic rhinitis is classified by symptom duration (intermittent or persistent) and severity (mild to moderate–severe), with either form potentially presenting across the full severity spectrum.⁴

The reported prevalence rates of AR in Asia, as determined using the International Study of Asthma and Allergies in Childhood (ISAAC) questionnaire, varied by country: 6.1% in China, 20.4% in Kuwait, 25% in the United Arab

Emirates, 34% in Thailand, and as high as 53% in Malaysia. Additionally, the Global Asthma Network (GAN) Phase 1 study in India provided prevalence rates of AR across different age groups. Among 20,084 children aged 6 to 7 years, the prevalence was 7.7%. In a group of 25,887 adolescents aged 13 to 14 years, the prevalence was 23.5%. Among 81,296 adults/parents surveyed, the prevalence was 9.8%.²

Patients often trivialize rhinitis symptoms, which may explain the high rate of self-medication without seeking advice, even with moderate to severe symptoms.⁶ A coexisting atopic condition like asthma or eczema, a parental history of atopy, and various environmental factors significantly increase the risk of AR in children and adolescents. Premature birth may also raise this risk by 96%.² In a cross-sectional study of children aged 6 to 15 in North Kerala (N=60), house dust mites (HDM) were identified as the most common allergen, affecting 33% of participants.⁷ Additionally, the Coexistence of AR and Asthma survey found that 65.24% to 80% of Indian patients with asthma also have concurrent AR.⁸

The skin prick test is widely recognized as the gold standard for diagnosing IgE-mediated allergic reactions, while serum-specific IgE testing is another valuable diagnostic tool for AR.^{9,10} However, in rural Indian settings, where access to advanced diagnostics is limited, tools like the Score for Allergic Rhinitis (SFAR) offer a pragmatic alternative. Introduced in 2002 by the Annesi-Maesano group,¹¹ the SFAR is a validated questionnaire designed to screen for AR and distinguish it from non-allergic forms of rhinitis using a quantitative scoring system.^{10,12} A cutoff of ≥ 7 is effective in differentiating AR and non-AR with a sensitivity of 74%, specificity of 83%, positive predictive value of 84%, and negative predictive value of 74%.¹⁰ The details of the SFAR questionnaire are enumerated in [Supplementary Sections 1 and 2](#).

While prior Indian studies focused on children or asthma comorbidity, data on in-clinic AR prevalence across broader age groups remain scarce. Given environmental triggers such as seasonal dust exposure and increasing urbanization,⁹ there is an urgent need for effective AR screening strategies in India to enable timely diagnosis and management. This study aimed to evaluate the in-clinic prevalence of AR among patients aged ≥ 11 years presenting with nasal symptoms, using the SFAR questionnaire (cutoff score of ≥ 7), across clinics and hospitals in 19 states/union territories of India.

Materials and Methods

This multicenter, cross-sectional study involved a retrospective analysis of data obtained during the in-clinic AR screening camps conducted at doctors' clinics/hospitals between September 2022 to April 2023. The objective of conducting these camps was to screen the patients presenting with nasal symptoms for AR to facilitate early AR diagnosis and appropriate management using an SFAR risk score. A convenience sampling method was employed based on participants attending the screening camps. The study utilized a mobile-automated diagnostic system/device (Kribado™, Indigital Technologies 2023) that offers a non-invasive screening protocol and instantly provides a risk score to assist physicians in screening patients and identifying early risk features, thereby aiding in appropriate treatment.¹³ The SFAR questionnaire, which evaluates patient-reported variables such as demographics, seasonal patterns, common symptoms, allergens/triggers, and prevalence of AR, was integrated into this mobile-automated diagnostic system, which provided a non-invasive screening method and an immediate risk score for AR. The questionnaire was provided in English and not translated into local dialects, as most people in India are proficient in English. Additionally, participants received assistance at clinics or hospitals if they encountered any language or digital literacy barriers. A cutoff of ≥ 7 was effective in differentiating AR and non-AR. This threshold has been validated in prior studies, showing a sensitivity of 74% and specificity of 83%, supporting its utility in clinical screening.¹⁰ A total of 40,001 patients aged 11 years and above from 19 states/union territories of India with nasal symptoms were included. The patients with nasal symptoms who were not interested in participating in the study were excluded. No patient identification details were collected through this device. Hence, a digital consent form was embedded in the Kribado™ device itself for the provision of future analysis and publication of this data. In the case of minors, this consent was obtained digitally from the parents or legal guardians. This study was conducted in accordance with the ethical principles of the Declaration of Helsinki. The ethics committee approval was obtained to analyze the data retrospectively. The study was approved by the ACEAS- Independent Ethics Committee (ECR/281/Indt/GJ/2017/RR-21).

Around a week prior to the camp, posters and banners were posted in clinics to raise awareness and invite patients who were experiencing symptoms such as sneezing, runny nose, nasal congestion, red and watery eyes, and nasal itching.

Statistical Analysis

Demographic characteristics of the patients were analyzed using descriptive statistics. Age (a continuous variable) was presented as mean, median, standard deviation, 95% confidence intervals of mean, and range (minimum, maximum). Categorical variables (gender and state of residence) were presented using frequencies and percentages. The proportion of patients suggestive of AR (score ≥ 7) was calculated using descriptive statistics. Multivariate analysis was performed using logistic regression to account for potential confounding variables, including age and gender. The associations among various risk factors associated with the presence of AR were analyzed using the chi-square test. All statistical analyses were performed using SPSS 27.0 for Windows and at the 5% level of significance using two-tailed tests. The null hypothesis was rejected if $p < 0.05$.

Results

Total Study Population

Responses to the SFAR questionnaire were obtained from 3358 physicians for 40,001 patients from 19 states/union territories of India. Patients from Maharashtra accounted for the largest proportion of the population studied (23.7%). Table 1 provides a state-wise summary of patient distribution.

Table 1 Summary Statistics for the State-Wise Distribution of Patients

State	Frequency	Percent	Percent Excluding Missing
Andhra Pradesh	855	2.1%	2.2%
Bihar	379	1.0%	1.0%
Delhi	2538	6.3%	6.5%
Goa	52	0.1%	0.1%
Gujarat	1523	3.8%	3.9%
Haryana	2848	7.1%	7.3%
Himachal Pradesh	609	1.5%	1.6%
Jammu & Kashmir	1054	2.6%	2.7%
Karnataka	2485	6.2%	6.4%
Kerala	1942	5.0%	5.0%
Madhya Pradesh	473	1.2%	1.2%
Maharashtra	9256	23.1%	23.7%
Punjab	2026	5.1%	5.2%
Rajasthan	1782	4.5%	4.6%
Tamil Nadu	1613	4.0%	4.1%
Telangana	2089	5.2%	5.4%
Uttar Pradesh	5368	13.4%	13.8%
Uttarakhand	103	0.3%	0.3%
West Bengal	2000	5.0%	5.1%
Missing: Details not available	1006	2.5%	
Total	40,001	100.0%	

Demographics of the total study population are represented in Table 2. Age data were missing for 573 patients, who were excluded from the association and regression analysis. The study population was predominantly male (65.4%), and the mean age of the patients was 39.08 ± 11.78 years; 34.5% of the study population was in the age group of 31–40 years.

The prevalence of nasal symptoms in the total study population based on the month of the year is represented in Figure 1. Sneezing was the most reported symptom, reported by 27,649 (69.1%) patients in the total study population. The presence of a blocked nose and runny nose (apart from cold or flu in the past 12 months) was reported by 22,533 (56.3%) and 23,725 (59.3%) patients, respectively. Nasal symptoms, accompanied by itchy, watery eyes, were reported by 19,513 (48.8%) patients. The most common months for nasal problems were October to January, reported by approximately 30–37.5% of participants.

The history and symptomatology of the total study population are represented in Figures 2 and 3. The details of the history and symptomatology of AR according to different age groups of patients are enumerated in Table 3. A family history of asthma/eczema/AR was reported by 37.0% (N=14,800) of the patients. Among the total patients, 18,173 (45.4%) believed that they were allergic, 7621 (19.1%) were tested for allergy, and 11,572 (28.9%) were diagnosed as allergic (asthma/eczema/AR) by a physician. The most common trigger factor for AR was HDMS, accounting for 54.7% of the total population.

AR-Positive (SFAR Score ≥ 7) Study Population

Out of the total 40,001 participants, 21,480 (53.7%) were AR-positive (AR+) with an SFAR score of ≥ 7 . Among the AR+ patients, 46% were already diagnosed by a physician, and 31.5% were tested for allergy; whereas, among AR-negative (AR–; SFAR score < 7) patients, 9.2% were already diagnosed as AR– by a physician, and only 4.6% were tested for allergy. The prevalence of AR was slightly higher in females than in males (54.7% vs 53.0%).

Approximately 50% of AR+ patients reported a family history of asthma/eczema/AR. Among the AR+ cases, sneezing was the most commonly reported symptom, reported by 86.8% of patients. The presence of a blocked nose

Table 2 Descriptive Statistics for Demographic Parameters

Parameter	Mean $\pm$ SD/Frequency	(Min, Max)/
Age	39.08 ± 11.78	(11.0, 100.0)
Age group		
11–20 years	1119	2.8%
21–30 years	8967	22.7%
31–40 years	13,617	34.5%
41–50 years	8305	21.1%
51–60 years	5588	14.2%
More than 60 years	1832	4.6%
Total	39,428	
Missing	573	
Gender		
Male	26,156	65.4%
Female	13,286	33.2%
Missing	559	1.4%
Total	40,001	

Abbreviation: SD, Standard deviation.

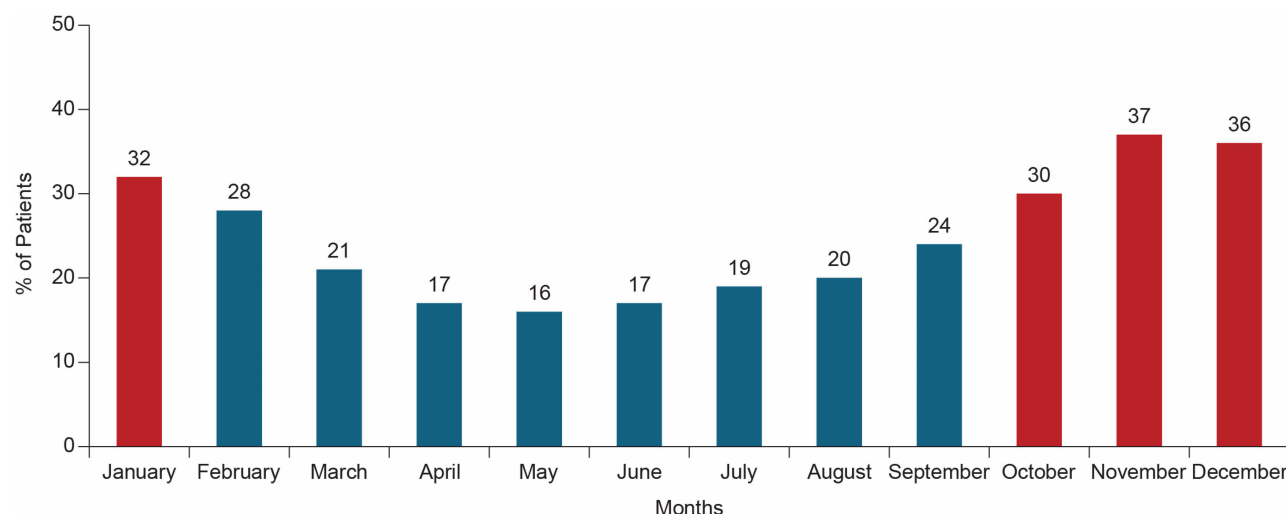


Figure 1 Month-wise prevalence of nasal symptoms as reported by patients (n=40,001).

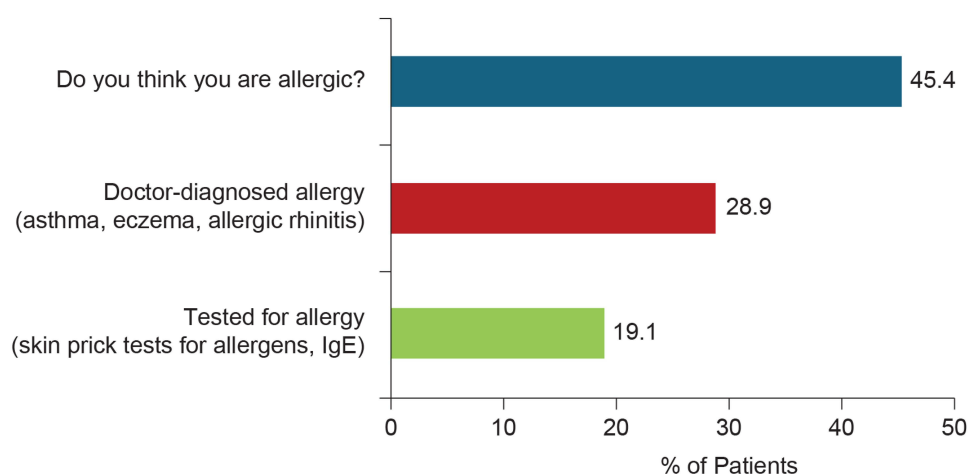


Figure 2 Patient-reported history as derived from the total study population.

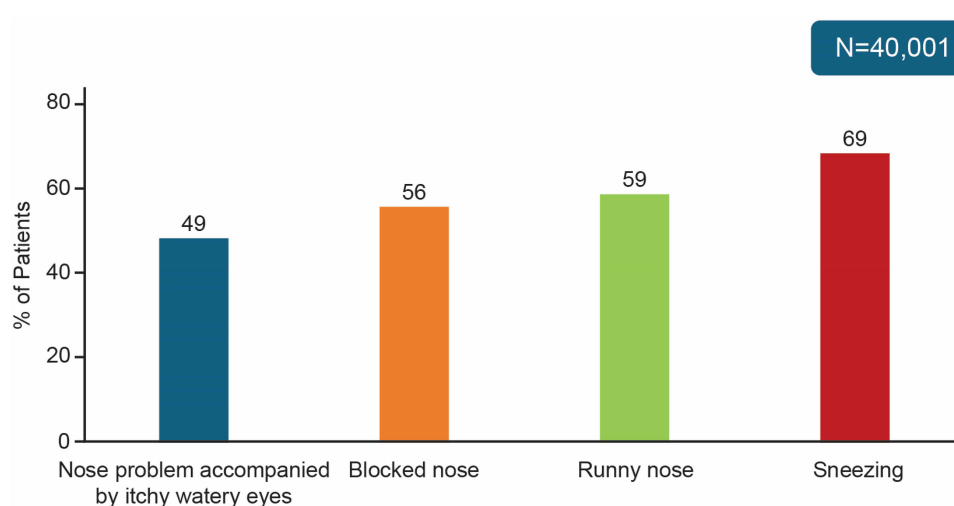


Figure 3 Patient-reported symptomatology from the total study population.

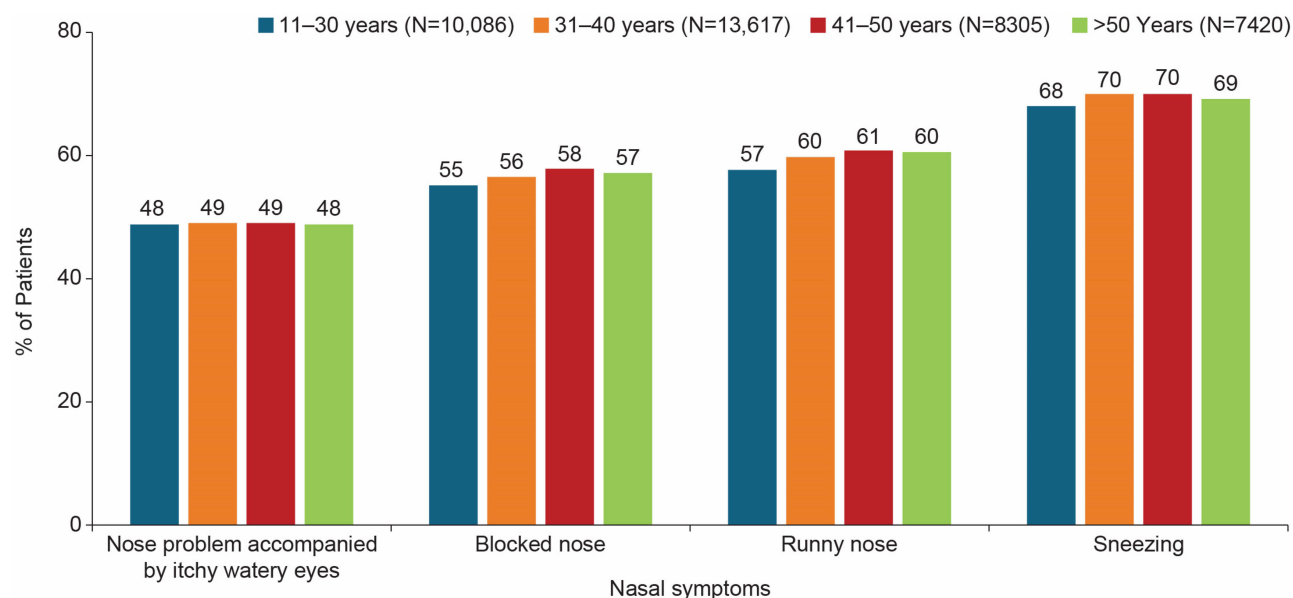
Table 3 Descriptive Statistics for the History and Symptomatology of AR According to Different Age Groups of Patients

Allergic Symptoms	11–30 Years (N=10,086)		31–40 Years (N=13,617)		41–50 Years (N=8305)		>50 Years (N=7420)		p-value
	Frequency	%	Frequency	%	Frequency	%	Frequency	%	
In the past 12 months, has this nose problem been accompanied by itchy watery eyes?	4890	48.5%	6638	48.7%	4069	49.0%	3597	48.5%	0.889
In the past 12 months, have you had a blocked nose apart from a cold or flu?	5533	54.9%	7662	56.3%	4784	57.6%	4224	56.9%	<0.001
In the past 12 months, have you had a runny nose apart from a cold or flu?	5788	57.4%	8106	59.5%	5038	60.7%	4487	60.5%	<0.001
In the past 12 months, have you had sneezing apart from a cold or flu?	6834	67.8%	9506	69.8%	5792	69.7%	5107	68.8%	0.000

and runny nose (in the past 12 months) was reported by 74.5% and 78.2% of patients, respectively. Nasal symptoms, accompanied by itchy, watery eyes, were reported by 70.7% of the AR+ patients.

Females showed a significant preponderance of nasal symptoms and itchy/watery eyes than males, with a statistically significant difference ($p<0.001$); however, there was no significant difference noted for blocked nose, runny nose, and sneezing. The prevalence of AR in the different age groups was 50%–56%, and there was no significant age-wise trend. However, among the different age groups, the prevalence of blocked nose and running nose symptoms was significantly different, showing an upward trend with advancing age (Figure 4).

The prevalence of allergic symptoms, like itchy/watery eyes, sneezing, and runny/blocked nose, was higher in the AR+ group than in the AR– group. Indoor dust was the most common trigger factor for nasal symptoms, as reported by 54.7% of the patients. The presence of pets such as cats/dogs (30.6%) and pollen (40.0%) were the other associated trigger factors (Figure 5).

**Figure 4** Age-wise distribution of nasal symptoms.

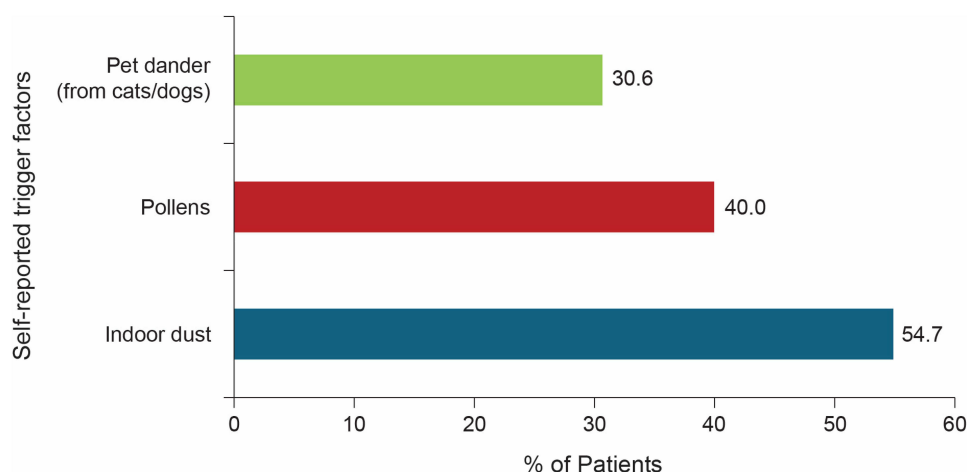


Figure 5 Trigger factors associated with AR as reported by patients.

Association Analysis

According to the results of the association analysis, the presence of AR is significantly correlated with female gender, advancing age, a history of asthma, eczema, and exposure to trigger factors like pollen, indoor dust, and pet dander (from cats and dogs). The details of association analysis are illustrated in [Table 4](#).

Table 4 Summary Statistics for Association Analysis to Estimate Risk Factors Associated

Risk factors		N	Suggest the Presence of AR (Score ≥ 7)		No presence of AR (Score < 7)		p-value	OR	95% CI for OR
			Frequency	%	Frequency	%			
Gender	Male	26,155	13,870	53.0%	12,285	47.0%	0.000	0.935	(0.89, 0.97)
	Female	13,286	7267	54.7%	6019	45.3%			
Age	11–30 years	10,086	5257	52.1%	4829	47.9%	0.078	Reference	Reference
	31–40 years	13,617	7255	53.3%	6362	46.7%	<0.001	1.05	(0.99, 1.10)
	41–50 years	8305	4538	54.6%	3767	45.4%	<0.001	1.11	(1.04, 1.17)
	50+ years	7420	4080	55.0%	3340	20.6%	<0.001	1.12	(1.06, 1.19)
Do you think you are allergic?	Yes	18,173	15,914	87.6%	2259	12.4%	0.000	20.58	(19.51, 21.72)
	No	21,828	5566	25.5%	16,262	74.5%			
Has a doctor already diagnosed that you suffer from an allergy (asthma, eczema, AR)?	Yes	11,572	9873	85.3%	1699	14.7%	0.000	8.42	(7.96, 8.91)
	No	28,429	11,607	40.8%	16,822	59.2%			
Have you already been tested for allergy (skin prick tests for allergens, IgE), and were they positive?	Yes	7621	6773	88.9%	848	11.1%	0.000	9.6	(8.91, 10.34)
	No	32,380	14,707	45.4%	17,673	54.6%			
In the past 12 months, has this nose problem been accompanied by itchy watery eyes?	Yes	19,513	15,190	77.8%	4323	22.2%	0.000	7.93	(7.58, 8.30)
	No	20488	6290	30.7%	14,198	69.3%			
In the past 12 months, have you had a blocked nose apart from a cold or flu?	Yes	22,533	16,002	71.0%	6531	29.0%	0.000	5.36	(5.14, 5.60)
	No	17,468	5478	31.4%	11,990	68.6%			

(Continued)

Table 4 (Continued).

Risk factors		N	Suggest the Presence of AR (Score ≥ 7)		No presence of AR (Score < 7)		p-value	OR	95% CI for OR
			Frequency	%	Frequency	%			
In the past 12 months, have you had a runny nose apart from a cold or flu?	Yes	23,725	16,793	70.8%	6932	29.2%	0.000	5.99	(5.73, 6.26)
	No	16,276	4687	28.8%	11,589	71.2%			
In the past 12 months, have you had bouts of sneezing apart from cold or flu?	Yes	27,649	18,647	67.4%	9002	32.6%	0.000	6.96	(6.63, 7.31)
	No	12,352	2833	22.9%	9519	77.1%			
Family history of asthma/eczema/AR	Yes	14,787	10,728	72.6%	4059	27.4%	0.000	3.55	(3.40, 3.72)
	No	25,214	10,752	42.6%	14,462	57.4%			
Indoor dust	Yes	21,897	15,849	72.4%	6048	27.6%	0.000	5.81	(5.56, 6.06)
	No	18,104	5631	31.1%	12,473	68.9%			
Pollens	Yes	15,981	12,161	76.1%	3820	23.9%	0.000	5.02	(4.80, 5.25)
	No	24,020	9319	38.8%	14,701	61.2%			
Pet dander (from cat/dogs)	Yes	12,248	9667	78.9%	2581	21.1%	0.000	5.05	(4.81, 5.31)
	No	27,753	11,813	42.6%	15,940	57.4%			

The results of the multivariate association analysis indicate that the presence of AR is significantly associated with doctor-diagnosed presence of nose problem, accompanied by itchy watery eyes (p-value <0.001 , adjusted OR (AOR)=16.814, [15.501,18.239]) and doctor-diagnosed allergies (asthma, eczema, allergic rhinitis) (p-value <0.001 , AOR=10.390, [9.470,11.399]). Additionally, the presence of AR was significantly associated with a family history of asthma/eczema/allergic rhinitis (AOR = 5.14, [4.747, 5.565]), and exposure to trigger factors such as house dust (AOR = 6.607, [6.123, 7.129]), pollens (AOR = 5.238, [4.828, 5.684]), and animals (cats/dogs) (AOR = 4.589, [4.198, 5.016]) (Table 5).

Table 5 Summary Statistics for Multivariate Association Analysis to Estimate Risk Factors Associated with the Presence of AR (Score ≥ 7)

Risk Factors		N	Suggest the Presence of Allergic Rhinitis (Score ≥ 7)		No Presence of Allergic Rhinitis (Score < 7)		p-value	OR	95% CI for OR	p-value	Adj. OR	95% CI for OR
			Frequency	%	Frequency	%						
Gender	Male	26155	13,870	53.0%	12,285	47.0%	0.000	0.935	(0.89, 0.97)	0.256	0.958	(0.890, 1.031)
	Female	13286	7267	54.7%	6019	45.3%						
Age	11-30 Years	10086	5257	52.1%	4829	47.9%	0.078			0.007		
	31-40 Years	13617	7255	53.3%	6362	46.7%	<0.001	1.05	(0.99, 1.10)	0.003	1.14	(1.04, 1.25)
	41-50 Years	8305	4538	54.6%	3767	45.4%	<0.001	1.11	(1.04, 1.17)	0.005	1.16	(1.04, 1.28)
	50+ Years	7420	4080	55.0%	3340	20.6%	<0.001	1.12	(1.06, 1.19)	0.41	1.05	(0.95, 1.16)
Has a doctor already diagnosed that you suffered from an allergy (asthma, eczema, allergic rhinitis)?	Yes	11572	9873	85.3%	1699	14.7%	0.000	8.42	(7.96, 8.91)	<0.001	10.39	(9.470, 11.399)
	No	28429	11,607	40.8%	16,822	59.2%						

(Continued)

Table 5 (Continued).

Risk Factors		N	Suggest the Presence of Allergic Rhinitis (Score ≥ 7)		No Presence of Allergic Rhinitis (Score < 7)		p-value	OR	95% CI for OR	p-value	Adj. OR	95% CI for OR
			Frequency	%	Frequency	%						
In the past 12 months has this nose problem been accompanied by itchy watery eyes?	Yes	19513	15,190	77.8%	4323	22.2%	0.000	7.93	(7.58, 8.30)	<0.001	16.814	(15.501,18.239)
	No	20488	6290	30.7%	14,198	69.3%						
In the past 12 months have you had Blocked nose apart from cold or flu?	Yes	22533	16,002	71.0%	6531	29.0%	0.000	5.36	(5.14, 5.60)	<0.001	5.28	(4.895,5.696)
	No	17468	5478	31.4%	11,990	68.6%						
In the past 12 months have you had Runny nose apart from cold or flu?	Yes	23725	16,793	70.8%	6932	29.2%	0.000	5.99	(5.73, 6.26)	<0.001	4.491	(4.152,4.858)
	No	16276	4687	28.8%	11,589	71.2%						
In the past 12 months have you had Sneezing apart from cold or flu?	Yes	27649	18,647	67.4%	9002	32.6%	0.000	6.96	(6.63, 7.31)	<0.001	6.157	(5.639,6.722)
	No	12352	2833	22.9%	9519	77.1%						
Family history of Asthma / Eczema/ Allergic rhinitis	Yes	14787	10,728	72.6%	4059	27.4%	0.000	3.55	(3.40, 3.72)	<0.001	5.14	(4.747,5.565)
	No	25214	10,752	42.6%	14,462	57.4%						
House dust	Yes	21897	15,849	72.4%	6048	27.6%	0.000	5.81	(5.56, 6.06)	<0.001	6.607	(6.123,7.129)
	No	18104	5631	31.1%	12,473	68.9%						
Pollens	Yes	15981	12,161	76.1%	3820	23.9%	0.000	5.02	(4.80, 5.25)	<0.001	5.238	(4.828,5.684)
	No	24020	9319	38.8%	14,701	61.2%						
Animals Cat/Dogs	Yes	12248	9667	78.9%	2581	21.1%	0.000	5.05	(4.81, 5.31)	<0.001	4.589	(4.198,5.016)
	No	27753	11,813	42.6%	15,940	57.4%						

Discussion

This multicenter, cross-sectional study assessed the prevalence of AR in patients aged above 11 with nasal symptoms and visiting doctors' clinics/hospitals from 19 states and union territories of India. Among those evaluated, 53.7% were diagnosed with AR. AR was significantly associated with the female gender. Several factors may explain the female preponderance observed. Estrogens enhance immune responses and mast cell activity, increasing susceptibility to allergic conditions. Greater indoor exposure to allergens from kitchens or waste burning may also contribute, particularly in traditional settings.^{14–17} The observed female preponderance in allergic rhinitis may, in part, reflect gender-specific health behaviors and higher healthcare utilization among women, as evidenced by National Family Health Survey (NFHS)-5 data showing increased health-seeking among educated, economically empowered women despite prevailing access barriers.^{18,19} Other associated factors included the age group of 11–40 years, the presence of allergic symptoms, a family history of AR/asthma/allergy, and allergy to trigger factors.

Among all AR symptoms, sneezing was the most common. This was reported in 69.1% of the total population and 86.8% of the AR+ subgroup. HDM was the most common allergen reported in 73.8% of AR+ cases.

The prevalence of AR in India during 2001–2003 was reported as 24.4% in children aged 13–14 years.²⁰ The more recent community-based GAN phase 1 study observed a comparable prevalence of 23.5% in adolescents of the same age group and 9.8% in adults.² In contrast, our in-clinic study found a substantially higher prevalence of 53.7% in patients aged 11–60 years; this higher prevalence may be due to the inclusion of patients already experiencing nasal symptoms. This study showed that approximately 50% of AR+ patients reported the presence of a family history of asthma/eczema/AR.

The coexistence of AR and asthma can lead to a worsening of asthma symptoms.⁸ A survey conducted from March to May 2015 across 10 Indian cities (Delhi, Lucknow, Meerut, Kolkata, Jaipur, Mumbai, Chennai, Hyderabad, Thiruvananthapuram, and Bengaluru) indicated that the burden of allergic diseases has been rising in terms of prevalence as well as severity; the study reported a 65.24% prevalence of coexisting AR in a study population of 1161 asthma patients with a mean age of 40.41 years.⁸ The study also reported that 80.3% of the patients with concomitant AR were from southern India, and the co-existence of AR and asthma was significantly ($p<0.005$) associated with a family history of atopy.⁸ A similar association was found in a cross-sectional study conducted in Jeddah, where a positive family history of AR was a significant determinant in the study population ($n=650$).²¹ Female patients in both studies showed a significantly higher prevalence of nasal symptoms and itchy/watery eyes compared to males, with 72.9% of females in the Jeddah study reporting nasal blockage and 67% experiencing itchy/watery eyes.²¹ Similarly, in this study, female patients showed a significantly higher preponderance of nasal symptoms and itchy/watery eyes compared to males ($p<0.001$).

In addition to the demographic and clinical factors associated with AR, seasonal variations also play a significant role in symptom severity. Approximately 30–37.5% of the patients reported an increase in nasal symptoms from October to January. A cross-sectional study ($n=140$) on the socio-demographic profile of AR patients aged 18–60 years conducted in a tertiary care unit in Uttar Pradesh, India, for a period of 1 year (November 2020 to October 2021) reported that AR patients are most affected in monsoon and winter.²² Additionally, crop residue burning during months of November–December in Punjab, North India, is known to exacerbate allergic rhinitis symptoms, such as runny nose and sneezing.²³ Residents of coastal regions also exhibit a higher prevalence of nasobronchial allergies, likely due to persistent humidity and exposure to allergens such as mold spores, dust mites, agricultural dust, and industrial pollutants.^{24,25}

Indoor dust was observed to be the most common triggering factor for nasal symptoms, as reported by 54.7% of the patients in this study. HDM, made up of a variety of mite species that are almost ubiquitous in human habitats, is a common allergen.²⁶ A cross-sectional study ($n=15$) conducted in Poland on the development of a plausible tool for HDM-triggered AR by using a method of distributing HDM at different concentrations in an allergen exposure chamber reported that HDM was a prominent trigger factor for AR at concentrations of 3000 p/m³ or higher.²⁶ A prospective study conducted in Vellore, India, which included 328 children with AR with a mean age of 10.3 years, reported that the most common sensitization for allergy was for insects (cockroaches), followed by HDM and pollens, while most children had polysensitization (73%).²⁷ In this regard, the findings of the present study indicate that the identification of indoor environmental factors might play a pivotal role in mitigating the prevalence of allergic diseases, specifically AR.

In the present study, 45.5% of patients thought they were allergic. Only 28.9% of patients were diagnosed by a physician for allergy, and 19.1% were tested for allergy. The SFAR score is calculated based on patient-reported responses (as recalled by the individual). Only the final scores were shared with the consulting physician. A score of ≥ 7 indicated the presence of AR. As this was a retrospective study, details of prior allergy testing were not assessed. Further evaluations were conducted per the clinician's discretion, and no standardized follow-up protocols were adopted.

A multicenter, real-life study to identify the reasons for uncontrolled AR, which included 430 patients from Belgium, China, the Democratic Republic of the Congo, India, and the US, reported that India and China had a high percentage of patient-related factors, such as non-compliance to treatment guidelines (India: 44%, China: 40%) and incorrect use of medication (India: 41%, China: 44%).²⁸ Trivialization of rhinitis symptoms and self-medication by patients have been reported previously.⁶

The SFAR is a dynamic tool that provides information on trigger agents, family history, and medical history to aid in the pre-assessment of individuals with AR.¹² In the present study, only 46% of patients had previously been diagnosed with allergies by a doctor, and only 31.5% had undergone allergy testing in the past. This low uptake of allergy testing is likely driven by limited healthcare infrastructure, financial constraints, and low awareness, factors that may be more pronounced in rural settings.²⁹

The lack of awareness of AR symptoms among patients may be suggestive of underdiagnosis of allergic rhinitis, and SFAR may be considered a useful tool for quick screening and early diagnosis of AR. This study estimated the AR prevalence by using SFAR scores recorded by the KribadoTM device, a new-generation hand-held screening instrument.¹³ KribadoTM is a non-invasive screening tool that generates a risk score at the pre-admission level. Using this screening

device, clinics and hospitals may identify at-risk patients early on and start them on appropriate treatments. The Kribado™ device appears to be a promising tool for the fast calculation of SFAR scores in clinical practice.³⁰

While SFAR and the Kribado™ device are valuable for diagnosing classic AR, it is important to consider local allergic rhinitis (LAR), which exhibits overlapping symptoms (eg, rhinorrhea, sneezing, and nasal itching) with AR and is often misdiagnosed as chronic non-allergic rhinitis. The key difference is that the allergic response in LAR is limited to the nasal mucosa only, without the systemic sensitization as seen in classic AR; thus, it may impact the SFAR score and diagnosis.³¹

Allergic disorders are a growing public health concern in India. This study emphasizes the urgent need for a strategic, multi-faceted approach to enhance the quality of care for allergic disorders in India. Awareness must be raised among healthcare professionals, policymakers, and the public through education campaigns and collaborations with allergy societies, emphasizing importance of allergen avoidance. Further research to identify local phenotypes and environmental triggers is necessary. Also, improving access to affordable medications and cost-effective allergy diagnostics requires coordinated efforts between the government and industry sectors in resource-limited settings.^{32,33} Region-specific guidelines and national screening programs could support early diagnosis and equitable care across urban and rural areas.²⁹

Strengths/Limitations of This Study

This is one of the largest cohort studies on allergic rhinitis in India. The strengths of this study include the high sample size (n=40,001) and the inclusion of in-clinic patients across 19 states/union territories of India.

The use of the Kribado™ device for rapid in-clinic screening and the use of the SFAR score (a validated score with good sensitivity and specificity) are the other novel factors of this study. The strength of SFAR in this study lies in its ability to effectively distinguish AR from non-AR, with validation metrics of 74% sensitivity and 83% specificity. However, given these performance characteristics, the reported rate of 53.7% may not accurately reflect the true prevalence of AR in India, as some cases may have been missed.

Furthermore, since screening was limited to in-clinic patients presenting with nasal symptoms, the observed prevalence is likely higher than that reported in community-based studies. Potential biases may include recall bias and inaccuracies in self-reporting or by the assistant, resulting from misinterpreted symptoms or misunderstood questions. In addition, this study did not examine the impact of air pollution on the prevalence of AR. Further, data collection was not evenly distributed across all regions. Therefore, potential regional or seasonal variations in patient recruitment should be considered when interpreting the findings. The male predominance in our cohort (65.4%) may be due to the convenience sampling method or different symptom reporting patterns leading to underrepresentation of the female population. This imbalance may have influenced the observed gender associations and conclusions related to gender preponderance and should be interpreted accordingly. We acknowledge that potential biases from self-reporting inaccuracies may also affect data quality.

Future Directions

The dataset from this large cohort offers substantial potential for in-depth analyses, including regional variations and key risk factors linked to AR in India. Future studies could extend SFAR use beyond specialist settings to general practice and community settings to better estimate the true prevalence of AR. Using SFAR as a screening tool in the general population could facilitate early diagnosis of allergic rhinitis and support effective public health planning.

Conclusion

This study stands as one of the largest and comprehensive analyses of allergic rhinitis, addressing the important public health issue and providing actionable insight for AR screening in India. It offers valuable insights that could shape future research and healthcare strategies for managing this condition nationwide. This study concluded that 53.7% of the study population with nasal symptoms who visited doctors' clinics in India across the 19 states/union territories had AR. The most common trigger factor for AR was exposure to indoor dust, and patients were most impacted during the winter months of October to January. AR was found to be significantly associated with the female gender, the age group of 11–40 years, the presence of allergic symptoms, and a positive family history of AR. After adjusting for age, gender, and other confounders, the presence of AR was significantly associated with nasal problems accompanied by itchy, watery eyes and a history of doctor-diagnosed allergies (asthma, eczema, or allergic rhinitis).

Abbreviations

AR, Allergic rhinitis; HDM, House dust mite; IgE, Immunoglobulin E; ISSAC, International Study of Asthma and Allergic Diseases in School Children; NFHS, National Family Health Survey; SFAR, Score for Allergic Rhinitis.

Data Sharing Statement

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

Ethics Approval and Informed Consent

Informed consent was taken digitally, and the study was approved by the ACEAS- Independent ethics committee (ECR/281/Indt/GJ/2017/RR-21).

Acknowledgments

We would like to acknowledge BioQuest Solutions Pvt. Ltd. for their editorial assistance.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Funding

This work was funded by Cipla Ltd.

Disclosure

VG, GT, AU and JG are employees of Cipla Ltd. Other authors declare no conflicts of interest in this work.

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