

Correlation between allergic rhinitis severity and quality of life among adult patients: A hospital-based cross-sectional study.

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Page | 1

Abstract

Background:

Allergic rhinitis (AR) is among the most prevalent chronic non-communicable airway disorders worldwide and is frequently dismissed as a trivial complaint.

Objectives:

To assess HRQoL in adults with AR using the standardised Rhinoconjunctivitis Quality of Life Questionnaire (RQLQ[S]), to classify disease severity and duration using the Allergic Rhinitis and its Impact on Asthma (ARIA) criteria, and to determine the correlation between AR severity and HRQoL impairment.

Methods:

A hospital-based, analytical cross-sectional study was conducted in the Department of Otorhinolaryngology at a tertiary healthcare centre in Haryana over six months (October 2025 to March 2026). Two hundred consecutive adults aged 18–65 years with a clinical diagnosis of AR, supported by a positive skin prick test or ELISA allergy test, were enrolled. Severity and duration were classified using ARIA criteria; symptom burden was quantified using the Total Nasal Symptom Score (TNSS) and a 0–100 mm visual analogue scale (VAS); HRQoL was measured using the 28-item RQLQ(S) across seven domains.

Results:

The mean age was 32.4 ± 10.8 years, and 108 participants (54.0%) were women. Moderate–severe AR accounted for 136 cases (68.0%), and persistent disease accounted for 104 cases (52.0%). The mean overall RQLQ(S) score was 2.94 ± 1.14 and rose stepwise across ARIA classes (Kruskal–Wallis $p < 0.001$). The overall RQLQ(S) score correlated strongly with TNSS ($p = 0.71$), VAS ($p = 0.68$), and ARIA severity category ($p = 0.66$; all $p < 0.001$). Moderate–severe severity independently predicted a 1.28-point higher RQLQ(S) score (95% CI 1.02–1.54, $p < 0.001$; adjusted $R^2 = 0.58$).

Conclusion and Recommendation:

HRQoL impairment in adults with AR is graded and closely tracks ARIA-defined severity, with the severity dimension outweighing the intermittent–persistent dimension. Routine incorporation of a brief severity or HRQoL screening instrument into rhinitis consultations is recommended, so that clinicians can identify patients whose daily functioning and sleep are meaningfully compromised and escalate treatment accordingly.

Keywords: Allergic rhinitis; Quality of life; Allergic Rhinitis and its Impact on Asthma classification; Rhinoconjunctivitis Quality of Life Questionnaire; Sleep; Cross-sectional studies

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Introduction

Allergic rhinitis (AR) is an immunoglobulin E-mediated inflammatory disorder of the nasal mucosa that follows exposure to inhaled allergens in sensitised individuals. It presents with some combination of rhinorrhoea, sneezing, nasal pruritus and nasal obstruction, and frequently coexists with allergic conjunctivitis, asthma and atopic dermatitis. Although rarely life-threatening, AR is one of the most common chronic conditions encountered in general and specialist outpatient practice and imposes a disproportionate burden on daily functioning relative to how seriously it is usually taken by patients and clinicians alike [1,2].

Global estimates place the prevalence of AR at approximately 10–30% of adults, and analyses of allergic disease burden across 204 countries confirm that the absolute number of affected individuals continues to rise even where age-standardised rates have plateaued [2]. In India, epidemiological data show wide inter-regional variation attributable to differences in aerobiology, climate, ambient particulate exposure, dietary patterns and urbanisation, alongside a documented shortage of trained allergy specialists and limited access to allergen-specific immunotherapy [3,4]. Together, these factors mean that a substantial proportion of Indian patients with AR are managed empirically, without formal severity assessment and without any structured evaluation of the disease impact on their lives.

The Allergic Rhinitis and its Impact on Asthma (ARIA) initiative reframed rhinitis classification along two independent axes — duration (intermittent versus persistent) and severity (mild versus moderate–severe), the latter anchored explicitly to sleep disturbance, impairment of daily activities, sport and leisure, interference with work or school, and troublesome symptoms [5]. This was a deliberate shift away from the older seasonal–perennial dichotomy towards a patient-centred construct, and subsequent guidelines have retained severity-driven treatment escalation as a central principle [6]. Because the ARIA severity criterion is itself defined in terms of functional impairment, the extent to which it predicts formally measured health-related quality of life (HRQoL) is both a validation question and a clinically actionable one.

HRQoL in rhinitis is most commonly quantified using the Rhinoconjunctivitis Quality of Life Questionnaire (RQLQ) developed by Juniper and Guyatt, and its standardised-activity variant, the RQLQ(S), which preserves the measurement properties of the original while permitting comparison across cohorts [7,8]. Studies in primary care and specialist settings have consistently shown that the severity axis of the ARIA classification discriminates HRQoL

impairment more sharply than the duration axis [9,10], and that nasal obstruction and consequent sleep fragmentation are dominant contributors to that impairment [11]. Reports from Iranian, Thai, and Korean adult cohorts have described comparable gradients of HRQoL loss across severity categories, with additional modification by age and mood state [12–14].

Despite this body of work, several gaps persist. First, most of the evidence linking ARIA severity to RQLQ scores derives from European, Middle Eastern, and East Asian populations; corresponding adult data from Indian tertiary-care outpatient settings are sparse. Second, few studies simultaneously report a clinician-applied severity classification, an objective symptom score, and a validated HRQoL instrument in the same cohort, which is necessary to establish whether a brief symptom measure can serve as a practical surrogate for a longer HRQoL questionnaire in busy clinics [15]. Third, the relative contribution of severity versus chronicity to HRQoL impairment, after adjustment for comorbidity and treatment adherence, has rarely been quantified in this population.

The present study was therefore undertaken to assess HRQoL among adults with AR attending a tertiary-care outpatient department, to classify their disease using ARIA criteria, and to determine the strength and direction of the correlation between AR severity and HRQoL impairment. It was hypothesised that RQLQ(S) scores would increase monotonically across ARIA classes, and that the severity dimension would explain more variance in HRQoL than the duration dimension.

Materials and Methods

Study design and setting

This was a hospital-based, observational, analytical cross-sectional study conducted in the Department of Otorhinolaryngology of a tertiary-care teaching hospital in Haryana, serving both urban and peri-urban catchment populations. Data were collected over a six-month period from 1 October 2025 to 31 March 2026. This window was selected to span both the post-monsoon and the spring pollen periods of the region, thereby capturing seasonal as well as perennial presentations. The study is reported in accordance with the STROBE statement for cross-sectional studies.

Participants and eligibility criteria

Consecutive adults presenting to the outpatient department with symptoms suggestive of AR during the study period were screened for eligibility.

Inclusion criteria

Age 18 to 65 years, of either sex; a clinical diagnosis of allergic rhinitis based on a history of two or more nasal symptoms (rhinorrhoea, sneezing, nasal itching, nasal obstruction) for more than one hour on most days, with compatible anterior rhinoscopic findings; a positive skin prick test or ELISA allergy test to at least one allergen on the standard aeroallergen panel used at the study centre; and willingness to provide written informed consent and to complete the study questionnaires.

Exclusion criteria

Non-allergic rhinitis, including vasomotor, drug-induced, hormonal, occupational-irritant and infective rhinitis; chronic rhinosinusitis with or without nasal polyposis, or gross anatomical obstruction (grade III–IV deviated nasal septum, sinonasal mass); acute upper respiratory tract infection within the preceding four weeks; prior sinonasal surgery, or receipt of allergen-specific immunotherapy within the preceding twelve months; systemic corticosteroid use within four weeks, or antihistamine use within seven days, of assessment; and pregnancy, lactation, uncontrolled systemic illness or a diagnosed psychiatric disorder that would independently confound quality-of-life reporting.

Sample size

The primary analytical endpoint was the correlation coefficient between ARIA-defined AR severity and the overall RQLQ(S) score. Assuming a two-sided α of 0.05 and 80% power, a minimum of 193 participants was required to detect a correlation of $\rho=0.20$ as statistically significant — a deliberately conservative threshold, since previously reported correlations between rhinitis severity measures and HRQoL scores have generally exceeded 0.50 [9,10]. The sample was rounded to 200 participants to allow for incomplete questionnaire returns. This size also provides adequate precision for the secondary comparison of mean RQLQ(S) scores across the four ARIA classes.

Sampling technique

Consecutive non-probability sampling was employed. All patients meeting the eligibility criteria during the study period were approached in the order of their presentation until the target of 200 was reached. Patients who declined participation and those with incomplete primary outcome data were recorded and reported.

Study instruments and definitions

ARIA classification

Each participant was classified along two axes by the examining clinician. Duration was recorded as intermittent (symptoms present on fewer than 4 days per week, or for fewer than 4 consecutive weeks) or persistent (symptoms on 4 or more days per week and for 4 or more consecutive weeks). Severity was recorded as mild (none of the following present) or moderate–severe (one or more present): abnormal sleep; impairment of daily activities, leisure or sport; impairment of work or school performance; troublesome symptoms [5]. For selected analyses, the four resulting classes were collapsed into a binary severity variable (mild versus moderate–severe).

Total Nasal Symptom Score (TNSS)

The four cardinal nasal symptoms — rhinorrhoea, sneezing, nasal itching and nasal obstruction — were each graded by the participant on a 0–3 scale (0=absent, 1=mild, 2=moderate, 3=severe), giving a composite score of 0–12 reflecting the preceding 7 days.

Visual analogue scale (VAS)

Participants marked overall symptom bother during the preceding 7 days on a 100 mm horizontal line anchored at “not at all bothersome” (0 mm) and “extremely bothersome” (100 mm).

RQLQ(S)

HRQoL was assessed with the standardised Rhinoconjunctivitis Quality of Life Questionnaire, a 28-item disease-specific instrument covering seven domains: activity limitation, sleep, non-nasal/non-ocular symptoms, practical problems, nasal symptoms, ocular symptoms and emotional function [7,8]. Each item is scored 0 (not troubled) to 6 (extremely troubled) over a one-week recall period; the overall score is the unweighted mean of all 28 items, and each domain score is the mean of its constituent items. Higher scores indicate greater impairment, and a change or between-group difference of 0.5 points is regarded as the minimal important difference.

Skin prick testing

Testing was performed on the volar forearm using a standardised commercial aeroallergen panel comprising house dust mites, regionally relevant pollens, fungal spores, animal dander, and insect and food allergens, with histamine and saline as positive and negative controls. A mean wheal diameter of 3 mm or more greater than the negative control at 15–20 minutes was recorded as positive, or an ELISA

allergy test was performed as an alternative confirmatory measure.

Data collection procedure

After written informed consent, a structured proforma was used to record sociodemographic details (age, sex, residence, education, occupation, monthly household income category), smoking and biomass-fuel exposure, duration of rhinitis symptoms in years, family history of atopy, comorbid asthma, conjunctivitis and atopic dermatitis, current pharmacotherapy and self-reported adherence, and days of work or study missed in the preceding month. Anterior rhinoscopy and, where indicated, diagnostic nasal endoscopy were performed. ARIA classification, TNSS, VAS and RQLQ(S) were then completed in a single visit in that fixed order to minimise anchoring bias.

Efforts to minimise bias

Several measures were undertaken to reduce potential sources of bias. Selection bias was minimised by consecutive, non-probability enrolment of all eligible patients presenting during the study period, rather than convenience or referral-based selection, and by recruiting across two aeroallergen seasons to avoid disproportionate representation of purely seasonal presentations. Diagnostic (classification) bias was addressed by requiring objective confirmation of atopy through skin prick testing or ELISA allergy testing rather than clinical impression alone, and by having ARIA severity and duration assigned according to pre-specified, guideline-defined criteria applied uniformly to all participants. Information and recall bias were reduced by using validated, standardised instruments (TNSS, VAS, RQLQ[S]) with a fixed one-week recall period, by administering all questionnaires through trained interviewers in a language the participant understood, and by completing the instruments in a fixed order (ARIA classification, TNSS, VAS, RQLQ[S]) at a single visit to limit anchoring and order effects. Observer bias was limited through use of a structured proforma and pre-defined operational definitions for all sociodemographic and clinical variables. Non-response and attrition bias were addressed by recording and reporting the number and stated reasons for non-participation and incomplete data at every stage of recruitment. Residual confounding was addressed statistically through multivariable linear regression adjusting for ARIA duration, symptom duration, comorbid asthma, sex and treatment adherence, with model assumptions verified using residual plots and variance inflation factors.

Statistical analysis

Data were entered in Microsoft Excel and analysed using IBM SPSS Statistics version 29.0 (IBM Corp., Armonk, NY, USA), with figures prepared in GraphPad Prism version 10. Normality was assessed using the Shapiro–Wilk test and inspection of Q–Q plots. Continuous variables are summarised as mean±standard deviation or as median with interquartile range as appropriate, and categorical variables as frequencies and percentages. Between-group comparison of RQLQ(S) scores across the four ARIA classes was performed using the Kruskal–Wallis test with Dunn post hoc pairwise comparison and Bonferroni adjustment; binary severity comparisons used the Mann–Whitney U test. The primary analysis — the association between AR severity and HRQoL — was assessed using the Spearman rank correlation coefficient, with correlations interpreted as weak ($p < 0.30$), moderate ($0.30–0.59$), or strong (≥ 0.60). A multivariable linear regression model was constructed with the overall RQLQ(S) score as the dependent variable and ARIA severity, ARIA duration, symptom duration in years, comorbid asthma, sex, and treatment adherence as independent variables; model assumptions were checked through residual plots and variance inflation factors. A two-sided p -value below 0.05 was taken as statistically significant.

Ethical considerations

Written informed consent was obtained from every participant in a language they understood, and the confidentiality of patient information was maintained throughout the study.

Results

Participant flow

A total of 250 patients presenting with symptoms suggestive of AR during the study period were initially considered for potential eligibility. Of these, 238 were formally assessed for eligibility against the inclusion and exclusion criteria; 12 were not assessed because they left the department before screening could be completed. Of the 238 assessed, 214 were confirmed eligible, and 24 were excluded (non-allergic rhinitis, $n=10$; chronic rhinosinusitis or significant septal deviation, $n=6$; recent systemic corticosteroid or antihistamine use, $n=4$; other exclusion criteria — recent upper respiratory infection, prior sinonasal surgery, pregnancy or uncontrolled systemic illness, $n=4$). Of the 214 eligible patients, 9 declined participation (lack of time, $n=5$; unwillingness to complete questionnaires, $n=4$) and 5 provided incomplete primary outcome data and were

excluded from analysis. The remaining 200 participants completed all study instruments and were included in the final analysis, a response rate of 95.7% among eligible

patients. Participant flow through the study is summarised in Figure 1.

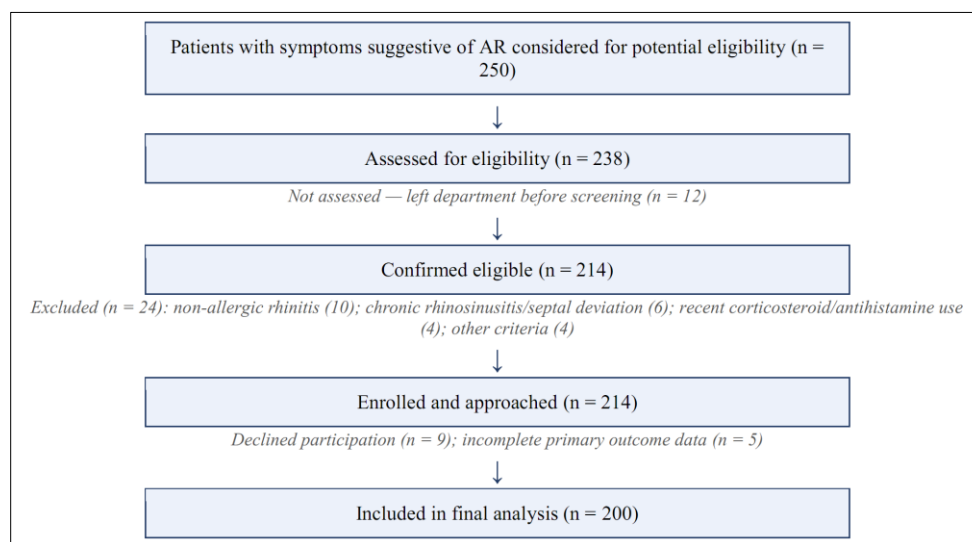


Figure 1. Participant flow diagram.

Participant characteristics

The mean age of the analysed cohort was 32.4±10.8 years (range 18–64), and 108 participants (54.0%) were women. The median duration of rhinitis symptoms was 5.0 years (IQR 3.0–9.0). A family history of atopy was present in 118 participants (59.0%). House dust mite was the commonest

sensitising allergen (122, 61.0%), followed by pollens (68, 34.0%), fungal spores (36, 18.0%) and animal dander (24, 12.0%). Comorbid asthma was recorded in 48 (24.0%), allergic conjunctivitis in 96 (48.0%), and atopic dermatitis in 22 (11.0%). Baseline characteristics are summarised in Table 1.

Table 1: Baseline Demographic and Clinical Characteristics of the Study Participants (N = 200)

Characteristic	n / Mean	% / SD
Age, years (mean, SD)	32.4	± 10.8
Age group 18–30 years	96	48.0%
Age group 31–45 years	72	36.0%
Age group 46–65 years	32	16.0%
Female sex	108	54.0%
Urban residence	124	62.0%
Graduate or above education	86	43.0%
Current or former smoker	34	17.0%
Regular biomass fuel exposure	46	23.0%
Symptom duration, years (median, IQR)	5.0	3.0–9.0
Family history of atopy	118	59.0%
Comorbid asthma	48	24.0%
Allergic conjunctivitis	96	48.0%
Atopic dermatitis	22	11.0%
Sensitised to house dust mite	122	61.0%

Sensitised to pollens	68	34.0%
Polysensitised (≥ 2 allergens)	104	52.0%
TNSS, 0–12 (mean, SD)	7.9	± 2.8
VAS, 0–100 mm (mean, SD)	58.6	± 19.4
Good self-reported treatment adherence	92	46.0%

Note. SD = standard deviation; IQR = interquartile range; TNSS = Total Nasal Symptom Score; VAS = visual analogue scale.

Distribution of ARIA classes

Moderate–severe disease predominated: 136 participants (68.0%) were classified as moderate–severe and 64 (32.0%) as mild, while 104 (52.0%) had persistent and 96 (48.0%) intermittent disease. The single largest class was moderate–severe persistent AR (74 participants, 37.0%). Mean overall RQLQ(S) scores increased in a stepwise fashion across the

four classes and differed significantly between them (Kruskal–Wallis $H=118.62$, $df=3$, $p<0.001$), as shown in Table 2. Post hoc pairwise comparisons showed that both moderate–severe classes differed significantly from both mild classes (all adjusted $p<0.001$), whereas the difference between mild intermittent and mild persistent disease did not reach significance (adjusted $p=0.09$).

Table 2: Distribution of ARIA Classes and Corresponding Overall RQLQ(S) Scores (N = 200)

ARIA class	n	%	RQLQ(S), M (SD)	TNSS, M (SD)
Mild intermittent	34	17.0	1.68 (0.62)	4.2 (1.5)
Mild persistent	30	15.0	2.05 (0.71)	5.1 (1.7)
Moderate–severe intermittent	62	31.0	3.12 (0.84)	8.3 (2.1)
Moderate–severe persistent	74	37.0	3.86 (0.92)	9.8 (1.9)
Total	200	100.0	2.94 (1.14)	7.9 (2.8)

Note. Kruskal–Wallis test across the four classes: $p < .001$ for both RQLQ(S) and TNSS. ARIA = Allergic Rhinitis and its Impact on Asthma; RQLQ(S) = standardised Rhinoconjunctivitis Quality of Life Questionnaire; TNSS = Total Nasal Symptom Score; M = mean; SD = standard deviation.

Domain-wise quality-of-life impairment

The mean overall RQLQ(S) score for the cohort was 2.94 ± 1.14 . The most severely affected domains were nasal symptoms (3.62 ± 1.21), sleep (3.18 ± 1.30), and practical problems (3.05 ± 1.18); the least affected was ocular symptoms (2.30 ± 1.34). Every domain score was significantly higher in the moderate–severe group than in

the mild group, with the largest absolute between-group differences observed for sleep ($\Delta=1.86$) and activity limitation ($\Delta=1.61$), both far exceeding the minimal important difference of 0.5 points (Table 3). Work or study absenteeism of at least one day in the preceding month was reported by 52 of 136 participants (38.2%) with moderate–severe AR compared with 6 of 64 (9.4%) with mild AR ($p<0.001$).

Table 3: RQLQ(S) Domain Scores by ARIA Severity Category

RQLQ(S) domain	Mild (n = 64), M (SD)	Moderate–severe (n = 136), M (SD)	Difference	p
Nasal symptoms	2.44 (0.94)	4.18 (0.98)	1.74	$< .001$
Sleep	1.92 (0.88)	3.78 (1.07)	1.86	$< .001$
Practical problems	2.02 (0.85)	3.53 (1.02)	1.51	$< .001$
Activity limitation	1.88 (0.79)	3.49 (1.05)	1.61	$< .001$
Non-nasal/non-ocular symptoms	1.79 (0.81)	3.14 (1.09)	1.35	$< .001$
Emotional function	1.61 (0.76)	2.83 (1.11)	1.22	$< .001$
Ocular symptoms	1.54 (0.92)	2.66 (1.30)	1.12	$< .001$
Overall score	1.85 (0.68)	3.52 (0.94)	1.67	$< .001$

Note. Between-group comparison by Mann–Whitney U test. A difference of ≥ 0.5 points is considered the minimal important difference for the RQLQ(S). M = mean; SD = standard deviation.

Correlation between severity and quality of life

The overall RQLQ(S) score showed a strong, statistically significant positive correlation with all three severity measures: TNSS ($\rho=0.71$, 95% CI 0.63–0.77, $p<0.001$), VAS ($\rho=0.68$, 95% CI 0.60–0.75, $p<0.001$) and ARIA severity category ($\rho=0.66$, 95% CI 0.58–0.73, $p<0.001$). Correlation with the ARIA duration axis was appreciably

weaker ($\rho=0.31$, $p<0.001$), and the correlation with symptom duration in years was weak and non-significant ($\rho=0.11$, $p=0.12$). Among individual symptoms, nasal obstruction correlated most strongly with the overall RQLQ(S) score ($\rho=0.62$) and with the sleep domain in particular ($\rho=0.69$), whereas nasal itching showed the weakest association ($\rho=0.34$). Correlation coefficients for each domain are presented in Table 4 and Figure 3.

Table 4: Spearman Correlation of Severity Measures with RQLQ(S) Overall and Domain Scores (N = 200)

RQLQ(S) score	TNSS (ρ)	VAS (ρ)	ARIA severity (ρ)	ARIA duration (ρ)
Overall	0.71*	0.68*	0.66*	0.31*
Nasal symptoms	0.78*	0.70*	0.63*	0.29*
Sleep	0.66*	0.64*	0.69*	0.34*
Activity limitation	0.61*	0.63*	0.65*	0.28*
Practical problems	0.58*	0.59*	0.57*	0.26*
Non-nasal/non-ocular symptoms	0.54*	0.55*	0.52*	0.22*
Emotional function	0.49*	0.52*	0.51*	0.24*
Ocular symptoms	0.41*	0.45*	0.39*	0.17

Note. * $p < .001$. ρ = Spearman rank correlation coefficient. Higher RQLQ(S) scores indicate poorer quality of life; positive coefficients therefore indicate that greater severity accompanies greater impairment.

Independent predictors of quality-of-life impairment

In the multivariable linear regression model (adjusted $R^2=0.58$; $F(6,193)=46.72$, $p<0.001$), moderate–severe ARIA severity was the strongest independent predictor of a higher overall RQLQ(S) score ($\beta=1.28$, 95% CI 1.02–1.54, $p<0.001$). Comorbid asthma ($\beta=0.42$, 95% CI 0.19–0.65,

$p<0.001$), persistent disease duration ($\beta=0.31$, 95% CI 0.09–0.53, $p=0.006$), and poor treatment adherence ($\beta=0.36$, 95% CI 0.14–0.58, $p=0.001$) were also independently associated with greater impairment. Sex and symptom duration in years were not significant after adjustment. Variance inflation factors were below 2 for all covariates, and residual plots showed no material departure from model assumptions (Table 5, Figure 2).

Table 5: Multivariable Linear Regression for the Overall RQLQ(S) Score (N = 200)

Independent variable	β	95% CI	Standardised β	p
Moderate–severe ARIA severity	1.28	1.02 to 1.54	0.54	< .001
Persistent ARIA duration	0.31	0.09 to 0.53	0.14	.006
Comorbid asthma	0.42	0.19 to 0.65	0.16	< .001
Poor treatment adherence	0.36	0.14 to 0.58	0.15	.001
Female sex	0.12	–0.09 to 0.33	0.05	.264
Symptom duration (per year)	0.02	–0.01 to 0.05	0.06	.181

Note. Adjusted $R^2 = 0.58$. β = unstandardised regression coefficient; CI = confidence interval.

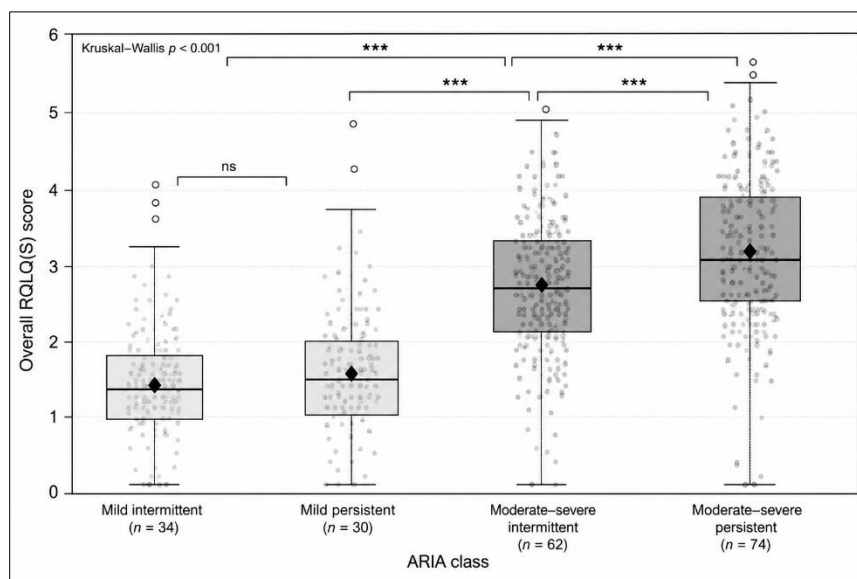


Figure 2. Distribution of overall RQLQ(S) scores across the four ARIA classes (n = 200). Boxes show the median and interquartile range; whiskers extend to 1.5× IQR; open circles denote outliers and solid diamonds the group means. Individual observations are overlaid as jittered points. Scores rise stepwise from mild intermittent to moderate-severe persistent disease (Kruskal-Wallis $H=118.62$, $df=3$, $p<0.001$). Post hoc Dunn comparison with Bonferroni adjustment: * $p<0.001$; ns, not significant. Higher scores indicate poorer quality of life.**

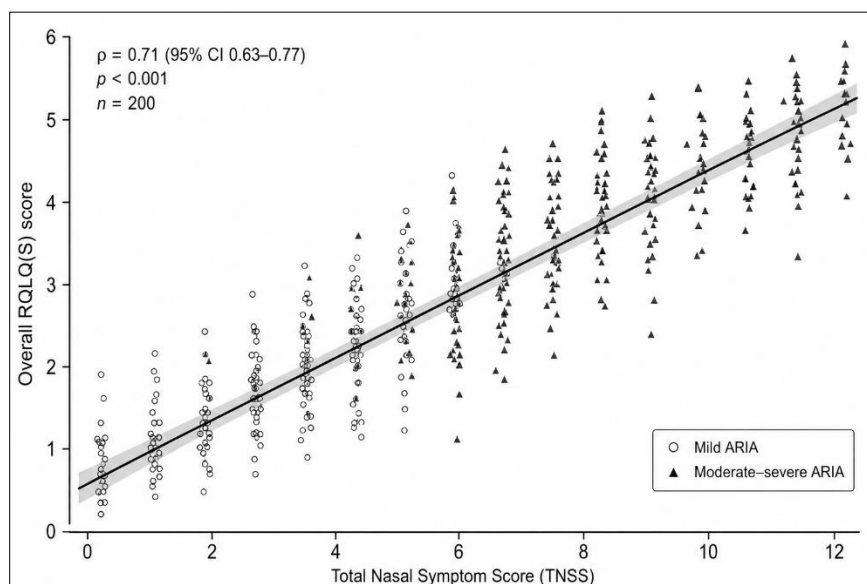


Figure 3. Relationship between Total Nasal Symptom Score and overall RQLQ(S) score (n = 200). Each point represents one participant, jittered on the horizontal axis because TNSS takes

integer values; open circles denote mild and filled triangles denote moderate–severe ARIA severity. The solid line is the least-squares regression fit and the shaded band its 95% confidence interval. Spearman $\rho=0.71$ (95% CI 0.63–0.77), $p<0.001$.

Discussion

Page | 9

This cross-sectional study of 200 adults with skin-test-confirmed allergic rhinitis demonstrates a strong, graded relationship between formally classified disease severity and disease-specific health-related quality of life. Overall RQLQ(S) scores rose monotonically across the four ARIA classes, and the severity axis explained substantially more variance in HRQoL than the duration axis, both in bivariate correlation and after multivariable adjustment. The magnitude of the between-group difference in overall score (1.67 points between mild and moderate–severe disease) is more than three times the minimal important difference of 0.5 points, indicating that this is not merely a statistical but a clinically consequential separation.

The predominance of moderate–severe disease in this cohort (68.0%) is consistent with observations from other clinic-based samples. Bousquet and colleagues, studying 3,052 patients consulting general practitioners, found that 81% had moderate–severe rhinitis and that severity influenced quality of life, sleep, daily activity and work performance more than duration did — a finding that led those authors to argue that the “moderate–severe” label understates the true burden and should simply be termed severe [9]. The present data reproduce that hierarchy in an Indian tertiary-care setting: the ARIA severity axis correlated with the overall RQLQ(S) score at $\rho=0.66$ compared with $\rho=0.31$ for the duration axis. Valero et al., applying a modified ARIA criterion that separates moderate from severe disease and using the ESPRINT-15 instrument, similarly showed clear discrimination of HRQoL across severity strata [10]. The convergence of these findings across different HRQoL instruments and health systems strengthens the inference that ARIA severity is capturing a genuine and generalisable construct.

The domain profile observed in this study also aligns with existing evidence. Nasal symptoms, sleep and practical problems were the most affected domains, and the sleep domain showed both the largest absolute difference between severity groups and the strongest correlation with nasal obstruction specifically. Shariat et al., in a cohort of Iranian adults, found nasal congestion to be the most prevalent symptom and reported significant associations between congestion, sleep impairment and reduced quality of life [12]. The mechanistic basis for this is well described: recumbency and diurnal variation augment turbinate swelling overnight, while the inflammatory mediators of

allergic rhinitis — histamine, leukotrienes, prostaglandins and cytokines — may additionally influence sleep regulation independently of mechanical obstruction, producing daytime fatigue, somnolence and reduced learning and work efficiency [11]. This provides a plausible pathway linking a nominally “minor” nasal condition to the substantial functional impairment reported by participants, including the fourfold higher rate of work or study absenteeism in the moderate–severe group.

The finding that comorbid asthma independently predicted worse HRQoL is coherent with the united-airway framework that underpins the ARIA initiative, although recent work suggests the relationship is more nuanced than a simple continuum. The ARIA-McDALL analysis proposes that rhinitis alone and rhinitis-with-asthma multimorbidity may represent distinct entities with different genomic and transcriptomic signatures, sensitisation patterns, symptom severity and treatment response, rather than two points on a single disease spectrum [1]. Whichever model ultimately prevails, the practical implication for the clinician is the same: patients with rhinitis and asthma together warrant more intensive assessment and treatment than either condition alone would suggest. The independent association observed between poor adherence and impaired HRQoL similarly reinforces guideline emphasis on intranasal corticosteroids as first-line therapy for patients whose symptoms affect quality of life, and on structured patient education to sustain their use [6].

The wider context for these findings in India deserves emphasis. Allergic disease prevalence in the country varies considerably by region, reflecting heterogeneity in aerobiology, climate, air pollution, socioeconomic strata and urbanisation, and the burden is compounded by an unmet demand for trained allergy specialists, limited availability of standardised allergen extracts, and restricted access to allergen-specific immunotherapy [3,4]. In such a setting, where a formal allergy consultation may be unavailable to most patients, an instrument that allows non-specialists to identify severe disease quickly has practical value. The strong correlations observed between the RQLQ(S) score and both the TNSS ($\rho=0.71$) and a simple 0–100 mm VAS ($\rho=0.68$) suggest that these brief measures can serve as workable proxies for a 28-item questionnaire in a crowded outpatient clinic — an approach also supported by the Thai cohort of Katel et al., who found VAS scores tracked both ARIA severity and quality of life and proposed VAS as a

quick tool for stepping treatment up or down [13]. Recent efforts to develop and validate compact ARIA-based severity-and-impact instruments point in the same direction [15].

Two further observations merit comment. First, symptom duration in years was not associated with HRQoL after adjustment, indicating that patients do not simply habituate to, or progressively deteriorate with, longstanding disease; current severity is what matters. Second, although mood was not formally assessed in this study, the emotional-function domain was clearly affected in the moderate–severe group. Woo et al. demonstrated that depressed mood was independently associated with severe, uncontrolled upper airway disease and that older patients responded less well to standard ARIA-guided pharmacotherapy than younger patients [14]. This raises the possibility that a subgroup of apparently treatment-refractory rhinitis patients are in fact reporting a psychological burden that pharmacotherapy alone will not resolve, and argues for attention to mood in patients whose scores fail to improve.

Generalizability

The findings of this study should be generalised with caution. Participants were recruited from a single tertiary-care otorhinolaryngology department in Haryana using consecutive sampling, a design that inherently over-represents patients with more severe or treatment-refractory disease relative to the general community, where many individuals with mild, self-limiting AR never seek specialist care. The prevalence figures and severity distribution reported here therefore reflect a hospital-based referral population and should not be extrapolated to community prevalence estimates. The demographic profile of the cohort — a relatively young adult population from a single north Indian state with its own characteristic aerobiology, climate and pollution exposure — may also limit direct applicability to other Indian regions or to paediatric and elderly populations, which were excluded by the age criteria of the study. Nonetheless, the strength and direction of the association between ARIA-defined severity and RQLQ(S)-measured HRQoL are consistent with findings from primary-care, hospital and community cohorts across several countries, suggesting that the underlying relationship, if not the absolute prevalence figures, is likely to generalise across similar tertiary-care AR populations in India and comparable settings. Multicentre studies spanning India's distinct aerobiological zones, and encompassing primary-care as well as tertiary-care populations, would be needed to confirm the broader applicability of these findings.

Strengths and limitations

The strengths of this study include the use of a validated, internationally comparable HRQoL instrument alongside a clinician-applied severity classification and two independent symptom measures in the same cohort; confirmation of atopy by skin prick testing or ELISA allergy testing rather than clinical impression alone; interviewer administration of questionnaires to reduce literacy-related missing data; and a consecutive sampling frame spanning two seasons.

Several limitations must be acknowledged. First, the cross-sectional design permits no inference about causal direction or about how HRQoL changes with treatment; a longitudinal follow-up would be required to establish responsiveness. Second, the study was conducted at a single tertiary-care centre using consecutive sampling, so referral bias towards more severe disease is likely, as noted above under Generalizability. Third, the six-month study window, although chosen to span two aeroallergen seasons, may not fully capture year-round variation for participants with strictly seasonal disease. Fourth, HRQoL, adherence, and absenteeism were self-reported and are subject to recall and social desirability bias. Fifth, nasal airflow was not measured objectively (by peak nasal inspiratory flow or rhinomanometry), and mood was not assessed with a validated depression scale, both of which would have strengthened the interpretation of the sleep and emotional domains. Finally, residual confounding from unmeasured environmental exposures, particularly ambient particulate matter, cannot be excluded.

Recommendations

Three practical recommendations follow from these findings. Clinically, a brief severity assessment — ARIA classification supplemented by a VAS mark — should be documented at every rhinitis consultation, since it identifies with reasonable fidelity the two-thirds of patients whose sleep and daily functioning are meaningfully compromised. Therapeutically, the strong contribution of nasal obstruction to sleep impairment supports prioritising agents with proven decongestant efficacy, principally intranasal corticosteroids, in patients reporting sleep disturbance, together with structured adherence counselling and closer monitoring of patients with comorbid asthma. For research, longitudinal studies are needed to determine whether ARIA-guided treatment escalation produces HRQoL gains exceeding the minimal important difference in Indian populations, and multicentre studies across India's distinct aerobiological

zones are recommended to clarify how far the present findings generalise.

Conclusion

In this cross-sectional study of 200 adults with allergic rhinitis, health-related quality of life deteriorated in a graded and statistically robust fashion as ARIA-defined severity increased, with the severity axis contributing considerably more than the duration axis. Sleep and daily activity were the domains most affected, and nasal obstruction was the symptom most closely linked to impairment. Allergic rhinitis should therefore not be regarded as a trivial condition: for the substantial majority of adults presenting to outpatient care with moderate-severe disease, its impact on sleep, functioning and productivity is clinically meaningful. Routine documentation of severity, together with treatment escalation directed at nasal obstruction and attention to comorbid asthma and adherence, is recommended as a realistic route to reducing this burden.

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Abbreviations

AR, allergic rhinitis; ARIA, Allergic Rhinitis and its Impact on Asthma; CI, confidence interval; HRQoL, health-related quality of life; ICMR, Indian Council of Medical Research; IgE, immunoglobulin E; IQR, interquartile range; MID, minimal important difference; RQLQ(S), standardised Rhinoconjunctivitis Quality of Life Questionnaire; SD, standard deviation; SPT, skin prick test; STROBE, Strengthening the Reporting of Observational Studies in Epidemiology; TNSS, Total Nasal Symptom Score; VAS, visual analogue scale.

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Conflict of interest

The authors declare that they have no competing financial or non-financial interests.

Author contributions

Garima: conceptualisation, study design, data collection and manuscript drafting. Preeti: data analysis, interpretation of results, and manuscript review. Jagat Singh: study

supervision, critical revision of the manuscript for important intellectual content, and final approval of the version to be published. All authors read and approved the final manuscript.

Consent for publication

Not applicable.

Availability of data and materials

The dataset analysed during the current study is available from the corresponding author on reasonable request.

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