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ADMINISTRATIVE INFORMATION

Support - Not applicable.

Review Stage at time of this submission - Completed but not published.

Conflicts of interest - None declared.

INPLASY registration number: INPLASY2025110052

Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 18 November 2025 and was last updated on 18 November 2025.

INTRODUCTION

Review question / Objective To systematically evaluate the association between Allergic rhinitis and migraine risk through a comprehensive meta-analysis.

Condition being studied Allergic rhinitis and migraine are common chronic conditions that significantly impact patients' quality of life. Although observational studies suggest a potential link between AR and increased migraine risk, evidence remains inconsistent.

METHODS

Participant or population Patients diagnosed with allergic rhinitis, confirmed by clinical criteria, physician diagnosis, skin prick test (SPT), Immunoglobulin E (IgE) positivity, or validated diagnostic codes (ICD-9/10).

Intervention Not applicable.

Comparator Individuals without allergic rhinitis.

Study designs to be included Observational studies, including cohort, cross-sectional, and case-control studies. Studies without clear diagnostic criteria, case reports, animal studies, reviews, letters, or conference abstracts without sufficient data were excluded.

Eligibility criteria Initial screening based on titles and abstracts was performed independently by two reviewers using EndNote software (X20). Full-text assessments of potentially eligible articles were conducted independently, with discrepancies resolved by consensus or a third reviewer.

Information sources A comprehensive literature search was conducted systematically across four electronic databases: PubMed, Web of Science Core Collection, Scopus, and China National Knowledge Infrastructure (CNKI).

Main outcome(s) PubMed: "allergic rhinitis"(Majr) OR "allergic rhinitis"(tiab) AND migraine*(tiab) OR "Migraine Disorders"(Majr), yielding 3,397 records. Web of Science: TS=("allergic rhinitis" AND migraine), yielding 57 records.

Scopus: TITLE-ABS-KEY("allergic rhinitis" AND migraine), yielding 247 records.

CNKI: TITLE=("allergic rhinitis" AND migraine), yielding 53 records.

Additionally, reference lists of eligible studies and relevant systematic reviews were manually reviewed to identify potential additional studies.

Quality assessment / Risk of bias analysis

Quality assessment was conducted independently by two reviewers using the Newcastle-Ottawa Scale (NOS) for cohort and case-control studies, and the Joanna Briggs Institute (JBI) Critical Appraisal Checklist for cross-sectional studies[23, 24]. NOS ratings were categorized as low (0–3), moderate (4–6), or high (7–9). For cross-sectional studies, methodological quality was appraised using the JBI Critical Appraisal Checklist, which includes eight items evaluating sample frame, sample size, subject and setting description, validity of exposure and outcome measurement, identification and management of confounders, and appropriateness of statistical analysis. Each item was rated as Yes/No/Unclear/Not applicable, and an overall quality level (High/Moderate) was assigned accordingly. Cohort and case-control studies were judged as low (0–3), moderate (4–6), or high (7–9) quality according to NOS scores, while cross-sectional studies were judged as high quality if ≥70% of items were "Yes," moderate if 50–69% were "Yes," and low if <50% were "Yes."

Strategy of data synthesis Statistical analyses were performed using Review Manager (RevMan, version 5.4) and R software (meta and metafor packages). Adjusted odds ratios (aORs) and hazard ratios (aHRs) were considered directly if available; otherwise, crude ORs were calculated from 2×2 contingency tables. Due to anticipated heterogeneity, the DerSimonian-Laird random-effects model was applied to pool effect estimates. Heterogeneity was assessed using Cochran's Q statistic and quantified by the I² statistic, where I² values of 25%, 50%, and 75% corresponded to low, moderate, and high heterogeneity, respectively.

To test the robustness of the findings, several sensitivity analyses were conducted, including exclusion of cross-sectional studies, restriction to large-sample studies, and comparison of adjusted versus unadjusted effect estimates. Leave-one-out analyses were further performed by sequentially

excluding each study to assess its individual influence on the pooled effect.

To explore potential sources of heterogeneity, we performed multivariate meta-regression and τ^2 decomposition analyses, examining study-level covariates such as study design, age group, sample size, and geographic region.

A cumulative meta-analysis was also conducted by ordering studies chronologically by publication year to evaluate temporal trends and the stability of pooled estimates as evidence accumulated.

Absolute effect measures were derived by applying pooled relative effect estimates to baseline prevalence scenarios of migraine in different populations. From these conversions, risk differences, population attributable fractions (PAFs), and number needed to treat-like (NNT-like) values were calculated to enhance clinical and public health interpretability.

Subgroup analysis Subgroup analyses were planned based on age groups, study designs (cohort, case-control, cross-sectional) and effect measure.

Sensitivity analysis Sensitivity analyses were conducted by removing individual studies sequentially to test result stability. Publication bias was visually examined through funnel plots and statistically assessed by Egger's regression test, with significance set at $P < 0.05$.

Country(ies) involved China.

Keywords Allergic rhinitis; Migraine; Meta-analysis; Risk factor; Systematic review.

Contributions of each author

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