

Association Between Allergic Conjunctivitis and Myopia: A Systematic Review and Meta-analysis of Observational Studies

INPLASY202640025

doi: 10.37766/inplasy2026.4.0025

Received: 7 April 2026

Published: 7 April 2026

Lin, TT; Yang, YC; Yang, HY; Wang, CY; Lee, CW; Shyong, MP; Hsu, NW; Chiou, SH; Tsai, DC.

Corresponding author:

Der-Chong Tsai

dctsai@nycu.edu.tw

Author Affiliation:

Department of Ophthalmology,
National Yang Ming Chiao Tung
University Hospital, Yilan, Taiwan.

ADMINISTRATIVE INFORMATION

Support - This work is supported by the National Science and Technology Council, Taiwan (Grant number: NSTC 114-2314-B-A49-049).

Review Stage at time of this submission - Preliminary searches.

Conflicts of interest - None declared.

INPLASY registration number: INPLASY202640025

Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 7 April 2026 and was last updated on 7 April 2026.

INTRODUCTION

Review question / Objective The objective of this systematic review and meta-analysis is to evaluate the association between allergic conjunctivitis (AC) and myopia across various observational studies to clarify whether AC serves as an independent risk factor for myopic development. To this end, the proposed systematic review will address the following question: Is there a statistically significant association between the presence of allergic conjunctivitis and the prevalence or risk of myopia in different populations?

Participants (P): Individuals across all age groups (pediatric and adult populations) involved in observational studies.

Exposure (E/I): Allergic conjunctivitis, identified through clinical signs and symptoms (e.g., ocular itching, redness, papillae) or precise diagnostic codes (e.g., ICD-9-CM).

Comparator (C): Control groups consisting of individuals without a diagnosis of allergic conjunctivitis.

Outcome (O): The outcome will be the pooled odds ratio (OR) for the prevalence or risk of myopia, with myopia typically defined by a spherical equivalent (SE) of ≤ -0.50 D or clinical diagnosis.

Study Design (S): Observational studies, including cross-sectional and case-control studies.

Rationale The rapid rise in the prevalence of myopia has emerged as a major public health concern worldwide, with projections estimating that nearly 50% of the global population will be affected by 2050. Allergic conjunctivitis (AC) is one of the most common immunological inflammatory ocular surface disorders in children and adolescents, with a prevalence of 10-20% that parallels the rising trend of myopia.

The association between AC and myopia is biologically plausible through two primary pathways:

1. **Inflammatory Mechanism:** Ocular surface inflammation leads to the release of histamine and pro-inflammatory cytokines (e.g., TNF- α , IL-6), which may activate signaling pathways involved in scleral remodeling and axial elongation.

2. **Mechanical Mechanism:** Chronic eye rubbing, a hallmark symptom of AC, induces repetitive corneal deformation and transient intraocular pressure spikes, which may contribute to biomechanical changes in the sclera and promote myopic progression.

Despite this biological plausibility, existing epidemiological evidence remains inconsistent. Some observational studies suggest that AC is an independent risk factor, while others report no significant correlation or attribute the link to shared environmental confounders. To date, no systematic review or meta-analysis has synthesized the available observational evidence on this topic. Therefore, this review is essential to bridge the current knowledge gap, evaluate the strength of the association, and determine if managing AC could serve as a novel modifiable factor in myopia prevention strategies.

Condition being studied Allergic Conjunctivitis (AC): A common immunological inflammatory disorder of the ocular surface, characterized by symptoms such as ocular itching, redness, and tearing. It affects approximately 10-20% of the pediatric and adolescent population worldwide, often paralleling the rising prevalence of refractive errors.

Myopia: A leading refractive error characterized by blurred distance vision, typically resulting from the excessive axial elongation of the eyeball. Myopia is a major global public health concern due to its association with sight-threatening complications, including retinal detachment, glaucoma, and myopic macular degeneration.

Relationship of Interest: This systematic review specifically addresses the epidemiological association between these two conditions. It investigates whether the chronic ocular surface inflammation and the mechanical stress from eye rubbing associated with allergic conjunctivitis are linked to an increased prevalence or risk of myopia.

METHODS

Search strategy A systematic and comprehensive literature search will be conducted in the following electronic databases from their inception: PubMed, Web of Science, Cochrane Library and ClinicalTrials.gov.

The search strategy incorporates a combination of free-text terms related to refractive errors and

allergic diseases. The specific keywords and string to be used are: ("myopia" OR "refractive error*" OR "axial length" OR "axial myopia") AND ("allergic conjunctivitis" OR "vernal keratoconjunctivitis" OR "VKC" OR "seasonal allergic conjunctivitis" OR "perennial allergic conjunctivitis" OR "allergic rhinitis" OR "hay fever" OR "asthma" OR "eczema" OR "atopic dermatitis" OR "atopy" OR "atopic disease*").

To maximize sensitivity and prevent the omission of relevant data, terms related to a broad spectrum of atopic conditions will be included to capture studies evaluating allergic conjunctivitis as part of systemic atopy. Manual screening of reference lists from included articles and relevant reviews will also be performed to identify additional eligible studies. No language restrictions will be applied to the search.

Participant or population Individuals across all age groups (pediatric, adolescent, and adult populations) enrolled in observational studies with available refractive data and documented ocular surface health assessments.

Intervention The exposure of interest consists of a clinical diagnosis of allergic conjunctivitis (AC), encompassing various subtypes such as seasonal allergic conjunctivitis (SAC), perennial allergic conjunctivitis (PAC), and vernal keratoconjunctivitis (VKC), defined by clinical criteria or validated diagnostic codes.

Comparator The comparator consists of individuals without a history or clinical diagnosis of allergic conjunctivitis (AC).

Study designs to be included Observational studies, including cross-sectional, case-control, and cohort studies.

Eligibility criteria Inclusion criteria:

1. Observational studies, including cross-sectional, case-control, or cohort designs.
2. Comparison between participants with and without allergic conjunctivitis (AC).
3. Reporting of myopia prevalence or risk as odds ratios (ORs) with 95% confidence intervals (CIs), or sufficient raw data for calculation.

Exclusion criteria:

1. Non-observational studies, such as reviews, case reports, editorials, or animal studies.
2. Studies with overlapping or duplicate patient populations.
3. Studies lacking outcome data.

Information sources Electronic databases: PubMed, Cochrane Library, Web of Science
Additional sources: Clinical trial registries (e.g., ClinicalTrials.gov), conference proceedings, and reference lists of included studies.

Main outcome(s) The outcome will be the pooled odds ratio (OR) with 95% confidence intervals (CIs) for the association between allergic conjunctivitis (AC) and myopia, calculated separately for different study designs. Myopia will be typically defined as a spherical equivalent (SE) of ≤ -0.50 D or a clinician-confirmed diagnosis.

Data management Two reviewers (T.T. Lin and Y.C. Yang) will independently extract data using a standardized form in Excel, including study characteristics, patient demographics, exposure status (allergic conjunctivitis subtypes), and outcome data. Discrepancies will be resolved by consensus or consultation with a third reviewer (D.C. Tsai). Data will be double-checked for accuracy before analysis.

Quality assessment / Risk of bias analysis The methodological quality of the included observational studies will be assessed using the Newcastle-Ottawa Scale (NOS). Two reviewers will independently evaluate each study based on three key domains: the selection of study groups, the comparability of the groups, and the assessment of either the exposure or the outcome of interest. Each study will be categorized as having a "low risk", "moderate risk", or "high risk" of bias based on the overall quality score. Any discrepancies will be resolved through consensus or by consulting a third reviewer.

Furthermore, the certainty of evidence for each outcome will be assessed using the Grading of Recommendations, Assessment, Development and Evaluations (GRADE) approach. The assessment will consider five downgrading factors: risk of bias, inconsistency, indirectness, imprecision, and publication bias. The overall certainty of evidence will be classified into four levels: high, moderate, low, or very low.

Strategy of data synthesis All statistical analyses will be performed using Python, version 3 (Google Colab, Google LLC, Mountain View, CA, USA). The association between allergic conjunctivitis and myopia will be evaluated using pooled odds ratios (ORs) with 95% confidence intervals (CIs). A random-effects model will be employed for the meta-analysis due to anticipated variations in study populations. Heterogeneity will be assessed using Cochran's Q test and quantified with the I^2 statistic. For studies reporting both adjusted and

crude estimates, the most fully adjusted OR will be used in the primary analysis. Publication bias will be assessed using funnel plots and Egger's regression test if ten or more studies are included. All visualizations, including forest plots, will be generated using the Matplotlib library.

Subgroup analysis Subgroup analyses will be conducted according to study design. Because different study designs provide distinct types of evidence, the data from each subgroup will not be combined into a single overall estimate to ensure a rigorous interpretation of the findings.

Sensitivity analysis Sensitivity analyses will be performed to assess the stability of the results and identify potential sources of heterogeneity. A leave-one-out approach will be employed, involving the sequential exclusion of each individual study to determine its influence on the overall pooled estimate. Additionally, crude odds ratios (ORs) will be examined and compared with the primary adjusted estimates, when available, to evaluate the robustness of the findings and the impact of potential confounding factors.

Language restriction No language restrictions will be applied to the literature search or the selection of studies.

Country(ies) involved Taiwan.

Other relevant information The review is supported by the National Science and Technology Council, Taiwan (Grant number: NSTC 114-2314-B-A49-049). The funder (National Science and Technology Council, Taiwan) had no role in the design of the study, the collection, analysis, and interpretation of data, or the writing of the protocol. Contributorship: Tzu-Tang Lin and Yu-Chieh Yang contributed equally to this work.

Keywords allergic conjunctivitis; myopia; meta-analysis; systematic review.

Contributions of each author

Author 1 - Tzu-Tang Lin - Conceptualized the review question; drafted the protocol and manuscript; coordinated study selection and data extraction; contributed to interpretation of findings. Email: a25414977@gmail.com

Author 2 - Yu-Chieh Yang - Co-led protocol development; performed literature screening and data extraction; contributed to manuscript drafting and critical revision. Email: yuchiehyang94@gmail.com

Author 3 - Hsin-Yu Yang - Provided clinical domain expertise in pediatric refractive development and

myopia prevention; refined eligibility criteria an intervention taxonomy; critically revised the protocol for clinical relevance.

Email: lisa771102@yahoo.com.tw

Author 4 - Chiao-Yu Wang - Managed data organization and cleaning; supported verification of extracted outcomes and follow-up harmonization.

Email: reala12z890@gmail.com

Author 5 - Chia-Wei Lee - Advised on intervention classification and feasibility in real-world settings; contributed to interpretation of results and manuscript revision.

Email: utgard1214@gmail.com

Author 6 - Mong-Ping Shyong - Reviewed and revised the protocol/manuscript for intellectual content.

Email: mpshyong@gmail.com

Author 7 - Nai-Wei Hsu - Provided methodological oversight on evidence synthesis planning and reporting; reviewed the protocol/manuscript and advised on presentation of outcomes and interpretation.

Email: davidnwh@ms28.hinet.net

Author 8 - Shih-Hwa Chiou - Provided expert guidance on study design considerations and reporting standards; critically revised the protocol/manuscript and approved the final content.

Email: 10010@hosp.nycu.edu.tw

Author 9 - Der-Chong Tsai - Supervised the project; provided overall methodological and clinical oversight; adjudicated disagreements during study selection/data extraction; critically revised the protocol/manuscript and approved the final version.

Email: dctsai@nycu.edu.tw