



Research article

Comparison of clinical research trends and hotspots in allergic rhinitis and asthma from 2013 to 2023 based on bibliometric analysis

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ABSTRACT

Purpose: To analyze and compare clinical research trends and hot topics in allergic rhinitis (AR) and asthma and provide valuable theoretical data and references for future research.

Methods: Clinical studies focusing on AR or asthma published from 2013 to 2023 were retrieved from the Web of Science Core Collection. Eligible articles were screened and analyzed using bibliometrics from multiple indicators.

Results: A total of 261 eligible articles on AR and 991 qualified articles on asthma were screened. The following bibliometric analyses identified the Journal of Allergy and Clinical Immunology as the most influential publication on AR and asthma and proved the significant contributions of Harvard University in clinical studies on AR and asthma. The analyses also revealed that the top ten prolific authors for AR were from China, the United Kingdom, Japan, and Germany, whereas the top ten productive authors for asthma were mainly from the USA. Collaborations among countries for AR were relatively concentrated in the Occident, whereas international cooperation on asthma was mainly achieved by the Occident and certain Eastern countries.

Conclusions: This study compared and analyzed the current status and evolution of AR and asthma-related clinical research using bibliometric analysis. Additionally, the study comprehensively summarized the impactful authors, institutions, and countries, and revealed the replacement and evolution of hotspots.

1. Introduction

Allergic rhinitis (AR)—a nasal mucosal inflammation secondary to allergen exposure and immunoglobulin E (IgE) regulation—is characterized by nonspecific but irritating symptoms, such as sneezing, itching, nasal discharge, and obstruction [1,2]. Significantly, approximately 5–15 % of children and 10–40 % of adults worldwide suffer from AR, which warns of a serious disease and socio-economic burden and even presents challenges to clinical and scientific researchers [3]. Allergen avoidance and environmental control, pharmacotherapy, traditional Chinese medicine, surgical intervention, and allergen immunotherapy can alleviate the symptoms or discomfort of AR to a certain extent [1,3,4]. Numerous clinical and scientific researchers have been committed to exploring the etiology, pathology, and treatment methods of AR and have achieved heartening results. For instance, the effects of traditional Chinese medicines, circMIRLET7BHG, and NOD-like receptor thermal protein domain-associated protein 3 on AR have

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been revealed [5–9]. Furthermore, allergen immunotherapy (AIT) is widely used for the treatment of AR [1,10,11], and intralymphatic immunotherapy can alleviate AR symptoms as an alternative to conventional AIT [12,13]. Unfortunately, pharmacotherapy for AR requires a long procedure, which reduces treatment compliance and weakens the therapeutic effect of AR [14]; approximately 20 % of patients were dissatisfied with the effectiveness of pharmacotherapy [3]. Hence, investigating the pathogenesis of AR and exploring more scientific and effective treatment methods are currently top priorities.

Allergic asthma and AR are classified as type I hypersensitivity reactions mediated by IgE. AR has been identified as a pivotal comorbidity and determinant factor of asthma [1,15]. Given the identical airway hypothesis, AR and allergic asthma tend to be discussed as comorbidities [1,16–18]. Accordingly, investigating the research trends and hotspots of asthma, including its pathogenesis, therapeutic measures, and research methodologies, is considerably significant for improving AR-related research. A discussion of AR research trends and hotspots may also provide new insights into asthma. Although some studies have explored the research status of AR or asthma through bibliometric analysis [19–21], no reports have explored the same issue through a comparative analysis based on bibliometrics. Based on these considerations, this study explored AR- and asthma-related clinical studies from the Web of Science Core (WoS) Collection. Furthermore, this study analyzed and compared the research tendencies and topical issues of AR and asthma using bibliometrics, hoping to shed new light on AR and asthma research. We structured and reported our study according to the Preferred Reporting Items for Bibliometric Analysis (PRIBA), a reporting guideline for bibliometric research [22], to provide a meaningful reference for interested researchers.

2. Materials and methods

2.1. Database for retrieval

All clinical studies on AR or asthma were retrieved and collated separately from the WoS Core Collection (Science Citation Index Expanded, Social Sciences Citation Index, and Art & Humanities Citation Index) using the Advanced Search Query Builder (Item 5a of Table S1). The WoS Core Collection is a widely recognized comprehensive document storage and retrieval platform that widely used in literature analysis and metrology research (Item 5b of Table S1 [22,23]).

2.2. Literature retrieval strategy

The detailed search strategies were as follows (Item 7 of Table S1).

- (1) for AR (retrieval date, November 11, 2023) (Item 5c of Table S1), (((TS=('Rhinitis, Allergic' OR 'Rhinitis, Allergic, Seasonal' OR 'Perennial allergic rhinitis' OR 'Allergic Rhinitides' OR 'Rhinitides, Allergic' OR 'Allergic Rhinitis' OR 'Seasonal Allergic Rhinitis' OR 'Allergic Rhinitides, Seasonal' OR 'Allergic Rhinitis, Seasonal' OR 'Rhinitides, Seasonal Allergic' OR 'Rhinitis, Seasonal Allergic' OR 'Seasonal Allergic Rhinitides' OR 'Pollen Allergy' OR 'Allergies, Pollen' OR 'Allergy, Pollen' OR 'Pollen Allergies' OR 'Pollinosis' OR 'Pollinoses' OR 'Hay Fever' OR 'Fever, Hay' OR 'Hayfever' OR 'Rhinitis, Allergic, Nonseasonal') AND TS=('Randomized Controlled Trial' OR 'Controlled Clinical Trial' OR 'Clinical Trial' OR 'Clinical Study' OR 'Clinical Trials, Randomized' OR 'Trials, Randomized Clinical' OR 'Controlled Clinical Trials, Randomized' OR 'Intervention Study')) AND DOP=(2013-01-01/2023-11-10)) AND DT=(Article) AND LA=(English).
- (2) for asthma (retrieval date, November 18, 2023) (Item 5c of Table S1), (((TS=('Asthma' OR 'Asthmas' OR 'Bronchial Asthma' OR 'Asthma, Bronchial') AND TS=('Randomized Controlled Trial' OR 'Controlled Clinical Trial' OR 'Clinical Trial' OR 'Clinical Study' OR 'Clinical Trials, Randomized' OR 'Trials, Randomized Clinical' OR 'Controlled Clinical Trials, Randomized' OR 'Intervention Study')) AND DOP=(2013-01-01/2023-11-10)) AND DT=(Article) AND LA=(English). After obtaining the retrieval results, eligible studies were further screened according to inclusion and exclusion criteria by reference to the title and abstract.

2.3. Inclusion and exclusion criteria

The detailed inclusion and exclusion criteria are as follows (Item 6 of Table S1).

- (1). For AR research, if the research object was AR, AR and asthma, or an allergic disease, including AR, it was included, and if it was not clear whether AR was included, it was excluded. Therefore, studies focusing on AR should be conducted.
- (2). For asthma research, if the research focused on asthma, asthma and AR, or allergic diseases, including asthma, it was included; if it was not clear whether asthma was included, it was excluded. In other words, study participants with asthma should be included.
- (3). Clinical studies on humans and should be published in English in the form of articles.
- (4). Studies, which were consensus, guidelines, or reviews, were excluded.
- (5). Studies were published between January 1, 2013, and November 10, 2023.

2.4. Bibliometric analysis

- (1) Software involved.

All eligible studies meeting the inclusion criteria were further analyzed using bibliometrics with the help of Biblioshiny, mainly using default settings (Item 9 of Table S1). Biblioshiny is a web-based application that depends on BIBLIOMETRIX—an open-source R tool used for comprehensive science mapping analysis of scientific documents [24]. The partial results were visualized and integrated using GraphPad Prism (version 9.0.0) and Adobe Photoshop (version 13.0.1).

(2) Bibliometric Indicators.

The included studies were mainly evaluated based on the following indicators: overview (annual scientific production, average citations per year); contribution of authors, sources, affiliations, and countries (core sources by Bradford's law, prolific or impactful authors, institutions, or countries; collaboration among authors, institutions, or countries); evolution of hotspots or keywords (Item 8 of Table S1).

3. Results

3.1. Literature searching and screening

Following the retrieval strategy, 387 articles on AR and 1837 articles on asthma were retrieved from the Web of Science Core Collection. To obtain eligible literature more accurately, the search results were manually filtered according to the inclusion and exclusion criteria. Ultimately, 261 eligible articles on AR and 991 qualified articles on asthma were included in subsequent analyses. The detailed procedure is presented in the flowchart (Fig. 1) (Item 10 of Table S1).

3.2. Summary of global clinical research trends on AR and asthma

From 2013 to 2023, 261 clinical studies focused on AR, and 991 clinical studies dealt with asthma. The annual publication volumes of articles on AR and asthma remained stable, with growth rates of 0.87 % and -3.41 %, respectively, but the total citations increased annually, according to Web of Science analysis (Fig. 2 and Table 1). The 261 articles on AR, published by 1697 authors, covered 604 authors' keywords and 6103 references, which were less than the 991 asthma-related studies, completed by 6313 authors, involving 2118 authors' keywords and 25,367 references (Table 1). However, the international co-authorship rate for AR (29.5 %) was higher than that for asthma (26.24 %) (Table 1). Bradford's law analyses identified nine and ten core journals for AR and asthma, respectively, which included 34.87 % and 34.21 % of the total articles in their respective fields and further provided significant references and optimal choices for researchers in both fields (Fig. 3). Notably, the Journal of Allergy and Clinical Immunology and Trials, as common core journals in both fields, embodied their contributions to both fields (Fig. 3). According to the source's local impact by the H-index, the Journal of Allergy and Clinical Immunology was the most impactful publication and may provide an appropriate choice for the clinical research fields of AR and asthma (Figure S1).

3.3. Analysis and comparison of the authors' contributions in the clinical research fields of AR and asthma

In terms of personal contributions, the top ten most published authors, including OKUBO K, NOLTE H, and BERNSTEIN DI, contributed the most articles (76/261, 29.12 %) in the field of clinical research on AR, while the other top ten most prolific authors, including PHIPATANAKUL W, ISRAEL E, and WEISS ST, contributed the most articles (173/991, 17.46 %) in the field of clinical research on asthma (Fig. 4, Figure S2). The proportion of documents contributed by the top ten most prolific authors in the AR field was higher than that in the asthma field. Nevertheless, from the perspective of author influence, whether in the field of AR or asthma, not all of the top ten authors with the most published articles were the most influential authors, and even the sorting of the top ten most

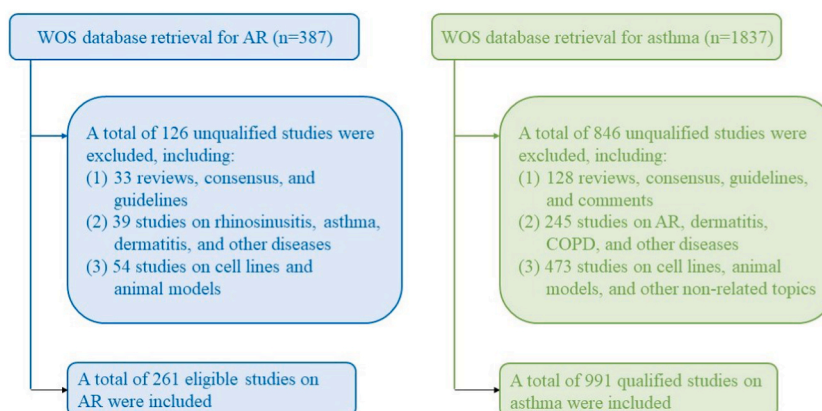


Fig. 1. Flowchart for literature retrieval and screening WOS, Web of Science; AR, allergic rhinitis; COPD, chronic obstructive pulmonary disease.

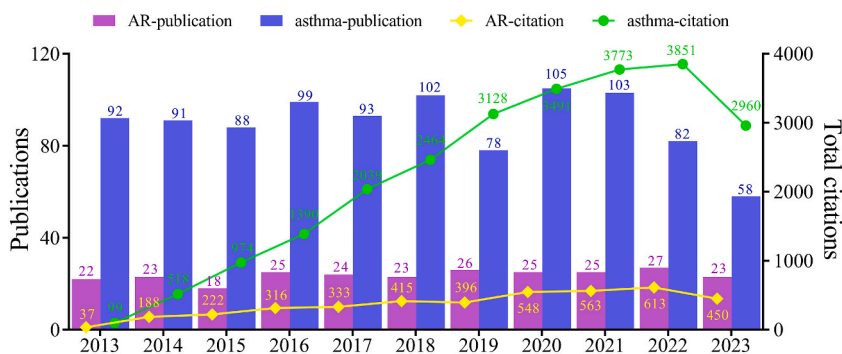


Fig. 2. Annual publications and total citations of AR and asthma related clinical studies AR, allergic rhinitis. Note that articles in 2023 were from January to November. Data analysis was based on the Web of Science database.

Table 1

Main information of AR and asthma clinical studies.

Description	AR	asthma
Timespan	2013–2023	2013–2023
Sources (Journals, Books, etc)	107	296
Documents	261	991
Annual Growth Rate (%)	0.87	–3.41
Document Average Age	4.8	5.11
Average citations per document	15.64	24.92
References	6103	25367
Keywords Plus (ID)	674	2196
Author's Keywords (DE)	604	2118
Authors	1697	6313
Authors of single-authored docs	1	3
Single-authored docs	1	3
Co-Authors per Doc	7.81	8.78
International co-authorships (%)	29.5	26.24

AR: Allergic Rhinitis.

influential authors did not match that of the top ten most prolific authors (Fig. 5). For instance, ZHNG L and OKANO M, who contributed productive articles on AR, were not listed among the top ten most influential authors (Figs. 4A and 5A). CAMARGO CA and WECHSLER ME showed similar results in the field of asthma (Figs. 4B and 5B). From the viewpoint of citations, documents with the top global and local citations for AR were contributed by PATEL D (<https://doi.org/10.1016/j.jaci.2012.07.028>) and CHOI SM (<https://doi.org/10.1111/all.12053>) respectively, while the documents with the highest global and local citations for asthma were completed by HANANIA NA (<https://doi.org/10.1164/rccm.201208-1414OC>) and LITONJUA AA (<https://doi.org/10.1001/jama.2015.18589>) respectively (Table S2).

3.4. Contributions of institutions and countries in AR and asthma

Among institutions dedicated to researching AR and asthma, Humboldt University of Berlin, Charite Universitätsmedizin Berlin, and Free University of Berlin ranked in the top ten productive institutions in clinical research on AR and contributed 127 articles (48.66 % of 261). Harvard University, Johns Hopkins University, and Harvard Medical School occupied positions among the top ten prolific institutions in similar fields of asthma and supported 831 articles (83.85 % of 991), which prompted that the most productive institutions have contributed most articles, especially studies on asthma (Fig. 6). Harvard University has made significant contributions to the clinical studies on AR and asthma, providing 11 and 208 articles, respectively, for AR and asthma (Fig. 6). Timeline analyses of production indicated that the institution's cumulative production increased annually for AR and asthma (Figure S3). Three-field plot analyses revealed that the top ten productive authors who focused on AR belonged to the Capital Medical University in China, Imperial College London in the United Kingdom, Nippon Medical School in Japan, and three institutions in Germany, including Humboldt University of Berlin, Free University of Berlin, and Charite Universitätsmedizin Berlin (Figure S4A). Interestingly, the three-field plot also presented the top ten prolific authors who dedicated themselves to research on asthma; they were mainly affiliated with academic institutions in the USA, including Harvard University, Johns Hopkins University, Brigham and Women's Hospital, Harvard Medical School, Pennsylvania Commonwealth System of Higher Education, University of California System, and University of Pennsylvania (Figure S4B). Furthermore, two British companies, AstraZeneca and GlaxoSmithKline, were involved in asthma-related studies, reflecting the importance of the relevant research and commercial prospects (Figure S4B). According to the corresponding authors' countries, China (57 articles) and the USA (350 articles) occupied the top positions in the countries producing research on AR

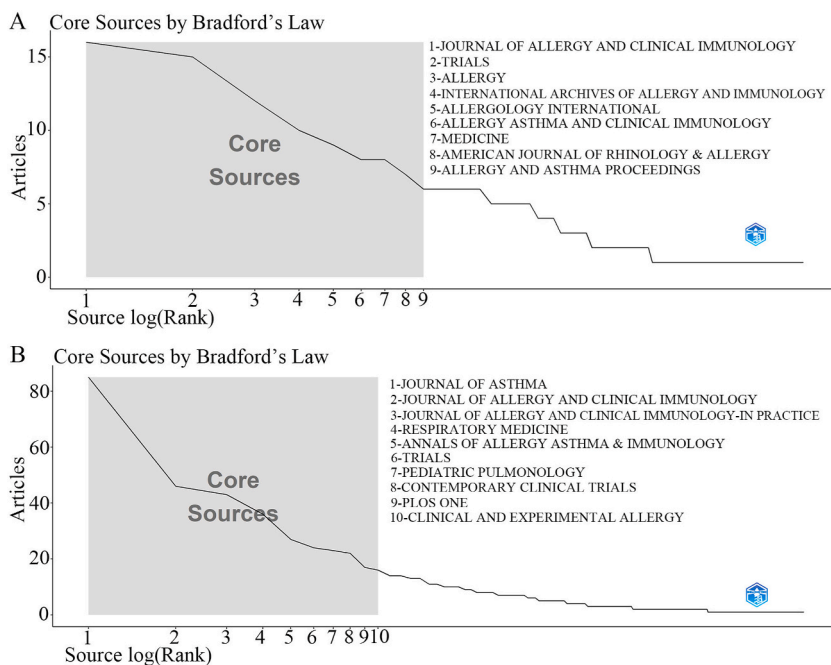


Fig. 3. Core journals for allergic rhinitis and asthma related studies Core journals for allergic rhinitis related clinical studies (A) and asthma related clinical studies (B). Bradford's law indicates that most articles were contributed by core journals.

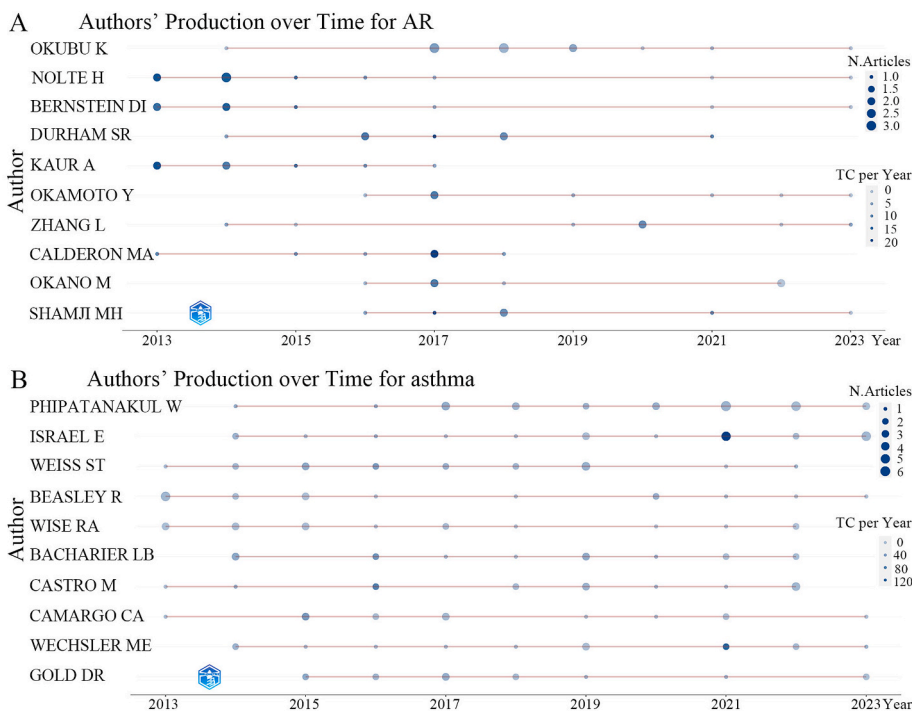


Fig. 4. Author production overtime for AR and asthma AR, allergic rhinitis; N, of Articles, number of articles; TC, total citations per year.

and asthma (Table 2). In the research field of AR or asthma, the USA ranked first among the most-cited countries, followed closely by the United Kingdom (Table 2). Additionally, the country's cumulative production maintained a slight increase for AR and asthma, except for significant growth in China and the USA (Figure S5).

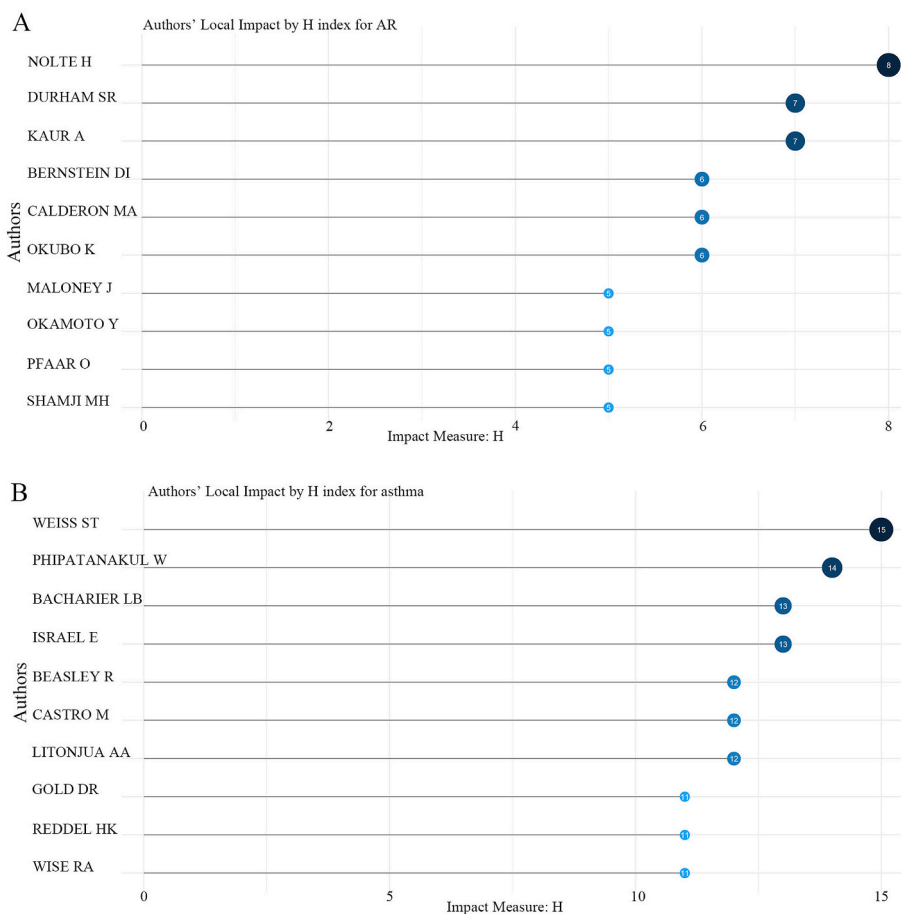


Fig. 5. Most influential authors in AR and asthma AR, allergic rhinitis. The authors' impact was measured using the H-index. H means high citations.

3.5. Summary of collaboration at author, institution, or country level

The authors' collaboration networks showed that the degree of cooperative intimacy varied among the authors; however, the closeness of collaboration among authors who focused on asthma was more than that of AR (Fig. 7). The collaboration network among the authors of AR identified nine clusters, with the two largest clusters (blue and green clusters), and prompted the largest node (NOLTE H), which indicated the author with the highest frequency of occurrence in AR (Fig. 7A). Meanwhile, the collaborative network of asthma generated 11 clusters, with the largest cluster (purple cluster), and hinted at the highly collaborative author (PHIPATANAKUL W) with the highest betweenness in asthma (Fig. 7B). Additionally, cooperation within the cluster was closer, but there were varying degrees of cooperation among the different clusters, which further indicated collaboration among authors (Fig. 7).

In terms of collaborative degrees, the institutions that studied allergic diseases were clustered into nine and 17 clusters for AR (Fig. 8A) and asthma (Fig. 8B), respectively. Institutions in the same cluster showed closer cooperative relationships, although they were affiliated with different countries. For instance, in the largest cluster (green cluster) gathered by 11 institutions that studied AR, Humboldt University of Berlin belongs to Germany, and Harvard University belongs to the USA, but Humboldt University of Berlin and Harvard University have a cooperative relationship (Fig. 8A). The institutions located in different clusters maintain varying degrees of cooperation. For example, among the institutions that focused on asthma, Boston Children's Hospital, a node located in the largest cluster (brown cluster), collaborated with Harvard University, which is located in the second cluster (purple cluster) (Fig. 8B).

The degree of cooperation among countries also varied. Nonetheless, for AR, cooperation among countries was relatively concentrated in the Occident, with the closest cooperation between the USA and Germany, as well as between the USA and the United Kingdom (Fig. 9A). Although studies on asthma were mainly conducted by the Occident, Eastern countries, such as China, South Korea, and Japan, also participated in pivotal collaborations (Fig. 9B).

3.6. Co-occurrence, hotspots, and emerging keywords of AR and asthma

The co-occurrence networks of keywords plus were obtained using Biblioshiny according to the default parameters (Clustering

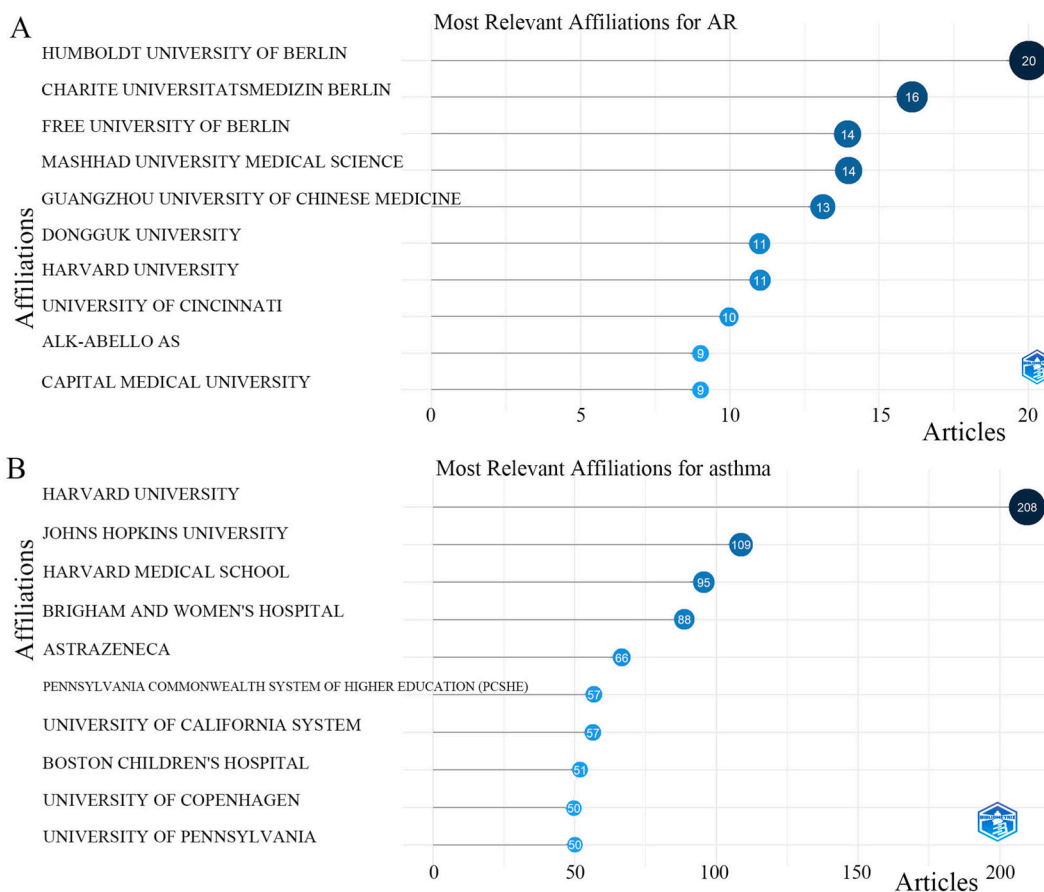


Fig. 6. Most relevant affiliations for AR and asthma AR, allergic rhinitis. This figure presents the most productive institutions dedicated to AR and asthma research.

Table 2

Top 10 productive countries and most cited countries.

Top 10 Productive Countries				Top 10 Most Cited Countries			
AR		asthma		AR		asthma	
Country	N(SCP/MCP)	Country	N(SCP/MCP)	Country	TC	Country	TC
CHINA	57(54/3)	USA	350(294/56)	USA	909	USA	9866
USA	30(11/19)	UNITED KINGDOM	88(44/44)	UNITED KINGDOM	512	UNITED KINGDOM	3215
GERMANY	21(11/10)	CHINA	70(61/9)	GERMANY	468	CANADA	1821
JAPAN	18(18/0)	AUSTRALIA	48(38/10)	CHINA	335	AUSTRALIA	1078
KOREA	18(17/1)	CANADA	39(32/7)	FRANCE	287	GERMANY	890
UNITED KINGDOM	14(4/10)	IRAN	29(27/2)	SPAIN	204	DENMARK	816
IRAN	12(11/1)	DENMARK	27(19/8)	JAPAN	185	NEW ZEALAND	790
THAILAND	12(9/3)	JAPAN	27(22/5)	KOREA	162	CHINA	705
AUSTRALIA	9(5/4)	NETHERLANDS	27(17/10)	DENMARK	153	SWITZERLAND	635
SPAIN	8(6/2)	BRAZIL*	25(21/4)	SWITZERLAND	150	NETHERLANDS	505

AR: Allergic Rhinitis, N: Number of Articles, SCP: Single Country Publications, MCP: Multiple Country Publications, TC: Total Citations.

The number of articles in Productive Countries was calculated based on corresponding authors' country. *NEW ZEALAND, like BRAZIL, ranked the tenth with 25(8/17) articles.

Algorithm: Walktrap, Number of Nodes: 50, Repulsion Force: 0.1, Minimum Number of Edges: 2). The network indicated that keywords for AR were grouped into three clusters and highlighted hot topics, such as the top ten hotspots with the highest betweenness and closeness, including asthma, efficacy, impact, safety, double-blind, quality-of-life, rhinitis, prevalence, children, and rhinoconjunctivitis (Fig. 10A, Table S3). Meanwhile, keywords related to asthma were concentrated into two clusters and revealed the top ten hottest topics: children, quality-of-life, randomized controlled trial, management, adults, exacerbations, outcomes, validation, childhood asthma, and adherence (Fig. 10B, Table S3). Thus, quality-of-life and children are hot topics of attention, whether in the

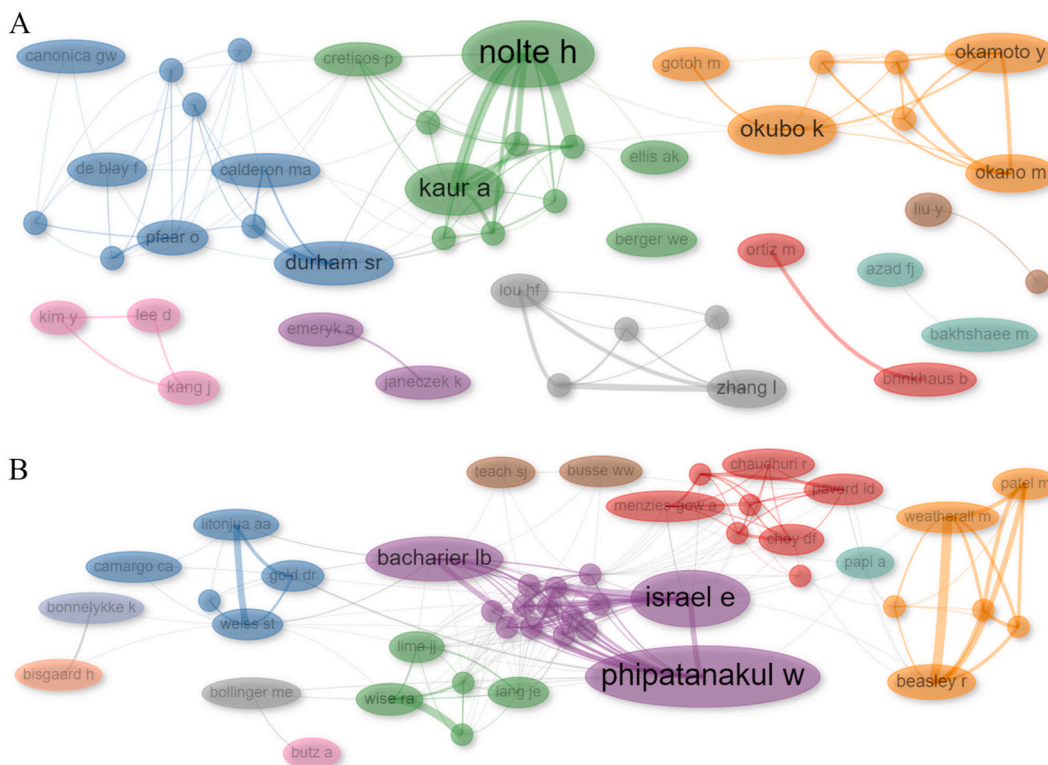


Fig. 7. Collaboration network of authors Collaborative network of authors studying allergic rhinitis (A) and asthma (B). The node size shows the frequency of occurrence and the thickness of the line represents the degree of closeness among different authors. Colours indicate different clusters with strong collaboration among authors. (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

fields of AR or asthma, further suggesting that paying attention to the impact of allergic diseases on children's quality of life may be a common focus in the fields of AR and asthma. Time-based keyword emergence analyses indicated that the focus on asthma and AR shifted in 2015 and 2016, respectively, and certain novel hotspots continued to emerge over time (Figure S7). For instance, immunotherapy became the focus of AR-related clinical research in 2016, lasting until 2022 and peaking in 2018 (Figure S7A). Thymic stromal lymphopoietin (TSLP) emerged as a popular topic in asthmatic clinical studies in 2020 (Figure S7B). Importantly, the thematic maps identified ten and 12 clusters for AR and asthma, respectively, and displayed the distribution of clusters in different themes. For instance, the clusters with acupuncture or safety as the cores were located in the quadrant of Motor Themes, while the clusters with rhinitis or asthma were located in the quadrant of Basic Themes (Fig. 11). Drawing support from the thematic maps, the analyses further suggested emerging issues—the cluster centered around nasal irrigation for AR (Fig. 11A) and clusters centered around depression and allergic rhinitis for asthma (Fig. 11B).

4. Discussion

Bibliometrics is a system that involves mathematics, statistics, philology, informatics, and other disciplines to explore and visualise the current research status around a certain topic from literature generation, structure, transmission, utilization, and multiple other indicators [25–29]. More critically, as an interdisciplinary field, bibliometrics can furnish valuable research directions and hotspots for concerned issues through overall analyses and has been extensively applied in medical science research [30–33]. For instance, bibliometric analysis has successfully explored tendencies in many fields, including renal transplantation [34], alternative protein allergenicity [35], and nanomedicine [36,37]. Furthermore, profit from the development of bibliometrics, profound progress has been achieved in the global evaluation and comprehensive analysis of research related to allergic diseases [38–40]. Bibliometric analysis has identified the significant roles of acupuncture and immunotherapy in the treatment of AR and has prompted anticipated hotspots and directions for future research on AR [41–43]. Additionally, using the methodology of bibliometrics, systematic evaluation and comprehensive analysis of asthma-related research have been completed, and research hotspots, frontiers, and directions in this field have been explored [44–46].

Among various allergic diseases, AR and asthma have attracted increasing attention from numerous researchers because of their serious impact on the quality of life and even their threat to life [1,11,47,48]. Given the theory of identical airways and the mutual influence of AR and asthma, exploring research tendencies in asthma could contribute to perfecting research strategies for AR.

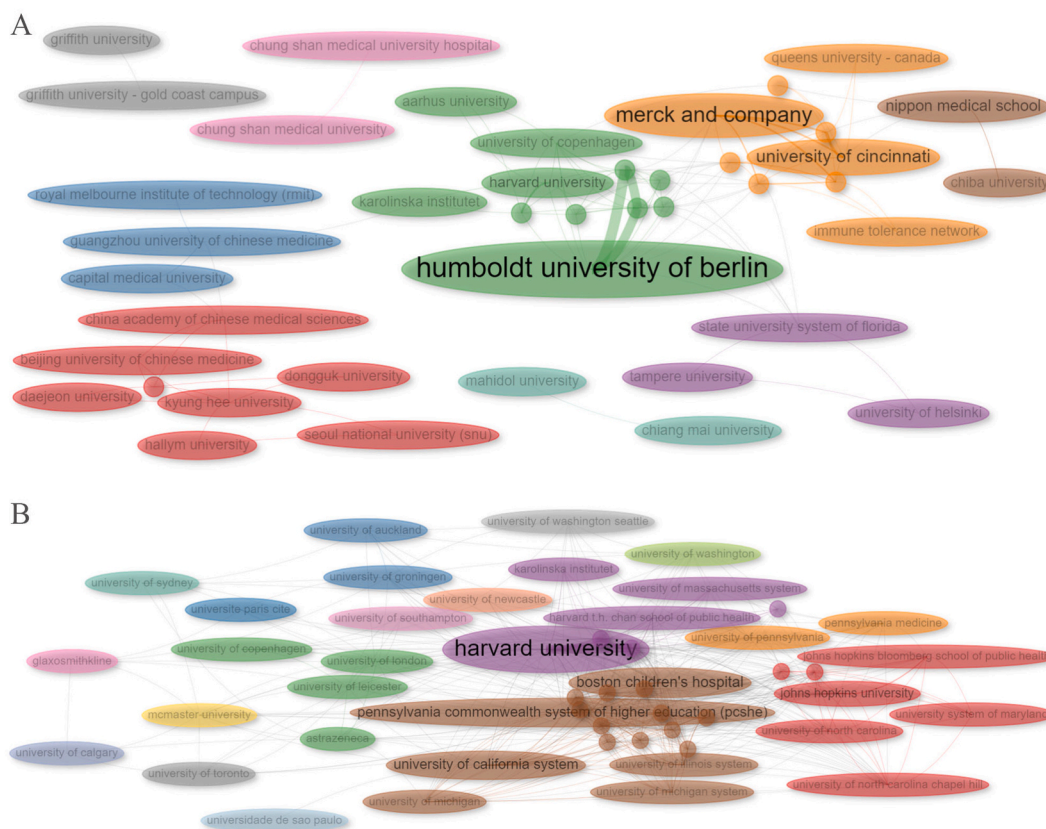


Fig. 8. Institutions' collaboration network The institutional collaboration networks revealed varying degrees of cooperation between different institutions, focusing on allergic rhinitis (A) and asthma (B). The node size shows the frequency of occurrence, and the thickness of the line represents the degree of closeness among different institutions. Colours indicate different clusters with strong collaboration among institutions. (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

Summarizing the current status of AR research could also benefit asthma-related research. Undoubtedly, a bibliometric analysis can effectively support this hypothesis. Bibliometrics has been applied separately to the overall review of AR and asthma and has provided significant research hotspots and directions in both fields [41,49–51]. Nonetheless, to the best of our knowledge, using the methodology of bibliometrics, a comprehensive analysis and comparison focusing on the research trends of AR and asthma has not been reported. To address this gap, the present study analyzed and compared the clinical research tendencies in the fields of AR and asthma to propose new inspirations and ideas for the two fields.

To complete the abovementioned assumption, this study incorporated numerous clinical studies (261 on AR and 991 on asthma) into a series of subsequent analyses. Significantly, the number of articles on asthma was four times that of articles on AR, indicating that more researchers and institutions have invested their energy in advancing asthma-related clinical research, although the prevalence of AR (5–50 %) [1] was higher than that of asthma (3.42 %) [52]. A possible reason for this phenomenon is that asthma could pose greater threats to human life, even causing death [48,52,53], although asthma and AR have varying degrees of impact on quality of life. Hence, identifying excellent research on asthma could provide new ideas and directions for research related to AR, and vice versa. According to Bradford's law [54], the present analysis identified the *Journal of Allergy and Clinical Immunology* as the core journal in AR and asthma, which also ranked first among the most influential publications with the highest H-index [55]. Researchers interested in allergic diseases should pay more attention to this journal to understand the cutting-edge research in related fields and incorporate it in candidate publications for submission. In addition to recommending the most prolific and influential authors who have made outstanding contributions in the field of allergic diseases, this study also highlighted hot topics in AR or asthma. The simultaneous occurrence of quality-of-life and children as hotspots for AR and asthma further indicates that focusing on the impact of allergic diseases on the quality of life of children may have greater clinical significance. Many studies have explored the impact of AR and asthma on children's quality of life [56–58]. However, more effective treatment methods must be explored, especially for patients with refractory AR [59].

Collaboration and communication can promote the development of scientific research, and collaborating with outstanding researchers in the field can better track and lead to cutting-edge topics. In light of this, this study identified prolific and impactful authors, institutions, and countries. For instance, NOLTE H, which had the highest H-index, was the most influential author in the field of AR-related clinical research and ranked second among prolific authors. In 2015, NOLTE H and his team observed the dosage and

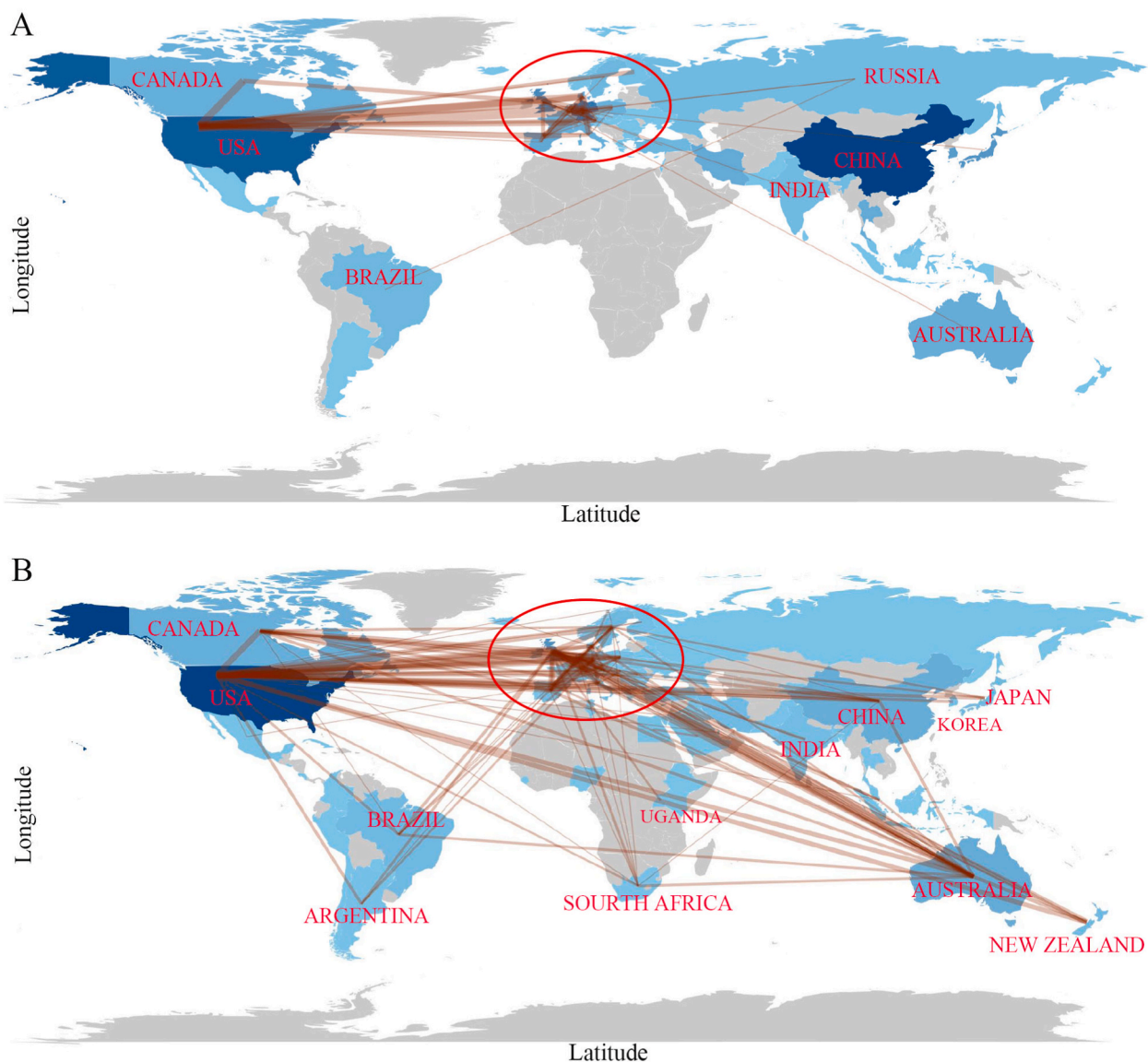


Fig. 9. Countries' collaboration world map (A): The countries with the most cooperation in studies on allergic rhinitis include USA, CANADA, and the countries within the red circle, which included GERMANY, UNITED KINGDOM, DENMARK, AUSTRIA, FRANCE, ITALY, BELGIUM, POLAND, and SWITZERLAND. (B): The countries with the most cooperation in studies on asthma include USA, CANADA, AUSTRALIA, NEW ZEALAND, and the countries located in the red circle, including UNITED KINGDOM, GERMANY, SWEDEN, ITALY, FRANCE, SPAIN, and IRELAND. (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

time dependence of sublingual immunotherapy (MK-8237) for AR and published their research findings, which displayed 118 citations and provided a significant reference for other studies [60]. Analyses recognized that the top ten most prolific authors on asthma were mainly concentrated in academic institutions in the USA, suggesting that asthma may impose a heavier burden on the USA [53,61]. The top ten productive authors on AR were mainly distributed in China, the United Kingdom, Japan, and Germany, which further prompted the four countries to bear a heavier burden of AR [62–65]. These findings provide valuable references for researchers seeking cooperation in AR and asthma studies. Nevertheless, some limitations were as follows. Owing to software limitations that Biblioshiny has the highest compatibility and ease of use with the WoS, only one search engine (WoS) was used to retrieve interesting studies. Hence, studies that were not indexed in the WoS were excluded, which caused unavoidable bias. Additionally, there may have been selection errors in the manual literature screening process (Item 14 of Table S1).

5. Conclusions

Overall, this study summarizes the research trends and prospects of AR and asthma using a bibliometric methodology.

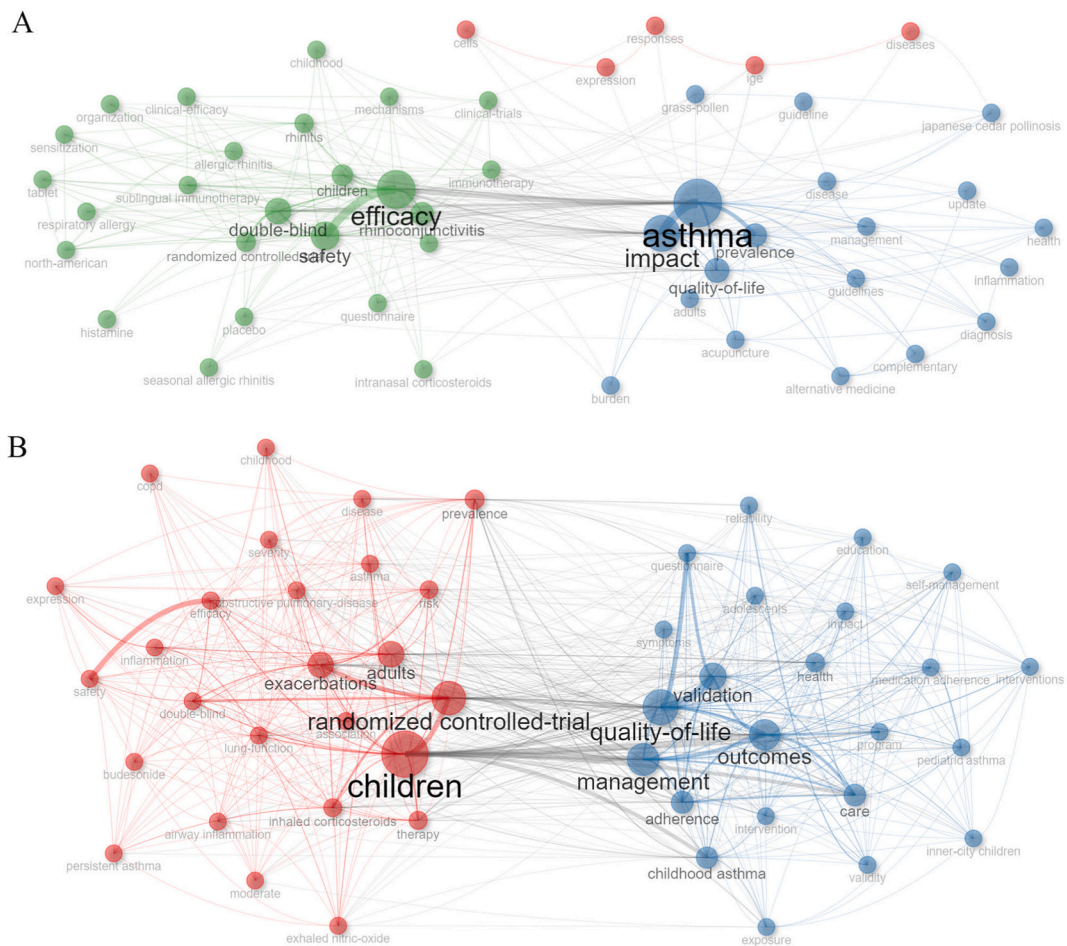


Fig. 10. Co-occurrence network of keywords plus The co-occurrence networks of keywords highlight the tendency of hotspots in allergic rhinitis (A) and asthma (B). The colours of the nodes represent different clusters. The distance between nodes represents the frequency of keyword co-occurrence. Node size represents the frequency of keyword occurrences. (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

Significantly, this study identified the *Journal of Allergy and Clinical Immunology* as the most influential journal in AR and asthma, providing an appropriate choice for clinical research in the two fields. Moreover, this study confirmed the significant contributions of Harvard University to the clinical studies on AR and asthma. Meanwhile, this study further identified impactful documents, authors, and institutions and prompted us to focus on the impact of allergic diseases on children's quality of life, which may be the hotspots of AR and asthma. Of particular importance, this study compared the aforementioned results regarding AR and asthma, which provided a dependable theoretical basis and reference for further research on AR or asthma (Item 13 of [Table S1](#)).

Ethical statement

Not applicable.

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Data availability statement

All relevant data were included in this study. All original articles were retrieved from the Web of Science Core Collection (Item 18 of [Table S1](#)).

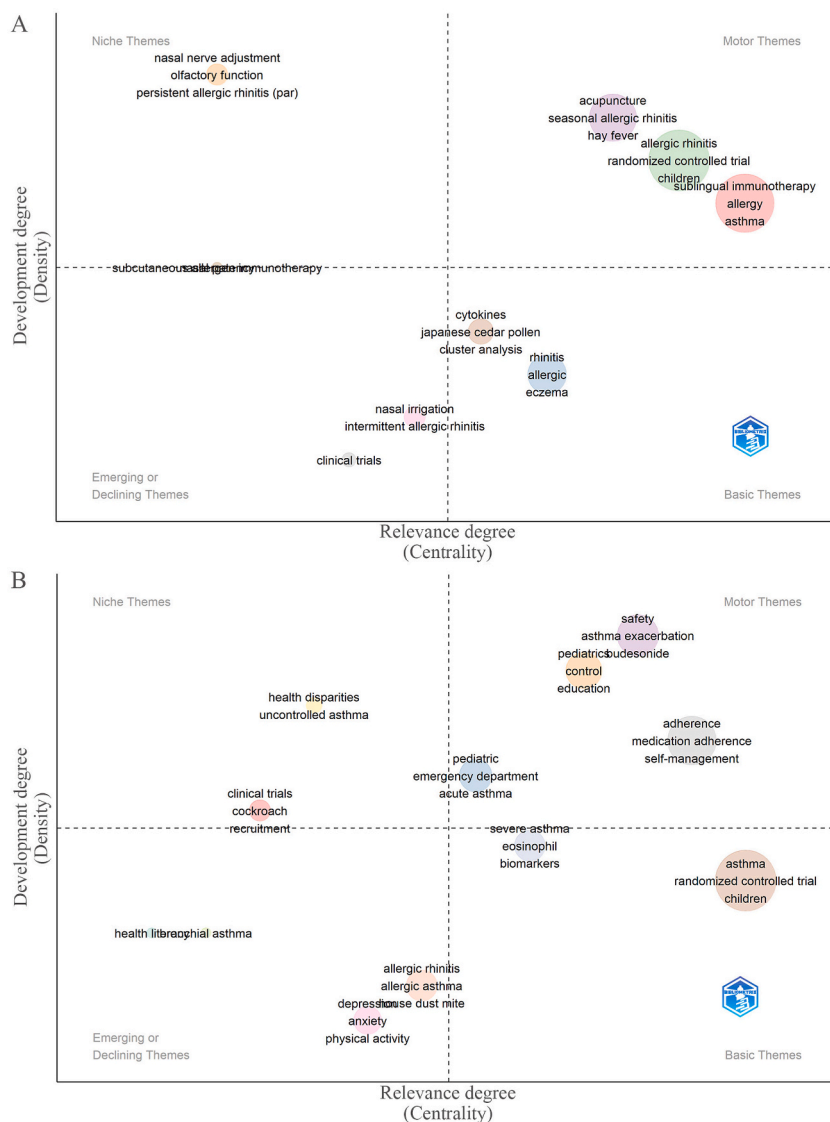


Fig. 11. Thematic map of authors' keywords Thematic maps show the distribution of the major clusters of authors' keywords for allergic rhinitis (A) and asthma (B). The colours represent the different clusters of keywords. (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

CRedit authorship contribution statement

Lei Zhao: Writing – original draft, Software, Methodology, Data curation, Conceptualization. **Jianwang Yang:** Writing – original draft, Visualization, Software, Data curation. **Tao Liu:** Visualization, Data curation. **Huan Cao:** Writing – review & editing. **Yuan Liang:** Writing – review & editing. **Baoshan Wang:** Supervision, Project administration, Methodology, Funding acquisition, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.heliyon.2024.e32829>.

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