Global productivity, international collaborations, and research trends in chronic spontaneous urticaria: A bibliometric overview

Hugo W. F. Mak, MBBS, MRes(Med),[a]* Freya K. L. Chung, MBBS,[a]* Philip H. Li, MD,[a,b] and Marcus Maurer, MD[c]†

Hong Kong and Guangdong, China, and Berlin, Germany

Background: The treatment of chronic spontaneous urticaria (CSU) remains a challenge despite novel therapies such as omalizumab. With growing international interest in research on CSU, a comprehensive review of the global productivity, collaborations, and trending topics in CSU research may help inform future directions in patient management.

Objectives: This study aims to outline the trends in CSU research by using bibliometric analysis, focusing specifically on global productivity, collaborative efforts, and emerging research topics spanning from 1977 to 2023.

Methods: Publications related to CSU, including original articles, reviews, and letters, were sourced from the Web of Science Core Collection, and statistical analyses were performed using the Bibliometrix package in R and IBM SPSS Statistics.

Results: A total of 2940 publications from 77 countries were analyzed. CSU research activity has increased exponentially since 2010, with more than half of the publications (50.2% [1477 of 2940]) published since 2016. These publications appeared in allergy, immunology, and dermatology journals led predominantly by European, Asian, and American researchers. International collaborations rose from 11.3% to 22.2%. Shifts in research focus, such as a shift in treatments from antihistamines to omalizumab, and growing emphasis on quality of life were noted.

Conclusion: This study revealed a dynamic and increasingly collaborative CSU research landscape, emphasizing the need for continuous global partnerships to enhance treatment outcomes and improve patients' quality of life. Challenges regarding access to advanced therapies persist, highlighting the importance of expanding international collaborations and inclusive research practices. (J Allergy Clin Immunol Global 2025;4:100455.)

Key words: *Bibliometric, chronic, research, spontaneous, trends, urticaria*

Chronic spontaneous urticaria (CSU), previously also referred to as chronic idiopathic urticaria, is a condition characterized by the occurrence of wheals, angioedema, or both for more than 6 weeks in the absence of identifiable triggers.[1] The global prevalence of CSU is estimated to be between 0.5% and 1%.[2] The majority of CSU cases can be classified as either type I ("autoallergic" CSU), which is characterized by IgE antibodies against local autoallergens, or type IIb ("autoimmune" CSU), which is marked by IgG autoantibodies to IgE or its receptors.[3] In both types, activation of the IgE pathway sparks mast cell degranulation, resulting in wheals and/or angioedema.

From a clinical perspective, diagnosing and treating CSU presents unique challenges. Because CSU is diagnosed on the basis of clinical observations, it is crucial to differentiate CSU from chronic urticaria caused by other factors such as autoimmune diseases, infections, or drug reactions. Additionally, it is important to distinguish CSU from other conditions that present with symptoms of wheals and/or angioedema, such as hereditary angioedema and urticarial vasculitis.[4-7] Another subtype of chronic urticaria, chronic inducible urticaria, may coexist with CSU, and patients may exhibit a more severe and refractory disease course.[8,9] Therapeutically, current regional and international guidelines advocate for a stepwise treatment approach for CSU, which includes second-generation H1 receptor blockers and add-on treatments such as omalizumab or cyclosporin.[1,4] Despite the availability of these treatments, many patients with CSU continue to experience this potentially debilitating disease, with only approximately one-third of these patients responding to standard dose antihistamines and less than 50% of patients achieving remission at 5 years.[10,11]

Although the output of CSU research has experienced substantial growth in recent years, there has been a lack of comprehensive reviews on worldwide productivity, collaboration, and emerging research trends. In this study, we aim to summarize the evolution of CSU research and provide guidance for future directions by analyzing its trends through bibliometric analysis.

METHODS

Bibliometrics is a field of study that analyzes academic publishing. It uses statistical methods to illustrate publishing trends and reveal relationships between various published works.[12,13] The methodology for this study, as detailed in Fig 1, involved retrieving all original articles, letters, and reviews related to CSU until December 31, 2023, from the Web of Science Core Collection (Clarivate, London, United Kingdom).

From [a]the Division of Rheumatology and Clinical Immunology, Department of Medicine, Queen Mary Hospital, The University of Hong Kong; [b]the Division of Rheumatology and Clinical Immunology, Department of Medicine, University of Hong Kong-Shenzhen Hospital, Guangdong; and [c]the Fraunhofer Institute for Translational Medicine and Pharmacology, Immunology and Allergology, Berlin.

*These authors contributed equally to this work.

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Corresponding author: Philip H. Li, MD, Department of Medicine, Queen Mary Hospital, The University of Hong Kong, 102 Pokfulam Rd, Hong Kong. E-mail: liphilip@hku.hk.

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Abbreviations used
ACARE: Angioedema Center of Reference and Excellence
CSU: Chronic spontaneous urticaria
PROM: Patient-reported outcome measure
QoL: Quality of life
TF: Term frequency
UCARE: Urticaria Center of Reference and Excellence

Duplicate and non-English records were excluded. We extracted metadata such as authors, countries, year and journal of publication, cited references, and authors' key words. For key word and trend analysis, synonyms or variations were consolidated into the most frequently used term.

Statistical analyses were performed using the Bibliometrix package on R, version 4.3.1 (R Foundation, Vienna, Austria). We analyzed temporal (by year) and geographic (by country) publication trends, as well as trends in collaboration. Key word and trend analyses were conducted to explore the most frequently used key words and research trends during the study period. The chi-square test was used to compare the proportion of multinational work between 1977 and 2010 with that between 2011 and 2024 by using IBM SPSS Statistics, version 28.0 (IBM, Armonk, NY). A 2-sided *P* value less than .05 was considered statistically significant. Ethical approval was not required because the study solely involved published scholarly data.

RESULTS

From 1977 to 2023, we analyzed a total of 2,940 articles (comprising 2,000 articles, 636 reviews, and 304 letters) from 77 countries. These articles were cited a total od 85,053 times, resulting in an h-index of 118 and an average of 28.93 citations per article. The global increase in publications on CSU has been exponential and particularly noticeable since 2010. As shown in Fig 2, more than half of all publications on CSU (50.2% [1,477 of 2,940]) were produced after 2016.

CSU research spans multiple specialties and disciplines, frequently appearing in major immunology, allergy, and dermatology journals (Table I). Research on CSU was not confined to any specific region and has garnered international interest. European authors have been notably productive in publications on CSU, although authors from Asia and America have also been highly prolific, with some of the earliest publications originating from Asia (Fig 3). Overall, 19.1% (560 of 2940) of the publications involved international coauthorship, with a significant increase from 11.3% (in 1977-2010) to 22.2% (in 2011-2024) ($P < .001$) (Fig 4). Various geographic areas around the world are represented, with a tendency for collaboration with European authors.

In total, we identified a total of 3266 different key words. The most frequent key words (including variations and synonyms) from 1977 to 2010 were *antihistamine* (term frequency [TF] = 66), *autologous serum skin test* (TF = 34), *histamine* (TF = 33), and *mast cell* (TF = 33). After 2010, the most frequent key words were *omalizumab* (TF = 353), *angioedema* (TF = 149), *antihistamine* (TF = 104), and *quality of life* (QoL) (TF = 100), as depicted in Fig 5. Trend topics are also illustrated in Fig E1 (available in the Online Repository at www.jaci-global.org), which shows the evolving topics in CSU over time.

DISCUSSION

To our knowledge, this is the first dedicated bibliometric analysis of the entirety of CSU-related publications. In this report, we have demonstrated a rapid growth in publications on CSU, especially since 2010, along with a significant increase in international coauthorships.

Synergy is crucial for advancing CSU care and research. This is perhaps best exemplified by the Urticaria Centers of Reference and Excellence (UCARE) and Angioedema Centers of Reference and Excellence (ACARE), 2 sister global networks that connect centers and have curated multiple successful multinational initiatives.[14] For instance, CURE (the Chronic Urticaria Registry) and CARE (the Chronic Angioedema Registry), which were inaugurated in 2015 and 2023, respectively, have led to a number of impactful reports that well summarize the real-world characteristics of CSU.[8,15,16] At the time of writing of this article, there are 186 accredited UCARE centers and 102 accredited ACARE centers globally. These centers are spread across 48 and 41 countries, respectively, spanning 6 continents. Additionally, the Chronic Urticaria Self-Evaluation App, CRUSE, which was launched in 2022, is a mobile health app (available in at least 17 countries in their local languages) that was developed by an international panel of experts.[17] These projects facilitate researchers and clinicians tackling CSU at an international level, paving the way for more standardized and equitable CSU research and care. They also provide an opportunity to explore previously unaddressed topics, such as the impact of comorbidities and distinct endotypes, including patients with concurrent CSU and chronic inducible urticaria.

Of note, our key word and trend analysis showed that the term *QoL* has rapidly gained popularity and has been ranked among the top 3 key words since 2011. Over the past decade, various urticaria- and angioedema-specific patient-reported outcome measures (PROMs) have been developed and validated across different languages and populations. Notable examples include the Urticaria Activity Score, Angioedema Activity Score, Urticaria Control Test, Angioedema Control Test, Chronic Urticaria QoL Questionnaire, and Angioedema QoL Questionnaire.[18-27] The availability of these PROMs has greatly enhanced our understanding of patients' experiences with CSU and has made our care more systematic, measurable, and patient centered.[28] International guidelines recommend the use of PROMs such as the Urticaria Control Test and the Urticaria Activity Score to assess individual disease control and guide treatment decisions, ultimately aiming for complete symptom control and normalization of QoL.[1,4] Recently, the introduction of digital technologies such as CRUSE has further facilitated the integration of PROMs into routine clinical practice and real-world research, making these assessments more digitalized, accessible, streamlined, and favored by patients. For example, CRUSE eliminates a significant obstacle to the application of PROMs in daily practice, namely, time constraint in consultations, by enabling patients to complete PROMs at home.[29] This tool also empowers patients to monitor their own disease control and treatment efficacy, as well as to identify potential triggers of their symptoms. As a result, patients can achieve better self-management of their disease, such as improvement of their adherence to medication.[30,31]

Another notable change in the field of CSU is the shift in treatment modalities from antihistamines to omalizumab, with omalizumab having undoubtedly become the cornerstone of CSU management and research since its debut for CSU in 2013.[32]

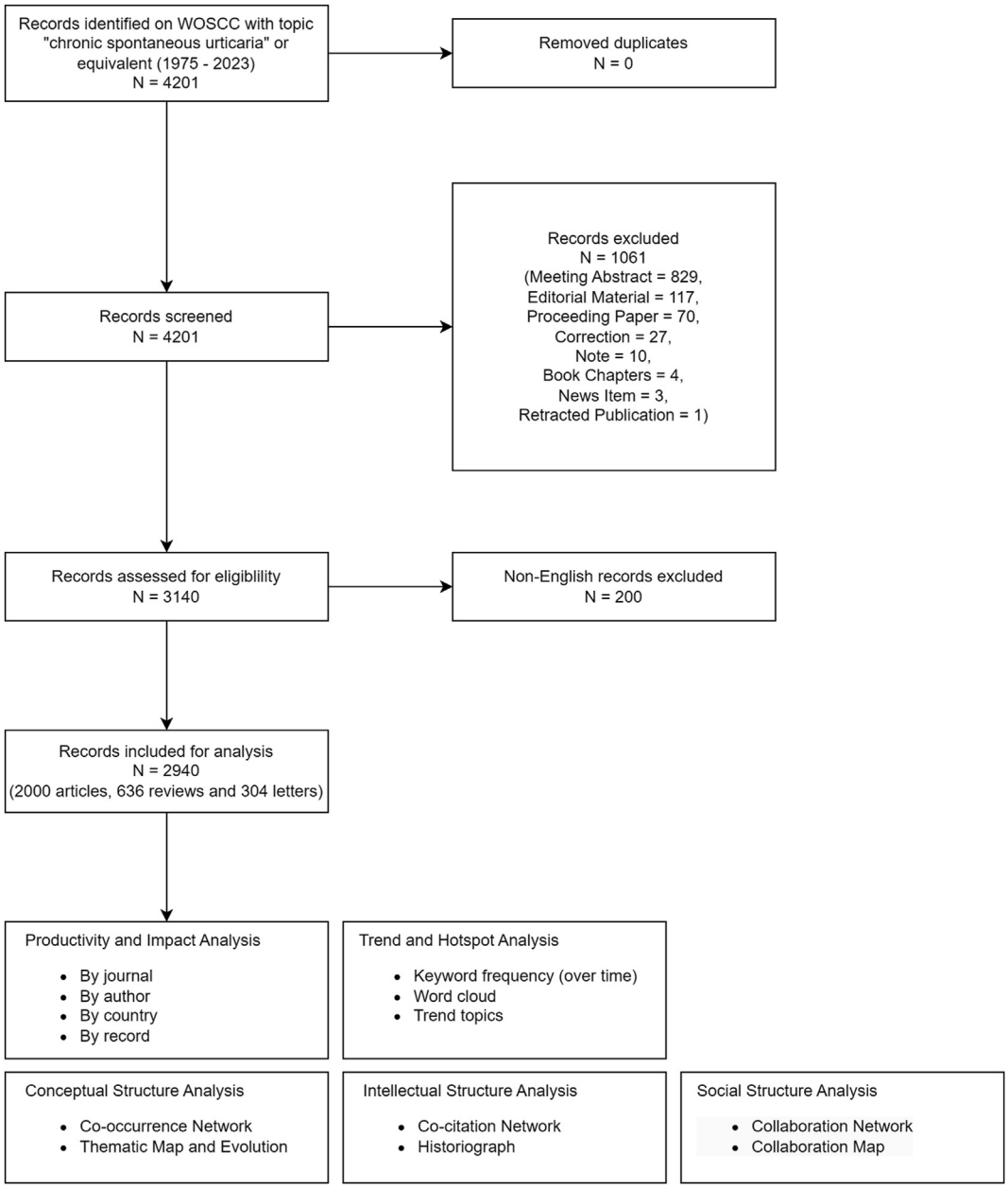

FIG 1. Strategy for CSU literature search.

However, access to omalizumab remains a real-world challenge in some parts of the world.[33,34] Even in developed regions such as Hong Kong, the high cost of omalizumab continues to be a significant treatment barrier for patients with CSU. Fewer than 6% of patients received omalizumab when they had to finance the drug themselves compared with 29% when the drug's cost could be reimbursed. Clinically, the group that utilized omalizumab more had significantly greater improvements in PROMs.[34] Type IIb autoimmune CSU, which accounts for approximately 15% of all cases, also remains a difficult entity for immunologists because of its relatively slower or inadequate response to omalizumab.[35] As of the writing of this article, all licensed treatment options for CSU remain symptomatic, with no disease-modifying or curative treatments yet available.[36] Fortunately, since the success of omalizumab, the enthusiasm for and efforts to introduce biologics or small molecule therapies for antihistamine-refractory CSU have continued, with various promising and potentially more effective treatments under active investigation.[37-42] Whether these novel therapeutics can address the unmet treatment needs in CSU management will be of great interest for future research.

This study has several limitations, including its observational nature, the exclusion of non-English articles (which may underestimate the contributions from certain regions), the reliance on a single data source, and the absence of detailed manual screening of individual publications. The number of articles published specifically by UCARE and ACARE centers were also unavailable. It is also possible that the proportion of international collaborations has been overestimated, as many missed non-English publications tend to be mononational. This highlights the

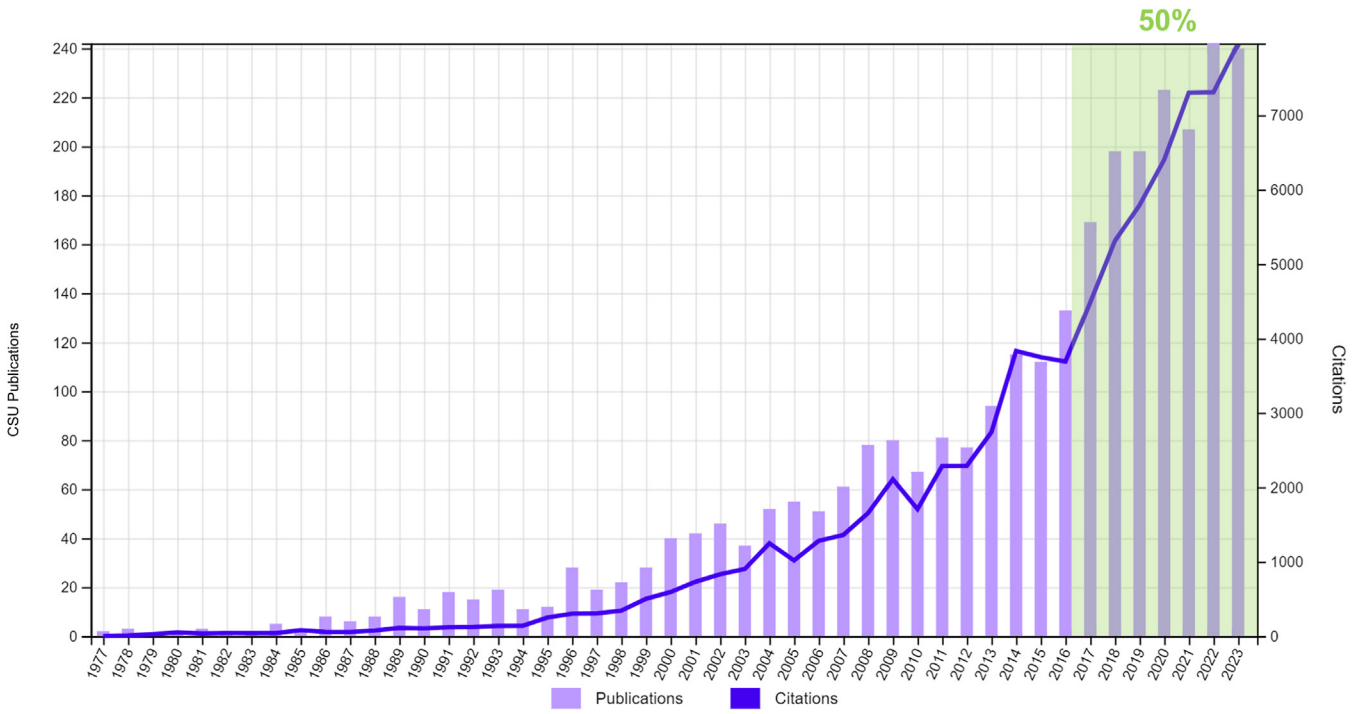

FIG 2. Trends in CSU publications and citations.

TABLE I. Top 10 journals with the most publications related to CSU

Journal title	Articles	Citations	Citations per article	h-Index	Impact factor (2023)	Category
Journal of Allergy and Clinical Immunology	142	12,375	87.1	63	11.4	Immunology and allergy
Allergy	132	11,145	84.4	56	12.6	Immunology and allergy
Journal of Allergy and Clinical Immunology: In Practice	109	2,139	19.6	28	8.2	Immunology and allergy
Annals of Allergy, Asthma & Immunology	98	2,541	25.9	33	5.8	Immunology and allergy
British Journal of Dermatology	88	5,786	65.8	42	11.0	Dermatology
Journal of the European Academy of Dermatology and Venereology	73	1,981	27.1	28	8.4	Dermatology
International Archives of Allergy and Immunology	70	1,756	25.1	24	2.5	Immunology and allergy
Clinical and Experimental Allergy	55	2,753	50.1	31	6.3	Immunology and allergy
Dermatologic Therapy	51	402	7.9	13	3.7	Dermatology
Allergy and Asthma Proceedings	44	705	16.0	16	2.6	Immunology and allergy

Citations, citations per article, and h-index were calculated by using publications related to CSU only.

Author	Country of origin	Articles	Citations	Citations per article	H-index	Production over year
Marcus Maurer	Germany	256	17464	68.2	69	
Riccardo Asero	Italy	96	6807	70.9	37	
Martin Metz	Germany	83	7084	85.3	46	
Torsten Zuberbier	Germany	63	6584	104.5	32	
Karsten Weller	Germany	56	3173	56.7	28	
Petra Staubach-Renz	Germany	54	6354	117.7	34	
Alicja Kasperska-Zajac	Poland	50	919	18.4	18	
Pavel Kolkhir	Germany	49	2175	44.4	25	
Martin K. Church	UK	47	6718	142.9	31	
Michihiro Hide	Japan	47	4913	104.5	24	
Jonathan A. Bernstein	USA	47	3416	72.7	23	
Sarbjit S. Saini	USA	45	4821	107.1	28	

FIG 3. Top authors with the most publications related to CSU and their country of origin. Citations, citations per article, and h-index were calculated by using publications related to CSU only.

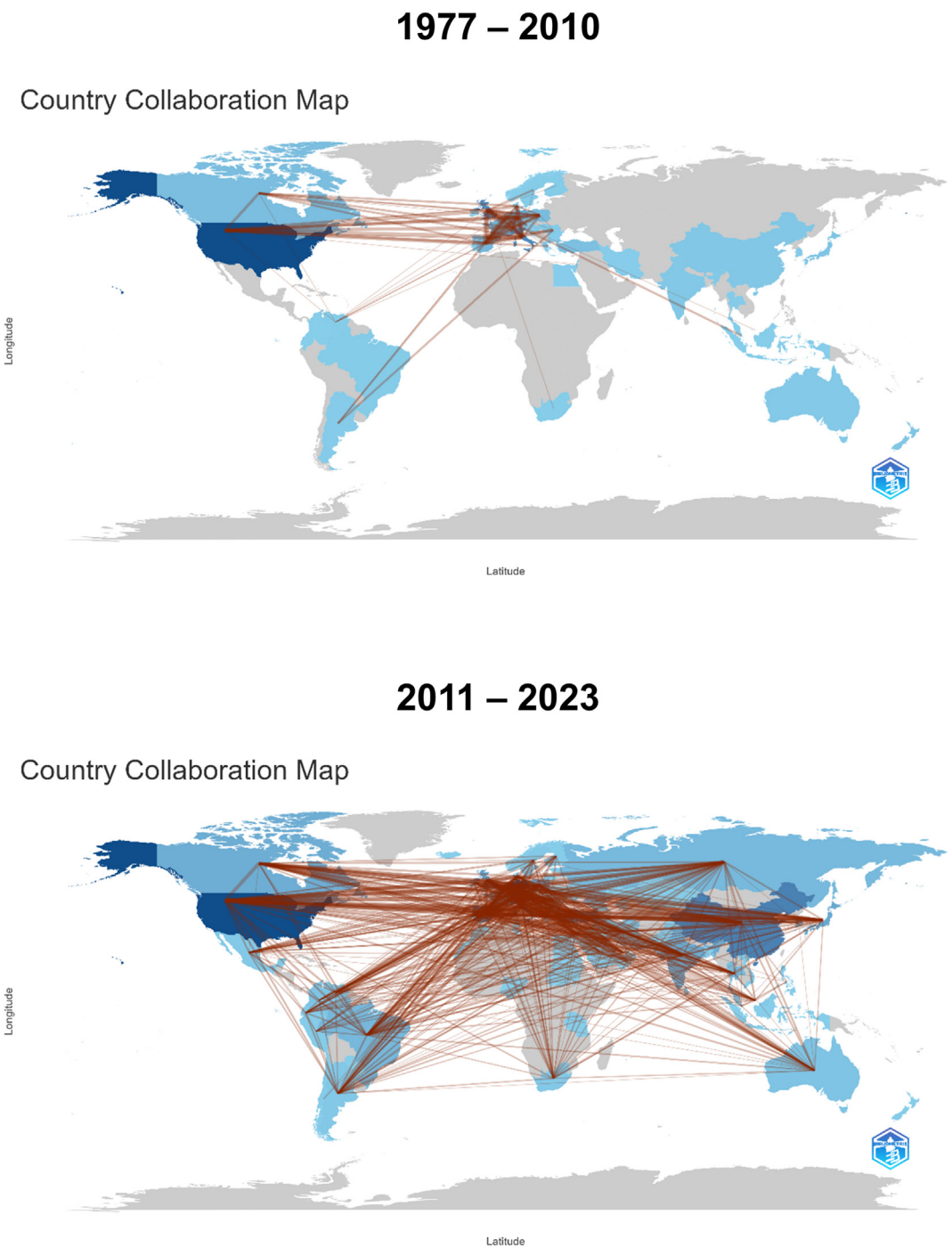

FIG 4. International collaborations in CSU research during the period from 1977 to 2010 and the period from 2011 to 2023.

need to promote international collaborations and improve access to scientific publications, especially for international publications beyond those available and indexed in English databases.

In conclusion, this article highlights the recent growth of literature, increase in international and multidisciplinary collaborations, and changing paradigms in the field of CSU research. The diminished QoL of patients with CSU has been well demonstrated, and further collaborative efforts to investigate and address this issue are warranted for the global CSU community.

DISCLOSURE STATEMENT

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FIG 5. Word clouds during the period from 1977 to 2010 and the period from 2011 to 2023 (by key word frequency). Font size is proportional to frequency of key words.

The rest of the authors declare that they have no relevant conflicts of interest.

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REFERENCES

1. Zuberbier T, Abdul Latiff AH, Abuzakouk M, Aquilina S, Asero R, Baker D, et al. The international EAACI/GA(2)LEN/EuroGuiDerm/APAAACI guideline for the definition, classification, diagnosis, and management of urticaria. Allergy 2022; 77:734-66.
2. Zuberbier T, Balke M, Worm M, Edenharter G, Maurer M. Epidemiology of urticaria: a representative cross-sectional population survey. Clin Exp Dermatol 2010; 35:869-73.
3. Church MK, Kolkhir P, Metz M, Maurer M. The role and relevance of mast cells in urticaria. Immunol Rev 2018;282:232-47.
4. Li PH, Au EYL, Cheong SL, Chung L, Fan KI, Ho MHK, et al. Hong Kong-Macau Severe Hives and Angioedema Referral Pathway. Front Allergy 2023;4: 1290021.
5. Krause K, Bonnekoh H, Jelden-Thurm J, Asero R, Gimenez-Arnau AM, Cardoso JC, et al. Differential diagnosis between urticarial vasculitis and chronic spontaneous urticaria: an international Delphi survey. Clin Transl Allergy 2023;13: e12305.
6. Bernstein JA, Ziaie N, Criado R, Criado PR, Rea S, Davis M. Chronic urticaria and angioedema: masqueraders and misdiagnoses. J Allergy Clin Immunol Pract 2023; 11:2251-63.
7. Kolkhir P, Bonnekoh H, Metz M, Maurer M. Chronic spontaneous urticaria: a review. JAMA 2024;332:1464-77.
8. Weller K, Gimenez-Arnau A, Grattan C, Asero R, Mathelier-Fusade P, Bizjak M, et al. The Chronic Urticaria Registry: rationale, methods and initial implementation. J Eur Acad Dermatol Venereol 2021;35:721-9.

9. Ornek Ozdemir S, Kuteyla Can P, Degirmentepe EN, Cure K, Singer R, Kocaturk E. A comparative analysis of chronic inducible urticaria in 423 patients: clinical and laboratory features and comorbid conditions. J Eur Acad Dermatol Venereol 2024;38:513-20.
10. Guillen-Aguinaga S, Jauregui Presa I, Aguinaga-Ontoso E, Guillen-Grima F, Ferrer M. Updosing nonsedating antihistamines in patients with chronic spontaneous urticaria: a systematic review and meta-analysis. Br J Dermatol 2016;175:1153-65.
11. Balp MM, Halliday AC, Severin T, Leonard SA, Partha G, Kalra M, et al. Clinical remission of chronic spontaneous urticaria (CSU): a targeted literature review. Dermatol Ther (Heidelb) 2022;12:15-27.
12. Yao Y, Liu Z, Ji J, Jiao Q. Mapping the intellectual structure of the research of omalizumab in chronic spontaneous urticaria: a bibliometric analysis. J Allergy Clin Immunol Glob 2024;3:100222.
13. Mak HWF, Trubiano JA, Blumenthal KG, Li PH. Bibliometric analysis of the trends and evolution in β-lactam allergy research. J Allergy Clin Immunol Glob 2024;3:100328.
14. Buttgereit T, Aulenbacher F, Gutsche A, Kolkhir P, Weller K, Vera Ayala C, et al. The Chronic Angioedema Registry (CARE): rationale, methods and implementation. Clin Exp Allergy 2024;54:712-6.
15. Buttgereit T, Vera C, Aulenbacher F, Church MK, Hawro T, Asero R, et al. Patients with chronic spontaneous urticaria who have wheals, angioedema, or both, differ demographically, clinically, and in response to treatment-results from CURE. J Allergy Clin Immunol Pract 2023;11:3515-25.e4.
16. Kolkhir P, Laires PA, Salameh P, Asero R, Bizjak M, Kosnik M, et al. The benefit of complete response to treatment in patients with chronic spontaneous urticaria-CURE results. J Allergy Clin Immunol Pract 2023;11:610-20.e5.
17. Neısınger S, Sousa Pinto B, Ramanauskaite A, Bousquet J, Weller K, Metz M, et al. CRUSE((R)) — an innovative mobile application for patient monitoring and management in chronic spontaneous urticaria. Clin Transl Allergy 2024;14:e12328.
18. Baiardini I, Braido F, Bindslev-Jensen C, Bousquet PJ, Brzoza Z, Canonica GW, et al. Recommendations for assessing patient-reported outcomes and health-related quality of life in patients with urticaria: a GA(2) LEN taskforce position paper. Allergy 2011;66:840-4.
19. Lennox RD, Leahy MJ. Validation of the Dermatology Life Quality Index as an outcome measure for urticaria-related quality of life. Ann Allergy Asthma Immunol 2004;93:142-6.
20. Weller K, Siebenhaar F, Hawro T, Altrichter S, Schoepke N, Maurer M. Clinical measures of chronic urticaria. Immunol Allergy Clin North Am 2017;37:35-49.
21. Kulthanan K, Chularojanamontri L, Rujitharanawong C, Weerasubpong P, Weller K, Maurer M. Angioedema Activity Score (AAS): a valid and reliable tool to use in Asian patients. Biomed Res Int 2019;2019:9157895.
22. Weller K, Groffik A, Church MK, Hawro T, Krause K, Metz M, et al. Development and validation of the Urticaria Control Test: a patient-reported outcome instrument for assessing urticaria control. J Allergy Clin Immunol 2014;133:1365-72, 72 e1-6.
23. Weller K, Magerl M, Peveling-Oberhag A, Martus P, Staubach P, Maurer M. The Angioedema Quality of Life Questionnaire (AE-QoL) - assessment of sensitivity to change and minimal clinically important difference. Allergy 2016;71:1203-9.
24. Weller K, Donoso T, Magerl M, Aygoren-Pursun E, Staubach P, Martinez-Saguer I, et al. Validation of the Angioedema Control Test (AECT)-a patient-reported outcome instrument for assessing angioedema control. J Allergy Clin Immunol Pract 2020;8:2050-7.e4.
25. Mak HWF, Lee E, Wong JCY, Li PH. Psychometric validation of the traditional Chinese chronic urticaria quality of life questionnaire. Clin Exp Allergy 2024.
26. Mak HWF, Wong JCY, So SWM, Lam DLY, Weller K, Maurer M, et al. Validation and correlations of the Angioedema Activity Score (AAS), Angioedema Quality of Life (AE-QoL) questionnaire, and Angioedema Control Test (AECT) in Chinese patients with angioedema. J Allergy Clin Immunol Glob 2024;3:100295.
27. Mak HWF, Lee E, Wong JCY, Weller K, Maurer M, Li PH. Validity, reliability, and sensitivity to change of the traditional Chinese Urticaria Control Test (UCT) in Hong Kong. J Allergy Clin Immunol Glob 2024;3:100290.
28. Cherrez-Ojeda I, Bousquet J, Gimenez-Arnau A, Godse K, Krasowska D, Bartosinska J, et al. Usage prevalence of angioedema patient-reported outcome measures: results from the UCARE and ACARE PROMUSE study. J Allergy Clin Immunol Pract 2024;12:2211-5.e1.
29. Cherrez-Ojeda I, Bousquet J, Gimenez-Arnau A, Godse K, Krasowska D, Bartosinska J, et al. Patient-reported outcome measures in atopic dermatitis and chronic urticaria are underused in clinical practice. J Allergy Clin Immunol Pract 2024;12:1575-15783.e1.
30. Maurer M, Weller K, Magerl M, Maurer RR, Vanegas E, Felix M, et al. The usage, quality and relevance of information and communications technologies in patients with chronic urticaria: a UCARE study. World Allergy Organ J 2020;13:100475.
31. Neısınger S Ramanauskaite Ariste, Kocaturk E, Reınhardt B, Lıngnau A, Cherrez-Ojeda, Maurer M. Embracing digital health solutions: the pivotal role of the CRUSE app in chronic spontaneous urticaria management. Asthma Allergy Immunol 2023;21:079-81.
32. Maurer M, Rosen K, Hsieh HJ, Saini S, Grattan C, Gimenez-Arnau A, et al. Omalizumab for the treatment of chronic idiopathic or spontaneous urticaria. N Engl J Med 2013;368:924-35.
33. Kan AKC, Wong TTH, Chiang V, Lau CS, Li PH. Chronic spontaneous urticaria in Hong Kong: clinical characteristics, real-world practice and implications for COVID-19 vaccination. Allergy Asthma Immunol Res 2023;15:32-42.
34. Mak HWF, Chiang V, Chan ETS, Lee E, Yim JSH, Lam DLY, et al. Disparities in chronic spontaneous urticaria: eligibility for drug reimbursement associated with clinical outcomes. J Allergy Clin Immunol Glob 2024;3:100243.
35. Kolkhir P, Munoz M, Asero R, Ferrer M, Kocaturk E, Metz M, et al. Autoimmune chronic spontaneous urticaria. J Allergy Clin Immunol 2022;149:1819-31.
36. Maurer M, Kolkhir P, Pereira MP, Siebenhaar F, Witte-Handel E, Bergmann KC, et al. Disease modification in chronic spontaneous urticaria. Allergy 2024;79:2396-413.
37. Maurer M, Khan DA, Elieh Ali Komi D, Kaplan AP. Biologics for the use in chronic spontaneous urticaria: when and which. J Allergy Clin Immunol Pract 2021;9:1067-78.
38. Kaplan A, Lebwohl M, Gimenez-Arnau AM, Hide M, Armstrong AW, Maurer M. Chronic spontaneous urticaria: focus on pathophysiology to unlock treatment advances. Allergy 2023;78:389-401.
39. Jain V, Gimenez-Arnau A, Hayama K, Reich A, Carr W, Tillinghast J, et al. Remibrutinib demonstrates favorable safety profile and sustained efficacy in chronic spontaneous urticaria over 52 weeks. J Allergy Clin Immunol 2024;153:479-86.e4.
40. Siebenhaar F, Altrichter S, Bonnekoh H, Hawro T, Hawro M, Michaelis EG, et al. Safety and efficacy of lirentelimab in patients with refractory indolent systemic mastocytosis: a first-in-human clinical trial. Br J Dermatol 2023;189:511-9.
41. Maurer M, McLaren J, Chon Y, Gorski K, Bernstein J, Hayama K, et al. Sustained improvement in UAS7 after 16-week treatment with tezepelumab in biologic-naïve adults with CSU: results of the phase 2b INCEPTION study. J Allergy Clin Immunol 2024;153:AB373.
42. Mustari AP, Bishnoi A, Kumaran MS. Biologicals in treatment of chronic urticaria: a narrative review. Indian Dermatol Online J 2023;14:9-20.