Journal of Dental Sciences 20 (2025) 254–260

Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.e-jds.com

Original Article

A scientometric study of syphilis research by dermatologists and stomatologists: Underpinning their roles in public health

Yeqiang Li [a†], Chenxi Li [b,c†], Xuemin Shen [b,c], Zhengyu Shen [d**], Wei Liu [b,e*]

[a] *Department of Stomatology, The People's Hospital of Suzhou New District, Suzhou, China*
[b] *Department of Oral Mucosal Diseases, Shanghai Ninth People's Hospital, Shanghai Jiao Tong University School of Medicine, Shanghai, China*
[c] *College of Stomatology, Shanghai Jiao Tong University, National Center for Stomatology, National Clinical Research Center for Oral Diseases, Shanghai Key Laboratory of Stomatology, Shanghai Research Institute of Stomatology, Shanghai, China*
[d] *Department of Dermatology, Shanghai Ninth People's Hospital, Shanghai Jiao Tong University School of Medicine, Shanghai, China*
[e] *Department of Oral and Maxillofacial-Head and Neck Oncology, Shanghai Ninth People's Hospital, Shanghai Jiao Tong University School of Medicine, Shanghai, China*

Received 28 July 2024; Final revision received 1 August 2024
Available online 9 August 2024

KEYWORDS
Bibliometrics;
Cutaneous;
Oral mucosa;
Research trends;
Sexually transmitted diseases;
Syphilis

Abstract *Background/Purpose: The Lancet Infectious Diseases* launched a call to action for dermatologists in the rise of syphilis. In practice, dermatologists and stomatologists perform early diagnoses of syphilis and refer patients to adequate treatment.
Materials and methods: This scientometric study aimed to investigate and compare research trends and characteristics of syphilis publications by dermatologists and stomatologists in the Scopus database, with emphasis on the analysis of the keywords that can reflect research directions and topics of concern.
Results: Among 18,120 papers on syphilis, 1981 (10.9%) and 201 (1.1%) were published by dermatologists and stomatologists, respectively. The total citation count was 18,629 and 2,376 with an *h* index of 52 and 25 for publications by dermatologists and stomatologists, respectively. Common keywords in papers by both dermatologists and stomatologists included male, *Treponema pallidum*, benzathine penicillin, differential diagnosis, human immunodeficiency virus, secondary syphilis, syphilis serology, cutaneous syphilis, neurosyphilis, congenital

* Corresponding author. Department of Oral and Maxillofacial-Head and Neck Oncology, Shanghai Ninth People's Hospital, 500 Quxi Road, Shanghai 200011, China.
** Corresponding author. Department of Dermatology, Shanghai Ninth People's Hospital, 639 Zhizaoju Road, Shanghai 200011, China.
E-mail addresses: neuronszy@sina.com (Z. Shen), liuweb@hotmail.com (W. Liu).
† Y. Li and C. Li contributed equally to this work.

https://doi.org/10.1016/j.jds.2024.08.001

syphilis, lymphadenopathy, chancre, gonorrhea, rash, erythema, and papule. Distinctive keywords used by dermatologists included infant, pregnancy complications, lymphocytic infiltration, spirochete, and genetics. Keywords that included questionnaire, awareness, infection risk, attitude to health, sexual health, oral sex, and unprotected sex were used by stomatologists.

Conclusion: In the modern context, both dermatologists and stomatologists play important roles in providing early recognition and timely diagnosis of syphilis, advocating for public health campaigns aimed at increasing awareness, and improving access to care for at-risk patient populations.

Introduction

Syphilis is a sexually and vertically transmitted bacterial infection caused by the bacterium *T pallidum*.[1] The prevalence of syphilis is high in low income and middle income countries, and it is a major cause of adverse pregnancy outcomes in these countries. High income countries have had a low prevalence of syphilis among heterosexual men and women, but a resurgence of the infection has occurred among men who have sex with men (MSM), in the last few decades.[1] In Europe, an increased incidence of syphilis has been reported since 2010. This trend appears to be accelerating, especially among MSM.[1] Syphilis has increased by 80% in the United States over the past 5 years, as reported by the US Centers for Disease Control and Prevention.[2] Outbreaks in heterosexual populations have also been reported, with an increase in congenital syphilis cases. Moreover, patients with syphilis present a higher risk of being infected by other sexually transmitted diseases (STDs), especially acquired immunodeficiency syndrome caused by human immunodeficiency virus (HIV), because syphilitic lesions are vulnerable sites for virus penetration.[3] Syphilis has long been a menacing human pathogen and remains a pertinent global public health concern.

The course of syphilis is separated into three stages: primary, secondary, and tertiary; lesions can present in a variety of ways depending on the stage.[4] Dermatologists are uniquely positioned to identify the disease in incipient stages, given its prominent cutaneous manifestations, thus steering prompt treatment, preventing complications, and interrupting the chain of transmission. Opportunistic testing in dermatology clinics, where patients seek services that include genital wart removal, is crucial.[2,4] In addition, oral lesions can be present in 30%–40% of cases and are as polymorphic as their cutaneous counterparts. Oral findings may be the sole clinical finding in as many as 61% of cases.[4] Because oral lesions are highly contagious, stomatologists/dentists undergo academic training that makes their participation in multi-professional teams important for diagnosis and treatment of STDs, especially syphilis and HIV infection.[4] A recent paper in *The Lancet Infectious Diseases* entitled "The rise of syphilis: a call to action for dermatologists" called attention to the alarming surge in cases of syphilis and the crucial role dermatologists can play in addressing this public health concern.[2]

In practice, both dermatologists and stomatologists can play roles in public health systems by guiding patients with syphilis, mainly by performing early and accurate diagnosis and referring patients to adequate treatment. Scientometrics is a useful tool that utilizes bibliometric and citation data to assess scientific output and research trend of a specific research field.[5] Most bibliometric/scientometric analyses of STDs focus on many aspects of HIV,[6–8] with no relevant study on syphilis. Therefore, the objective of the current study was to investigate and compare the scientometric characteristics and trends of syphilis publications by dermatologists and stomatologists. Understanding the scientometrics of syphilis will serve as a call to action for both dermatologists and stomatologists and contribute to intervention healthcare programs to control syphilis.

Materials and methods

A literature search utilized the Scopus database, as done in previous bibliometric analyses.[9–12] Scopus provides the most comprehensive overview of the global research output and has a low likelihood of article omissions compared to other databases.[10–12] Medical subject term "syphil*" in the Title was used in the literature search to retrieve all the papers on syphilis, without restriction to paper type and year of publication. The asterisk is a wildcard used in place of any number of characters for the most comprehensive search of relevant literature. Only English language literature was included because it is an international language of knowledge exchange. In clinical practice, dermatologists and stomatologists generally belong to the dermatology and stomatology affiliation, respectively. Hence, the papers with the word ("derm*") and (dent* OR oral OR stomatolog*) in the affiliation generally represent scientific output of dermatologists and stomatologists, respectively. Accordingly, respective syphilis-related publications by dermatologists and stomatologists were retrieved.

The scientometric characteristics of all the eligible articles were reviewed. The following information was recorded as follows: publication year, title, abstract, keywords, citation count, paper type, journal, authorship, affiliation, and country/region of origin. A list of 160 index keywords, journals, authors, affiliation, and country/region were automatically recognized in the order of highest to lowest frequency by the Scopus database. Data search and

extraction were performed independently by two investigators, and discrepancy of results was resolved in a consensus symposium. Microsoft Office Excel 365 was used for index model building, and the Bibliometrix Biblioshiny R-package software was used for bibliometric statistics. In this descriptive study, variables are presented as numbers and percentages. No comparisons were made, and thus no *P*-values were set. All raw data utilized in this study were sourced from publicly available database. Human participants or animals were not involved in this investigation. Therefore, ethical approval was not applicable.

Results

Bibliometric characteristics

With the search strategy algorithm, 18,120 papers on syphilis were published until the time of the search. A total of 1,981 (10.9%) and 201 (1.1%) papers were published by dermatologists and stomatologists, respectively. Fig. 1A illustrates the number and distribution of their paper types. To assess scientific influence of the academics, the citations of their papers were retrieved (Fig. 1B). The total citation count was 18,629 and the *h* index was 52 for syphilis publications by dermatologists. The respective values for stomatologists were 2,376 and 25. The detailed information on publication year, title, journal, citation count, authors, affiliation, keywords, and document types of the top-100 most-cited papers on syphilis are presented in supplementary Table S1. Among the top-100 papers, 12 papers were contributed by dermatologists (Table S2) and one by stomatologists (Table S3).

To further clarify the treads of scientific output concerning syphilis, we assessed the annual number and accumulated citation count of the papers during 2008—2023. The annual number of the publications by dermatologists spirally raised from 24 to 88 during 2008—2023 (Fig. 1C). The accumulated citations of the papers stably increased from 333 to 1534 during this period (Fig. 1D). The annual number of the publications by stomatologists slightly increased from 4 to 14 during 2008—2023, and the accumulated citations of the papers slightly increased from 50 to 211 during this period. Fig. 2 displays cloud graphs of journal of publications, contributing authors, institutions, and countries/regions. Table S4 presents the journal of publication, contributing authors, institutions, and countries/regions of origin with largest number of articles (rank, 1—10).

Research characteristics

Based on the frequency of keywords in all included papers, we highlighted the analysis of research characteristics of the papers on syphilis by dermatologists and stomatologists. The common keywords, study design, drug use, and syphilis-related disorders by dermatologists and stomatologists were identified. Common keywords, such as male, *T pallidum*, benzathine penicillin, human immunodeficiency virus (HIV) infection, differential diagnosis, and syphilis serology were similar in the publications by both dermatologists and stomatologists (Fig. 3A). Most study designs (Fig. 3B) and drug use (Fig. 3C) were similar in the publications by both dermatologists and stomatologists, with slightly different order. Among these drugs, ceftriaxone and tetracycline were more used by dermatologists, while probenecid and prednisolone were mentioned in the publications by stomatologists. As expected, related disorders, such as secondary syphilis, HIV infection, cutaneous syphilis, neurosyphilis, congenital syphilis, lymphadenopathy, chancre, gonorrhea, erythema, rash, and papule, were common concerns in the publications by both dermatologists and stomatologists.

To elucidate the respective research directions and concerned topics, we further analyzed the distinctive keywords of the papers on syphilis by dermatologists and stomatologists (Fig. 4A). Concerning diagnostics, skin biopsy, skin, reagin test, sensitivity/specificity, antibody titer, bacterium antibody, blood, cerebrospinal fluid, computer assisted tomography, and reaginic antibody were distinctive keywords for dermatologists. Oral biopsy, tongue, palate, lip, oral manifestations, diagnostic error, and nuclear magnetic resonance imaging were distinctive keywords for stomatologists. Distinctive keywords of infant, pregnancy complications, lymphocytic infiltration, spirochete, and genetics were mainly used by dermatologists. Distinctive keywords used by stomatologists were questionnaire, awareness, infection risk, attitude to health, sexual health, oral sex, and unprotected sex. Interestingly, related disorders, such as latent syphilis, psoriasis, genital ulcer, fever, alopecia, headache, maculopapular rash, and pruritus, were mainly mentioned by dermatologists. Related disorders mentioned by stomatologists were mouth ulcer, mouth lesion, granuloma, hepatitis B, hepatitis C, thrush, and tuberculosis (Fig. 4B).

Discussion

Despite advancements in education and control, the public's understanding of STDs remains fraught with challenges.[1] The resurgence of syphilis cases worldwide highlights the continued relevance of STDs in public health discourse, underpinning the vital role of dermatologists in diagnosis, treatment, and broader preventive measures.[13] However, the results of this bibliometric study revealed that dermatologists contributed 10.9% of all the papers on syphilis, and participated in 12 of 100 most-cited papers on syphilis. To some extent, this might be a reason that a paper newly published in *The Lancet Infectious Diseases* launched a call to action for dermatologists in the rise of syphilis.[2] Where syphilis once was a skin disease studied intently and diagnosed clinically by dermatologists, other clinicians began to assume the responsibility when methods of laboratory diagnosis evolved and awareness grew that syphilis is "less and less a skin disease".[14] These highlighted an opportunity for dermatologists to become reengaged, particularly with the resurgence of syphilis cases.[15]

Bibliometric characteristics including journals of publications, authors, institutions, and research keywords were identified in sequence. These would aid clinicians and researchers in choosing target journals, finding potential collaborators or partner institutions, as well as promoting mutual understanding and more reciprocal cooperation regarding syphilis research. The rise in the incidence of

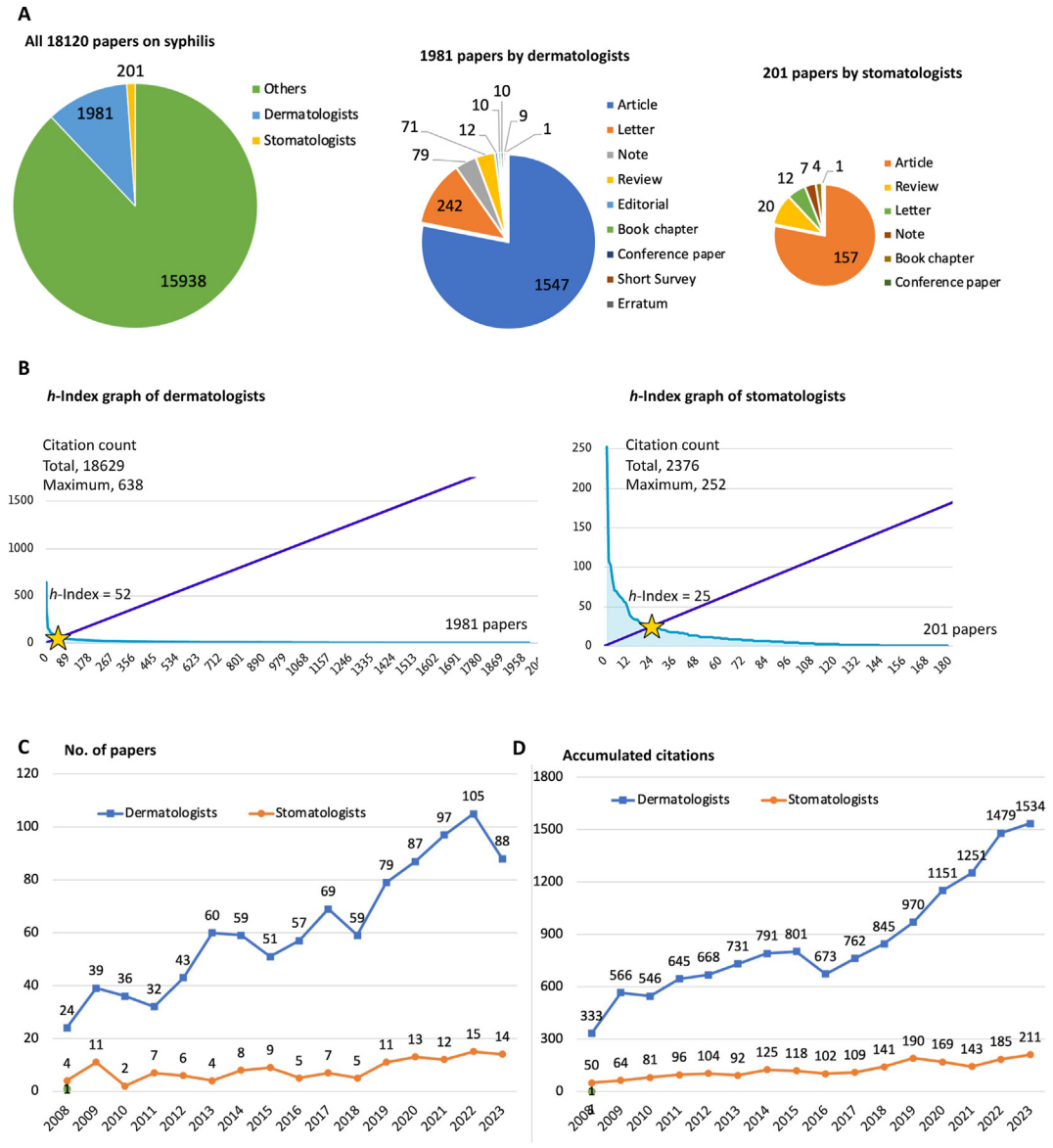

Figure 1 Citation characteristics of the papers on syphilis (**A**) Document types and distribution of the papers (**B**) The *h*-Index graphs of the publications by dermatologists and stomatologists (**C**) The annual number of the papers during 2008–2023 (**D**) The accumulated citations of the papers during 2008–2023.

syphilis necessitates a coordinated effort. Although syphilis is well-known to dermatologists, familiarity of its manifestations is essential among primary care practitioners and other concerned specialists, such as gynecologists, pediatricians, urologists, and stomatologists. Collaboration, education, and proactive serological testing are important components of a comprehensive response to this public health threat. The importance of the consulting and working multidisciplinary among different specialists must be highlighted. By championing such initiatives, the impact of this resurgent epidemic can be mitigated.

To comprehend the research directions and concerned topics of syphilis, the research keywords of the publications by dermatologists and stomatologists were analyzed. The complexity and diversity of clinical manifestations of syphilis and its related disorders, such as HIV infection, neurosyphilis, congenital syphilis, latent syphilis, lymphadenopathy, chancre, gonorrhea, erythema, rash, papule, psoriasis, genital ulcer, fever, alopecia, headache, and pruritus, often referred to as the great mimic, underscore the importance of dermatologists. HIV and syphilis have a complex bilateral relationship. Besides sharing risk factors, the presence of a mucosal lesion favors the penetration of a virus. A chancre is a synonym of primary syphilis or reinfection. Patients with a history of syphilis, even if appropriately treated, are significantly less likely to develop a chancre.[1] Interestingly, dermatologist's keywords did not contain terms related to the mouth, while stomatologist's keywords included terms related to skin/cutaneous. This might suggest that the manifestations in the mouth appear earlier than those on the skin, or the dermatologists may neglect the mouth signs.

Figure 2 Cloud graphs of journal of publication, contributing authors, institutions, and countries/regions of origin in the publications by (**A**) dermatologists and (**B**) stomatologists. The font size indicates the number of papers; a larger size means more papers in the cloud graphs.

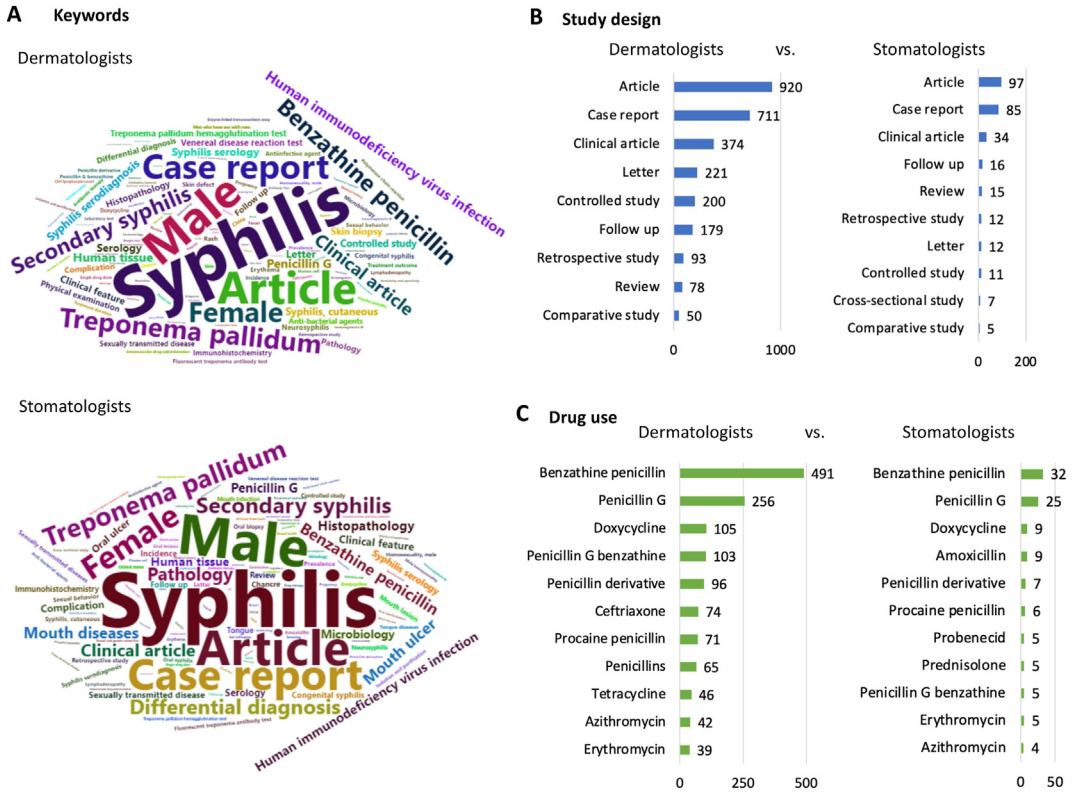

Figure 3 Research characteristics of syphilis publications by dermatologists and stomatologists (**A**) Cloud graphs of research keywords. The ranks of (**B**) study design related disorders and (**C**) drug use.

Oral mucosal manifestations can be present in 30–40% of syphilis patients and are as polymorphic as their cutaneous counterparts.[4] Some papers reported that first signs of this disease appeared in oral mucosa, preceding other presentations.[3] The tongue was most common affected (32–43%), followed by the lips (25–40%) and palate (20–34%).[4] Oral lesions of syphilis can be seen in all three stages, most commonly in the second stage. Oral chancre observed in primary syphilis is often characterized as a painless ulcer, measuring 1–2 cm, with a firm and rolled border. Patients often progress to the secondary stage 2–12 weeks after the chancre appears.[3] Secondary syphilis presents multiple and generally symptomatic classic chancre-ulcers and mucous patches, which constitute 80% of presentations of secondary syphilis.[3] Tertiary syphilis presents after many years in the setting of untreated syphilis and is separated into gummatous, neuro, and cardiovascular syphilis. Because oral lesions are highly contagious, the reliability of correct diagnosis aids adequate management, reduces the infection chain, and reduces the risk of transmission to health professionals.[16]

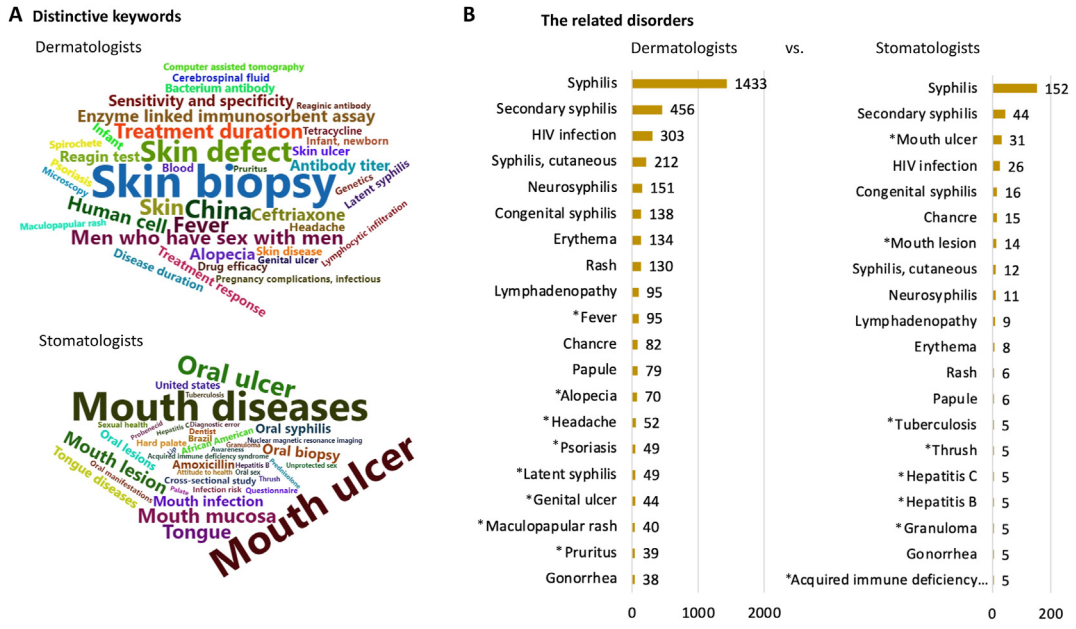

Figure 4 Distinctive characteristics of syphilis publications by dermatologists and stomatologists (**A**) Cloud graphs of distinctive keywords (**B**) The ranks of syphilis related disorders. Asterisk (*) indicates distinctive disorder/symptom.

Laboratory diagnosis confirmation of syphilis is performed using serological tests. The asymptomatic nature of the latent stage means diagnosis is only possible with serological screening tests. For general patients, the diagnosis needs an index of clinical suspicion during anamnesis. Dentists and clinicians should include anamnesis regarding the sexual behaviors of their patients, and be prepared to recognize and diagnose oral and systemic manifestations of STDs, especially syphilis.[17] In medicine and dentistry, anamnesis about sexual behavior is an essential step to the proper diagnosis and treatment of disease. Anamnesis should be performed routinely, particularly when symptoms suggest sexually transmitted infections, individuals at high risk of syphilis, including males, MSM, people with HIV infection, history of incarceration, sex work, military service, and drug use, and also considering factors that include local prevalence, socioeconomic determinants, and sexual network characteristics.[18]

In summary, this study is the first comprehensive report of the scientometric characteristics of syphilis publications by dermatologists and stomatologists. In the modern context, both dermatologists and stomatologists play roles in providing early recognizing and timely diagnosis of syphilis, advocating for public health campaigns aimed at increasing awareness, and improving access to care for at-risk patient populations.

Declaration of competing interest

The authors have no conflicts of interest relevant to this article.

Acknowledgements

This work was supported by National Construction Project of Clinical Key Specialized Department (No. [2013]544) and Research Discipline fund no. KQYJXK2020 from Ninth People's Hospital, Shanghai Jiao Tong University School of Medicine and College of Stomatology, Shanghai Jiao Tong University.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jds.2024.08.001.

References

1. Peeling RW, Mabey D, Chen XS, Garcia PJ. Syphilis. *Lancet* 2023;402:336–46.
2. Mehta H, Bishnoi A, Vinay K. The rise of syphilis: a call to action for dermatologists. *Lancet Infect Dis* 2024;24:e219–20.
3. Khan M, Sharma A, Hathorn T, et al. The mucosal manifestations of syphilis in the head and neck. *Ear Nose Throat J* 2023: 1455613231165159.
4. Navarrete J, Saavedra-Portales S. Syphilis for dermatologists - current concepts. *Clin Dermatol* 2024;42:134–54.
5. Wang G, Yu Z, Ji T, Shi L, Liu W. A scientometric study of betel quid chewing and oral cancer and precancerous lesions with distinct regional characteristic. *J Dent Sci* 2023;18: 1378–83.
6. Nguyen TT, Do AL, Nguyen LH, et al. Scholarly literature in HIV-related lesbian, gay, bisexual, and transgender studies: a bibliometric analysis. *Front Psychol* 2023;14:1028771.
7. Doan LP, Nguyen LH, Auquier P, et al. Social network and HIV/AIDS: a bibliometric analysis of global literature. *Front Public Health* 2022;10:1015023.
8. Rashid A, Li K, Feng Y, et al. HIV-1 genetic diversity a challenge for AIDS vaccine development: a retrospective bibliometric analysis. *Hum Vaccines Immunother* 2022;18:2014733.
9. Chen MC, Chen SH, Cheng CD, et al. Mapping out the bibliometric characteristics of classic articles published in a Taiwanese academic journal in dentistry: a scopus-based analysis. *J Dent Sci* 2023;18:1493–509.

10. Zhou S, Zhang Q, Deng Y, Shen Z, Liu W. Pemphigus and pemphigoid research by dermatologists and stomatologists: a scientometric and comparative study. *J Dent Sci* 2023;18:1510—6.
11. Gao X, Liu W, Wang H. The scientometric characteristics of cheilitis researched by multidisciplinary specialists: a comparative study. *J Dent Sci* 2024;19:303—9.
12.. Kocyigit E, Kocak T. Rheumatic diseases and gut microbiota publications in 2002-2022: a Scopus-based bibliometric analysis. *Rheumatol Int* 2023;43:2115—24.
13. Ji-Xu A, Leslie KS. Syphilis: recommendations for dermatologists on a resurgent epidemic. *Int J Dermatol* 2023;62:583—8.
14. Cossman JP, Fournier JB. Frequency of syphilis diagnoses by dermatologists. *JAMA Dermatol* 2017;153:718—9.
15. Hernández-Bel P, Magdaleno-Tapial J. Syphilis epidemic still uncontrolled in our society: what should dermatologists do? *Actas Dermosifiliogr (Engl Ed)* 2019;110:789—90.
16. Garbin CAS, Pacheco Filho AC, Garbin AJI, Pacheco KTDS. The dentist's role in syphilis prevention and control. *Rev Soc Bras Med Trop* 2019;52:e20180252.
17. Meseli SE, Pelit S. Syphilis and dentists: the data about knowledge and awareness of clinicians in Turkey. *Int J STD AIDS* 2023;34:408—15.
18. Gianfaldoni S, Tchernev G, Wollina U, et al. Syphilis such as the other sexually transmitted diseases are a cultural background of dermatologist. *Open Access Maced J Med Sci* 2017;5:551—3.