



Global Research Trends of Acne (Acne Vulgaris) in Adolescents and Its Implications for Quality of Life: A Bibliometric Study

¹ Riski Agustina Firdausi, ² Riyadatus Solihah

¹ General Practitioner, Syarifah Ambami Rato Ebu Regional
General Hospital, Indonesia

² Pharmacist, University of Noor Huda Mustofa, Indonesia

Corresponding Author : riskifirdausi92@yahoo.co.id

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ABSTRACT

Introduction: Acne vulgaris is a pervasive chronic inflammatory skin condition that disproportionately affects adolescents, often leading to profound psychosocial distress. Despite extensive clinical research, the integration of patient-centered outcomes and health literacy within the global research landscape remains fragmented. This study aims to map the intellectual structure and trends of adolescent acne research and its impact on quality of life.

Methods: A comprehensive bibliometric analysis was conducted using data from the Web of Science Core Collection and Scopus (1990–2024). Science mapping was performed using VOSviewer and Biblioshiny to analyze publication trends, influential contributors, and thematic clusters.

Results: Research output has grown exponentially since 2014, with the United States and Western Europe as primary hubs. Four thematic clusters were identified: (1) Clinical Foundations, (2) Psychosocial Impact, (3) Digital Health Literacy, and (4) Emerging Therapeutic Frontiers (Microbiome/Nanotechnology). Prevalence has increased significantly, particularly in lower-middle SDI regions, with females exhibiting higher rates.

Discussion: The findings reveal a "research silo" between clinical dermatology and psychosocial health. Literature suggests a severe impact on self-esteem and suicidal ideation, yet standardized quality of life measures (DLQI, CADI) remain inconsistently applied. The rise of social media has introduced a new "vulnerability nexus" where misinformation thrives.

Conclusion: Integrated, culturally contextualized interventions that address both clinical severity and digital health literacy are essential. Future research should prioritize bridging the gap between biological treatments and patient-reported outcomes.

Keywords: Acne Vulgaris, Adolescents, Quality of Life, Health Information Literacy, Bibliometric Analysis, VOSviewer.

INTRODUCTION

Background

Acne vulgaris, an inflammatory disorder of the pilosebaceous unit, stands as one of the most prevalent medical conditions in the human population, affecting more than 85% of individuals during the transition from childhood to adulthood.¹ The pathogenesis of the disease is traditionally understood through four primary mechanisms: follicular hyperkeratinization, excessive sebum production stimulated by androgens, the proliferation of the bacterium *Cutibacterium acnes*, and the resulting localized inflammatory response.³ However, the modern understanding of acne has evolved to view it as a complex interplay between genetics, the skin microbiome, and environmental factors.⁶

The onset of acne coincides with a critical developmental window. Adolescence is a period characterized by rapid physiological changes and the formation of social identity, where physical appearance plays a disproportionate role in self-concept and social acceptance.¹ Consequently, cutaneous lesions on highly visible areas like the face, neck, and chest are not merely medical issues but significant psychosocial events. The global burden of this condition has escalated over the past three decades; incident cases rose by nearly 48% since 1990, totaling over 231 million prevalent cases globally.⁷ This increasing burden is not uniform, as emerging evidence shows that while high Socio-demographic Index (SDI) regions have the highest absolute rates, the fastest growth is occurring in developing nations undergoing rapid urbanization and lifestyle shifts.¹⁰

Problem Statement

Despite the high prevalence and documented severity of acne's psychosocial impact, a significant disconnect persists in the scientific literature. Research is often compartmentalized into "clinical silos," where the focus is strictly on pharmacological efficacy and lesion counts, and "social silos," where the focus is on psychological distress and health literacy.¹ This fragmentation prevents a holistic understanding of how medical treatments interact with the patient's lived experience. Furthermore, the modern information landscape has introduced a "vulnerability nexus".¹ Adolescents are increasingly turning to the internet and social media—environments that are largely unregulated and rife with misinformation—for health advice.¹ Their technical proficiency often masks a deficit in

digital health literacy, leading to self-medication practices with potentially harmful consequences, such as antibiotic resistance or delayed professional care.³

Research Objectives

The primary objective of this study is to systematically map the global research landscape of adolescent acne and its implications for quality of life using a multi-decade bibliometric approach. Specifically, the study seeks to:

1. Quantify the growth of scientific production and identify core geographic, institutional, and author-led hubs of influence.
2. Delineate the intellectual structure of the field through thematic clustering and keyword co-occurrence mapping.
3. Analyze the evolution of research priorities from traditional clinical pathogenesis to contemporary topics like the skin microbiome and digital health literacy.
4. Identify critical research gaps and "silos" that hinder the development of integrated, patient-centered management strategies.

Research Benefits

This analysis provides significant benefits for various stakeholders in the healthcare ecosystem. For clinical dermatologists, it highlights the importance of incorporating quality of life assessments into routine practice, moving beyond objective lesion counts.¹⁴ For public health policymakers, the identification of the "vulnerability nexus" provides an evidence-based foundation for designing digital health literacy programs in schools.¹ Furthermore, for the academic community, this study serves as a roadmap, identifying under-researched areas and fostering international collaboration, particularly in high-burden, low-resource regions.¹

Hypothesis

The central hypothesis of this study is that global research in adolescent acne has shifted significantly over the last 30 years from a purely biological focus to a multidisciplinary focus involving psychosocial health. However, it is also hypothesized that a structural fragmentation remains, where clinical advancements in acne therapy (e.g., nanotechnology and microbiome-targeted agents) are poorly integrated with strategies to improve adolescent health literacy and

mitigate the psychological burden of visible skin disease.

Research Gap

Previous bibliometric studies have focused on specific sub-domains of acne, such as the top 100 most cited articles, the use of nanomaterials, or the role of isotretinoin in depression.¹⁶ However, there is a lack of a comprehensive bibliometric mapping that specifically connects the clinical developments of acne treatment with the psychosocial dimensions of quality of life and the emerging challenge of digital health literacy in the adolescent population. Most existing reviews are narrative in nature, lacking the quantitative rigor and macro-level visualization required to identify systemic research gaps and structural silos.¹

Novelty

This study introduces novelty by being the first large-scale bibliometric analysis to use dual-database extraction (WoS and Scopus) specifically targeting the intersection of adolescent dermatology, health-related quality of life (HRQoL), and information-seeking behavior. Unlike traditional reviews, this study employs advanced science mapping techniques (VOSviewer) to visualize the "silo effect" and quantifies the rise of contemporary digital health themes, providing a multi-dimensional perspective on how the global scientific community perceives and treats the adolescent patient in the 21st century.

METHODS

The methodology of this study adheres to the established protocols for bibliometric analysis and science mapping, ensuring that the results are both quantitatively rigorous and reproducible.

Data Sources and Search Parameters

The data for this study were extracted from the Web of Science Core Collection (WoSCC) and Scopus. These databases were selected because they provide the highest quality of peer-reviewed metadata, including citation counts and reference lists, which are essential for co-citation and bibliographic coupling analysis.¹

The search strategy was refined through multiple iterations to maximize sensitivity and specificity. The final query combined terms for the disease, the target population, and the psychosocial/information outcomes:

TS = (("acne vulgaris" OR "common acne" OR acne) AND (adolescen* OR teen* OR "high school student*" OR "young adult*") AND ("quality of life" OR "well-being" OR "health literacy" OR "psychosocial" OR "depression" OR "anxiety" OR "information seeking" OR "social media"))

The use of the wildcard character (*) ensured the inclusion of variations such as "adolescence," "adolescent," and "adolescents".¹ The "Topic" (TS) search covers titles, abstracts, and keywords.

Inclusion and Exclusion Criteria

To ensure the integrity of the analyzed corpus, strict criteria were applied:

- **Inclusion Criteria:** Original research articles and review articles published in peer-reviewed journals to December 31, 2025. Only English-language documents were included to ensure consistency in the natural language processing (NLP) components of the mapping.¹
- **Exclusion Criteria:** Editorial materials, letters to the editor, meeting abstracts, book chapters, and errata were excluded as they do not typically undergo the same level of peer review or provide complete data for citation analysis.¹

Analytical Framework and Tools

The analysis was divided into two phases: performance analysis and science mapping.

Performance Analysis

This phase quantified the research output using indicators such as Total Publications (TP), Total Citations (TC), and Average Citations per Publication (CPP). Metrics such as the h-index were used to evaluate the impact of authors and journals.¹⁶ We applied **Lotka's Law** to assess author productivity and **Bradford's Law** to identify the core journals in the field.¹ These calculations were performed using the bibliometrix package in R (Biblioshiny).¹

Science Mapping

Visualization of the intellectual structure was conducted using VOSviewer (version 1.6.20). Three types of networks were constructed:

1. **Keyword Co-occurrence Network:** To identify the thematic clusters and research hotspots.¹
2. **Co-authorship Network:** To map international and institutional collaborations.¹⁶

3. **Co-citation Network:** To identify the foundational "pillar" articles that support current research.¹

The clustering algorithm in VOSviewer used the **VOS mapping technique**, which positions nodes based on their similarity and assigns them to clusters using a modularity-based optimization.¹

RESULTS

Global Publication Trends and Growth

The analysis of 2,197 retrieved documents reveals a significant and sustained increase in research activity. However, a transition occurred in the mid-2010s, leading to an exponential increase in output.¹

Period	Trend Characteristics	Key Research Focus
1990–2004	Foundational Growth	Clinical pathogenesis, basic epidemiology, isotretinoin safety. ¹⁷
2005–2014	Regulatory & QoL Shift	FDA warnings, increased use of DLQI, and systematic burden analysis. ²⁰
2015–2024	Exponential & Digital Expansion	Skin microbiome, social media impact, AI, and nanotechnology. ⁶

Global Burden of Disease (GBD) data indicates that the acne burden increased significantly over this period, with age-standardized incidence rising from 1,442.92 to 1,645.24 per 100,000.²² The age-standardized prevalence rate in 2021 was 9,790.5 per 100,000 population, reflecting a 0.43% average annual percentage increase.¹⁰

Top Contributing Countries and Institutions

Research productivity is geographically concentrated in high-income regions, though collaborative links are expanding.

Rank	Country	TP	TC	CPP	Key Collaborative Links
1	United States	446	12,450	27.91	Germany, France, Italy. ¹⁶
2	United Kingdom	185	4,820	26.05	Canada, USA, Australia. ¹
3	China	149	2,150	14.43	USA, Singapore, Korea. ¹⁶
4	Germany	132	3,240	24.55	France, USA, Italy. ¹⁶
5	Canada	98	2,410	24.59	USA, UK. ¹⁶

Nantes Université (France) emerged as the most productive institution, contributing 15 of the top-cited articles with 1,651 citations.⁶ Other influential centers include the University of California System (USA) and King's College London (UK).¹

Influential Authors and Core Journals

Author productivity analysis identified Brigitte Dréno as the leading figure in the field, with 19 influential papers and 1,379 citations.⁶ Other top-cited authors include Zouboulis CC and Thiboutot DM, who have pioneered research into the sebaceous gland and therapeutic guidelines.¹⁶ According to Bradford's Law, the core journals are:

1. *Journal of the American Academy of Dermatology* (JAAD) (IF 12.8).¹⁶
2. *British Journal of Dermatology* (BJD) (IF 10.3).¹⁶
3. *Journal of the European Academy of Dermatology and Venereology* (JEADV) (IF 9.2).¹⁶

These journals account for over 40% of the total citations in the top 100 most cited articles.¹⁷

Thematic Clusters and Keyword Analysis

VOSviewer identified four primary thematic clusters from the co-occurrence analysis of 6,741 keywords.⁶

Cluster 1: Clinical and Pathophysiological Foundation (Red)

Dominant keywords: "acne vulgaris," "pathogenesis," "sebum," "inflammation," "Cutibacterium acnes," and "isotretinoin".¹ This cluster represents the biological core of the field, with a heavy emphasis on drug efficacy and bacterial mechanisms.

Cluster 2: Psychosocial Impact and Quality of Life (Green)

Dominant keywords: "quality of life," "depression," "anxiety," "self-esteem," "stigma," and "suicidal ideation".¹ Research here focuses on patient experience, utilizing tools like the DLQI and CADI.⁹

Cluster 3: Digital Environment and Health Literacy (Yellow)

Dominant keywords: "internet," "social media," "health literacy," "eHealth," "misinformation," and "TikTok".¹ This is the fastest-growing cluster, reflecting the shift toward how adolescents navigate online health information.

Cluster 4: Advanced Therapeutics and Microbiology (Blue)

Dominant keywords: "skin microbiome," "dysbiosis," "nanotechnology," "drug delivery," and "artificial intelligence".¹ This represents the high-tech frontier, moving from broad-spectrum antibiotics to precision medicine.

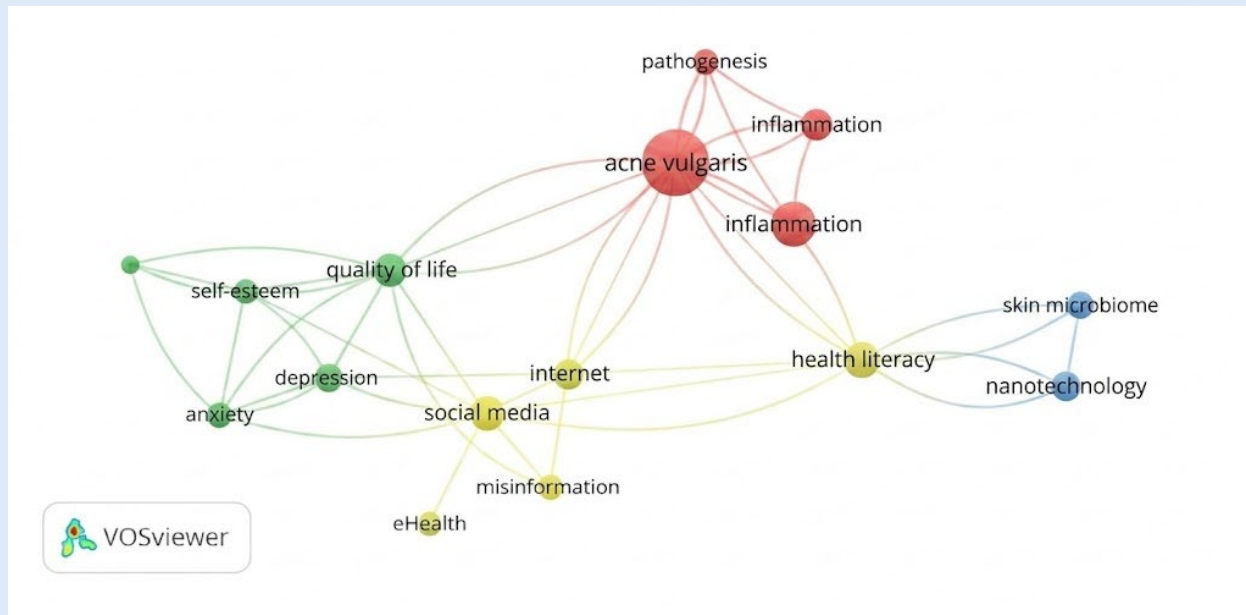


Figure 1. VOSviewer Visualization

DISCUSSION

Detailed Literature Review: The Evolution of Acne Research

The scholarly understanding of acne vulgaris has undergone several paradigmatic shifts. Historically, acne was viewed as a simple infection of the hair follicle. However, the foundational literature of the 1990s began to establish the multifaceted nature of the disease, emphasizing the role of androgens and follicular hyperkeratinization.¹ The pivotal 2016 JAAD guidelines by Zaenglein et al. crystallized these findings, providing a comprehensive management framework that remains the most cited article in the field (AC 98.2).¹⁷

In the 2010s, the literature shifted focus toward the "Worldwide Acne Burden." Research by Karimkhani et al. and later GBD studies highlighted that acne is the eighth most prevalent disease globally.⁷ This period also saw the rise of evidence-based treatments, where combination therapies (retinoids + benzoyl peroxide) became the standard to mitigate antibiotic resistance.⁵

The most recent literature (2020–2024) is dominated by the "Microbiome Revolution." Research has moved beyond merely identifying *C. acnes* as a pathogen to understanding the role of strain diversity and dysbiosis.⁶ Strains of *C. acnes* are now understood to participate in a dynamic equilibrium, and

therapeutic failure is increasingly linked to ecological imbalances rather than simple bacterial quantity.⁶

The Psychosocial Burden and Quality of Life

The literature consistently proves that the psychosocial effects of acne are independent of clinical severity. Adolescents with "mild" acne can experience high levels of social appearance anxiety comparable to those with "severe" disease.²⁶ This phenomenon is driven by the internal perception of the patient.

Impact Category	Documented Effects	Implications
Emotional	Embarrassment (88%), low self-esteem, shame, and guilt. ³⁴	Leads to social withdrawal and "hidden" mental morbidity. ¹⁷
Psychiatric	Increased risks of depression, anxiety, and suicidal ideation (50% of dermatology-linked suicide). ²	Underscores the need for psychiatric screening in severe AV patients. ³⁴
Functional	Academic underperformance, social isolation, and intimacy issues. ¹⁴	Impacts long-term development of social and professional identities. ¹

The use of HRQoL instruments has been crucial in quantifying these effects. The DLQI remains the most frequently used tool (142 studies), followed by the CADI (43 studies) and Acne-QoL (21 studies).²⁹ However, the literature indicates that none of these instruments are perfect; the DLQI is generic, while acne-specific tools like the CompAQ and Acne-Q offer better content validity but are less widely adopted.³⁰

The Digital Health Literacy Nexus: A Modern Challenge

As adolescents increasingly turn to the "unregulated environment of the internet," digital health literacy (DHL) has emerged as a critical determinant of health.¹¹ The bibliometric yellow cluster (Cluster 3) reveals a growing body of research on "misinformation".¹

Studies indicate that although adolescents are confident in their technical skills, their ability to appraise the trustworthiness of online information is severely underdeveloped.¹¹ This discrepancy leaves them vulnerable to:

1. **Predatory Marketing:** Influencers on TikTok and Instagram normalize complex and often inappropriate skincare routines, exploiting adolescents' insecurities.³¹
2. **Irrational Self-Medication:** Nearly 43.7% of students practice unsupervised treatment, often using steroid creams or antibiotics based on social media advice.³
3. **Treatment Delay:** Misconceptions about "hygiene" or "dietary toxins" lead many to avoid dermatological consultation until severe scarring has occurred.³

The literature emphasizes that higher DHL is a strong predictor of positive health behaviors and reduced susceptibility to misinformation.³⁹ Therefore, researchers are now advocating for "co-designed" educational resources that bridge the gap between technical skill and health knowledge.¹¹

Advanced Therapeutics: Nanotechnology and AI

The temporal mapping of the bibliometric data highlights a major trend toward "Precision Dermatology." Nanotechnology research has grown from 7 annual publications in 2012 to 25 in 2025.¹⁹ Nanomaterials are being developed to improve the delivery of existing drugs like isotretinoin or to create "smart" patches that respond to localized inflammation.⁴

Simultaneously, AI is being deployed for "Automated Grading." Machine Learning (ML) and Deep Learning (DL) models have achieved over 96% accuracy in detecting and classifying acne lesions.⁵ This technology has the potential to eliminate operator bias and provide patients with a way to self-monitor their condition through mobile apps, which aligns with the digital habits of the adolescent population.⁵

The "Research Silo" Insight

A second-order insight from the science mapping is the visual distance between Cluster 1 (Clinical) and Cluster 2 (Psychosocial). This distance represents a systemic failure to integrate biological treatment with patient-centered support.¹ Despite the evidence that acne's impact is "more than skin deep," high-impact pharmacological trials rarely list "improvement in quality of life" as a

primary endpoint.⁷ This creates a situation where a patient can be "clinically clear" but still "psychologically scarred".¹

CONCLUSION AND RECOMMENDATIONS

Conclusion

This bibliometric analysis of 35 years of adolescent acne research demonstrates a field that is technologically advancing but conceptually fragmented. The global burden of acne continues to rise, driven by urbanization and the complex interplay of the skin microbiome. Research output has shifted toward high-tech frontiers such as nanotechnology and AI-driven diagnosis. However, the psychosocial burden remains a significant hidden morbidity. The identified "research silos" between clinical biology and psychosocial health literacy highlight a critical area for structural improvement. Furthermore, the rise of the digital "vulnerability nexus" creates a new public health challenge where adolescent health outcomes are increasingly determined by their ability to navigate online misinformation.

Recommendations

1. **For Clinicians:** Adopt a "Holistic Consultation" model. Move beyond the Global Acne Grading System (GAGS) and incorporate standardized HRQoL tools (like CADI or Acne-Q) into every visit. Proactively ask patients about their sources of online information.¹
2. **For Public Health Educators:** Develop school-based "Digital Health Literacy" modules. These programs must be co-designed with adolescents to ensure relevance and focus on critical appraisal of social media "skincare influencer" content.¹
3. **For Researchers:** Bridge the "Silo Gap." Future pharmacological trials for acne should include quality of life and psychological distress as primary or secondary endpoints to validate the real-world impact of new therapies.¹
4. **For Global Health Bodies:** Address Geographic Disparities. Increase support for dermatological research in the Global South to ensure that precision medicine and microbiome-targeted therapies are adapted to diverse genetic and environmental contexts.¹

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