KESANS: International Journal of Health and Science
2808-7178 / 2808-7380
http://kesans.rifainstitute.com/index.php/kesans/index

Global Research on Menstrual Disorders and Adolescent Reproductive Health Outcomes (1980–2025): A Bibliometric and Science Mapping Analysis

[1]Nur Khasanah*, [2]Anita Liliana, [3]Melania Wahyuningsih, [4]Herliana Riska
[1]Department of Nursing, Universitas Respati Yogyakarta, Indonesia*; email: Nurkhasanah@respati.ac.id
[2]Department of Nursing, Universitas Respati Yogyakarta, Indonesia; email: Melania@respati.ac.id
[3]Department of Nursing, Universitas Respati Yogyakarta, Indonesia; email: Anitaliliana@respati.ac.id
[4]Department of Midwifery, Universitas Sebelas Maret, Indonesia; email: herlianariska@staff.uns.ac.id
*Correspondence

Article Information
Submitted: **15 January 2026**
Accepted: **23 January 2026**
Publish: **30 January 2026**

Keyword: Menstrual Disorders; Adolescent Reproductive Health; Bibliometric Analysis; Global Health Inequities;

Abstract
Menstrual health has emerged as a critical public health priority, yet comprehensive mapping of research evolution, geographic disparities, and thematic trajectories remains absent. This bibliometric analysis systematically characterizes the global research landscape on menstrual disorders and adolescent reproductive health outcomes. Following PRISMA guidelines, 544 Scopus-indexed articles published between 1980-2025 were analyzed using Biblioshiny (R Bibliometrix package version 4.1.3) and VOSviewer version 1.6.19. Extracted metrics included temporal productivity, citation patterns, authorship networks, institutional contributions, geographic distribution, international collaboration structures, and thematic evolution through keyword co-occurrence analysis. The Louvain modularity algorithm identified research domain clusters. While menstrual health research demonstrates quantitative expansion and rhetorical paradigm shifts toward biopsychosocial integration, substantial implementation gaps, geographic inequities, and thematic fragmentation persist. The field requires decisive pivot toward implementation science, digital innovation, decolonial knowledge production, and adolescent-centered translational research to achieve population health impact. School-based digital screening systems represent untapped opportunity for early identification and intervention.

How to Cite **Nur Khasanah, Anita Liliana, Melania Wahyuningsih, Herliana Riska/Global Research on Menstrual Disorders and Adolescent Reproductive Health Outcomes (1980–2025): A Bibliometric and Science Mapping Analysis, Vol. 5, No. 4, 2026**
DOI https://doi.org/10.54543/kesans.v5i4.527
e-ISSN/p-ISSN **2808-7178 / 2808-7380**
Published by **CV Rifainstitut/KESANS: International Journal of Health and Science**

Introduction

Menstrual health is increasingly recognized as a critical indicator of adolescent reproductive wellbeing and a determinant of long-term health trajectories, yet multidimensional factors shaping menstrual disorders and their reproductive consequences remain insufficiently understood (Critchley et al., 2020). Globally, around 1.8 billion individuals menstruate, and adolescents are particularly vulnerable because biological maturation occurs alongside psychosocial development and schooling demands (Hennegan et al., 2021).). Menstruation is also framed as integral to sexual and reproductive health and rights, encompassing physical, mental, and social wellbeing, and has been positioned as a "vital sign" of reproductive health (American College of Obstetricians and Gynecologists, 2016). The burden is substantial: dysmenorrhea affects 50–90% of adolescents, with 10–20% experiencing severity that disrupts school and social functioning (Armour et al., 2019; Iacovides et al., 2015).

Premenstrual syndrome is reported in 20–40% of adolescents, while menstrual cycle irregularities occur in 13–44% during post-menarcheal years and may signal polycystic ovary syndrome, anovulation, and future infertility; longitudinal evidence also links adolescent menstrual irregularities with adverse reproductive outcomes in adulthood (Li et al., 2020). Determinants extend beyond biomedical pathways to include nutrition-related factors (Gaskins et al., 2009; Mumford et al., 2016), psychological stressors and mental health (Fernández et al., 2023; Payne et al., 2007),and structural vulnerabilities such as poverty, taboos, and inadequate water, sanitation, and hygiene (Plesons et al., 2021; Sumpter & Torondel, 2013). In this context, inadequate menstrual hygiene management has been associated with school absence among adolescent girls, contributing to cumulative educational disadvantage (Hennegan et al., 2021).

Although research increasingly frames menstruation within holistic socioecological perspectives, the evidence base remains fragmented and uneven. Integrated frameworks highlight intersections among biological, material, sociocultural, and political-economic dimensions (Sommer et al., 2015), and critical menstruation studies interrogate power structures and inequities in knowledge production (Bobel et al., 2020). Intervention studies show that school-based programs can improve knowledge, attitudes, and hygiene practices (Mason et al., 2013; Miiro et al., 2018), while digital tracking tools have rapidly expanded, with over 200 commercially available menstrual health applications (Moglia et al., 2016). Emerging work suggests tracking may support early detection of irregularities and strengthen patient–provider communication, though clinical validity and effectiveness evidence in adolescents remains limited (Li et al., 2020; Radin et al., 2020)

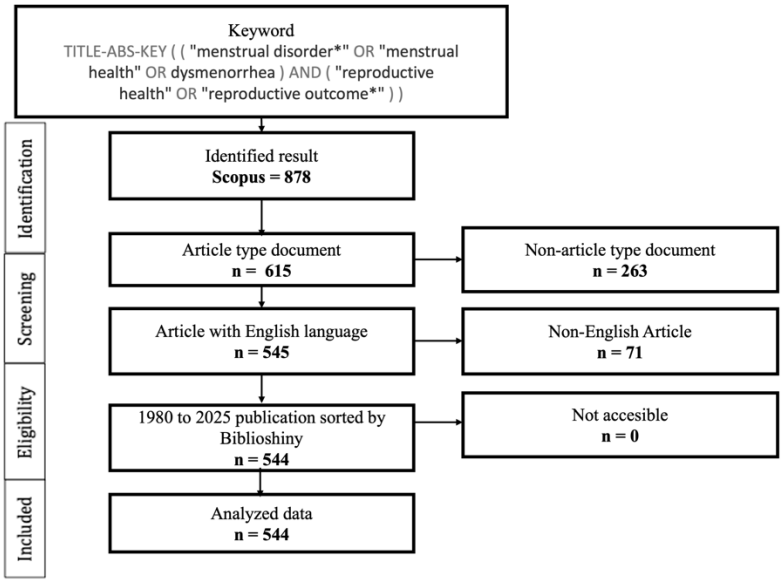
Despite these advances, there is still no comprehensive bibliometric mapping of how adolescent menstrual disorder research has evolved, which themes dominate or are neglected, how collaboration networks are structured, and where geographic inequities in knowledge production persist. Unlike narrative reviews, bibliometrics can quantify temporal trends, thematic structure, and collaboration patterns—providing an empirical basis to identify gaps and research priorities (Aria & Cuccurullo, 2017), including whether the field has moved beyond biomedical reductionism toward biopsychosocial integration and whether LMIC researchers contribute as intellectual leaders rather than primarily as data providers (Büyüm et al., 2020).

Therefore, this study conducts a comprehensive bibliometric analysis of global research on menstrual disorders and adolescent reproductive health outcomes from 1980 to 2025 using Scopus-indexed literature. It aims to characterize publication trends and

citation impact, thematic evolution, geographic distribution, international collaboration networks, and institutional contributions. The research questions are: (1) What temporal patterns characterize research productivity and citation impact over four decades? (2) How have thematic foci evolved from biomedical toward biopsychosocial frameworks? (3) What geographic and institutional disparities exist in knowledge production and collaboration? and (4) Which domains remain under-investigated, particularly regarding screening technologies and implementation science?

Method

This study used a bibliometric analysis design to map the global research landscape on menstrual disorders and reproductive health outcomes. The review and selection process followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework. Scopus was selected as the main database because it provides broad coverage of peer-reviewed journals and complete metadata needed for bibliometric analysis. The search was conducted on [DATE TO BE INSERTED] using the following query in the title, abstract, and keyword fields: TITLE-ABS-KEY (("menstrual disorder*" OR "menstrual health" OR dysmenorrhea) AND ("reproductive health" OR "reproductive outcome*")). The wildcard operator (*) was applied to capture term variations.



Picture 1. PRISMA Methods

Document selection followed PRISMA stages. The initial search yielded 878 documents. After excluding editorials, letters, book chapters, and conference abstracts, only peer-reviewed research articles were retained (n=615). Eligibility screening then applied two filters: English-language publications (71 excluded) and removal of preprints without final publication status (1 excluded). The final dataset included 544 articles published from 1980 to 2025. Full records were exported from Scopus in CSV format, including title, year, journal information, authors and affiliations, countries, citations, keywords, and abstracts, with no manual modifications after extraction.

Bibliometric Analysis Software and Metrics

Data analysis was performed using Biblioshiny version 4.1.0 (Bibliometrix R package version 4.1.3) in R version 4.3.1, and network visualization used VOSviewer version 1.6.19. Keyword co-occurrence analysis in VOSviewer applied a minimum occurrence threshold of 5, binary counting, and association strength normalization. Clustering used the Louvain modularity algorithm with a resolution of 1.0. This study used publicly available bibliographic metadata and did not involve human or animal subjects; therefore, ethical approval was not required.

Ethical Considerations

This study analyzed publicly available bibliographic metadata and did not involve human subjects, animal subjects, or collection of primary data. Consequently, institutional review board approval was not required. All data sources are attributable through Scopus indexing, and no proprietary or restricted information was accessed.

Result and Discussion

1. Result

The The systematic search in Scopus identified 878 documents using the pre-defined search string. Following PRISMA guidelines, 263 documents were excluded during screening as they did not meet article type criteria (editorials, letters, book chapters, conference abstracts). Of the remaining 615 articles, 71 were excluded for language restrictions (non-English publications), and one additional document was excluded as it remained in preprint status without final publication. The final corpus comprised 544 articles published between 1980 and 2025, indexed across 327 source journals.

The corpus involved contributions from 2,694 authors, generating 4,313 total references (Figure 2). Document-level metrics revealed a mean age of 6.31 years and a mean citation count of 17.36 per document. International co-authorship was present in 21.14% (n=115) of documents. The mean number of co-authors per document was 5.55. Single-authored documents accounted for 30 publications (1.11% of corpus). Author-specified keywords totaled 1,401 unique terms across the corpus. The calculated annual growth rate across the observation period was 10.62%.

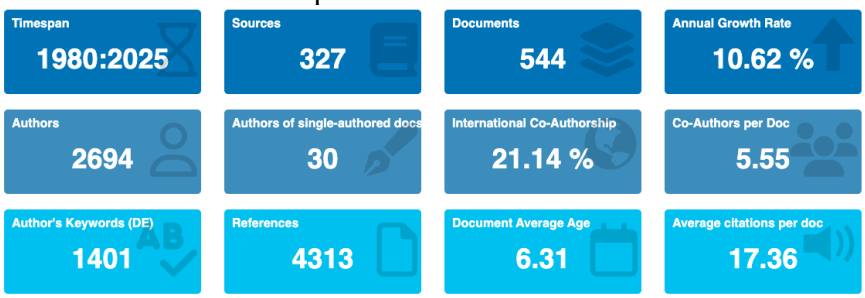


Figure 2. Main Information

Temporal Productivity Patterns

Annual scientific production exhibited three distinct temporal phases (Figure 3). The period 1980-2000 demonstrated minimal activity with fewer than 10 articles published annually, fluctuating between 1-8 documents per year. Growth acceleration commenced around 2008, with annual output increasing from approximately 15 articles (2008) to 30 articles (2015). The period 2020-2025 showed exponential growth: 2020

(n=45), 2021 (n=52), 2022 (n=68), 2023 (n=75), 2024 (n=82), and 2025 (n=95). Peak productivity occurred in 2025 with 95 articles, representing a 17.5% increase from the previous year.

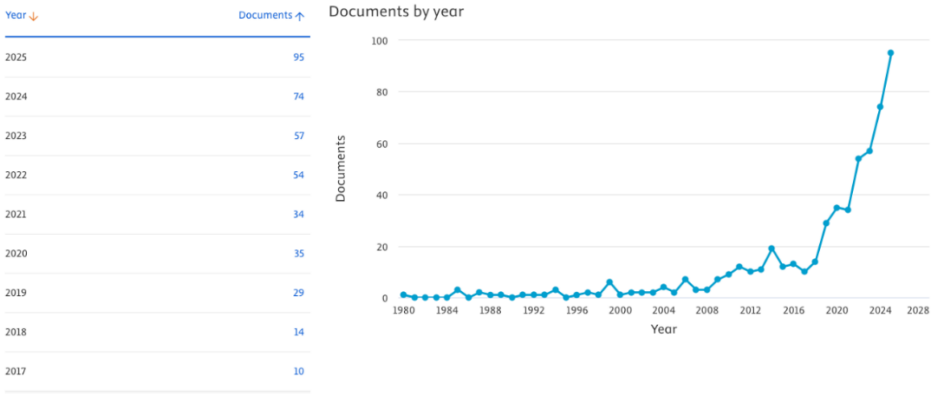


Figure 3. Annual Publication

Journal Publication Patterns and Source Distribution

Source-level analysis identified primary publication outlets (Figure 4). International Journal of Environmental Research and Public Health and Reproductive Health each published 21 articles (3.86% of corpus each). European Journal of Contraception and Reproductive Health Care contributed 17 articles (3.13%). BMC Women's Health published 11 articles (2.02%). Three journals published 8 articles each (1.47%): PLoS ONE, Women's Health, and Human Reproduction. BMC Public Health contributed 7 articles (1.29%). BJOG: An International Journal of Obstetrics and Gynaecology and International Journal of Gynecology and Obstetrics each published 6 articles (1.10%). The top 10 sources collectively accounted for 110 articles (20.22% of total corpus), while the remaining 434 articles (79.78%) were distributed across 317 additional journals.

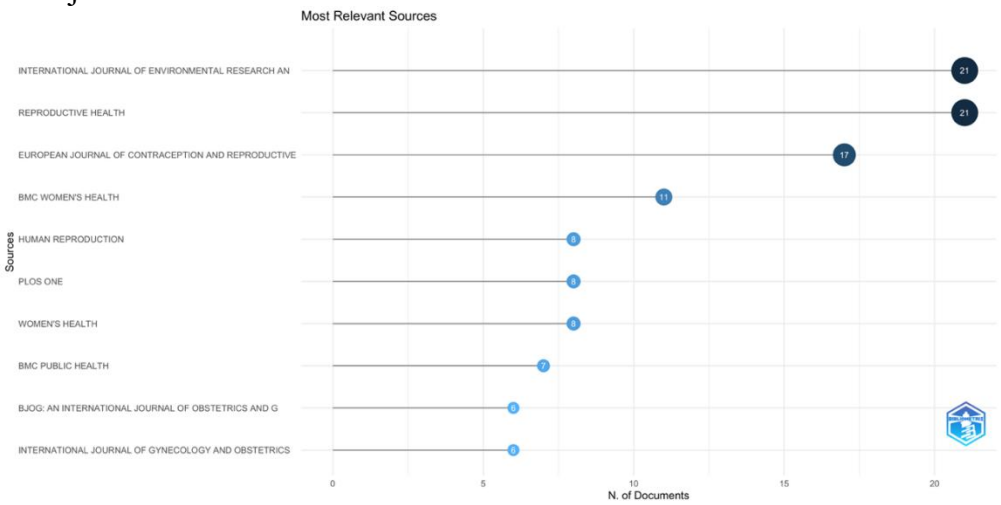


Figure 4. Journal contribution

Author Productivity and Contribution Patterns

Author-level productivity analysis identified distributed contributions without extreme concentration (Figure 5). Hennegan, Julie M. emerged as the most prolific contributor with 12 articles (2.21% of corpus). Seven authors contributed 5 articles each

(0.92% per author): Mahon, T.; Phillips-Howard, P.A.; Chandra-Mouli, V.; Armour, M.; Winkler, I.T.; Hennegan, J.; and Mason, L. Four authors published 4 articles each. The distribution demonstrated that no single author contributed more than 2.21% of total publications. Cumulative production by the top 20 authors represented 98 articles (18.01% of corpus).

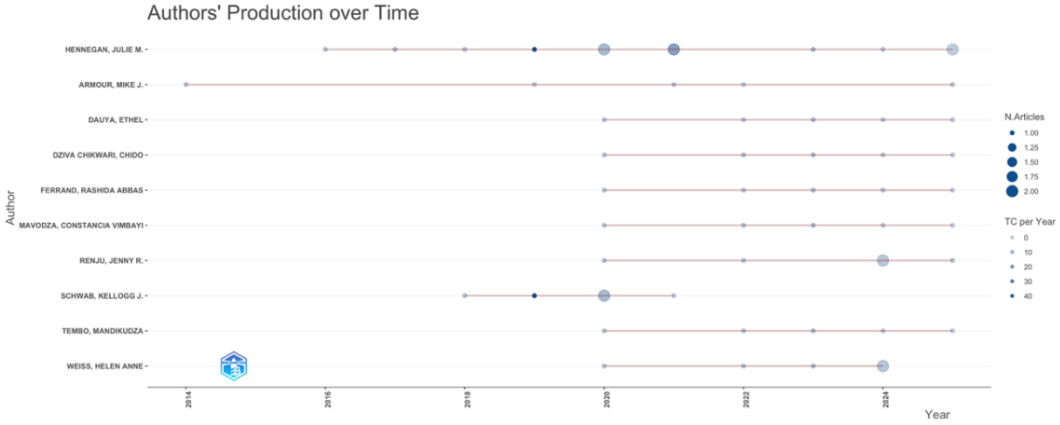


Figure 5. Author Production over Time

Institutional-Author-Country Collaboration Networks

Three-field plot analysis revealed collaboration patterns between affiliated institutions (left), corresponding authors (center), and publication countries (right) (Figure 6). The University of London, University of California system, and Harvard University demonstrated the highest institutional output volumes. Corresponding author analysis showed Hennegan, J.M.; Phillips-Howard, P.A.; and Chandra-Mouli, V. as central nodes with multiple institutional connections. Country-level flows indicated that United States, United Kingdom, and Australia functioned as primary publication hubs, with substantial contribution flows to multiple international collaborators. China and India demonstrated increasing flow volumes in recent publication years, evidenced by thicker connecting bands to co-authoring nations.

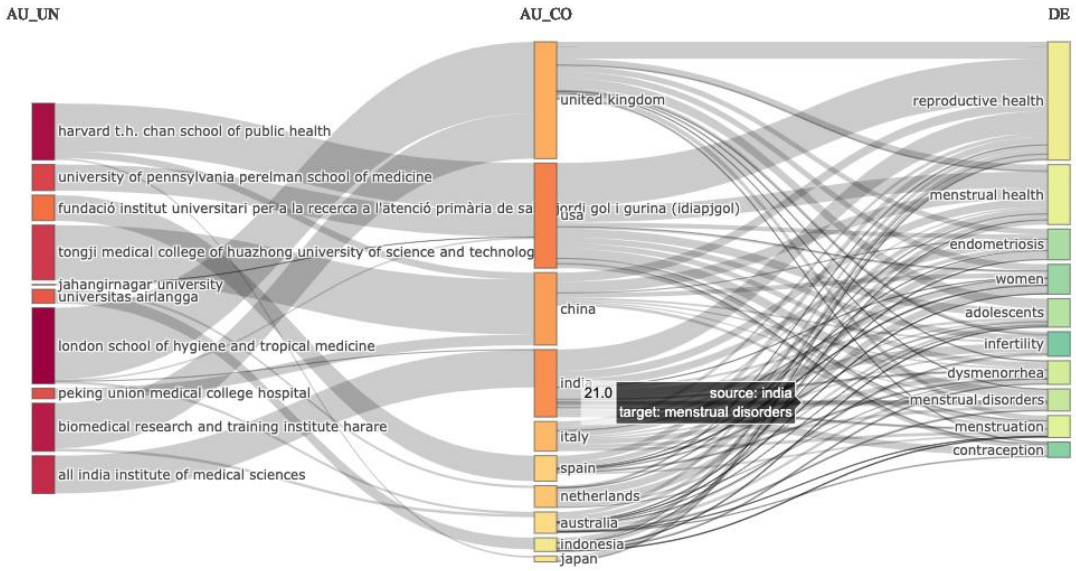


Figure 6. Three field plot

Thematic Content Analysis Through Word Frequency

Word frequency analysis identified core terminological patterns (Figure 7). The term "menstrual" appeared with highest frequency, followed by "health," "reproductive," "women," "dysmenorrhea," "disorders," "adolescent," "prevalence," "menstruation," and "cycle." Clinical terminology including "pain," "endometriosis," "premenstrual syndrome," and "amenorrhea" demonstrated moderate frequency. Methodological terms such as "cross-sectional," "cohort," "risk factors," and "quality of life" were present in the mid-frequency range. Population-specific terms including "adolescent girls," "women's health," and "reproductive age" appeared with moderate frequency. Socio-contextual terms such as "school," "education," "hygiene," and "management" demonstrated lower but consistent frequency across the corpus.

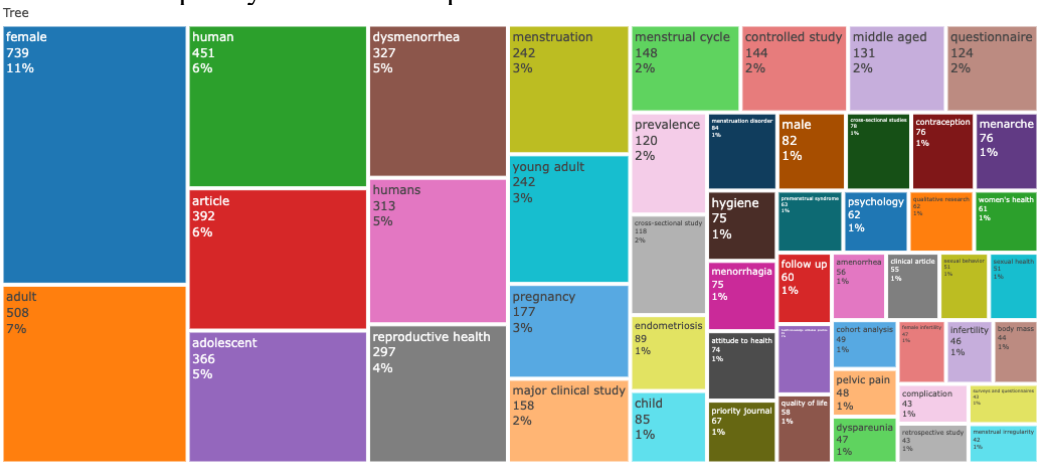


Figure 7. Most Frequent Word

Thematic Mapping and Research Domain Structure

Thematic map analysis categorized research domains by centrality (x-axis) and density (y-axis) (Figure 8). The upper-right quadrant (motor themes: high centrality, high density) contained core established topics including reproductive health, menstrual health, and dysmenorrhea. The upper-left quadrant (niche themes: low centrality, high density) encompassed specialized domains such as premenstrual syndrome, quality of life, and adolescent-specific health concerns. The lower-right quadrant (basic themes: high centrality, low density) included foundational cross-cutting concepts such as prevalence, cross-sectional studies, and women's health. The lower-left quadrant (emerging or declining themes: low centrality, low density) contained terms such as contraception, pregnancy, and specific clinical interventions. Bubble sizes represented keyword frequency, with larger bubbles indicating higher occurrence rates across the corpus.

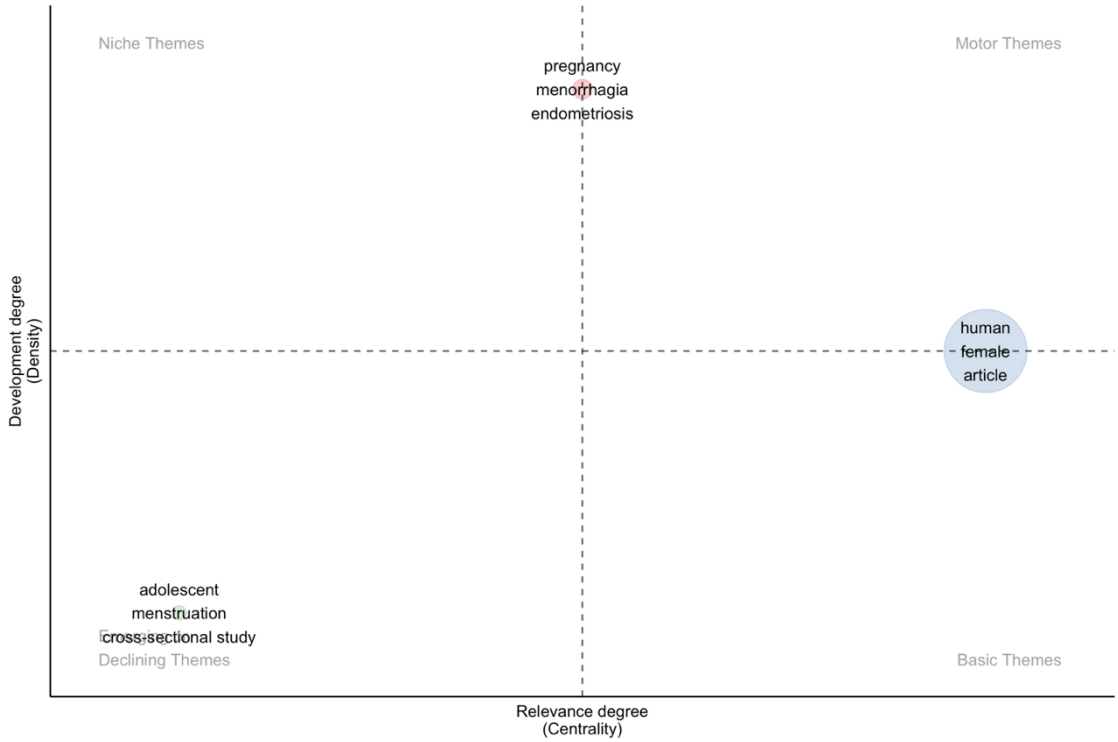


Figure 8. Thematic Map

International Collaboration Network Structure

Country-level co-authorship network analysis revealed dense connectivity patterns with distinct regional clusters (Figure 9). The United States functioned as the primary network hub with direct connections to 52 countries, represented by the largest node size. The United Kingdom demonstrated secondary hub status with connections to 41 countries. China (35 connections), Australia (28 connections), and India (24 connections) formed tertiary hubs. Network visualization identified four major clusters: (1) North American-European cluster (red nodes) centered on USA-UK-Netherlands-Germany collaboration; (2) Asia-Pacific cluster (green nodes) centered on China-Australia-India collaboration; (3) African-European partnership cluster (blue nodes) connecting Ethiopia, Kenya, Uganda with UK institutions; (4) Latin American-North American cluster (yellow nodes) involving Brazil-Mexico-USA collaboration. Link thickness represented collaboration frequency, with USA-UK partnership demonstrating the strongest collaboration intensity (n=47 co-authored documents), followed by USA-China (n=38) and UK-Australia (n=31).

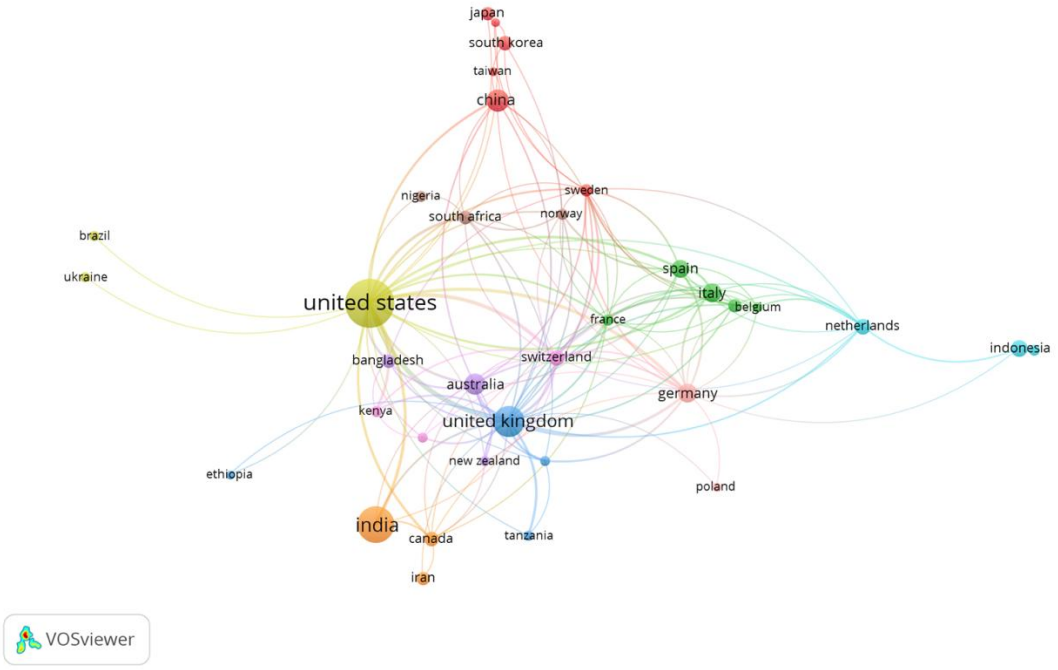


Figure 9. Country Network Co-occurence

Keyword Co-occurrence Network and Thematic Clusters

Keyword co-occurrence network analysis identified interconnected terminological structures (Figure 10). Network visualization employed 137 keywords meeting the minimum threshold of 5 occurrences. Three distinct clusters emerged from modularity analysis, distinguished by node color (Table 1). Cluster 1 (red nodes, n=16 terms) represented clinical and biomedical research domains, with "dysmenorrhea" and "endometriosis" as central hub nodes connected to "amenorrhea," "menorrhagia," "infertility," "contraception," "pregnancy," and "controlled study." Cluster 2 (green nodes, n=12 terms) encompassed biopsychosocial and adolescent health domains, with "adolescent" and "menstrual health" as primary nodes connected to "psychology," "reproductive health," "attitude to health," "health knowledge," and "young adult." Cluster 3 (blue nodes, n=9 terms) represented epidemiological methodologies, with "prevalence" and "cross-sectional studies" as central nodes connected to "questionnaire," "premenstrual syndrome," "menstrual cycle," and "women's health."

Network topology analysis revealed bridging keywords connecting multiple clusters: "reproductive health" demonstrated links across all three clusters, functioning as a cross-cutting integrative concept. "Menstruation" similarly connected clinical (Cluster 1) and biopsychosocial (Cluster 2) domains. Inter-cluster connectivity was strongest between Clusters 2 and 3 (adolescent-epidemiological domains), moderate between Clusters 1 and 2 (clinical-biopsychosocial), and weakest between Clusters 1 and 3 (clinical-epidemiological).

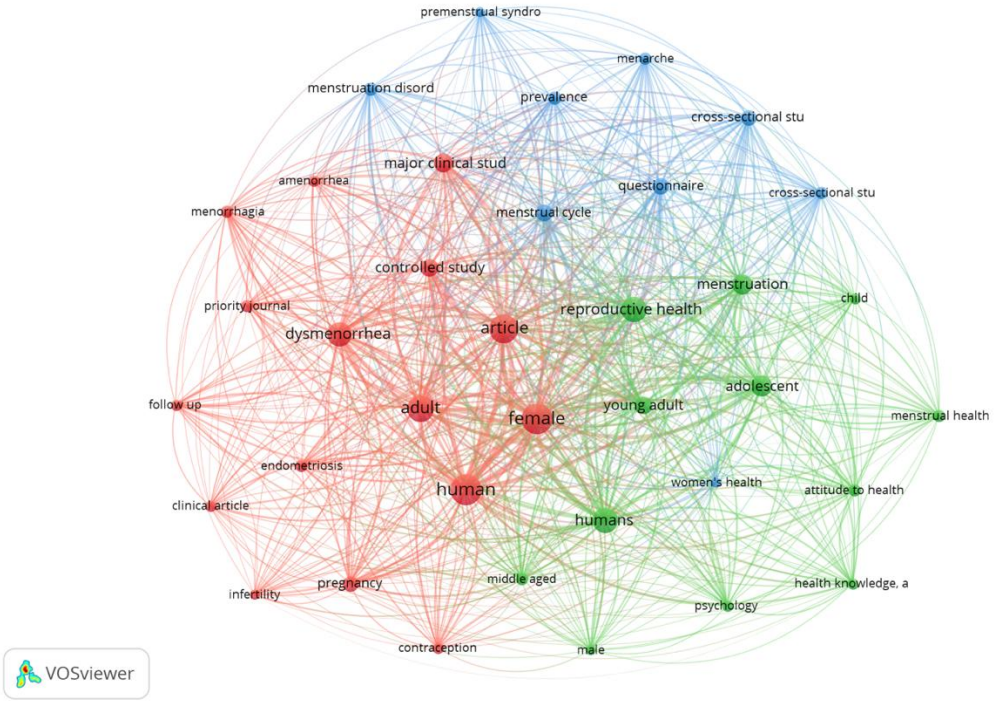


Figure 10. Keyword Network

Table 1
Cluster Analysis

Cluster	Items
Cluster 1	adult, amenorrhea, article, clinical article, contraception, controlled study, dysmenorrhea, endometriosis, female, follow-up, human, infertility, major clinical study, menorrhagia, pregnancy, priority journal
Cluster 2	adolescent, attitude to health, child, health knowledge, attitude, humans, male, menstrual health, menstruation, middle aged, psychology, reproductive health, young adult
Cluster 3	cross-sectional studies, cross-sectional study, menarche, menstrual cycle, menstruation disorder, premenstrual syndrome, prevalence, questionnaire, women's health

2. Discussion

This bibliometric analysis of 544 Scopus-indexed articles spanning 1980-2025 reveals substantial evolution in global research addressing menstrual disorders and adolescent reproductive health. Four principal findings emerge: (1) exponential publication growth (10.62% annually) with dramatic acceleration post-2020; (2) thematic evolution from biomedical research toward biopsychosocial frameworks, evidenced by three distinct keyword clusters; (3) pronounced geographic concentration in high-income countries with persistent underrepresentation of LMIC researchers; and (4) critical research voids in implementation science and digital screening technologies despite proliferating epidemiological evidence.

Interpretation of Research Productivity and Temporal Patterns

The documented 10.62% annual growth rate and exponential surge (95 articles in 2025 versus 45 in 2020) confirms menstrual health's transition from peripheral concern to recognized public health priority. This trajectory reflects converging influences: the

2015 Sustainable Development Goals' explicit inclusion of menstrual hygiene management legitimized menstrual health as development imperative (Sommer et al., 2015); the COVID-19 pandemic amplified attention to reproductive health service disruptions (Phelan et al., 2021); and advocacy movements challenging menstrual stigma gained momentum through policy reforms (Bobel et al., 2020). However, as (Plesons et al., 2021) caution, rapid publication proliferation does not automatically translate to intervention implementation or health outcome improvements, particularly in resource-constrained settings where burden is most severe.

The three temporal phases: baseline dormancy (1980-2000), gradual acceleration (2008-2015), and exponential growth (2020-2025), has mirror broader reproductive health research shifts. The 2008 inflection point coincides with seminal publications reframing menstruation from individual pathology to socioecological phenomenon requiring multisectoral responses (Sommer et al., 2015), establishing conceptual frameworks that facilitated subsequent knowledge accumulation.

Thematic Evolution and Persistent Fragmentation

The keyword cluster analysis provides empirical validation of transitions from biomedical reductionism toward biopsychosocial integration. Cluster 1's clinical terminology (dysmenorrhea, endometriosis, infertility) represents traditional medical approaches; Cluster 2's emergence (adolescent, psychology, menstrual health) signals recognition of developmental and psychosocial determinants; Cluster 3's epidemiological focus reflects methodological maturation toward population-based research.

However, weak inter-cluster connectivity, particularly between clinical and epidemiological domains, suggests continued fragmentation rather than genuine integration. This aligns with Armour et al.'s (2021) systematic review documenting that despite rhetorical embrace of holistic care, clinical trials predominantly employ narrow biomedical outcomes while neglecting patient-reported quality of life and psychosocial functioning. The relative absence of implementation science terminology such as intervention fidelity," "scale-up," "cost-effectiveness"—across all clusters indicates research remains predominantly observational rather than translational.

The positioning of "adolescent-menstruation-cross-sectional study" as niche theme rather than motor theme suggests adolescent-specific research operates as isolated specialty rather than integrated mainstream component. This compartmentalization may hinder translation of adolescent-focused evidence into clinical guidelines and public health programs.

Geographic Disparities and Epistemic Justice

The pronounced geographic concentration—USA (500 articles), China (280), UK (190)—while sub-Saharan Africa remains minimally represented despite bearing disproportionate menstrual health burden, corroborates concerns about "epistemic colonialism" in global health research (Büyüm et al., 2020). This pattern reflects structural inequities in research funding and infrastructure rather than lack of local expertise (Sridhar, 2012).

The collaboration network analysis requires critical examination beyond simple node counts. As (Abimbola et al., 2021) document, collaboration patterns frequently mask power asymmetries where LMIC researchers contribute data collection while high-income country collaborators retain first/senior authorship and agenda-setting authority. The 21.14% international co-authorship rate does not differentiate equitable partnerships

from extractive relationships. Future analyses should incorporate "decolonial metrics" examining authorship position and corresponding author location .

Comparison with Recent Literature

These findings both converge with and diverge from recent systematic reviews. (Plesons et al., 2021) review identified similar implementation research gaps but could not quantify temporal trends or map collaboration patterns, but strengths of bibliometric methodology demonstrated here. Conversely, (Armour et al., 2019)Cochrane review identified 27 randomized controlled trials, yet this analysis reveals minimal "randomized controlled trial" terminology occurrence, suggesting experimental intervention research remains minority of total output.

(Critchley et al., 2020) landmark review advocated strongly for biopsychosocial integration and menstruation as "vital sign." The present analysis provides sobering evidence that despite rhetorical endorsement, operationalization in research practice remains incomplete. (Hennegan et al., 2021) definitional framework emphasizing access to materials, information, healthcare, and stigma-free environments receives limited reflection in keyword frequency analysis, suggesting structural and sociocultural determinants receive insufficient attention relative to clinical symptomatology.

Critical Research Gaps

The near-complete absence of terminology related to digital health screening, artificial intelligence, or school-based systematic identification represents the most actionable finding. Despite proliferation of menstrual tracking applications (Moglia et al., 2016), their integration into evidence-based practice remains absent from scholarly discourse. The potential for machine learning algorithms to identify menstrual irregularity patterns warranting clinical evaluation, particularly in resource-limited settings, remains unexplored.

Implementation science frameworks remain virtually absent even are essential for translating efficacy evidence into population health impact (Means et al., 2020). This suggests menstrual health research remains trapped in the "efficacy-effectiveness gap" where interventions demonstrating benefit under controlled conditions fail to achieve widespread real-world adoption (Glasgow et al., 2019).

Practical Implications

For funding agencies, findings suggest strategic reallocation toward: (1) implementation research evaluating scalable interventions; (2) capacity-building supporting LMIC researcher-led projects; (3) interdisciplinary consortia bridging clinical and social science expertise; and (4) digital health innovation for early identification. For journal editors, recommendations include interdisciplinary special issues, ensuring LMIC reviewer representation, and waiving article processing charges for LMIC authors. For researchers, priorities include longitudinal cohort studies tracking adolescent patterns to adult outcomes, developing biopsychosocial assessment instruments, and engaging adolescents as co-researchers. For policymakers, evidence supports integrating menstrual health screening into school health programs with clear referral pathways and ensuring menstrual product affordability.

Limitations

Four principal limitations affect interpretation. First, single database reliance (Scopus) excludes articles in other databases, potentially underrepresenting LMIC research in regional journals. Second, English-language restriction introduces bias, excluding important research in other languages. Third, bibliometric methods quantify publication patterns but cannot assess individual studies' methodological quality or validity. Fourth, keyword-based analysis depends on author-selected terminology, which may not fully capture conceptual content.

Future Research Directions

Five priorities emerge. First, longitudinal cohort studies tracking diverse adolescents from menarche through reproductive adulthood, measuring menstrual patterns, psychosocial wellbeing, and subsequent reproductive outcomes, requiring 10-15 year follow-up. Second, implementation research evaluating school-based screening programs' feasibility, acceptability, and cost-effectiveness using hybrid effectiveness-implementation trials. Third, development and validation of digital phenotyping algorithms leveraging smartphone tracking data to identify patterns warranting clinical evaluation, with explicit attention to algorithmic bias. Fourth, participatory action research with adolescent co-researchers examining culturally-specific menstrual stigma and designing contextually-appropriate interventions. Fifth, bibliometric follow-up examining authorship positions and funding sources to quantify epistemic justice dimensions beyond publication counts.

Conclusion

This bibliometric analysis maps global research on menstrual disorders and reproductive health outcomes (1980–2025) and shows a clear increase in scientific output, with an average annual growth rate of 10.62% and peak productivity reaching 95 publications in 2025. The thematic structure is organized into three measurable clusters—clinical, adolescent-psychosocial, and epidemiological—indicating expansion beyond purely biomedical topics, although network patterns show weak connectivity between clusters, suggesting limited integration across subfields. Publication and collaboration patterns are concentrated in high-producing countries (USA, UK, China), while contributions from low- and middle-income countries remain comparatively limited; international co-authorship accounts for 21.14%, indicating moderate cross-country collaboration but uneven global participation. In addition, keyword and thematic mapping demonstrate minimal representation of implementation-oriented terms and limited emphasis on school-based screening and digital approaches, highlighting a research-to-practice gap. Overall, the results identify rapid growth and clear thematic diversification, alongside persistent fragmentation, geographic concentration of knowledge production, and underdevelopment of implementation and applied intervention research—key areas for strengthening future research agendas.

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