

Global Research Trends in Preeclampsia Screening and Early Diagnosis: A Bibliometric Analysis

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ABSTRACT

Background: Preeclampsia remains a major cause of maternal and neonatal morbidity and mortality worldwide, while research on biomarkers, screening strategies, and early diagnostic approaches has increased substantially. However, a comprehensive understanding of global research trends and emerging hotspots in preeclampsia screening and early diagnosis remains limited, prompting this study to analyze these trends using bibliometric analysis.

Subjects and Method: This was a descriptive bibliometric study conducted using the Scopus database. The target population consisted of publications related to preeclampsia screening and early diagnosis published between 2020 and 2026. Documents were identified using keywords related to preeclampsia, screening, prediction, and early diagnosis. Of 3,105 retrieved records, 882 English-language articles and reviews meeting the eligibility criteria were included in the analysis. The variables analyzed included annual scientific production, citation performance, source journals, authorship characteristics, institutional contributions, country productivity, keyword occurrence, and thematic evolution. Data were analyzed using R programming and VOSviewer.

Results: Research on preeclampsia screening and early diagnosis increased substantially during the study period and reached its highest productivity in 2025. *BMC Pregnancy and Childbirth* was the most productive journal, while the 2021 ISSHP guideline on hypertension in pregnancy was the most globally cited document. The University of Oxford was the leading institutional contributor. Thematic and keyword analyses showed growing attention to biomarkers, placenta, prenatal diagnosis, and predictive models. Five major research clusters were identified, covering maternal risk factors, molecular biomarkers, screening and diagnostic methods, clinical and laboratory parameters, and predictive models. Bioinformatics and messenger RNA emerged as developing research themes.

Conclusion: Research on preeclampsia screening has shifted toward biomarker-based prediction and molecular diagnostic approaches, reflecting the growing emphasis on early detection strategies. This bibliometric study provides a comprehensive overview of global research trends, emerging hotspots, and research gaps that may guide future investigations, strengthen biomarker based screening strategies, and foster international collaboration to improve maternal healthcare.

Keywords: preeclampsia; early diagnosis; biomarkers; bibliometric analysis; research trends

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BACKGROUND

Maternal health remains a major priority in global public health because complications during pregnancy and childbirth continue to contribute substantially to maternal morbidity and mortality. Preeclampsia is recognized as a major cause of maternal and perinatal morbidity and mortality worldwide (Kirkham et al., 2023). It is a hypertensive disorder of pregnancy characterized by elevated blood pressure after 20 weeks of gestation accompanied by maternal and/or fetal organ involvement (Rana et al., 2022). Globally, preeclampsia affects approximately 2–8% of pregnancies and remains a leading cause of maternal and neonatal complications (Mészáros et al., 2023).

Preeclampsia is associated with several serious complications, including preterm birth, fetal growth restriction, maternal organ dysfunction, and, in severe cases, maternal and neonatal death. Previous studies have reported that preeclampsia increases the risk of preterm birth, fetal growth restriction, and maternal cardiovascular complications (Aneman et al., 2020). Beyond pregnancy, women with a history of preeclampsia are at a higher risk of developing cardiovascular disease later in life (Verlohren et al., 2022). The high burden of complications related to preeclampsia remains a significant challenge, particularly in developing countries where access to maternal health-care services and early detection strategies is often limited (Poon et al., 2023).

Screening and early diagnosis of preeclampsia are essential for reducing the risk of maternal and neonatal complications. Furthermore, machine learning models have been reported to improve the prediction of preeclampsia compared with

conventional screening methods (Hackelöer et al., 2023). Other studies have demonstrated that combining maternal characteristics with biomarkers provides better predictive performance than relying solely on maternal risk factors (Rana et al., 2022).

In addition, advances in precision medicine and digital health technologies have accelerated research on preeclampsia screening and early diagnosis. Recent studies have highlighted the potential of machine learning approaches to enhance predictive accuracy for preeclampsia (Han et al., 2023). Researchers have also focused on identifying novel biomarkers capable of detecting preeclampsia during the first trimester of pregnancy (Bartal and Sibai, 2022). However, no single biomarker has yet demonstrated optimal sensitivity and specificity across all types of preeclampsia, indicating that research on screening and early diagnostic approaches continues to evolve (Han et al., 2023). As research continues to expand across multiple diagnostic approaches, the volume and diversity of publications have increased substantially, making it increasingly difficult to obtain a comprehensive understanding of the overall development of this field.

Bibliometric analysis is a quantitative method used to evaluate the development of a research field based on publication metadata, including publication output, citations, publication sources, author collaborations, and research trends (Hoang, 2025). This approach has been widely applied to assess publication trends, identify leading contributors, and examine collaboration patterns across various scientific domains (Cilmiaty, 2024; Ghozali et al., 2024; Hoang, 2025; Romaniyanto et al., 2025; Wijayanto et al., 2023). Although

bibliometric analysis has been widely applied in many health-related fields, no comprehensive bibliometric study has systematically mapped the global landscape of preeclampsia screening and early diagnosis. Consequently, current evidence provides limited understanding of publication trends, influential contributors, international collaboration, thematic evolution, and emerging research hotspots in this field. Addressing these knowledge gaps is important for guiding future research priorities and supporting evidence-based maternal healthcare. Therefore, this study aimed to conduct a comprehensive bibliometric analysis of global research trends in preeclampsia screening and early diagnosis.

SUBJECTS AND METHOD

1. Study Design

This was a descriptive bibliometric study conducted using the Scopus database as the sole data source. Data retrieval was performed on May 23, 2026. The study analyzed publications related to preeclampsia screening and early diagnosis published between 2020 and 2026.

2. Population and Sample

The target population consisted of scientific publications related to preeclampsia screening and early diagnosis. The accessible population included publications indexed in the Scopus database. The search strategy was conducted using Boolean operators and the TITLE-ABS-KEY (“preeclampsia” AND (“screening” OR “prediction” OR “early diagnosis”)), and related terms. The search was limited to English-language articles and reviews published in final form.

The inclusion criteria were original research articles and review articles focusing on preeclampsia screening and early diagnosis, peer-reviewed publications, and articles published in English. The exclusion criteria included grey literature, editorials, conference proceedings, and publications not directly related to preeclampsia screening. A total of 3,105 documents were identified during the initial search process. After screening based on the eligibility criteria, 882 publications were included in the final analysis.

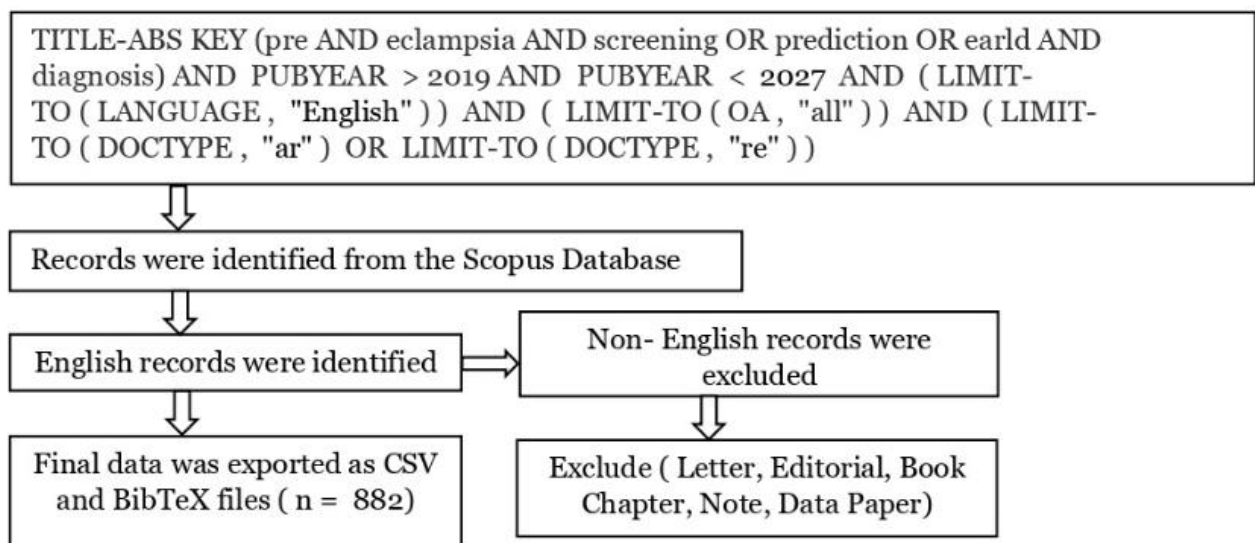


Figure 1. Publication Screening Flowchart

3. Study Variables

The variables analyzed in this bibliometric study included annual scientific production, citation performance, source journals, authorship characteristics, institutional contributions, country productivity, keyword occurrence, and thematic evolution.

4. Operational Definition of Variables

Annual scientific production: the number of publications related to preeclampsia screening and early diagnosis published in each year during the study period.

Citation performance: the number of citations received by publications related to preeclampsia screening and early diagnosis.

Source journals: the journals that published publications related to preeclampsia screening and early diagnosis, assessed based on the number of publications contributed by each journal.

Authorship characteristics: the contribution and productivity of individual authors based on their publication output in the research field.

Institutional contributions: the number of publications contributed by each institution in the research field.

Country productivity: the number of publications contributed by authors affiliated with each country in the research field.

Keyword occurrence: the frequency of occurrence of specific keywords within the retrieved publications.

Thematic evolution: the development and changes in research themes over time, identified through keyword analysis..

5. Study Instruments

Publication metadata were extracted from the Scopus database using the export feature. The extracted data included author names and affiliations, document type, journal title, year of publication, citation counts, and keywords. The data were

exported in CSV and BibTeX formats. Bibliometric analyses and visualizations were performed using R programming and VOSviewer software.

6. Data Analysis

Descriptive bibliometric indicators were analyzed in R using the Bibliometrix package through the Biblioshiny interface to evaluate annual scientific production and temporal research trends. Thematic mapping, co-word analysis, and thematic clustering were conducted to identify major research themes and thematic evolution. Network analysis was performed using VOSviewer 1.6.2 to visualize bibliometric relationships, including co-authorship, co-occurrence, and co-citation networks.

7. Research Ethics

This study used secondary data obtained from a publicly accessible database and did not involve human participants or identifiable personal information. Therefore, ethical approval was not required.

RESULTS

1. Sample Characteristics

A total of 3,105 publications were identified from the Scopus database. After applying the inclusion and exclusion criteria, 882 English-language articles and reviews published between 2020 and 2026 were included in the final analysis (Figure 2). The analyzed publications consisted of original research articles and review articles focusing on preeclampsia screening and early diagnosis. The increasing volume of publications within this period reflects growing scientific attention toward improving early detection strategies for preeclampsia.

2. Scientific Production and Citation Analysis

Figure 2 illustrates the increasing number of publications related to preeclampsia screening and early detection over recent

years. Publication output remained relatively low during 2020–2021, beginning with 80 publications in 2020 and increasing to approximately 90 publications in 2021. A more noticeable increase was observed in 2022, with around 110 publications. The number of publications remained relatively stable between 2022 and 2023. A substantial increase occurred in 2024, reaching approximately 170 publications, followed by a peak in 2025 with more than 220 publications. The lower number of publi-

cations recorded in 2026 does not reflect the full annual output, as publication and indexing processes were still ongoing when the data were retrieved in the middle of the year. This increasing publication trend indicates that preeclampsia screening has become an expanding research priority, likely driven by advances in biomarker discovery, predictive modelling, and precision medicine approaches in maternal healthcare.

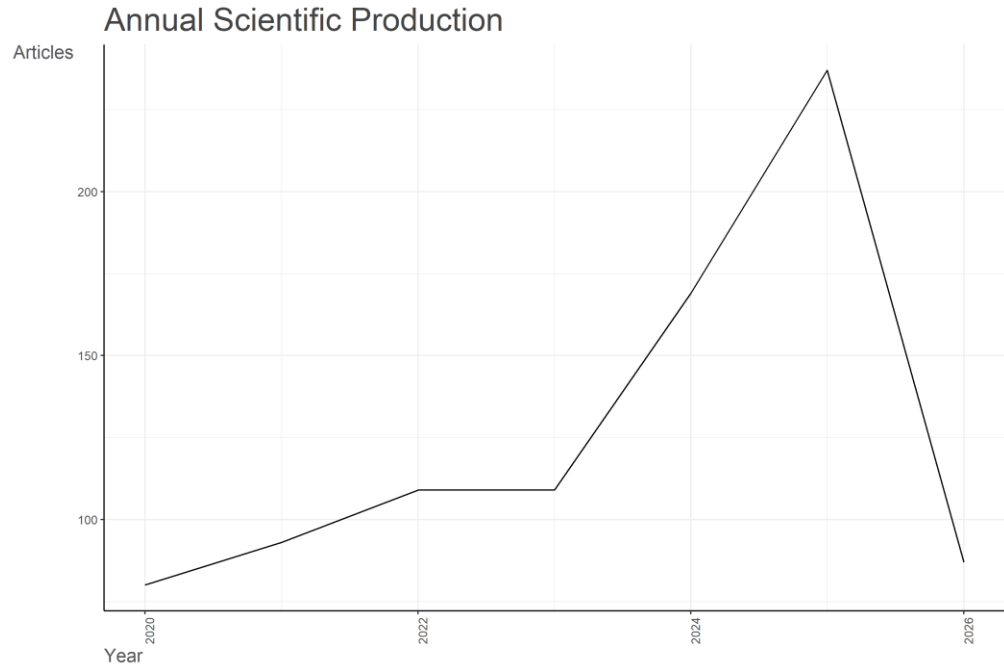


Figure 2. Annual Production and Total Citation

Figure 3 presents the ten most productive publication sources. BMC Pregnancy and Childbirth was the leading source with 59 publications, followed by Ultrasound in Obstetrics and Gynecology (45 publications) and Pregnancy Hypertension (31 publications). These findings indicate that research on preeclampsia screening is primarily disseminated

through journals specializing in maternal-fetal health, obstetrics, gynecology, and hypertensive disorders of pregnancy. The concentration of publications in specialized maternal fetal health journals suggests that preeclampsia screening research remains closely linked to clinical obstetric practice and translational maternal medicine.

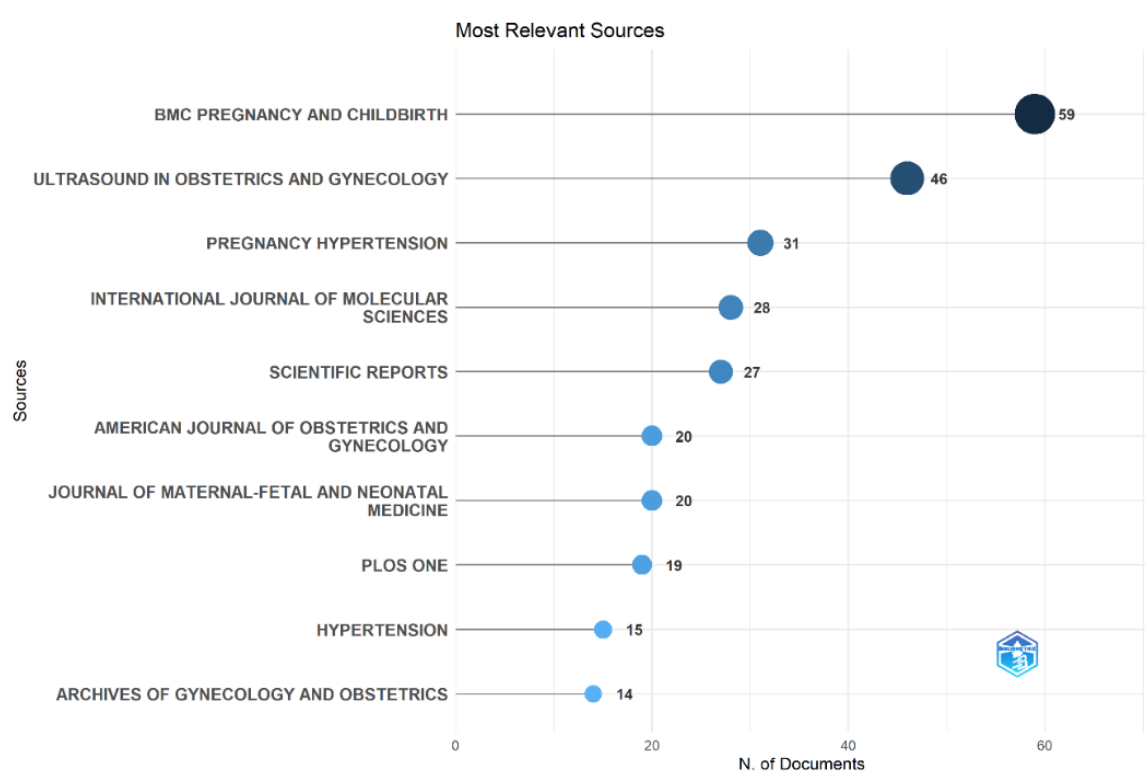


Figure 3. Top 10 Publishing Sources

The most influential publications are presented in Table 1 and Figure 4. The most globally cited document was the 2021 ISSHP guideline published in Pregnancy Hypertension by Brown *et al* (2018), which received 813 citations and an average of 162 citations per year. Highly cited publications were predominantly related to international clinical guidelines, angiogenic biomarkers, and predictive approaches for preeclampsia. Furthermore, several influential publications focused on angiogenic biomarkers,

particularly soluble fms-like tyrosine kinase-1 (sFlt-1) and placental growth factor (PlGF), reflecting the growing interest in biomarker-based screening approaches for the early detection and prediction of preeclampsia risk. The prominence of these highly cited studies suggests that clinical guidelines and biomarker validation studies have played a key role in shaping the direction of current preeclampsia screening research.

Table 1. Most Global Cited Documents

No	Author, Year	Title	Journal	No of Citation	Average Citation per Year
1.	Kirkham et al. (2023)	The 2021 international society for the study of hypertension in pregnancy classification, diagnosis & management recommendations for international practice	Pregnancy hypertension	813	162
2.	Macdonald et al. (2022)	Clinical tools and biomarkers to predict pre-eclampsia	Ebio-medicine	235	47
3.	Rana et al., (2022)	Imbalance in circulating angiogenic factor in the pathophysiology of preeclampsia and related disorders	Am J Obstet Gynecol	228	45

No	Author, Year	Title	Journal	No of Citation	Average Citation per Year
4.	Kim et al. (2020)	Environmental risk factors, protective factors, and peripheral biomarkers for ADHD: an umbrella review	Lancet psychiatr	215	30
5.	Stepan et al. (2023)	Clinical utility of sFlt-1 and PlGF in screening, prediction, diagnosis and monitoring of preeclampsia and fetal growth restriction	Ultrasound Obstet Gynecol	204	51
6.	Stepan et al., (2020)	Combining biomarkers to predict pregnancy complications and redefine preeclampsia: the angiogenic-placental syndrome	Hypertension	200	28
7.	Bartal and Sibai (2022)	Eclampsia in the 21 st century	Am J Obstet Gynecol	196	39
8.	Aneman et al. (2020)	Mechanisms of key innate immune cells in early and late onset preeclampsia	Front Immunol	196	28
9.	Moufarrej et al. (2022)	Early prediction of preeclampsia in pregnancy with cell-free RNA	Nature	189	37
10.	Verlohren et al. (2022)	Clinical interpretation and implementation of the sFlt-1/PlGF ratio in the prediction, diagnosis and management of preeclampsia	Pregnancy hypertension	185	37

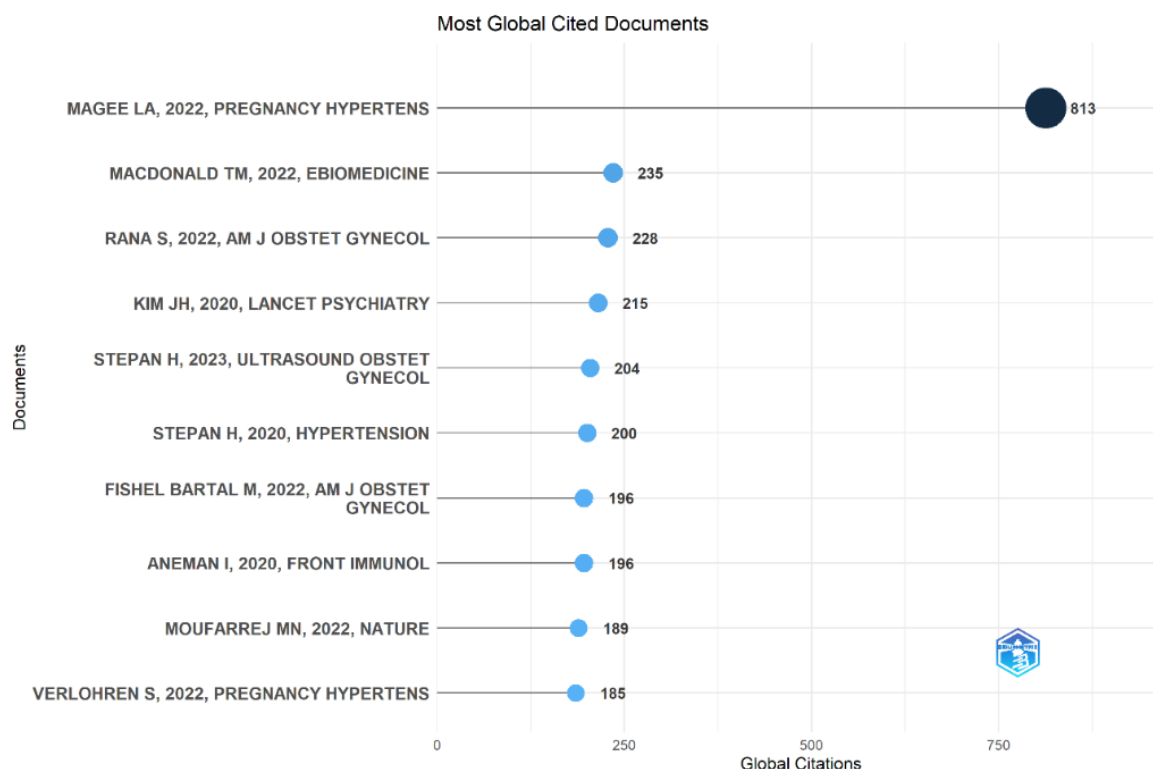


Figure 4. Most Global Cited Documents

Institutional productivity is shown in Figure 5. The University of Oxford ranked first with 31 publications, followed by King's College London (24 publications)

and the University of Toronto (23 publications). The dominance of institutions from Europe, North America, and Australia highlights the strong contribution of major

international academic centers to research on preeclampsia screening and early diagnosis.

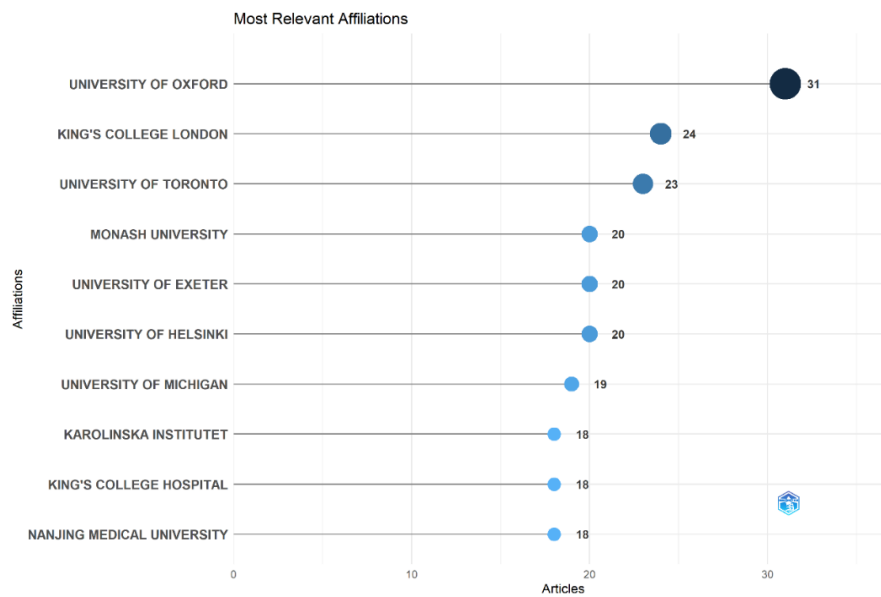


Figure 5. Top 10 Publishing Affiliations

3. Trend Topic Analysis

Figure 6 presents the trend topic analysis based on author keywords from publications published between 2020 and 2026. The visualization demonstrates a gradual

shift from general pregnancy-related topics toward more specific themes associated with preeclampsia diagnosis and risk detection.

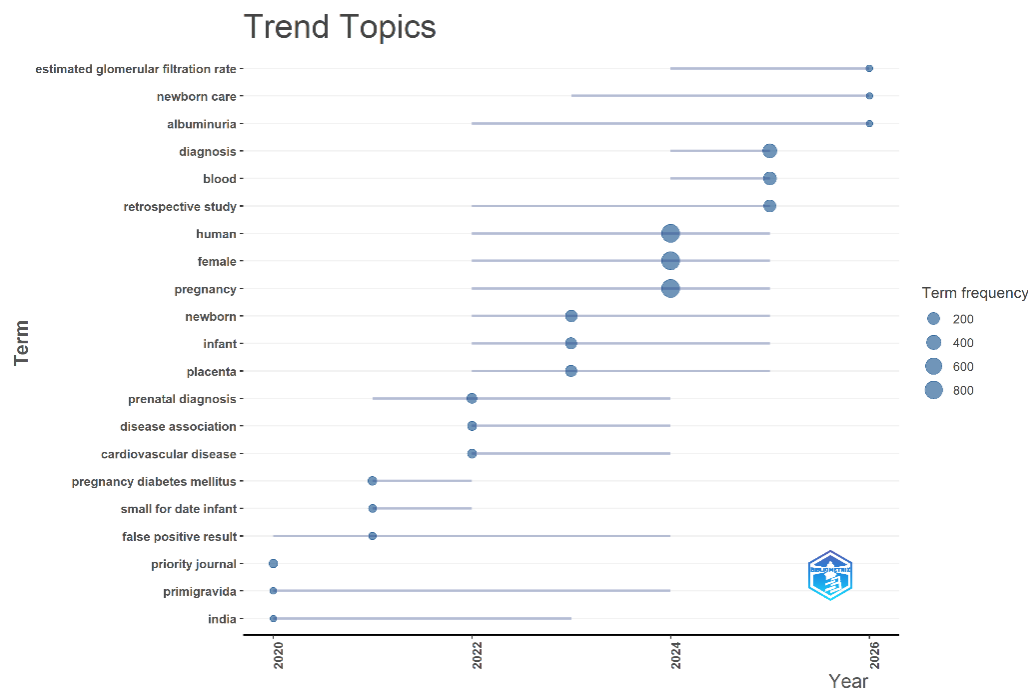


Figure 6. Trend Topics Analysis Based Author's Keyword

The most frequently occurring terms included pregnancy, female, and human, indicating that research in this field remains primarily focused on pregnant women. In addition, keywords such as: newborn, infant, and placenta became increasingly prominent between 2022 and 2025, suggesting growing interest in neonatal outcomes and the role of the placenta in preeclampsia. The emergence of terms such as prenatal diagnosis, diagnosis, and blood indicates an increasing emphasis on early detection through antenatal screening, blood-based biomarkers, and diagnostic approaches for identifying preeclampsia risk during early pregnancy. Other emerging topics included cardiovascular disease, albuminuria, and estimated glomerular filtration rate, reflecting increased attention to cardiovascular complications and renal dysfunction among women with preeclampsia. Overall, research trends in preeclampsia screening have evolved from

general obstetric issues toward risk based screening, biomarker applications, and the evaluation of maternal and neonatal outcomes. This transition indicates a shift from descriptive understanding of preeclampsia toward more predictive and personalized approaches aimed at identifying high risk pregnancies earlier.

3. Thematic Analysis

Figure 7 presents a thematic map generated from keywords identified in publications related to preeclampsia screening. The thematic map is divided into four quadrants: motor themes, niche themes, emerging or declining themes, and basic themes. Motor themes represent well-developed topics that are strongly connected to the research field, whereas basic themes represent fundamental topics that are highly relevant but remain under continuous development (Ahmad et al., 2025).

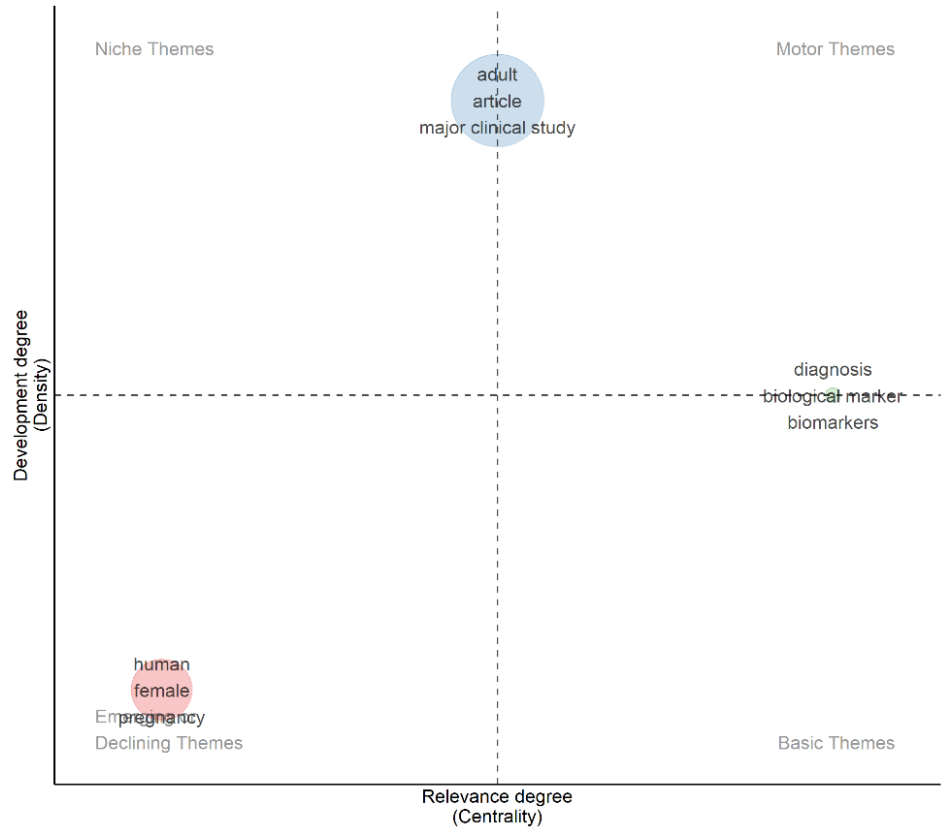


Figure 7. Thematic Map Representation

The analysis showed that diagnosis, biological marker, and biomarkers were located within the basic themes quadrant. This finding suggests that biomarkers and diagnostic approaches constitute fundamental components of preeclampsia screening research and continue to serve as central research topics. The results further highlight the growing interest in the use of biological biomarkers for the early detection and risk assessment of preeclampsia during pregnancy. The position of biomarkers as a basic theme indicates that although biomarker research is already well established, continuous investigation is still

required to improve clinical applicability, accuracy, and integration into routine screening pathways.

4. Keyword co-occurrence and density visualization

A total of 7,204 keywords were identified from the retrieved publications. Applying a minimum occurrence threshold of 10 resulted in 533 eligible keywords for network visualization. The co-occurrence analysis generated five thematic clusters comprising 533 items and 73,029 links (Figure 8), indicating a highly interconnected research structure.

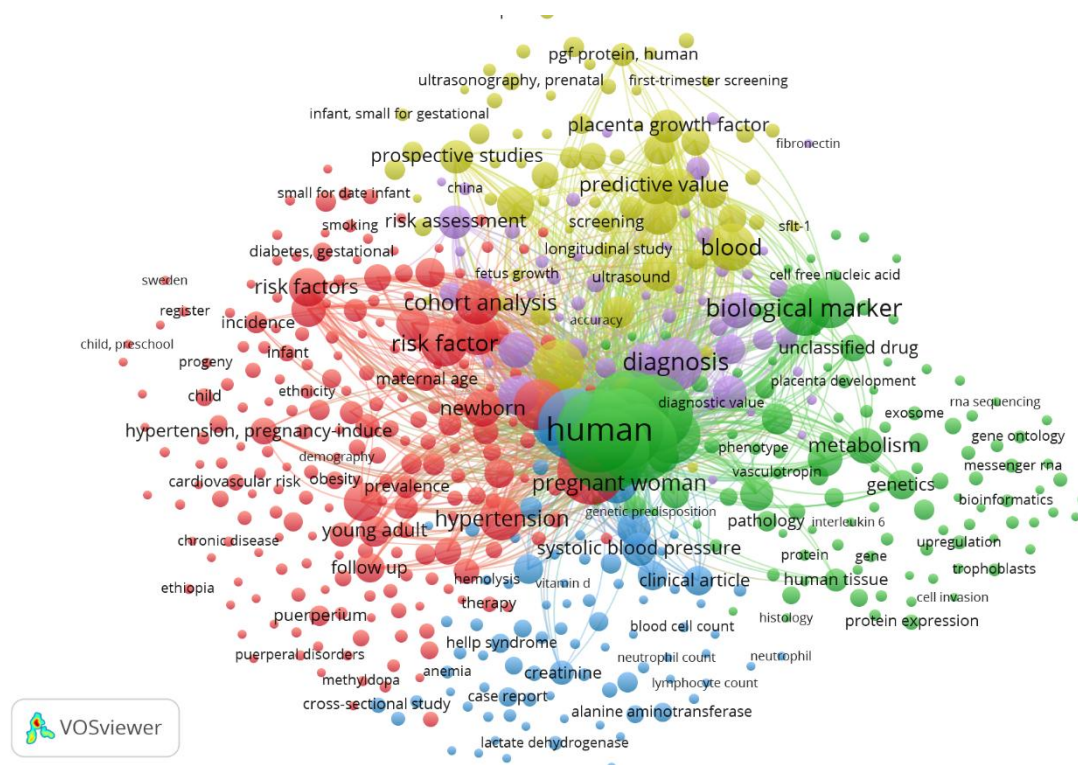


Figure 8. Keyword Co-Occurrence Mapping

The density visualization presented in Figure 9 revealed that the keywords human, pregnant woman, diagnosis, biological marker, and risk factor occupied the areas with the highest density, indicating their central role within the literature. In contrast, terms such as gene ontology, messenger RNA, and bioinformatics

appeared in lower-density peripheral areas, suggesting that these topics represent emerging directions in preeclampsia screening research. The dominance of these keywords demonstrates that current research is primarily concentrated on clinical identification, diagnostic strategies, and risk assessment of preeclampsia.

approaches and bioinformatics, remain developing areas with potential for future research expansion.



Furthermore, the predominance of publications focusing on angiogenic biomarkers, such as soluble fms-like tyrosine kinase-1 (sFlt-1) and placental growth factor (PlGF), suggests that current

research is increasingly moving toward biomarker-based approaches. This trend is also reflected in the trend topic analysis, thematic mapping, and co-occurrence analysis, in which terms such as “diagnosis,” “biological marker,” “predictive value,” and “placenta” emerged as major research topics. These findings indicate a shift in research focus from general obstetric issues toward more specific approaches for the diagnosis and prediction of preeclampsia risk. Although angiogenic biomarkers represent major advances in preeclampsia screening, their clinical implementation remains influenced by factors such as cost, laboratory availability, and healthcare infrastructure. Therefore, future research should not only focus on improving predictive accuracy but also evaluate the feasibility, scalability, and cost-effectiveness of these approaches across different healthcare settings.

The co-occurrence analysis identified five major thematic clusters in preeclampsia screening research:

1. Maternal Risk Factors (Red Cluster)

This cluster focuses on maternal risk factors, including “risk factor,” “obesity,” and “hypertension,” indicating that risk factor identification remains a central component of preeclampsia screening. Previous studies have shown that women with a history of preeclampsia are at a higher risk of developing hypertension within two years postpartum (Giorgione et al., 2020). Other studies have demonstrated that maternal characteristics, obstetric history, and first-trimester blood pressure can be incorporated into predictive models to identify the risk of pregnancy complications, including preeclampsia (Shen et al., 2022). The persistence of maternal risk factor research within the bibliometric landscape indicates that

conventional clinical assessment remains fundamental despite advances in molecular approaches. This suggests that future screening strategies may require integrated models combining maternal characteristics, biomarkers, and computational prediction rather than relying on a single screening component.

2. Molecular Biomarkers and Biological Aspects (Green Cluster)

This cluster emphasizes the biological and molecular aspects of preeclampsia and is characterized by terms such as “biological marker,” “genetics,” “metabolism,” “placenta,” and “messenger RNA,” reflecting the growing use of molecular and biomarker-based approaches for the early detection of preeclampsia. Imbalances in angiogenic factors, particularly elevated levels of sFlt-1 (anti-angiogenic) and reduced levels of PlGF (pro-angiogenic), have been identified as key mechanisms in the pathogenesis of preeclampsia (Morey et al., 2023). In addition, previous studies have reported the potential of extracellular microRNA (ex-miRNA) as a non-invasive biomarker capable of distinguishing disease severity, with improved diagnostic accuracy when combined with angiogenic markers such as the sFlt-1/PlGF ratio, thereby supporting the use of multi-biomarker approaches for early detection (Verlohren et al., 2022). The emergence of this cluster as a prominent research theme indicates a transition from conventional clinical risk assessment toward molecular approaches incorporating placental biomarkers. Recent evidence has demonstrated that angiogenic biomarkers, particularly the sFlt-1/PlGF ratio, may improve risk assessment and support earlier identification of women at risk of preeclampsia. However, the high research activity surrounding biomarker discovery does not necessarily reflect immediate readiness for widespread clinical

application. Further prospective studies, larger multicentre cohorts, and evaluations of cost-effectiveness are required to determine whether these approaches can be integrated into routine antenatal care across different healthcare systems (Fung et al., 2026).

3. Screening and Diagnostic Methods (Yellow Cluster)

This cluster is related to screening methods and includes terms such as “screening,” “first trimester pregnancy,” “blood,” “intra-uterine growth restriction,” “placental growth factor,” and “ultrasonography.” Studies within this cluster frequently apply the Fetal Medicine Foundation (FMF) algorithm, which combines maternal risk factors, mean arterial pressure (MAP), uterine artery Doppler measurements, and serum biomarkers such as placental growth factor (PlGF) and pregnancy-associated plasma protein-A (PAPP-A) for preterm preeclampsia screening. Previous studies have demonstrated that first-trimester screening can be effectively implemented in routine clinical practice and is capable of identifying women at high risk who may benefit from low-dose aspirin prophylaxis without disrupting existing prenatal screening programs (Ronzoni *et al.*, 2025).

The presence of first-trimester screening approaches within this cluster suggests that research priorities have shifted from diagnosing established disease toward preventing adverse outcomes through early risk stratification. However, the increasing complexity of screening approaches also raises important considerations regarding their implementation across different healthcare settings. Translation of these advances into clinical practice remains challenging, particularly in low- and middle-income countries (LMICs), where access to advanced biomarker-based screening tools may be limited. Studies

from Indonesia have demonstrated that resource-adapted screening algorithms may provide feasible alternatives in settings where tests such as PlGF and UtA-PI are not readily available in primary healthcare facilities (Nanda et al., 2025). Therefore, future research should focus not only on improving predictive accuracy but also on evaluating the feasibility, accessibility, and implementation of screening strategies across diverse healthcare settings.

4. Clinical and Laboratory Parameters (Blue Cluster)

The blue cluster represents clinical manifestations and laboratory parameters, including “systolic blood pressure,” “creatinine,” “proteinuria,” and “HELLP syndrome.” The diagnosis of preeclampsia is established based on a combination of elevated blood pressure, including systolic blood pressure ≥ 140 mmHg and/or diastolic blood pressure ≥ 90 mmHg, proteinuria (>300 mg/24 hours), elevated serum creatinine levels, thrombocytopenia, and increased liver transaminase levels. In the absence of proteinuria, elevated serum creatinine remains an important indicator of organ dysfunction associated with preeclampsia. Clinical manifestations such as pulmonary edema, visual disturbances, neurological symptoms, eclampsia, and HELLP syndrome also reflect disease severity (Tagetti and Fava, 2020). This cluster highlights the continuing importance of clinical and laboratory evaluations in establishing the diagnosis of preeclampsia. The coexistence of clinical parameters with molecular approaches indicates that future screening strategies are likely to remain multifactorial. Rather than replacing conventional clinical evaluation, emerging technologies may serve as complementary tools to improve risk classification and clinical decision-making.

5. Predictive Models and Diagnostic Accuracy (Purple Cluster)

This cluster is associated with the development of predictive models and the evaluation of diagnostic accuracy for preeclampsia. It is characterized by terms such as “prediction,” “diagnostic test accuracy study,” “retrospective study,” “meta-analysis,” and “comparative study.” These findings suggest that preeclampsia screening research is increasingly focused on assessing the performance of diagnostic methods and predictive models to improve early detection. The increasing attention toward predictive modelling reflects the growing role of artificial intelligence and data-driven approaches in maternal healthcare. However, future studies should prioritize external validation, transparency, and clinical applicability to ensure that predictive models can be effectively translated into real-world practice. This finding highlights that the advancement of predictive models should be accompanied by implementation research to determine whether these tools improve clinical decision making, reduce healthcare disparities, and remain applicable across diverse populations.

The trend topic analysis also revealed that recent studies have increasingly focused on topics such as “prenatal diagnosis,” “blood,” “placenta,” “albuminuria,” and “estimated glomerular filtration rate.” These findings indicate that research is no longer limited to the detection of preeclampsia during pregnancy but has expanded to include systemic complications, particularly renal dysfunction. Consistent with this trend, a recent study published in 2025 demonstrated that laboratory parameters such as hemoglobin, albumin, fibrinogen, and creatinine can be used to assess both the risk and severity of preeclampsia (Polat et al., 2025).

Meanwhile, the density visualization demonstrated that keywords such as “human,” “pregnant woman,” “diagnosis,” and “risk factor” remain at the center of research activity, whereas terms such as “gene ontology,” “messenger RNA,” and “bioinformatics” are emerging as novel molecular-based approaches. This pattern suggests that although clinical diagnosis and risk assessment remain mature research areas, molecular and computational approaches are still developing and represent potential directions for future innovation.

In addition, the dominance of institutions from developed countries, including the University of Oxford, King’s College London, and the University of Toronto, indicates that research on preeclampsia screening remains concentrated in institutions with strong research capacity and advanced technological resources. This concentration of research capacity highlights a potential imbalance between scientific productivity and global disease burden. Countries with limited research infrastructure may face challenges in adopting advanced screening technologies despite having substantial needs for improved preeclampsia detection. Therefore, strengthening international collaboration, technology transfer, and capacity building may be essential to ensure that advances in preeclampsia screening can be translated into equitable maternal healthcare strategies.

From a research perspective, these findings indicate the need for future studies that evaluate the external validity, cost-effectiveness, and implementation feasibility of emerging preeclampsia screening approaches across different healthcare settings. For clinical practice, the findings suggest that future screening strategies should integrate maternal characteristics, biomarkers, and clinical parameters to

improve risk stratification rather than relying on a single predictive component. For policymakers, the concentration of research output in high-resource settings highlights the importance of strengthening international collaboration and developing context-specific strategies to support equitable implementation of preeclampsia screening, particularly in resource-limited settings.

This bibliometric study demonstrates that global research on preeclampsia screening has evolved from conventional clinical risk assessment toward biomarker-based prediction, molecular diagnostics, and data-driven approaches. The identified research clusters highlight the multidisciplinary nature of the field, encompassing maternal risk factors, biomarkers, screening strategies, clinical parameters, and predictive modelling. However, the current research landscape remains concentrated in high-resource settings, indicating the need for broader international collaboration and implementation-focused studies. Future research should prioritize clinically applicable, cost-effective, and context-specific screening strategies, particularly for health-care systems with limited resources. These findings provide evidence to guide researchers, clinicians, and policymakers in developing more effective and equitable approaches for early detection and prevention of preeclampsia.

This study was limited to publications indexed in the Scopus database, which may have excluded relevant studies indexed in other databases. Therefore, the findings should be interpreted within the scope of the Scopus indexed literature.

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CONFLICT OF INTEREST

There was no conflict of interest in this study.

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