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Global Research Trends on Mercury Exposure in Prenatal: A Bibliometric Analysis and Systematic Review

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ABSTRACT
Mercury (Hg) is a highly toxic heavy metal that can bioaccumulate in the human body, posing significant risks to maternal and fetal health. This study analyzed global research trends and the thematic focus of scientific literature regarding mercury exposure in pregnant women and its clinical implications. We conducted a bibliometric analysis and systematic literature review of 1, 236 documents indexed in the Scopus database from 2015 to 2026. Data were analyzed using VOSviewer and Tableau software. Publication trends showed a significant increase, peaking at 98 documents in 2021, with the United States being the leading contributor. The thematic analysis identified three primary clusters: environmental exposure (specifically methylmercury from seafood), pregnancy complications (preeclampsia and hypertension), and neurotoxicity. A systematic review confirmed a positive correlation between maternal mercury levels and adverse outcomes, including miscarriage, low birth weight (LBW), and preeclampsia. Mercury exposure remains a critical public health concern. Future research should prioritize mitigation strategies for environmental exposure pathways to safeguard maternal health and fetal neurological development.

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1. Introduction

Mercury (Hg) exposure is a critical global public health challenge that requires urgent attention. As a heavy metal with complex toxicological properties and a high potential for bioaccumulation, mercury causes a range of adverse health outcomes. Human exposure occurs through diverse pathways, including dietary intake, environmental contamination, and industrial activities, posing severe risks such as neurological damage and developmental disorders (Clarkson et al., 2003; Rice et al., 2014)

Several chemical forms of mercury contribute to human exposure, of which methylmercury is the most prevalent organic form found in food, particularly in fish and seafood. Regular consumption of fish contaminated with methylmercury can lead to its accumulation in the human body, potentially causing neurotoxicity and developmental impairment, especially in children (Koren & Bend, 2010; Magos & Clarkson, 2006; Park & Zheng, 2012; Rice et al., 2014). Furthermore, exposure can occur via inhalation of mercury vapor, a pathway prevalent among workers in industries utilizing the metal, as well as through cultural practices involving its application in domestic settings (Bose-O'Reilly,

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Drasch, et al., 2010; Clarkson et al., 2003; Wang & Fang, 2021). Mercury vapor is efficiently absorbed into the systemic circulation, where it subsequently bioaccumulates within the tissue matrices (Clarkson & al., 2007). Other sources include the use of mercury-containing dental amalgams as restorative materials for dental caries. This practice may represent a potential exposure pathway, particularly for dental professionals who experience occupational mercury (Hg) exposure within clinical settings (Güallar & al., 2002; Park & Zheng, 2012).

Mercury exposure occurs through distinct pathways, notably via inhalation. Once inhaled, mercury vapor enters the lungs and is rapidly absorbed into the systemic circulation, inducing toxic effects throughout the body (Clarkson et al., 2003; Wang & Fang, 2021). Ingestion of contaminated fish and seafood is the primary route of methylmercury exposure. Bioaccumulation within marine ecosystems allows mercury to concentrate in aquatic organisms, thereby posing health risks to human consumers, particularly children and pregnant women (Park & Zheng, 2012; Rice et al., 2014). Dermal exposure, although less common, may also occur through direct contact with mercury in solution or mercury-containing cosmetic products (Chan, 2011; Wang & Fang, 2021).

Mercury exposure in humans can be detected in blood, urine, hair, and breast milk. Blood mercury levels primarily reflect recent exposure, as concentrations decline by approximately half every three days after exposure ceases, thereby providing an indicator of mercury intake from dietary sources. The adverse health effects of mercury exposure may be acute or chronic and include impairment of renal and hepatic function, respiratory and gastrointestinal disorders, central nervous system toxicity, seizures, and, in severe cases, death (Bose-O'Reilly, McCarty, et al., 2010).

Mercury exposure in pregnant women constitutes a significant global public health challenge with severe implications for the developing fetus. This heavy metal can accumulate within the placenta and directly impair fetal brain development. Research indicates that such exposure not only compromises maternal health but is also associated with an increased risk of congenital defects and neurological disorders in the offspring (Björnberg, 2005; C. W. Chen et al., 2012; Nyland & al., 2011). Certain mercury compounds undergo bioaccumulation, can cross the placental barrier to the fetus, and can be transferred into colostrum and breast milk (Bjornberg et al., 2003; M. Chen & al., 2014). Such exposure has been associated with serious adverse health outcomes in newborns, including congenital abnormalities and an increased risk of neurodevelopmental disorders, such as hyperactivity and autism spectrum–related conditions (Shay et al., 2019).

Maternal exposure to a combination of chemical and nonchemical stressors is a critical determinant of health for both mothers and children. The co-occurrence of mercury exposure and psychosocial factors, such as stress or depression, is of particular concern, given its association with adverse birth outcomes and persistent neurodevelopmental

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sequelae (Gokoel & al., 2020; Monk & al., 2016). Substantial evidence indicates a synergistic interplay between these stressors (Padula et al., 2020). Notably, significant dysregulation of maternal cortisol profiles has been observed in women subjected to high stress alongside mercury concentrations above the median compared to their counterparts who experienced equivalent stress levels but lower mercury burdens (Schreier & al., 2015; Yu et al., 2025).

This study integrated an exploratory review with bibliometric analysis to synthesize the prevailing findings, methodological approaches, and evolutionary trends regarding mercury exposure in pregnant women. By mapping the intellectual structure of the field and highlighting influential authors, high-impact journals, and key geographic contributors, this analysis aims to offer critical insights into the current state of heavy metal research. The objective of this systematic review is to synthesize and critically evaluate the existing evidence regarding the effects of mercury exposure in pregnant women on maternal and fetal health outcomes. This review aims to identify major exposure pathways, assess commonly used biomarkers, and examine the association between mercury levels and adverse pregnancy outcomes, including miscarriage, low birth weight, preeclampsia, and impaired fetal neurodevelopment. Additionally, this study seeks to provide a comprehensive understanding of current research findings to support future preventive strategies and public health interventions. Ultimately, these findings are intended to inform the development of future interventions designed to mitigate mercury burdens in maternal populations.

Furthermore, this bibliometric analysis is valuable because it provides a comprehensive overview of global research trends on mercury exposure among pregnant women, which is a critical public health concern. Using bibliometric techniques, this study identified the countries, research themes, and scientific developments that have exerted the greatest influence over the past decade. These findings indicate that Hg exposure, primarily through seafood consumption and environmental sources, is associated with an increased risk of pregnancy complications, including preeclampsia, miscarriage, and fetal neurodevelopmental disorders. Accordingly, this study serves as an important reference for researchers, healthcare professionals, and policymakers to develop effective prevention and intervention strategies to safeguard maternal and infant health in the future.

2. Methodology

Research Types

This study examined research trends related to mercury exposure in pregnant women using data extracted from the Scopus database for the years 2015 to 2026. Relevant publications were identified through a structured search strategy using the keywords “mercury exposure AND Pregnancy” OR “prenatal exposure AND mercury” applied to article titles, abstracts, and keywords in English within the specified timeframe. The collected

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dataset consisted of 1,048 original articles and 188 reviews, all sourced from journals, for a total of 1,236 publications. A total of 1,236 publications were screened using OpenRefine in Microsoft Excel. The screened dataset was subjected to further analysis using VOSviewer for visual representation and interpretation. This multistage approach provides a comprehensive understanding of the current state of research on the impact of mercury exposure on pregnancy outcomes.

Bibliometric Analysis

Bibliometric analysis is a widely used approach to explore and evaluate large bodies of scientific literature. This enables the examination of publication and citation distributions, thereby providing insights into the structure, evolution, and maturity of a given research field. The reliability of bibliometric indicators is influenced by several key factors, most notably database selection, including the scope and disciplinary coverage of bibliometric databases and the accuracy of publication identification based on authors' institutional affiliations. Bibliometric indicators are generally more robust at higher levels of aggregation and are therefore better suited for analyzing patterns across large research groups or scientific domains rather than for evaluating individual researchers or small research teams.

Following the bibliometric analysis, a systematic literature review was conducted. Figure 1 presents the study selection flow diagram based on the PRISMA guidelines, illustrating the process of identification, screening, and inclusion of studies in the review. During the identification stage, 3,336 records were retrieved from the Scopus database. No records were removed prior to screening due to duplication, ineligibility by automation tools, or other reasons (all n = 0). In the screening stage, all 3,336 records were evaluated based on predefined criteria. A total of 2,100 records were excluded for not meeting the inclusion criteria. The inclusion criteria were (1) articles or review papers published between 2015 and 2026, (2) documents in the final publication stage, and (3) publications available in English. The exclusion criteria were (1) publications in languages other than English and (2) non-journal documents such as theses, dissertations, books, book chapters, and conference papers. Subsequently, 1,236 records were selected for further retrieval (reports sought for retrieval). At the eligibility stage, all 1,236 articles were assessed in detail and met the criteria for inclusion in the final analysis.

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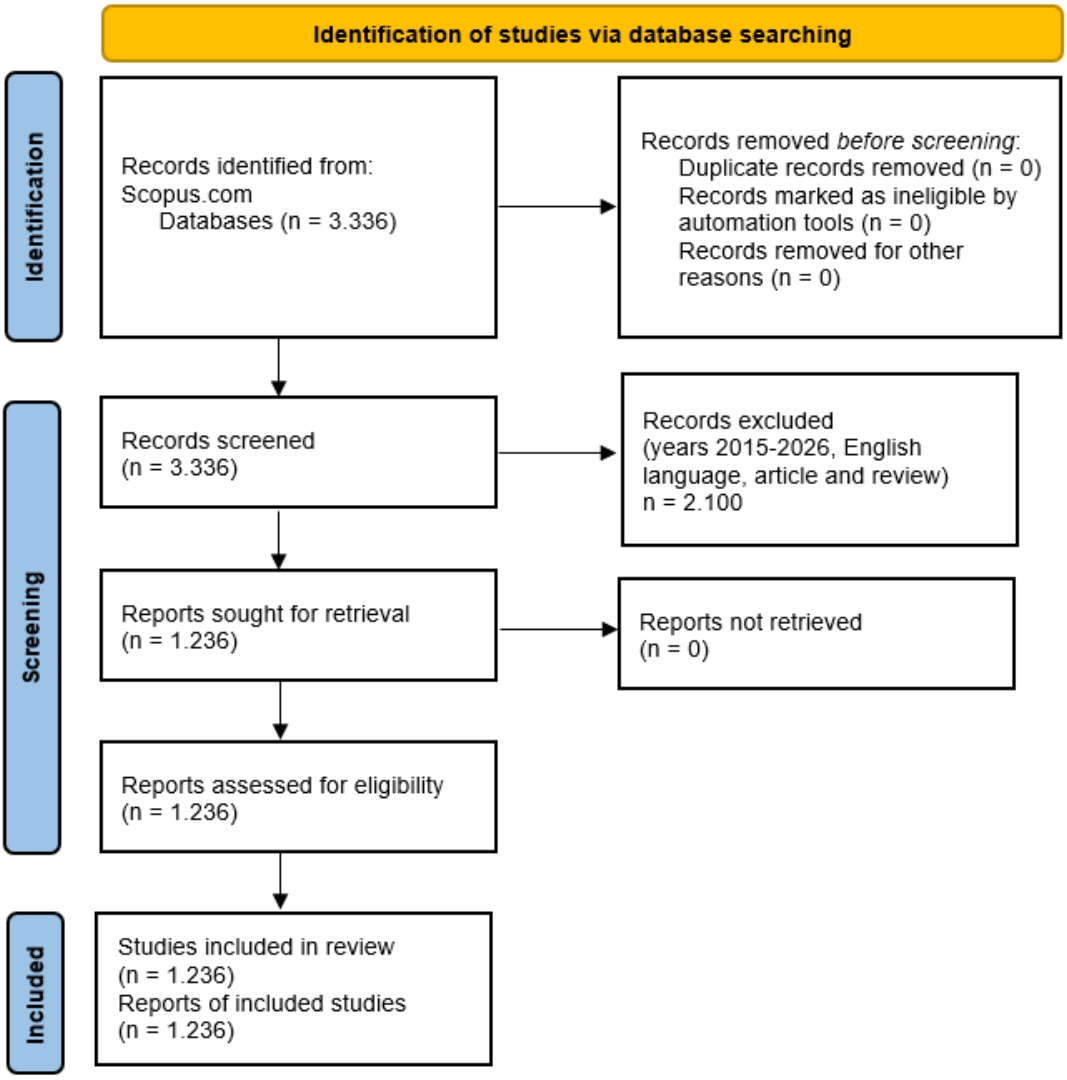


Figure 1. Table Data Processing Flowchart

Systematic Review Analysis

Systematic review analysis is used to collect or synthesize data from previous studies to answer specific research questions. Systematic review analysis involves several stages, including the development of research results, assessment of evidence, and evaluation of conclusions.

Ethics Statement

This article is a review study employing bibliometric analysis rather than original research and therefore does not require ethical approval.

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3. Results and Discussion

Contribution by Country

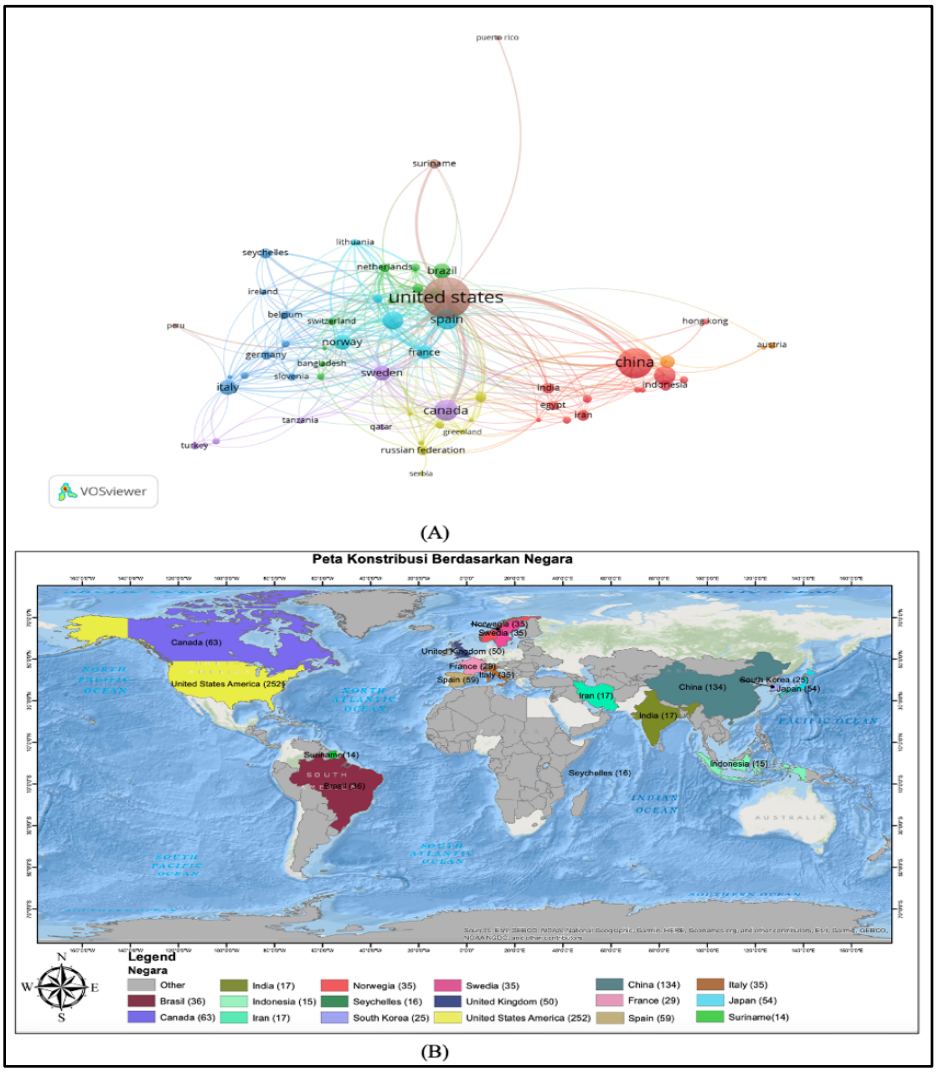


Figure 2. (A) Publication trends by country in research on mercury exposure in pregnant women. (B) contribution map by country

Figure 2, (A) illustrates that the number of publications produced by a country reflects the level of scholarly engagement and the distribution of authorship within a given research topic. As shown in the figure, among the 119 countries, only 75 published three or more documents. The United States accounted for the highest volume of research on mercury exposure among pregnant women and demonstrated extensive international collaboration, partnering with 57 countries and establishing approximately 378 collaborative links. Brazil, China, Japan, Canada, Sweden, and Norway were major contributors to this collaborative network.

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Figure 2, (B) illustrates the distribution of Scopus-indexed scientific publications related to mercury and pregnancy according to the authors' countries of origin. The United States contributed the largest number of publications (435 documents), followed by China (168 documents) and Canada (111 documents). Spain ranked second with approximately 94 publications, followed by the United Kingdom (87 documents), Japan (approximately 79), Brazil, Italy, Sweden, and Norway, each contributed approximately 63 to 53 documents.

Publication Trends per Year Related to Mercury Exposure in Pregnant Women (2015–2026)

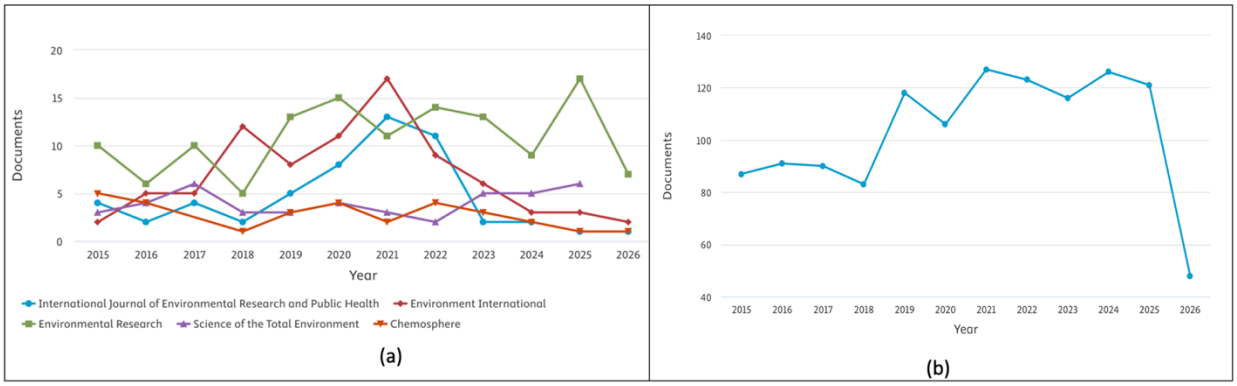


Figure 3. (a) Documents per year by source; (b) Number of Publications on Mercury Exposure in Pregnant Women per Year (2015-2026)

The figure 3. Consists of two panels illustrating publication trends related to mercury exposure in pregnant women.

In Figure (a), the annual number of publications is presented by journal source over the period 2015–2026. The journals included in the analysis are Environmental Research, Environment International, International Journal of Environmental Research and Public Health, Science of the Total Environment, and Chemosphere. Overall, Environmental Research contributed a relatively higher number of publications compared to the other journals, although its output fluctuated across years. Environment International reached a peak around 2021, followed by a gradual decline in subsequent years. The International Journal of Environmental Research and Public Health showed an increasing trend up to approximately 2021–2022, after which a decrease was observed. In contrast, Science of the Total Environment and Chemosphere display lower and more stable publication counts throughout the study period. These patterns indicate that research on mercury exposure during pregnancy is disseminated across several leading journals, each exhibiting distinct publication dynamics.

Figure (b) illustrates the overall annual publication trend from 2015 to 2026. The number of publications shows a noticeable increase beginning in 2018 and reaches its highest level between 2021 and 2024. A slight decline is observed in 2025, followed by a

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more substantial decrease in 2026, which is likely attributable to incomplete indexing, as the year is still in progress.

Network analysis of co-occurrence of the keywords "Mercury (Hg) and Pregnant Women"

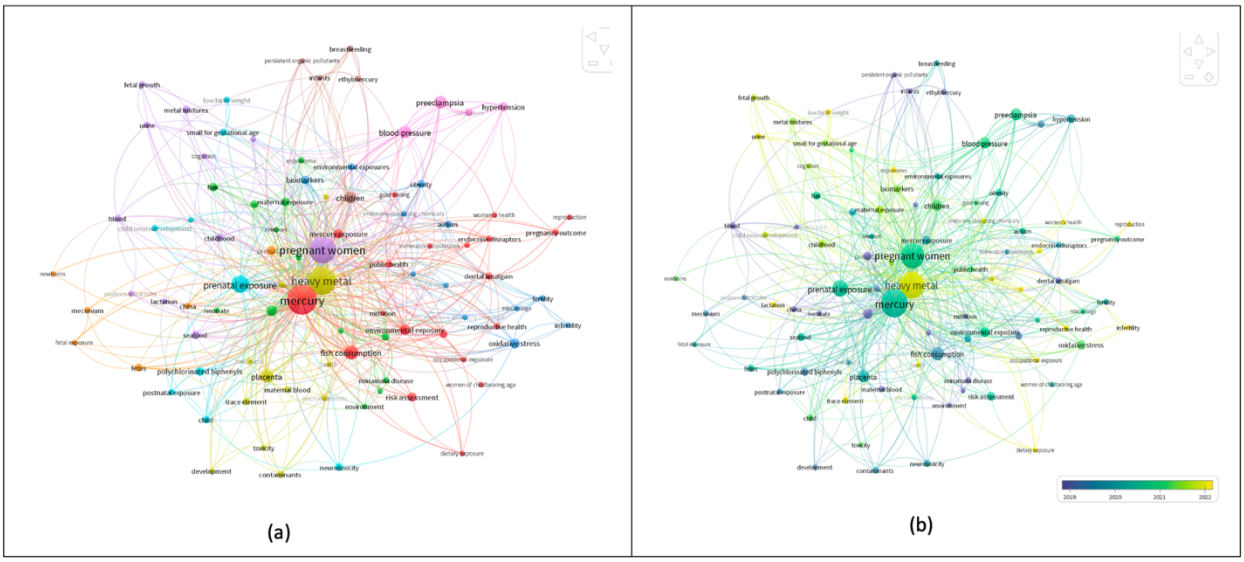


Figure 4. (a) Co-occurrence network of author keywords into groups; (b) Co-occurrence network of author keywords, 2015-2025

The figure 4. Figure 4 presents a keyword network visualization derived from a bibliometric analysis, illustrating the relationships among research topics related to heavy metal exposure during pregnancy and its impact on maternal health and child development. In Figure 4.In Figure 4 (a), clusters are mapped based on thematic proximity. Among the 1, 236 identified keyword items, several clusters were formed and distinguished by different colors: red, green, blue, yellow, purple, orange, and brown. The most prominent cluster is the red cluster, representing mercury (Hg), which comprises 75 items and 295 occurrences. The term "mercury (Hg)" is interconnected with several other clusters within the keyword co-occurrence network, including the purple cluster on "pregnant woman" (73 items; 227 occurrences), the yellow cluster focusing on "heavy metals" (72 items; 249 occurrences), the blue cluster on "prenatal exposure" (38 items; 84 occurrences), the brown cluster on "children" (24 items; 33 occurrences), and the pink cluster (20 items; 35 occurrences), which emphasizes "blood presure."

Figure 4.(b) Figure (b) displays an overlay visualization in which the colors represent the temporal evolution of the research themes. Earlier studies are indicated by darker tones (blue), whereas more recent topics appear in lighter colors (yellow). This distribution suggests a gradual shift from foundational topics, such as general exposure and toxicity, toward more specific and integrative themes, including biomarkers, environmental

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exposure pathways, and health-related outcomes. Emerging topics also reflect an increasing emphasis on multidisciplinary approaches and risk assessments.

Overall, the visualization highlights a well-connected and evolving research landscape, with growing attention to the complex interactions between environmental exposure, maternal health, and child development.

Document by year by Source and Document by subject area

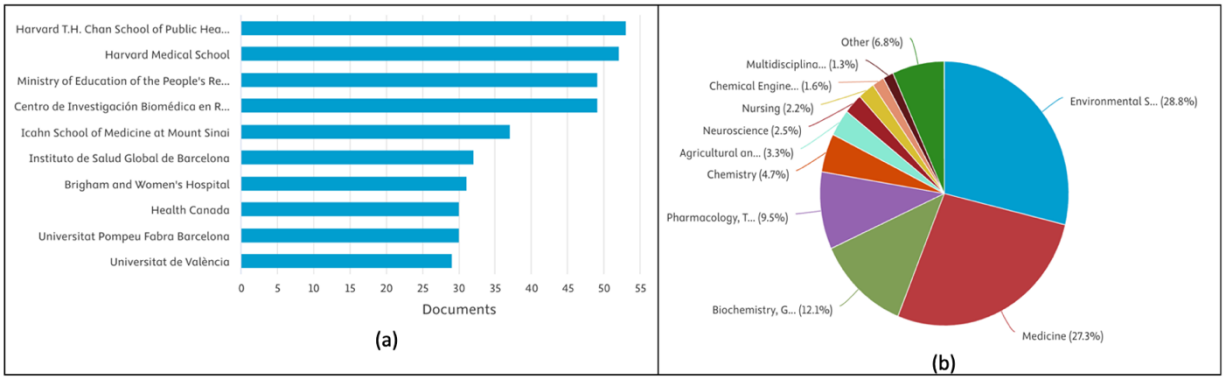


Figure 5. (a) Documen by afiliation; (b) Document by subject area

Figure 5 shows two panels illustrating the distribution of scientific publications on mercury exposure in pregnant women by institutional affiliation and subject area.

In Figure 5. (a) presents the number of publications contributed by leading institutions. Harvard T.H. Chan School of Public Health ranks as the top contributor, followed closely by Harvard Medical School and the Ministry of Education of the People's Republic of China. Other prominent contributors include the Icahn School of Medicine at Mount Sinai, Instituto de Salud Global de Barcelona, and Brigham and Women's Hospital. Additional contributions are observed from Health Canada, Universitat Pompeu Fabra, and Universitat de València. The distribution indicates that research output is concentrated among well-established academic and public health institutions, particularly in North America, Europe, and Asia.

Figure 5. (b) shows the distribution of publications by subject area. Environmental Science accounted for the largest proportion (28.8%), followed by Medicine (27.3%) and Biochemistry, Genetics, and Molecular Biology (12.1%). Other contributing fields include Pharmacology, Toxicology, and Pharmaceutics (9.5%), Chemistry (4.7%), Agricultural and Biological Sciences (3.3%), Neuroscience (2.5%), Nursing (2.2%), Chemical Engineering (1.6%), and Multidisciplinary fields (1.3%), with additional minor contributions categorized as “Other” (6.8%).

Overall, the figure highlights that research on mercury exposure in pregnant women is both institutionally concentrated and scientifically multidisciplinary, with a strong emphasis on environmental and health-related fields.

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A review and analysis of the literature on Hg exposure in pregnant women yielded the results presented in Table 1. Mercury exposure in pregnant women

Author	Population sample	Method	Variable	Biomarker	Results
Chiyang yu, Qingxia You, Xue Bai and Fangxiang Mu	Women aged 20–80 years with complete pregnancy history.	Smooth curves and weighted quantile regression (WQS)	Exposure to heavy metals such as manganese, selenium, cadmium, lead, and mercury measured using spectrometry linked to miscarriage	blood	Blood mercury levels were positively correlated with a higher risk of miscarriage (odds ratio 1.06, 95% confidence interval 1.03–1.09, P<0.001), which remained significant in both the adjusted models. A nonlinear relationship between mercury levels and miscarriage was identified.
Jefferey K. Wickliffe	Blood sample from pregnant women. Second trimester of the pregnancy.	Bayesian kernel machine regression	Exposure to heavy metals, namely cadmium, lead, and mercury, in the blood of pregnant mothers and their newborn babies .	blood	Mercury affects infant weight in a nonlinear manner. As mercury concentration increases, birth weight decreases.
Veronika Tursunova et all.	90 pregnant women. 55 pregnant women aged 19–38	Experiment	Hg levels in blood Mother pregnant and characteristics personal , style life and health	blood	No critical health problems related to Hg were found in pregnant

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Author	Population sample	Method	Variable	Biomarker	Results
	years in their third trimester, 35 pregnant women aged 19–39 years with a gestational age of 30–38 weeks.		data obtained through questionnaire		women in Aidarken; however, long-term chronic exposure to Hg levels can worsen thyroid health problems under certain environmental and lifestyle conditions.
Yujie Pan, Kunlong Qu, Huiling Li, dan Yuguo Lagu.	31 women aged 23-43 years old	Observational analytics cross-sectional design	31 female workers of childbearing age (23–43 years) who were chronically exposed to mercury vapor	Urine of women aged 23-43 years	Mercury vapor exposure in the workplace is dangerous for women of childbearing age and increases the risk of adverse effects on reproductive health.
Thi Ha Luu, ett all.	Pregnant women aged 18 years or older with a gestational age of > 20 weeks.	Cohort study. Logistic regression and weighted quantile sum (WQS) models were used.	Hg levels in hair in mothers pregnant	Hair	The Hg concentration in pregnant women's hair poses a risk of preeclampsia.
Kyle Dack, et all.	Blood sample from pregnant women	cohort study	Hg levels in the blood of pregnant mothers and dietary and sociodemographic factors	blood	There is 22.4% Hg from the lifestyle patterns of pregnant women, such as fish consumption, dental patients who install or

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Author	Population sample	Method	Variable	Biomarker	Results
					remove amalgam fillings, smoking, and the use of herbal products.
K. Ask Bjornberg.	123 hair samples from pregnant women with a gestational age of 32-34 weeks	Case-control study	Hg levels in hair and blood Mother pregnancy and frequency fish consumption with use questionnaire	Hair and Blood	Y-Hg in hair (median 0.35 mg/kg; range 0.07–1.5 mg/kg) was significantly associated ($R2 = 0.53$; $p < 0.001$) with MeHg in umbilical cord blood (median 1.3 µg/L; range 0.10–5.7 µg/L). Both T-Hg in hair and MeHg in umbilical cord blood increased with increasing seafood consumption ($r = 0.41$; $p < 0.001$ and $r = 0.46$; $p < 0.001$, respectively).
Seungho, Jin Hee Kim, Hyo-Bang Moon, Jeongim Park, Guyuyeon Choi	Blood and urine samples from pregnant women, the first urine sample from newborns, breast milk	This study used a physiologically based pharmacokinetic (PBPK) model.	cord blood Hg and growth variables at birth was analyzed based on parameters such as the sex of the newborn, living area, maternal age group, gestation	Hair, urine, and breast milk after giving birth, as well as the baby's first hair and urine after birth were collected.	According to the results, fetuses were exposed to approximately 26.3–86.9 mg (median: 39.4 mg) of Hg before birth. We also found that the

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Author	Population sample	Method	Variable	Biomarker	Results
	from mothers after giving birth, and baby hair.		day, and maternal body mass index.		amount of exposure had an impact on future weight gain and developmental status at birth. Hg in umbilical cord blood was significantly associated with infant length at birth, and follow-up weight showed a rapid upward trend for high levels of Hg in umbilical cord blood.

Discussion

Bibliometrik Anlysis

Figures 2. (A) and (B) provide an overview of the global structure and geographic distribution of research contributions in this field. The collaboration network in Figure (A) indicates a highly interconnected international landscape, with the United States occupying a central position as the main hub of scientific collaboration. Its extensive links with countries across Europe, Asia, and other regions suggest a strong capacity to facilitate knowledge exchange and cross-national research initiatives. European countries, including Italy, Germany, Spain, and France, form a dense cluster characterized by close internal collaboration, whereas China represents another major node with substantial connections both regionally and globally. This pattern reflects the presence of multiple influential research activity centers with varying degrees of integration across regions.

Figure (B) highlights the uneven distribution of research productivity worldwide. The United States contributes the largest share of publications, followed by China and several European countries such as Spain, the United Kingdom, and Norway. Contributions from countries such as Canada, Brazil, and Japan further demonstrate the broad international engagement in this area. Notably, emerging economies in Asia, including China, India, Indonesia, and South Korea, show increasing participation, indicating a shift toward more

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geographically diverse research efforts. Taken together, these findings suggest that while research output remains concentrated in a limited number of high-income countries, global collaboration networks are expanding, enabling wider participation and potentially enhancing the diversity of perspectives in addressing environmental exposure and its health implications.

Figure 3 depicts the annual trend in the number of published documents from 2020 to 2026, revealing a generally stable pattern with moderate fluctuations over time. The number of publications increased from 2020 to 2021, reaching an initial peak, followed by a slight decline in 2022 and 2023. A subsequent rise is observed in 2024, indicating renewed research activity, before a modest decrease again in 2025. Overall, the trend between 2020 and 2025 suggests sustained scholarly attention, with publication output consistently maintained at a relatively high level. A more pronounced drop is observed in 2026, with 46 documents, which is likely attributable to incomplete indexing as the year is still in progress. This heightened research activity aligns with the growing awareness of heavy metals as neurotoxic agents capable of inducing long-term neurological impairments in fetuses that may persist into adulthood (Grandjean & Landrigan, 2014)

Another important indicator of article content is the keyword selection, as shown in Figures 5 and 6. The analysis of frequently used keywords reflects the core aspects of research on Hg exposure among pregnant women. Consequently, keyword mapping is essential for identifying research patterns across the field and revealing gaps within the existing literature

Figures 4 (a) and (b) illustrate the structure and temporal evolution of keyword co-occurrence in the research domain. Figure (a) shows a network visualization of several thematic clusters formed based on the co-occurrence of keywords. The most prominent terms, such as *mercury*, *pregnancy*, and *heavy metals*, occupy central positions, indicating their pivotal role in the literature. These core topics are strongly linked to related concepts, including *lead*, *cadmium*, *neurodevelopment*, *placenta*, and *environmental exposure*, reflecting an integrated research focus on maternal exposure and its implications for fetal and child health. The clustering pattern suggests that earlier studies primarily concentrated on identifying types of heavy metals, exposure pathways, and associated pregnancy outcomes, including preterm birth and low birth weight.

The results of the keyword co-occurrence network analysis (Figures 4. (b)), together with publication trends by journal source over time. collectively illustrate the dynamics of research on Hg exposure among pregnant women between 2020 and 2026. Recent research increasingly emphasizes the role of environmental mercury exposure in elevating the risk of specific pregnancy complications, such as preeclampsia and high blood pressure (Yushida & Zahara, 2020). These patterns suggest that environmental exposure to heavy metals, including Hg, may contribute to pregnancy complications by adversely affecting circulatory

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function and placental health.

This integrated analysis reinforces the finding that mercury exposure represents a global environmental health issue that the attention of multiple scientific disciplines. Consistent with the overall annual publication trends (Figure 4), Figure 5 (a) and (b) provide complementary insights into publication patterns across leading journals and the disciplinary distribution of the research field. In Figure 5. (a), the annual number of documents published in selected journals from 2020 to 2026 demonstrates varying trends. Environmental Research and Environment International consistently contribute a relatively high number of publications, indicating their central role in disseminating research on environmental exposure and health. While Environmental Research shows noticeable fluctuations, including a peak in the mid-period followed by a decline, Environment International exhibits an earlier peak and a gradual decrease thereafter. Other journals, such as Science of the Total Environment, Neurotoxicology, and the International Journal of Environmental Research and Public Health, contribute more modestly but display periodic increases, suggesting intermittent surges of interest or special topic issues. The decline observed in 2026 across most journals is likely influenced by incomplete indexing for the current year rather than a substantive reduction in research output.

Figure 5. (b) illustrates the subject area distribution of the publications, highlighting the interdisciplinary nature of the field. The largest proportion of studies was in environmental science, followed by medicine and biochemistry, indicating a strong integration between environmental exposure assessment and biomedical research. Additional contributions from pharmacology and toxicology further emphasize the focus on the mechanisms of toxicity and health risk evaluation. Smaller yet notable proportions were observed in chemistry, agricultural sciences, chemical engineering, and neuroscience, reflecting the diverse methodological and thematic approaches applied in this area. Minor contributions from nursing and multidisciplinary fields suggest an expansion of relevance to clinical practice and broader scientific contexts. Overall, the distribution underscores that research on heavy metal exposure during pregnancy is inherently multidisciplinary, bridging environmental science with medical and life sciences to address complex public health challenges in the future.

Sistematic review

The issue of mercury exposure has become increasingly urgent in the context of pregnant women's vulnerability to both chemical and nonchemical stressors. Journals such as *Environmental Health Perspectives* and *Ecotoxicology and Environmental Safety* have also contributed to this body of literature, publishing approximately three to six articles per year. Their continued contributions underscore that this research domain encompasses ecotoxicological perspectives, particularly the impacts of toxic substances on ecosystems and human health. The primary route of mercury exposure is fish consumption, as

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methylmercury (MeHg), an organic form of mercury that bioaccumulates in fish, can cross the placental barrier and reach the developing fetus (Eick & al., 2022). This interpretation is highly consistent with the findings presented in Table 1, where the study by Hannah M. C. Schreier (2015) identified fish and seafood consumption as the primary pathway of mercury exposure (Schreier & al., 2015). The high publication output in these journals is closely linked to evidence demonstrating that mercury exposure, particularly environmental methylmercury, can readily cross the fetal blood–brain barrier and bind to tubulin proteins in neuronal cells, thereby disrupting cellular development. These mechanisms have been associated with an increased risk of miscarriage and reduced birth weight.

Table 1 also demonstrates the complexity of research in this field, which requires the measurement of sensitive biomarkers, such as hair and umbilical cord blood, as well as the application of advanced statistical methods, including Bayesian regression and weighted quantile sum (WQS) models. In addition, the primary exposure pathways involve fish and seafood consumption and lifestyle-related factors, such as dental amalgams and smoking (Kim et al., 2013). The study by Thi Ha Luu et al. provides specific evidence that elevated mercury concentrations in maternal hair are associated with an increased risk of preeclampsia. These findings are highly consistent with the results depicted in Figure 4, in which the red cluster is centered on pregnancy-related complications, particularly “preeclampsia” and “hypertension.

The dominance of environmental exposure themes directly explains why the major journals contributing to Figure 5.(a) are largely rooted in the field of Environmental Health. Journals such as *Environment International* and the *International Journal of Environmental Research and Public Health* have emerged as primary publication venues because their core research focus encompasses toxicological and ecotoxicological studies that examine the impact of environmental contaminants on human health. Prolonged prenatal exposure to high doses of Hg has been associated with the development of cerebral palsy, whereas lower levels of exposure may result in delayed neurodevelopment and reduced cognitive function. (4). Beyond general toxicology, Figure 4 features a distinct red cluster centered on clinical obstetric complications, specifically 'preeclampsia, blood pressure,' and_hypertension'. The observed interconnectivity between 'environmental exposure' (green cluster) and 'preeclampsia' (red cluster) signifies the research trajectory aimed at elucidating the link between environmental contaminants and severe clinical outcomes. The prominence of clinical themes with profound public health implications—given the severity of preeclampsia aligns seamlessly with the high publication volume observed in the International Journal of Environmental Research and Public Health. This venue prioritizes studies with tangible policy relevance, a scope that corresponds directly to findings identifying mercury exposure as a precipitating factor for preeclampsia risks. Collectively, these trends indicate that inquiry into gestational mercury exposure is garnering increasing

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academic traction, reflecting the critical urgency of this issue within the context of global environmental health

Although this bibliometric analysis provides a robust quantitative overview of research trends, it has several limitations. The analysis is based solely on a single academic database, namely Scopus, and therefore may not fully represent the global research landscape. Important studies published in journals not indexed in Scopus or indexed in other databases such as Web of Science, PubMed, or Google Scholar may have been overlooked. This limitation may result in the underrepresentation of significant contributions from journals or regions that primarily publish in non-English languages or operate at the local or regional level. Given that Scopus is dominated by English-language literature, research conducted and published in other languages, including Indonesian, Mandarin, and Spanish, which may have substantial local impact, is likely to be inadequately represented.

Furthermore, publications for the year 2026 only include documents that had been indexed at the time of data retrieval. The relatively low number of documents recorded for 2026 does not reflect a decline in research interest but rather represents an artifact of incomplete database indexing. This limitation may distort the interpretation of recent trends if not carefully considered. Although this analysis successfully identifies strong global research trends and situates them within the context of environmental health, readers should interpret the findings with caution, recognizing that the results are constrained by the scope of the Scopus database and the quality of the retrievable metadata, including titles, abstracts, and keywords.

4. Conclusion

Bibliometric analysis and literature reviews clearly underscore that mercury exposure in pregnant women is an urgent global public health issue with a significant increase in research trends, reaching its peak in 2021. This trend is driven by the dominant contribution of developed countries, such as the United States, which have the resources to conduct complex toxicology and epidemiology studies and publish mostly in leading environmental health journals (Environment International). The thematic focus of this research covers three main areas: identification of environmental sources of exposure (particularly methylmercury from seafood), understanding the mechanisms of neurotoxicity in the fetus, and links to pregnancy complications such as preeclampsia and hypertension.

Clinical evidence from literature reviews directly reinforces the urgency of this research, showing that higher mercury levels in pregnant women are positively correlated with the risk of miscarriage and low birth weight (LBW) as well as an increased risk of neurological development in infants. The link between environmental exposure and specific clinical outcomes, such as preeclampsia risk, has shifted the focus of research from general toxicology to specific obstetric complications. Therefore, future research should focus on

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developing effective intervention strategies and public health policies to minimize exposure, particularly through the strict monitoring of seafood consumption and other lifestyle exposure sources.

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