

BIBLIOMETRIC ANALYSIS OF MATERNAL INFECTIONS

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ABSTRACT

Background: Pregnancy is a period when susceptibility to infections increases due to physiological changes and weakening of the immune system. In order to gain a general perspective on maternal infections, in this study, we aim to make a bibliometric analysis of the literature related to maternal infections and explore the research status, hotspots and frontiers in this field in recent 10 years. **Methods:** In this bibliometric study, we retrieved publications from Web of Science (WoS) database Jan 1, 2004 to Jan 1, 2024 based on a variety of factors, including total citation numbers, languages, journals, countries, affiliations etc... Additionally, VOSviewer software version 1.6.18 used for representing global collaboration network and hot research themes. **Results:** Overall, 16496 Open Access articles from 1952 sources, contributed by 82420 authors retrieved from WOS between January 2004-2024, globally. All studies were published in science citation index expanded (SCI-EXPANDED) and social sciences citation index (SSCI), as a result of the Web of Science. The publications have been published in 13 different sources (journals, books, letters etc.), mostly original articles (%82). The average citations per documents was 31.19. The top active author was Romero R, the journal was Plos One with 846 articles, the affiliation was University of London and the country was USA. **Conclusion:** Our study systematically analyzed maternal infections, in the last 20 years. we need further investigate to provide new therapeutic perspectives to mitigate adverse perinatal outcomes due to maternal infections. In conclusion, bibliometric our study provide a general overview of maternal infections.

KEYWORDS: Bibliometrics, maternal infections, COVID-19, HIV, Zika virus.

INTRODUCTION

The critical role of a robust health system in achieving advancements in maternal health and reducing maternal mortality is widely acknowledged.^[10] Maternal infections during pregnancy pose significant risks to both the mother and the developing fetus. Understanding the implications, management strategies, and preventive measures is crucial for ensuring optimal maternal and fetal health. Pregnancy induces a unique state of immunocompromise in women, essential for the immune system to tolerate the growing fetus, making them vulnerable to infections due to the fetus's specific tropism for certain viruses.^[11] Factors such as a weakened immune system, insufficient prenatal care, exposure to infectious agents, and socio-economic influences contribute to an elevated risk of maternal infections during pregnancy.

Maternal infections during pregnancy pose substantial risks to both the mother and the developing fetus, leading

to complications such as preterm birth, low birth weight, and neonatal infections. Intrauterine infections, caused by bacteria or viruses, can directly impact fetal development by crossing the placenta. Notably, infections like cytomegalovirus (CMV) and Zika virus have been associated with congenital abnormalities, underscoring the importance of early detection and intervention.^[12]

Bibliometric analysis involves a systematic examination of scientific literature, encompassing books, papers, and journals, using mathematical and statistical methods. This method unveils the structure and dynamics of a particular field by scrutinizing institutional performances, collaborations, countries, and author contributions. Through bibliometric analysis, researchers can identify patterns and trends over specific time frames, aiding in the detection of knowledge accumulation within defined periods. This analytical approach acts as a valuable tool for presenting

information to fellow researchers, enabling efficient and accurate knowledge acquisition. There are many studies in the literature in this context.^[1-7,15,16]

In the context of maternal infections, this bibliometric analysis aims to quantitatively analyze scientific data related to the subject. The goal is to unveil the prevalent and discussed maternal infections within the scientific community in recent years, shedding light on the current state of research and knowledge dissemination in this crucial area.

MATERYAL-METHODS

Search strategy

Data of this bibliometric analysis was obtained from the WoS Core Collection between January 2004 and January 2024. "Maternal infection" was the key words chosen for use in the WOS search engine. Science citation index expanded (SCI-EXPANDED), and social sciences citation index (SSCI) as Web of Science indexes were selected. In addition, the study included only Open Access articles.

Data collection

Titles, document types, years of publication, names of authors, affiliations, key words, group authors, names of publishing journals, abstracts of each record, and citations within the WoS publications were saved as Bibtex files. We accessed material using the online library and digital resources of Çanakkale Onsekiz Mart University. The Hirsch (H) index was used as a measure of publishing impact.

Ethical approval

Given that bibliometric investigations do not involve the participation of humans or animals, ethical approval was deemed unnecessary.

RESULTS

Descriptive analysis

Summary statistics of the data retrieved from the WOS database are given in Table 1. A total of 16496 Open Access articles from 1952 sources, contributed by 82420 authors retrieved from WOS between January 2004-2024, globally. A total of 463052 number of references were used. The number of documents with a single author was 311. The average citations per documents was 31.19.

All studies were published in SCI-EXPANDED and SSCI, as a result of the Web of Science. The publications have been published in 13 different sources (journals, books, letters etc.)(Figure 1b), mostly original articles(%82). Moreover, the annual growth rate was found to be 14.91 percent.

The peak year of publications was year 2021 with 2007 articles(12%). It is followed by the 2022 year with 1969 documents. No articles have been published in 2006(Figure 2).

While most of the publications were written in English, it was observed that 9 languages other than English were used in the publications(Figure 1c). Each of the publications was categorized according to field and shown in Figure 1a.

Table 1: Summary statistics of the retrieved documents.

Description	Results
Timespan	2004:2024
Sources (Journals, Books, etc)	1952
Documents	16496
Annual Growth Rate %	-14,91
Document Average Age	6,6
DOCUMENT CONTENTS	
Keywords Plus (ID)	20926
Author's Keywords (DE)	22219
AUTHORS	
Authors	82420
Authors of single-authored docs	282
AUTHORS COLLABORATION	
Single-authored docs	311
Co-Authors per Doc	8,85
International co-authorships %	39,02

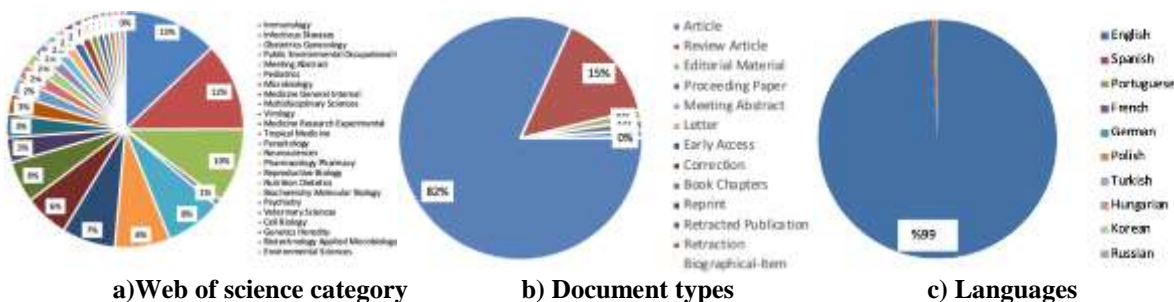


Figure 1: Properties of documents in the field of Maternal Infections.

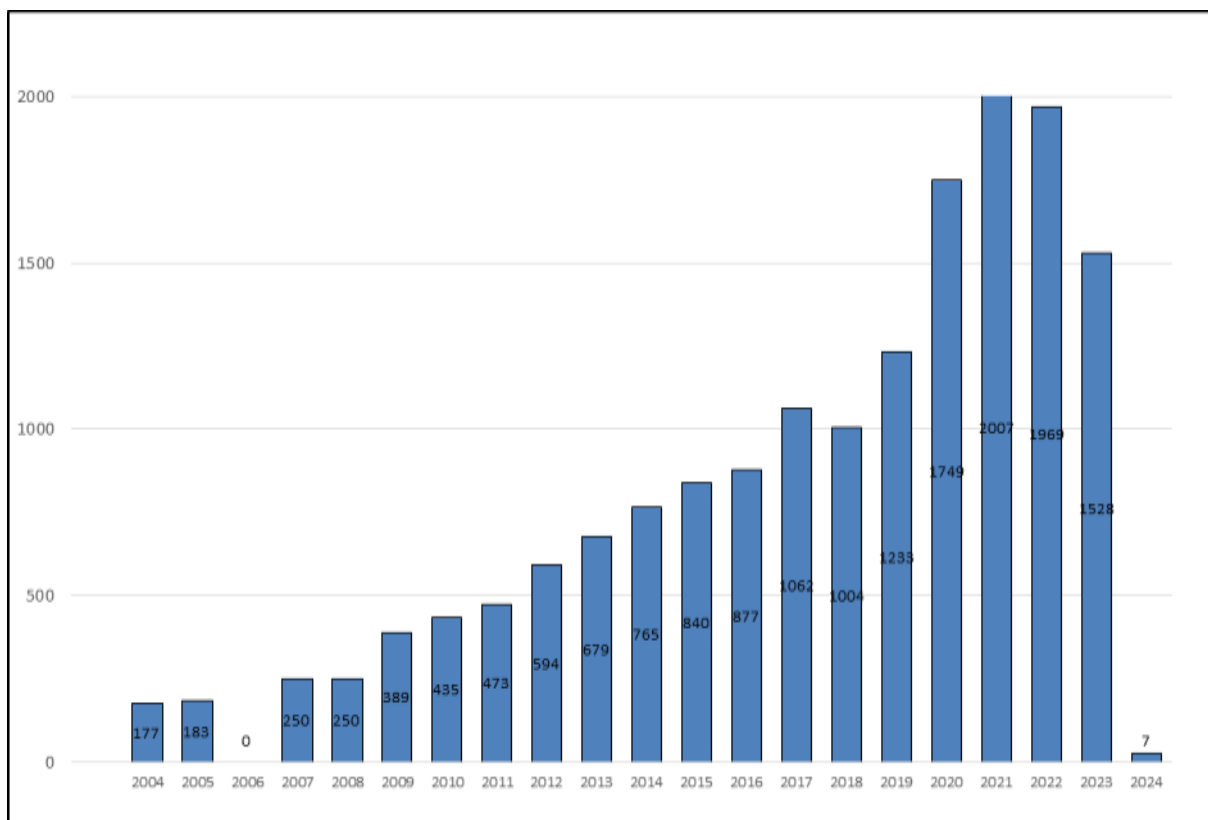


Figure 2: Annual Scientific Production.

Most influential journals

The top ten productive journals in this field were given in Table 2. The top active journal was Plos One with 846 articles on maternal infections. The following two journals were American Journal of Obstetrics and Gynecology with 408 and BMC Pregnancy and Childbirth with 286 articles. The articles have been published in 414 different journals. The journal with the highest H-index among these journals was Plos One with 404 H-index. The number of articles published between 2019 and 2023 has increased by stages.

Corresponding authorship analysis and journals

A total of 82420 authors contributed to 16496 Open Access articles about maternal infections. Romero R conducted 242 (28.35%) articles on maternal infections; Wang Y conducted 164 (17.18%) articles; and Li Y conducted 158 (16.95%) articles. The first 10 authors have published 9% of total articles. The most cited article was about retrospective review of medical records

of nine pregnant COVID-19 infected women with 2176 (%) citations and the first author was Chen, Huijun, correspondence to Zhang Y. from department of Gynaecology and Obstetrics of Zhongnan Hospital from Wuhan University, China (8).

Romero R. who is the chief of National institutes of health NIH USA had the highest H-index (78) of any author among the writers. Figure 6 shows the connections between the authors.

When we look at the Corresponding author’s country of the articles, the USA was mostly in the lead and followed by China and United Kingdom(Figure 3). Also the top most cited three countries were USA, United Kingdom and China (Figure 4). The average article citations of USA was 45.90 and is followed by United Kingdom with average 43.20 citations and China with 21.10.

The most productive three affiliations were University of London, University of California State and Harvard University (Table 2).

Table 2: Top 10 Affiliations, sources and authors.

	Affiliations	Record Count	Sources	H-Index	Number	Authors	Record Count	%
1	University of London	1049	Plos One	404	846	Romero R	242	28,35
2	University of California s.	1038	American Journal of Obstetrics and Gynecology	250	408	Wang Y	164	17,18
3	Harvard U	869	BMC Pregnancy and Childbirth	79	286	Li Y	158	16,95
4	National institutes of health NIH USA	779	Frontiers in Immunology	190	285	Zhang Y	137	15,75
5	Johns Hopkins U.	686	Journal of Infectious Diseases	269	257	Li J	130	15,27
6	London school of hygiene tropical medicine	563	Clinical Infectious Diseases	372	239	Wang X	120	14,26
7	Nih Eunice Kennedy Shriver National Institute of Child Health and Human Development NCHD	520	Scientific Reports	282	192	Wang J	114	14,28
8	Centers for Disease Control and Prevention USA	487	Journal of Maternal-Fetal & Neonatal Medicine	90	187	Zhang L	114	13,92
9	University of North Carolina	460	BMJ Open	139	184	Liu J	113	14,94
10	University of Washington	456	Vaccine	205	180	Liu Y	113	12,85

Table 3: Top 15 Most Cited Articles.

	Most Cited Article	Corresponding Author	H-Index Author	Source	Total citation	TC per Year
1	Clinical characteristics and intrauterine vertical transmission potential of COVID-19 infection in nine pregnant women: a retrospective review of medical records	Zhang Y, Chen H	26	Lancet	2176	544
2	Zika Virus Infection in Pregnant Women in Rio de Janeiro	Brasil P	43	New England Journal Of Medicine	1268	158.5
3	Preterm labor: One syndrome, many causes	Romero R	78	Science	1129	11.9
4	Clinical manifestations, risk factors, and maternal and perinatal outcomes of coronavirus disease 2019 in pregnancy: living systematic review and meta-analysis	Allotey J	18	Bmj-British Medical Journal	1194	597
5	Maternal Immune Activation Alters Fetal Brain Development through Interleukin-6	Smith SEP	19	Journal Of Neuroscience	1118	69.8
6	Context Sensitive Links Effectiveness of maternal influenza immunization in mothers and infants	Zaman K	33	New England Journal Of Medicine	909	56.8
7	Prenatal Infection and Schizophrenia: A Review of Epidemiologic and Translational Studies	Brown AS	52	American Journal Of Psychiatry	902	64.4
8	Maternal and Neonatal Morbidity and Mortality Among Pregnant Women With and Without COVID-19 Infection The	Villar, J	52	Jama Pediatrics	684	228

	INTERCOVID Multinational Cohort Study					
9	Context Sensitive Links Transplacental transmission of SARS-CoV-2 infection	Vivanti, AJ	15	Nature Communications	662	165.5
10	Maternal immune activation: Implications for neuropsychiatric disorders	Estes ML	34	Science	661	82.6
11	Zika Virus Infection during Pregnancy in Mice Causes Placental Damage and Fetal Demise	Miner JJ	29	Science	627	78.3
12	The psychological impact of COVID-19 on the mental health in the general population	Serafini G.	11	Qjm-An International Journal Of Medicine	611	152.7
13	Outcome of coronavirus spectrum infections (SARS, MERS, COVID-19) during pregnancy: a systematic review and meta-analysis	Di Mascio, D.	24	American Journal Of Obstetrics & Gynecology MFM	610	152.5
14	Zika Virus Infection with Prolonged Maternal Viremia and Fetal Brain Abnormalities	Driggers, RW	13	New England Journal Of Medicine	604	151
15	Neonatal Early-Onset Infection With SARS-CoV-2 in 33 Neonates Born to Mothers With COVID-19 in Wuhan, China	Zeng, LK	7	Jama Pediatrics	596	153

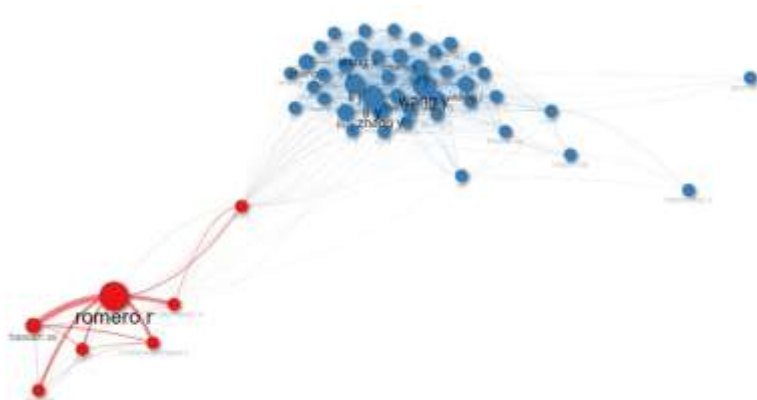


Figure 6: Connection between authors.

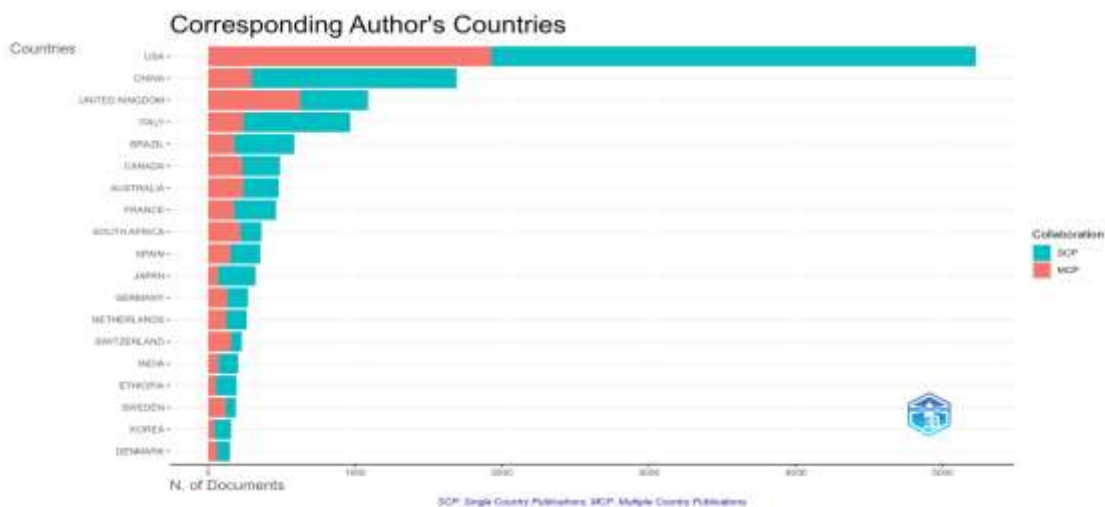


Figure 3: Corresponding author's country.

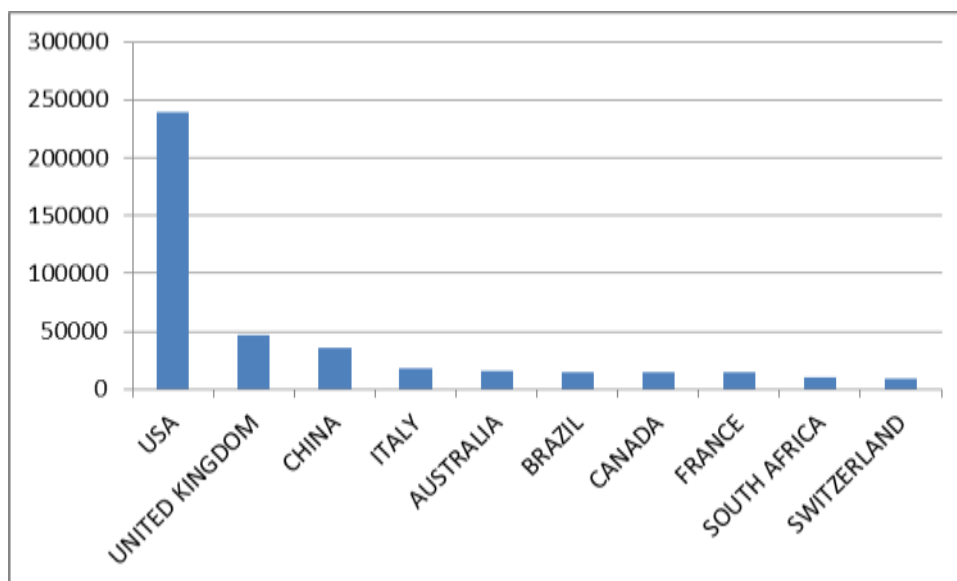


Figure 4: Most cited countries.

Highly cited articles

The most cited publication regarding maternal infection on an annual basis and in total was Zhang Y et al (Table 3) "COVID-19 in pregnancy" publication. The current study has revealed the leading role played by the USA, China, Italy, and the UK, in COVID-19 research. A potential reason for these findings may be attributed to the high prevalence of COVID-19 in those countries witnessing the first outbreak.^[13,14]

Most frequent words and co-occurrence network

The most frequent word in the articles was found to be "infection" with 2955 occurrences and a 14% frequency and followed by the "pregnancy" (1454, 7%) and the "risk" (1434, 6.8%). A total of 20901 most frequent words were found in the field.

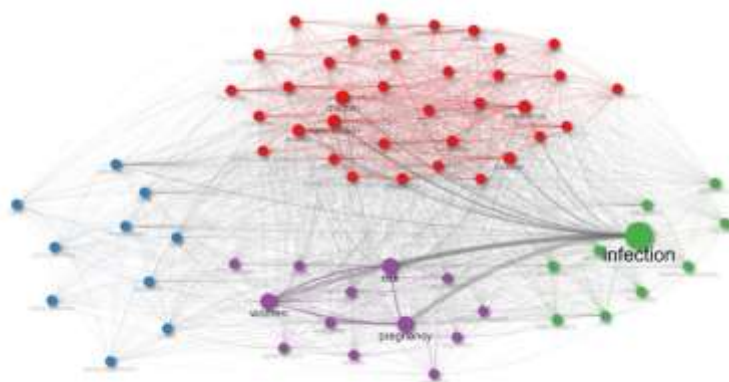


Figure 5: Most frequent words.

DISCUSSION

Bibliometric methods are routinely used to evaluate the work of specific fields by representing the most productive authors, publications, institutions, research fundings and countries and to establish academic ranking. This method provides the following scientific outputs and performs comprehensive scientific mapping analysis by using Bibliometrix.^[9]

The dominance of the research activities comes from USA mostly and followed by China and United Kingdom in the SCI-Expanded index.

In this study the most cited 15 articles about maternal infections reviewed. COVID-19 infection ranks first, while the article on Zika virus infections in pregnant women ranks second. When the top 15 most cited articles were examined, it was seen that the effects of COVID-19 and Zikavirus infections, which have occupied the medical world since 2019, were discussed at the forefront. Apart from these, articles on infectious causes of preterm birth, maternal immune activation, interleukin studies, psychological impact and relationship between infections and influenza immunization were seen. When the trend topics are analyzed, it is seen that Covid-19 comes first (Figure 7).

While the USA was the first productive country in the field, it was thought that the impact of the COVID-19 infection was at the forefront in the publications originating from China, which ranked second.

University of London, University of California p. and Harvard University were the three institutions that published the most on maternal infections (Table 2). Three of the top four most cited countries were USA

China and Italy, where COVID-19 is frequently seen (Figure 4).

When we look at the trending topics, we see that Covid, vaccination, depression and stress issues during pregnancy have become more prominent in 2019 and beyond (Figure 7). This situation is reflected in the studies of patients who had Covid infection during pregnancy and the society who completed their pregnancy due to Covid stress.

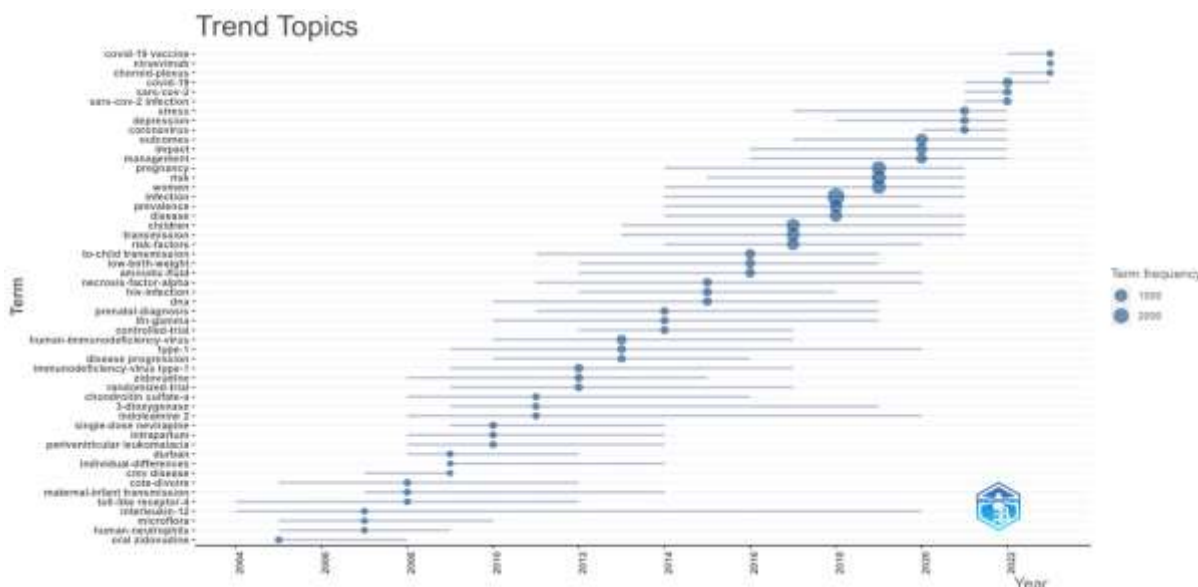


Figure 7: Trend Topics.

CONCLUSION

Maternal infections during pregnancy represent a significant public health concern due to their potential adverse effects on maternal and fetal health. Therefore, it is very important for each country to develop appropriate scientific strategies by closely examining maternal infections that may result in fetal harm or death, as a part of the national strategy. In this context, when the countries were scanned, it was determined that the most publications on the subject were produced by the USA, followed by United Kingdom and China.

The authors predominantly publish their articles in the USA, United Kingdom, China, and Italy, reflecting a global perspective resulting from international collaborations. Despite geographic variations, maternal infections during pregnancy necessitate meticulous attention due to their potential repercussions on both maternal and fetal well-being. A collaborative effort between healthcare providers and expectant mothers, guided by an understanding of the risks posed by various infections and the implementation of effective preventive strategies, is crucial to ensuring a healthy pregnancy and favorable outcomes for both mother and child.

Looking ahead, it is foreseeable that beyond the extensively studied Toxoplasma, CMV, and HIV infections in pregnant women, novel research endeavors

will emerge to explore the effects of newly identified viral infections on expectant mothers. Absolutely, the dynamic nature of scientific inquiry is pivotal in safeguarding maternal and fetal health. As new pathogens emerge, antimicrobial resistance patterns evolve, and our understanding of maternal-fetal physiology deepens, ongoing research is essential to inform clinical practice and public health policies. Through interdisciplinary collaboration, innovative technologies, and evidence-based approaches, we can adapt our strategies to address emerging challenges and optimize outcomes for pregnant women and their babies.

LIMITATIONS AND ADVANTAGES

The current study's data extraction method has scope limitations. In this bibliometric research we used a single database by searching selected keywords. As a result, the data collection technique was directed in line with our goal and was carried out by scanning only open Access publications on the web of science for the words 'maternal infection'. We do not mean to imply that the field of bibliometrics is defined to scan only these two words. But it can be difficult to explain an academic field in a search query.

Journalism Ethics considerations

Since the data were scanned and examined through WOS, ethical permission is not required for this study.

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AUTHOR CONTRIBUTION

Concept: Işıl Deniz Alıracı

Design: Işıl Deniz Alıracı, Mehmet Nuri Duran.

Data collection and processing: Işıl Deniz Alıracı, Mehmet Nuri Duran.

Analysis and interpretation: Işıl Deniz Alıracı, Mehmet Nuri Duran.

Literature review and writing: Işıl Deniz Alıracı, Mehmet Nuri Duran.

Critical review: Işıl Deniz Alıracı, Mehmet Nuri Duran.

Conflict of Interest

The authors declare that there is no conflict of interests.

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