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A Bibliometric Analysis Study on Pregnancy and COVID-19

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ABSTRACT

Introduction: This quantitative study aims to conduct a literature evaluation on COVID-19 and pregnancy published since September 2022. **Methods:** The data was retrieved from the Web of Science database. Authors, co-cited authors, publishing journals, keywords, countries, affiliations, H indexes, citation numbers, and connections between these parameters were used to identify and analyze the data. Microsoft Excel was used to assess the descriptive characteristics of publications, and VOSviewer was used to analyze and visualize selected criteria. **Results:** We extracted 1574 publications on COVID-19 and pregnancy according to search criteria. The majority (81.96%) were published in Science Citation Index Expanded journals, and 670 (42.56%) were published in 2021. Although 100 countries contributed to this topic, the highest number f articles was published by the United States of America (n=473), followed by the United Kingdom, Italy, China, and India. The University of London and Harvard University were the most productive affiliations, and the American Journal of Obstetrics and Gynecology published the most (n=84). The publications received 17,406 citations, an average of 11.06 per document. **Conclusion:** Since the emergence of COVID-19 and pregnancy, numerous countries, affiliations, and academics have focused on this issue, resulting in a rapid expansion of publications in this field of literature. So far, American, British, and Italian scientists have collaborated the most on COVID-19 and pregnancy research internationally.

INTRODUCTION

The first reported coronavirus disease (COVID-19) cases were from Wuhan, China, in 2019 [1]. On March 12, 2020, the World Health Organization (WHO) declared it a pandemic [2].

Pregnant women faced many unknowns during the COVID-19 pandemic [3], including whether COVID-19 is an independent risk factor for preterm birth and its potential long-term adverse effects on the fetus [3, 4]. Data about the impact of COVID-19 on expectant mothers and their unborn children is limited to low-quality case reports and series. However, compared to the SARS viruses, COVID-19 appears to be less dangerous. In most cases, pregnant women with COVID-19 were either asymptomatic or had minor symptoms. However, those with underlying disorders should receive special attention because they are more likely than the general population to have severe diseases [5]. According to a meta-analysis and systematic review study, this vulnerable population may have a higher risk of hospitalization, admission to intensive care units, and death due to COVID-19 [6]. These findings are consistent with a Centers for Disease Control and Prevention (CDC) study of over 400000 women of reproductive age with symptomatic COVID-19, which discovered a significantly higher adjusted risk ratio for death in pregnant individuals than non-pregnant individuals [7]. Risk factors for severe illness during pregnancy include older maternal age, non-white ethnicity, higher body mass index, and preexisting comorbidities such as hypertension and diabetes mellitus [8].

In the event of a breakthrough infection, vaccination can reduce the severity of the illness and the risk of being infected with SARS-COV-2. According to all available research [9, 10], all current COVID-19 vaccines are safe to use before, during, and after pregnancy. According to the CDC, COVID-19 immunization is recommended for anyone aged six months and above, including those expecting, breastfeeding, or trying to get pregnant [9]. In a previous study in the USA involving more than 35,000 pregnant women, there was no significant difference in side effects between pregnant and non-pregnant individuals. Pregnants did not exhibit any notable side effects [10].

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A few studies employing bibliometric analysis to examine COVID-19 have been published [11-16]. However, there are similar limited studies on COVID-19 and pregnancy [17,18]. Obstetric patients have attracted attention due to the possibility of more severe infection and unfavorable pregnancy outcomes. We sought to investigate the literature, particularly on COVID-19 and pregnancy literature.

MATERIAL AND METHODS

Study design. We used bibliometric analysis in this study and developed a database, including data collection, representation, and analysis standards.

We extracted the documents from the Web of Science (Wos) core collection between December 1, 2019, and September 10, 2022, with no language restrictions.

To conduct our search, we used the following queries in the WOS database: (sars2) OR (sars-2) OR ("SARS 2") OR ("novel coronavirus pneumonia") OR ("new human coronavirus") OR ("2019 novel coronavirus") OR ("2019 novel coronavirus infection") OR ("novel coronavirus") OR ("new coronavirus") OR ("severe acute respiratory syndrome coronavirus 2") OR ("sudden acute respiratory syndrome coronavirus 2") OR ("China coronavirus") OR ("Wuhan coronavirus") OR ("Wuhan seafood market pneumonia virus") OR (COVID-19) OR ("COVID19 virus") OR ("Coronavirus disease 2019") OR TITLE ("coronavirus disease-19") OR ("Coronavirus disease 2019 virus") OR ("SARS-CoV-2") OR ("2019-nCoV") OR ("2019-nCoV disease") OR ("2019-nCoV infection") and ("pregnancy") OR (" pregnant").

We investigated all of these documents from various bibliometric perspectives, including open accessibility of documents, document type, publishing language, citation counts, average citations per document, Hirsch (H)-indexes of the selected countries, top cited publications, global distribution of publications, the most productive institutions, highly publishing journals, and countries, international cooperation, the most applied keywords, bibliographic coupling, and co-citations of other documents.

After completing the data extraction procedure, we exported all the data into Microsoft Excel to analyze and rate several bibliometric indices, including the most frequently cited articles and top nations, institutions, and journals.

Study selection and data extraction. Two researchers worked separately on study selection and data extraction. A consensus was reached to resolve disagreements. To avoid confusion due to authors with shared short names, we added affiliations to the authors' names. If the affiliation differed from the short name, it was considered that there were two different authors. We only used the first affiliation for authors with more than one affiliation. We processed keywords containing different expressions and standardized them to a single keyword. To determine the cluster, we examined the frequency of the same keywords appearing in other publications using VOSviewer version 1.6.18 (https://www.vosviewer.com). We determined a minimal frequency of keyword recurrence in publications at least two times, depending on the number of studies included. Different objects, such as nations, organizations, or keywords, are represented by different nodes on the map. The size of the nodes reflects the number of publications or frequencies; the more significant the node, the more publications or frequencies there are. Linkages connecting the nodes represent relationships of cooperation, co-occurrence, or co-citations. Different colored nodes and lines represent different clusters. The VOSviewer's parameters included "ignoring documents with a large number of authors" and the fractional counting method of counting.

Data analysis. We tabulated various publication attributes, including authors, co-cited authors, publishing journals, keywords, countries, affiliations, H indexes, and citation numbers. We then used the connections between these parameters to identify and analyze the data. Co-cited authors, which are authors who have been referenced together, were also considered. The relationships between the countries, research institutions, and frequently used keywords were examined.

RESULTS

After scanning the Wos database with selected keywords, we found 1574 documents on COVID-19 and pregnancy. Of these, 821 were original articles, while others comprised 215 review articles, 187 meeting abstracts, 170 letters, 140 editorials, 134 notes, and 100 other documents (such as early access, corrections, news items, proceeding papers, and book chapters). English was the most preferred publishing language, accounting for 95.93% of all documents. Among all documents, 1,206 (76.62%) were open access, and most (81.95%) were published in journals indexed in the Science Citation Index Expanded (SCI-EXPANDED). 670 (42.57%) were published in 2021, and 527 (33.48%) in 2022. Figure 1 shows the global distribution of COVID-19 and pregnancy documents. The United States (USA) was the most productive country, publishing 473 scientific papers. In total, 100 countries contributed to COVID-19 and pregnancy literature. The other top countries with the most documents were the United Kingdom (n=154), Italy (n=119), China (n=92), India (n=88), Spain (n=85), Canada (n=81), Türkiye (n=72), Brazil (n=64) and Germany (n=50). Table 1 presents the initial top ten institutions linked to the retrieved documents, with authors from the University of London and Harvard University publishing most of the publications.

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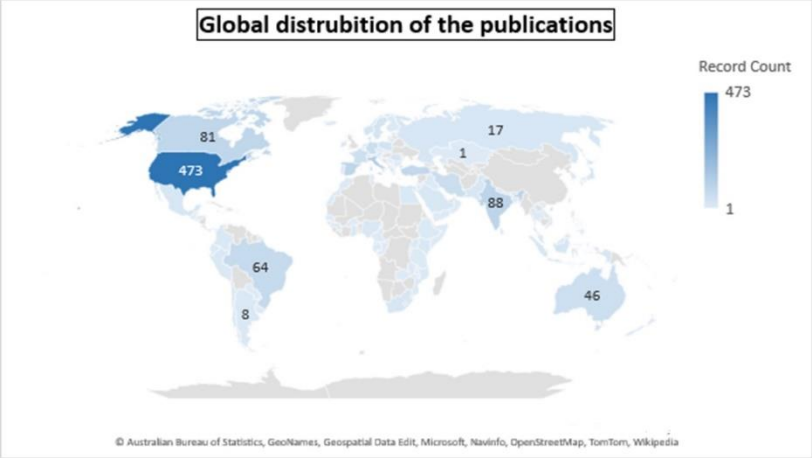

Fig. 1. Global distribution of the publications.

Table 1. The first top 10 institutions handling COVID-19 and pregnancy documents

Rank	Affiliations	Number of Publications	Percentage
1	University of London	67	4.257
2	Harvard University	44	2.795
3	University College London	40	2.541
4	University Of California System	37	2.351
5	University of Toronto	33	2.097
6	Udice French Research Universıities	32	2.033
7	Imperial College London	31	1.970
8	Centers For Disease Control Prevention USA	28	1.779
9	ST Georges University London	28	1.779
10	The University of Texas System	28	1.779

Showing 10 out of 2.676 entries, 63 record(s) (4.003%) do not contain data in the field being analyzed.

The majority of these documents were published in highly prestigious journals, such as the American Journal of Obstetrics and Gynecology (84 documents), The European Journal of Obstetrics and Gynecology and Reproductive Biology (39 documents), and BJOG: An International Journal of Obstetrics and Gynecology (37 documents), as shown in Table 2.

Table 2. The first top 25 journals that published COVID-19 and pregnancy documents

Rank	Journal	Number of publications	%	Journal Citation Indicator ™ 2021	Journal Impact Factor ™ 2021
1	The American Journal of Obstetrics and Gynecology	84	5.337	3.23	10.693
2	The European Journal of Obstetrics & Gynecology and Reproductive Biology	39	2.478	0.68	2.831
3	BJOG: An International Journal of Obstetrics & Gynaecology	37	2.351	2.16	7.331
4	The International Journal of Gynecology & Obstetrics	36	2.287	1.25	4.447
5	Obstetrics & Gynecology	36	2.287	1.92	7.623
6	The Journal of Maternal-Fetal & Neonatal Medicine	35	2.224	0.88	2.323
7	Ultrasound in Obstetrics & Gynecology	28	1.779	2.22	8.678
8	International Journal of Environmental Research and Public Health	25	1.588	0.93	4.614
9	The Journal of Perinatal Medicine	24	1.525	0.93	2.716
10	BMC Pregnancy & Childbirth	21	1.334	1.05	3.105

Showing 10 out of 520 entries

Rasmussen *et al*. (2020) wrote the most highly cited document, with 526 citations [19]. The total number of citations for all documents was 17406, with an average of 11.06 per document and an h-index of 55. The total number of citations for original publications (821 documents) was 10276, with an average citation of 12.52 per document and an H-index of 44. Figure 2 depicts the annual number of publications and citations. At the same time, Table 3 presents descriptive parameters for countries with a high publication rate, including the number and average number of citations per article and the H-index.

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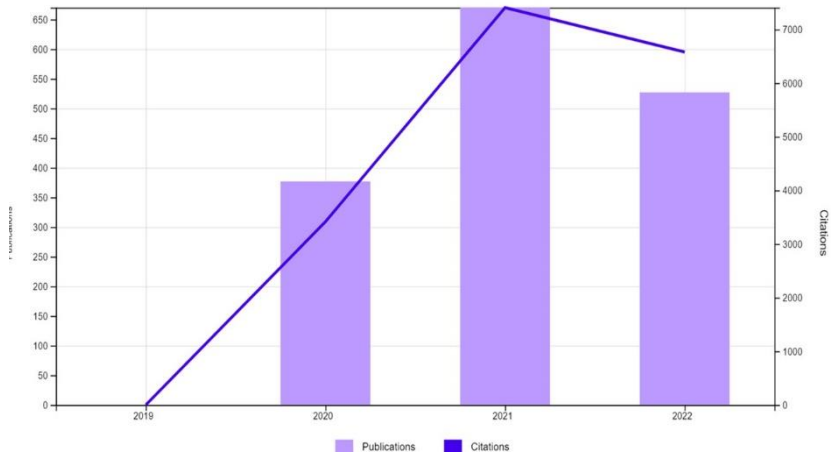

Fig. 2. Number of publications and citations by years

Table 3. Comparison of the number of publications, H-indexes, and citations of the countries with the most articles on COVID-19 and pregnancy

Country	Number of publication	H Index	Total number of citations	Average number of citations per document
The USA	473	38	7612	16.09
The United Kingdom	154	23	2613	16.97
Italy	119	19	2061	17.32
China	92	21	1910	20.76
India	88	11	462	5.25
The USA	473	38	7612	16.09

DISCUSSION

Our study aimed to identify the current situation and provide a global perspective on COVID-19 and pregnancy documents, including research gaps and the nations, affiliations, journals, and authors involved in their publication. Roman *et al*. (2022) [17] selected the time interval from January to December 2020 [17], while Bansal *et al*. [18] used the search sequence for 2020-21 in their similar studies. However, our study is superior as it includes data up to 2022, reflecting the ongoing publication of scientific papers on COVID-19.

Our country analysis revealed that the USA, the United Kingdom, Italy, China, India, Spain, Canada, Türkiye, Brazil, and Germany published the majority of COVID-19 and pregnancy literature. Meanwhile, according to the WHO Coronavirus (COVID-19) Dashboard data, the top 10 countries with the highest number of COVID-19 confirmed cases were the USA, India, France, Brazil, Germany, the Republic of Korea, the United Kingdom, Italy, Japan, and Russian Federation [19]. Seven top-ranked countries with the highest number of confirmed COVID-19 cases also significantly contributed to the scientific literature and efforts to fight the global epidemic.

The CDC received reports of 225,656 pregnant cases and 306 deaths with positive test results for SARS-CoV-2. The virus that causes COVID-19 in the USA [Data on COVID-19 during Pregnancy: Severity of Maternal Illness [20]. All information on this page is derived from American authorities' case reports given to the National Notifiable Diseases Surveillance System (NNDSS). Less than 20% of case reports currently include a woman's pregnancy status. Therefore, caution must be exercised when interpreting these data since they do not accurately reflect all pregnant Americans with COVID-19. Changes in the overall number of COVID-19 cases among pregnant women are primarily due to updates in pregnancy status among previously reported cases. The CDC's overall case statistics undergo a verification process with each jurisdiction, which means that case numbers published on other websites may differ from those presented on the CDC's website. For more information on COVID-19 during pregnancy, please refer to the Data on COVID-19 During Pregnancy: Maternal Severity [21]. The USA currently leads the world in COVID-19 and pregnancy research, with the highest number of publications, citations, and top country rankings for co-authorship analysis. These findings suggest that the USA, which hosts the most robust international collaborations, may significantly impact research in this area. Moreover, China ranked fourth in the total number of citations and first in the average number of citations per document. This might be because the disease was first identified in China.

Numerous countries, affiliations, and academics have focused on this issue since COVID-19 and pregnancy initially emerged. As a result, publications in this field of literature are expanding quickly. So far, American, British, and Italian scientists have collaborated the most on COVID-19 and pregnancy research. Most COVID-19

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publications were in reputable journals with high-impact factors and were open access. Furthermore, the current bibliometric analysis of COVID-19 and pregnancy literature highlights various aspects of the infection, such as pathogenesis, epidemiology, transmission, diagnosis, therapy, prevention, and complications. Figures 3, 4, and 5 reveal that American and European scientists, particularly those from the UK and Italy, are the most prolific and collaborative in COVID-19 and pregnancy research. Our frequently used keyword mapping has identified the most interesting topics, as shown in Figure 6.

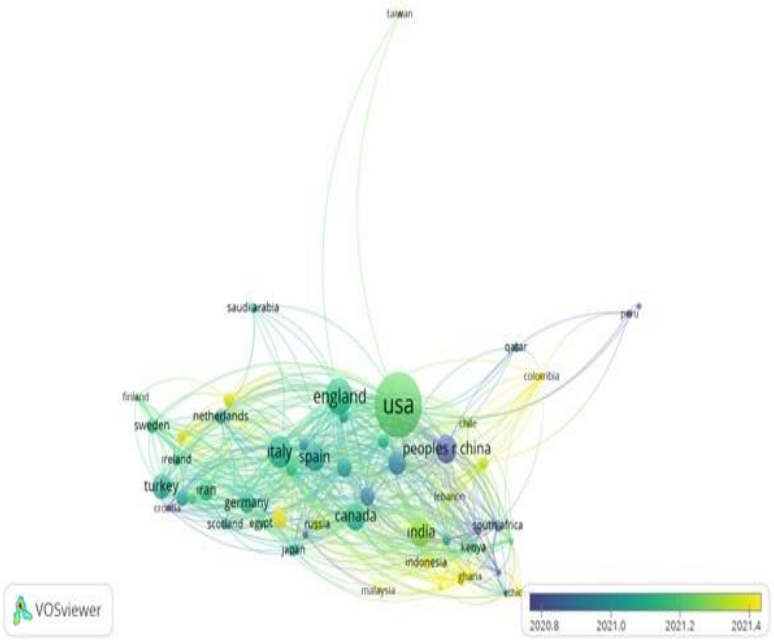

Fig. 3. Overlay visualization of co-authorship among countries. Figure 3 depicts the overlay visualization. According to the co-citation links between the two countries, their distance in the visualization roughly indicates their relationship. Generally, the closer two countries are closely related, the closer they are. Lines also depict the most substantial international co-authorship ties.

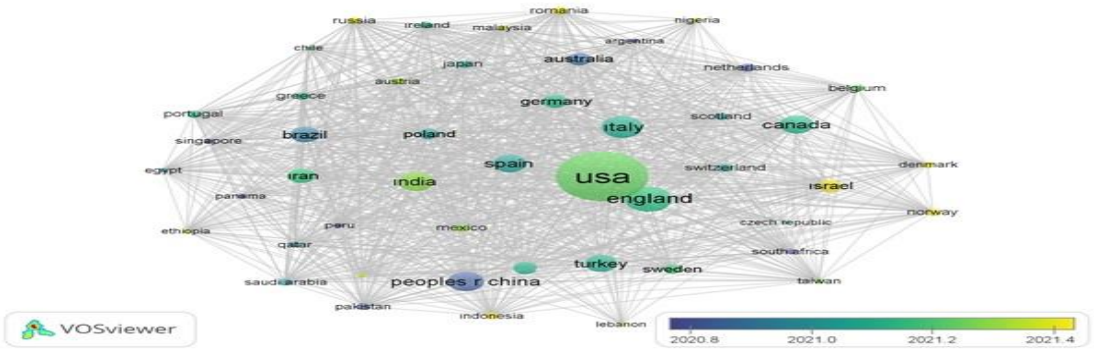

Fig. 4. Bibliographic coupling among countries with more than five documents. A connection between two items citing the same source is known as a "bibliographic coupling link" (Fig. 4).

This is the second comprehensive and systematic study to examine the characteristics and trends of the scientific literature on COVID-19 and pregnancy. However, this study is more recent and reflects newer data. Nonetheless, certain limitations should be acknowledged, such as the potential selection bias from publishing only articles with specific keywords. Second, although most articles in the WOSCC database are of excellent quality, occasional bibliographical omissions may occur. Finally, some newly published high-quality works may briefly rank slightly lower than established classics.

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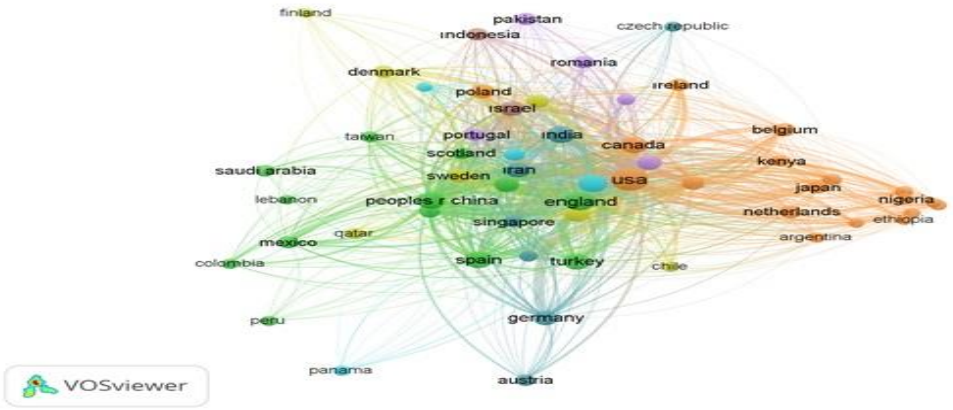

Fig. 5. Citation analysis among countries. Figure 5 depicts the network map of the citation analysis among countries for documents with more than 25 citations.

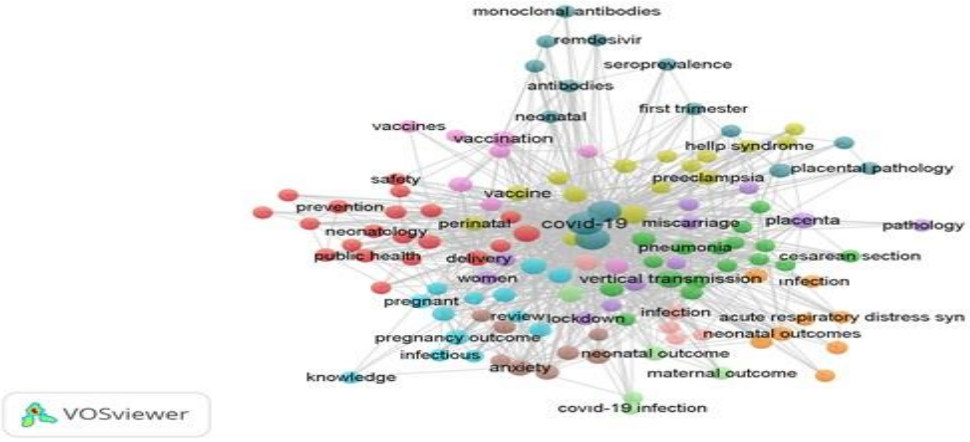

Fig. 6. Keyword analysis

Since the emergence of the COVID-19 pandemic, the relationship between COVID-19 and pregnancy has become a fascinating research topic. Our study found that many countries, organizations, and academics are actively studying this issue. As a result, there has been a rapid increase in publications on COVID-19 and pregnancy. So far, American, British, and Italian scientists have published the most articles and have collaborated internationally on COVID-19 and pregnancy research.

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CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest associated with this manuscript.

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