

Scientometric Study of The World Academic Production in Reproductive Medicine And COVID-19

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ABSTRACT

Background: COVID-19 has generated new gaps in knowledge, which in turn has had a significant impact on different areas of research, one of these being Reproductive Medicine. However, to date, no analysis of publications on this topic has been identified. Therefore, the aim of this study was to perform a bibliometric analysis of the worldwide scientific production of COVID-19 in Reproductive Medicine.

Method: We conducted an advanced bibliographic search in the Scopus database to identify articles on COVID-19 and Reproductive Medicine from 2019 to May 2022. The collected data was analyzed with Scival software, and the results were presented through summary tables.

Result: A total of 737 publications were collected and analyzed, of which 594 were original articles and 143 reviews. Leila V. Adamyan and Sechenov First Moscow State Medical University (Russia) were the most productive author and institution, respectively. The European Journal of Obstetrics, Gynecology and Reproductive Biology was the journal with the highest number of publications. In addition to that, we report a steady increase in the number of publications between 2020 and 2021, especially of articles published in first quartile (Q1) journals. Finally, although most of the publications had only national collaboration, the highest impact was found in those studies with international collaboration.

Conclusion: The scientific production on Reproductive Medicine and COVID-19 has reported a steady increase in recent years, especially in Q1 journals, which evidences a special interest in the subject by the scientific community. However, since new articles on COVID-19 are constantly being published, we recommend future bibliometric analyses to better analyze the topic.

Keywords: Academic production, COVID-19, reproductive medicine

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INTRODUCTION

The COVID-19 pandemic has generated, to date, more than 500 million cases and more than 6 million deaths worldwide.¹ This has had a wide impact on various areas such as the health system, which was affected mainly by an increase in the demand for health care.² Within all these problems and since the pandemic may have generated an increase in unplanned pregnancies, reproductive health care has become very important as a priority service, especially in the areas of contraception and protection against female violence.³ In addition to this, COVID-19 has been related to Reproductive Medicine in different ways. In the case of assisted reproduction, the pandemic has not only delayed or canceled many of them, but has also generated, in couples, an atmosphere of fear of contagion; all this has prompted the various reproductive health centers to increase their preventive measures.^{4,5} In the case of fertility, it has been reported that COVID-19 could decrease male fertility in the short term and that vaccination against COVID-19 does not affect fertility.⁶

All this shows gaps in knowledge and the need for future research to establish a better relationship between COVID-19 and Reproductive Medicine. In this context, bibliometric studies allow us to analyze the scientific production and productivity of specific institutions or topics⁷; to have a holistic view of a topic and guide future research on the predominant trends in the topic of interest. Although COVID-19 is one of the topics that has generated more publications and research opportunities, so far, there has not yet been an in-depth analysis regarding the relationship between COVID-19 and Reproductive Medicine, only a previous bibliometric study evaluating sexual behavior during the COVID-19 pandemic.⁸ Our results will be useful to develop future research as they will allow identifying different areas regarding the relationship of COVID-19 and Reproductive Medicine, as well as evidencing possible research opportunities.

Therefore, the aim was to analyze the global scientific landscape, visibility, and impact of academic production in reproductive medicine and COVID-19.

METHODOLOGY

Study design: The study was descriptive, retrospective and with a scientometric approach. A secondary data analysis was performed using the Scopus database, since it provides access to many journals, in addition to facilitating bibliometric analysis.⁹ This database also allows basic and advanced search strategies for the collection of articles.

Search strategy: In the present study, an advanced search strategy developed independently by two authors was used. Discrepancies were resolved by consensus to obtain a single strategy. TITLE, ABS and KEY field restrictions were used, which refer to title, abstract and keyword, respectively. In addition, the

Reproductive Medicine SUBJECTS code was used to retrieve documents related to the field of Reproductive Medicine. Free and controlled thesaurus terms (MeSH and Emtree) were used in addition to Boolean operators "OR" and "AND". The following search strategy was used:

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(TITLE-ABS-KEY ( 2019*cov OR ncov OR ( ( ( cov )
W/2 ( 19 OR 2019 OR 2 ) ) AND NOT ( "Coefficient*
of variation" OR "Torsion" OR cov*o* ) ) OR ( covid
W/2 ( 19 OR 2019 OR 2 ) ) OR covid19 OR ( *covid
AND NOT tocovid ) OR ( ( coronavirus OR "Corona
virus" OR cov ) W/2 ( disease OR infection ) W/2 (
2019 OR 19 OR 2 ) ) OR ( ( sars OR "Severe acute
respiratory syndrome" OR sras ) W/2 ( cov OR coro-
navirus OR "Corona virus" OR covid ) W/2 ("2" OR
2019 OR 19) ) OR "SARS-CoV2" OR sarscov2 OR
"SRAS-CoV2" OR "Severe acute respiratory syndrome
COV2" OR ( ( ( ( novel OR wuhan OR china OR pan-
demi* OR outbreak OR "new human" OR crisis OR
"new cases" OR "normalcy") W/2 ( coronaviru* OR
"corona viru*" OR covid ) ) OR ( "new corona*" AND
NOT ( coronar* ) ) ) ) OR "Corona pandemic" OR (wu-
han W/2 pneumonia) OR "Corona crisis" OR "Corona
outbreak" OR "20I 501Y.V1" OR "20J501Y.V3" OR
"CAL.20C" OR "20H501Y.V2" OR "mRNA 1273 vac-
cine" OR "Covishield" OR "AZD1222" OR
"Ad26.COV2.S" OR "JNJ 78436735" OR "Ad26COVS"
OR "BNT162 vaccine" OR "BNT162-01" OR
"BNT162b1" OR "BNT162a1" OR "BNT162b2" OR
"BNT162c2" ) ) AND SUBJECTS (2743 ) AND (
EXCLUDE ( DOCTYPE , "le" ) OR EXCLUDE ( DOCTYPE
, "ed" ) OR EXCLUDE ( DOCTYPE , "no" ) OR EXCLUDE
( DOCTYPE , "er" ) OR EXCLUDE ( DOCTYPE , "cp" ) OR
EXCLUDE ( DOCTYPE , "sh" ) ) AND ( LIMIT-TO (
PUBYEAR , 2022) OR LIMIT-TO ( PUBYEAR , 2021)
OR LIMIT-TO ( PUBYEAR , 2020) OR LIMIT-TO
( PUBYEAR , 2019 ) )
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Selection of information: All papers published from 2019 through May 14, 2022, were included. We excluded letters, editorials, notes, conference papers, errata, short surveys, and papers whose metadata did not allow for analysis. The sample size of our study was the data generated during that period.

Data analysis: The information collected was exported to Microsoft Excel 2016. The bibliometric indicators were obtained with the Scival tool (<https://www.scival.com/>). Scival is a software, property of Elsevier, that allows processing large amounts of data and generating powerful bibliometric analyses. With it, we analyzed the following variables: number of documents published, institutions, countries, authors, journals, and type of collaboration. To analyze the different variables, we used different indicators such as citations per document (which evaluates the average citation impact of each of the publications and is calculated by dividing the citation count by the document count), CiteScore (average number of citations received in a year by all articles published in a journal with respect to its 3 previous years) and the SCImago Journal and Rank (value of a citation according to the quality, field and

reputation of the journal).¹⁰ All the resulting information was presented in descriptive tables.

Ethical Aspects: No ethics committee approval was required since the data used were publicly available in the Scopus database and no human or animal interventions were performed.

RESULTS

A total of 737 documents related to Reproductive Medicine and COVID-19 were collected and analyzed, of which 143 were reviews. In addition, 7 articles were eliminated because of damage in their metadata (Figure 1).

It was evident that there were 4 large clusters, where the largest was represented by the red cluster (Coronavirus disease 2019), followed by the green cluster (Pregnancy). These clusters represented most of the co-occurrence in this study topic (Fig 2)

Leila V. Adamyan was the most productive author with 18 publications, while Liona C. Poon had the highest impact (46.4 citations per paper) with her 10 published articles. Alexander D. Makatsariya and Jamilya Khizroeva were the second and third most productive authors, respectively. Among the top 10 most productive authors, the majority were from Russia (8) and the rest from Hong Kong and France (Table 1).

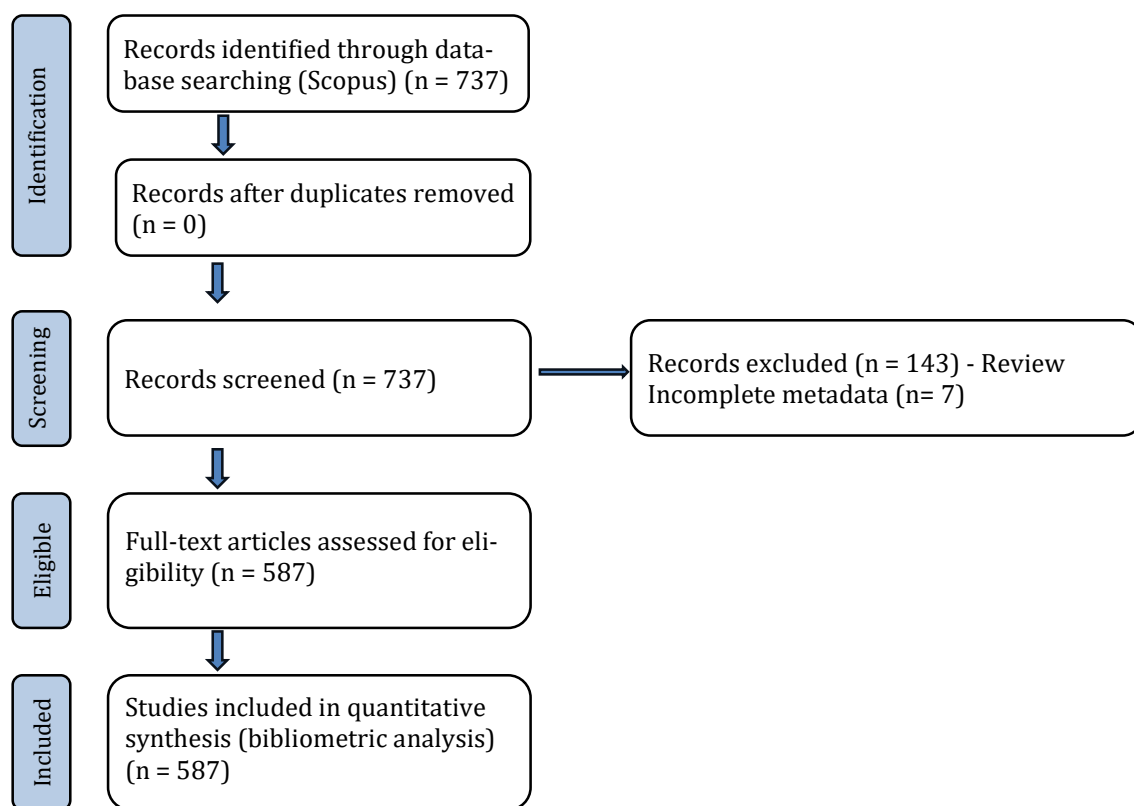


Figure 1: Flow diagram

Table 1: Top ten authors publishing on COVID-19 and Reproductive Medicine

Rank	Author	Documents N (%)	Total citation	Citations per document	h-Index	FWCI	Country
1	Adamian, Leila V.	18 (1.28)	30	1.7	14	1.12	Russia
2	Makatsariya, Alexander D.	16 (1.14)	44	2.8	10	0.94	Russia
3	Khizroeva, Jamilya Kh	15 (1.07)	40	2.7	9	0.82	Russia
4	Bitsadze, Victoria Omarovna	15 (1.07)	40	2.7	9	0.82	Russia
5	Tretyakova, Maria V.	14 (1.00)	40	2.9	5	0.88	Russia
6	Vechorko, Valeriy I.	13 (0.93)	27	2.1	4	1.52	Russia
7	Filippov, O. S.	11 (0.79)	22	2	4	1.17	Russia
8	Shkoda, A. S.	11 (0.79)	34	3.1	5	0.93	Russia
9	Poon, Liona C.	10 (0.71)	464	46.4	57	17.19	Hong Kong
10	Elalamy, Ismail	10 (0.71)	36	3.6	34	1.05	France

FWCI: Field-weighted citation impact

Table 4a: Documents on COVID-19 and Reproductive Medicine according to Cite Score Quartile (2019–2022)

CiteScore Quartile	2019	2020	2021	2022	Total
Q1	0	83	166	56	305
Q2	0	51	116	40	207
Q3	0	45	38	10	93
Q4	0	35	67	7	109
Total	0	214	387	113	714

Table 4b: Documents on COVID-19 and Reproductive Medicine according to type of collaboration (2019–2022)

Collaboration	Percentage (%)	Documents	Citations	Citations per document	FWCI
International	22.8%	166	2439	14.7	5.27
Only national	46.8%	340	3129	9.2	4.25
Only institutional	24.6%	179	1529	8.5	3.21
Single authorship (no collaboration)	5.8%	42	100	2.4	1.08

FWCI: Field-weighted citation impact

Sechenov First Moscow State Medical University (Russia) was the most productive institution (29 publications); however, Huazhong University of Science and Technology (China) was the institution with the highest impact (43.5 citations per paper), despite having only 22 publications. Russian Ministry of Health and A.I. Yevdokimov Moscow State University of Medicine and Dentistry were the second and third institutions with the second and third highest scientific production with 26 and 24 publications, respectively. Most of the 10 most productive institutions were Russian and French (Table 2).

Regarding the journals, *European Journal of Obstetrics, Gynecology and Reproductive Biology* was the journal with the highest number of publications (52), followed by *Contraception* (30) and *Andrology* (29). However, the journal with the highest impact was *Fertility and Sterility* with 23.7 citations per paper and 28 publications (Table 3).

Based on the CiteScore, there is an increase in the number of publications in 2021 compared to 2020. In addition, there is a higher percentage of articles published in first quartile (Q1) journals during 2021. Most publications had national-only collaboration (340 papers; 46.8%), followed by institutional-only collaboration (179 papers; 24.6%), international collaboration (166 papers; 22.8%) and no collaboration (42 papers; 5.8%). However, it was international collaboration (14.7 citations per document) that had the greatest impact over national collaboration (9.2 citations per document) (Table 4).

DISCUSSION

The impact of COVID-19 on medical knowledge and research has been of such magnitude that it has modified the objectives, promoted the production and oriented the diagnostic, preventive and therapeutic purpose of scientific production in the various areas, not being exempt from these, the area of Reproduc-

tive Medicine. Therefore, we conducted a bibliometric analysis from 2019 to 2022 in terms of number of published articles, author citations, institutions, and journals. The present bibliometric study found and analyzed 737 published articles, yielding several key observations.

Bibliometric analysis studies allow to analyze huge amounts of publications and to identify new gaps and opportunities in research on a given topic.⁹⁻¹¹ Regarding the topic of this study, only one previous bibliometric analysis evaluating sexual behavior during the pandemic by COVID-19 using the Scopus database was reported, and it found many articles with more than half of them funded.⁸

We report that, within the top 10 authors with the highest output, the first 8 belong to the Russian Federation and that Leyla V. Adamian was the author with the highest scientific output. Among her most cited recent articles was a comparative study with preliminary data that concluded that the COVID-19 vaccine "Gam-COVID-Vac" (Sputnik-V) had no adverse effects on semen parameters and serum level of sex hormones.¹² This is in accordance with previous studies which have reported that, recently, Russia presents a good scientific production related to COVID-19 vaccines [13] and that, moreover, since the beginning of the pandemic, Russia has reported a remarkable production on COVID-19.¹⁴ Despite all this, the author with the greatest scientific impact was Liona C. Poon from Hong-Kong, and her most cited study was a systematic review that evaluated the effect of COVID-19 on pregnancy, perinatal and neonatal stage, finding that more studies are still needed to establish an association between pregnancy and COVID-19 severity or complications.¹⁵ This may be explained by the fact that Hong Kong was one of the countries with the highest production of COVID-19 early in the pandemic.¹⁶

Similarly, among the most productive institutions, most are Russian and are led by Sechenov First Moscow State Medical University. Among their most

highly cited recent studies is a genetic study that analyzed the possible effect between COVID-19 and female fertility, finding some mimicry between SARS-CoV-2 glycoproteins and proteins related to oogenesis.¹⁷ However, it was the Chinese institution Huazhong University of Science and Technology that had the greatest scientific impact by presenting the highest citation per paper. A possible explanation could be the fact that if both China and the USA are the countries that have led the scientific production on COVID-19,^{18,19} and not only that, but this institution has previously reported to be one of the most productive regarding the topic of COVID-19.¹⁴⁻²⁰

The European Journal of Obstetrics, Gynecology and Reproductive Biology reported the highest number of publications and among its most recent publications were a review on implications that COVID-19 has generated in the worldwide provision of gynecological services²¹ and another review that analyzed reports of COVID-19 in pregnancy during the first 8 months of the pandemic.²² Despite this, it was the American journal Fertility and Sterility that had the greatest impact by presenting the most citations per paper. Among its most recently cited articles was a retrospective cohort that determined that frozen-thawed embryo transfer is not altered by either infection or COVID-19 vaccination [23]. The fact that it is a Q1 journal and that American journals reported higher productivity on COVID-19 during the pandemic¹⁸ could justify this higher impact.

We found that there was an increase in the number of publications between 2020 and 2021 and it was mostly in Q1 journals; this could be explained by the fact that the most emerging COVID-19 topics in current research²⁴ and that publications related to reproductive medicine and COVID-19 have received more interest in the scientific community. While the most frequent type of collaboration was national solo, it was international collaboration that had the greatest impact. This is consistent with the general picture regarding COVID-19, which has shown high international collaboration, especially between the USA, China, and Europe.¹⁹

LIMITATIONS

Limitations of this study include the fact that only publications and bibliometric data from the Scopus database were used, which does not necessarily reflect the totality of publications in our study topic; however, it has been previously reported that Scopus encompasses many journals and publications compared to other databases, which in a way can ensure that most publications in our topic were covered.²⁵ As a second limitation, publications with study types such as editorials, notes and letters to the editor were excluded, so the resulting amount is lower than the real one; however, these documents do not usually have a significant contribution in our study topic, since, with respect to COVID-19, most publications have been original studies and reviews.¹⁴ Although

we considered papers published up to May 2022, as COVID-19 is an emerging research topic, new papers are published every day, so new updates are recommended on a constant basis.

CONCLUSION

In conclusion, articles related to reproductive medicine and COVID-19 are mostly published by Russian authors and institutions, but the greatest impact is made by authors and institutions from Eastern countries such as China. In addition, there has been an increase in publications in first quartile journals, which would reflect a growing interest of the scientific community in this topic. In turn, publications with international collaboration reported the highest impact, which reinforces this growing interest. However, because COVID-19 has generated new research opportunities, new articles are constantly being published, so future bibliometric analyses are recommended to better analyze the topic.

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