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COVID-19: Mapping the Peer-Reviewed Research

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Abstract

Novel coronavirus is a new addition in the family of coronaviruses and was first reported in December 2019 in China. SARS and MERS were the earlier forms of viruses in this family of viruses. The outbreak was considered a pandemic in March 2020 by WHO. The pandemic moved the health sciences researchers around the world to study various aspects of widespread disease. To know the volume and hotspots of COVID-19 research this study is prepared using the bibliometric method of research evaluation. Scopus and Web of Science; two most widely used indexing databases are used to retrieve the already published research on the COVID-19 pandemic. Two data sources are selected for comprehensive coverage. Health scientists have carried out 1060 research studies on the pandemic until now. These publications have been cited with an average of 1.4 citations per publication. China is leading in producing COVID-19 research followed by the United States of America and the United Kingdom with 32%, 13%, and 6% share respectively. Top-ranked journals categorized in first and second quartiles are publishing most of the research on COVID-19. BMJ, the Lancet, and Journal of Medical Virology are the most preferred journals by the researchers to publish their research on COVID-19.

Keywords

bibliometrics, research output, research hotspot, coronavirus, novel coronavirus, COVID-19, 2019-nCoV acute respiratory disease, SARS-CoV-2

Introduction

Humans are familiar with the pandemics as they have faced deadly diseases over the course of history; be it smallpox, cholera, influenza, plagues, HIV/AIDS, Ebola or coronavirus in current times. Coronavirus is a term known for group of viruses that cause respiratory diseases in humans.

The early viruses in the family are SARS and MERS. Novel coronavirus is new addition in this group of viruses reported in December 2019 in China. A pneumonia of unknown cause was first identified in December 2019 and reported in WHO country office in China on the last day of year 2019. The disease was detected in Wuhan in the Hubei province of China. WHO issued its guidance on novel coronavirus and issued a tool to countries to check their ability to detect the virus. China made publically available the genome sequencing of novel coronavirus opening a way for other countries to develop diagnostic kits. WHO declared the outbreak as public health emergency of international concern first at the end of January 2020 and characterized it as a pandemic then later on March 11, 2020 (“Coronavirus (COVID-19) events as they happen,” 2020). WHO recommended the interim name of the outbreak as “2019-nCoV acute respiratory disease” that was finally named as “COVID-19”. The virus was given the name “SARS-CoV-2” (“Naming the coronavirus disease (COVID-19) and the virus that causes it,” 2020).

As of April 10, 2020, the virus has spread in the six regions of WHO named Europe, Americas, Western Pacific, Eastern Mediterranean, South-East Asia and Africa. There are 1.4 million confirmed cases of COVID-19 with more than 85000 deaths. United States of America is the most affected county with highest number of 0.4 million cases followed by Spain and Italy with more than 0.1 million confirmed cases for each (“WHO COVID-19 Dashboard,” 2020). It is feared that the numbers of affected people and mortalities may increase many folds in coming months.

The COVID-19 pandemic stimulated the research community to collect, arrange and disseminate scientific information on new disease. Medical scientists and health specialists are working to describe clinical characteristics of COVID-19 patients (Chen et al., 2020; Guan et al., 2020; Hu et al., 2020; Jiang et al., 2020; W. Yang et al., n.d.; Zhang et al., 2020). Teams and organizations are doing experimentations to produce vaccination (Ahmed, Quadeer, & McKay, 2020; Dhama et al.,

2020; Liu et al., 2020; Prompetchara, Ketloy, & Palaga, 2020). Economists are estimating the economic impact of the pandemic and governments are allocating funds to mitigate the reverse effects (Anderson, Heesterbeek, & Klinkenberg, 2020; Baldwin, Weder, & Mauro, 2020; Fernandes, 2020; McKibbin & Fernando, 2020; Stratton, 2020). With these multifaceted contributions from different segments of humanity and scientific fraternity, we put our contribution in a different way to help the researchers in the field with the mapping of published research on this pandemic as scientific community is interested to know the hotspots and volume of COVID-19 research.

This mapping of research will help researchers to know the status of already published literature on COVID-19, hence, providing a reference for future studies. Further, the study will provide empirical evidence to WHO and other relevant bodies to identify the countries and regions where the outbreak exists but no or little research is being produced. For this, we use bibliometric methods to map the research output on COVID-19 to answer the following research questions:

1. What is the volume of research published on COVID-19 so far?
2. What are the hotspots of research on COVID-19?
3. Is this research being noticed and cited by fellow researchers?
4. Which institutions are researching on COVID-19?

This study is prepared with the prime objective to provide a revealing picture of peer-reviewed literature on the COVID-19 that has already been published in the initial months of outbreak of disease. The other supplementary objectives of study are:

- To identify the countries and areas producing research on COVID-19.
- To know the size of research on COVID-19 that has been produced so far.

- To know the publication patterns of this research.

Review of Literature

SARS-CoV (severe acute respiratory syndrome coronavirus) and MERS-CoV (Middle East Respiratory Syndrome) were the earlier forms of coronavirus family of the viruses. Much scientific literature has been published on the outbreaks of these earlier forms of coronavirus. Several studies (Chiu, Huang, & Ho, 2004; Jarneving, 2007; Kostoff & SA Morse, 2011; L.-M. Yang & Yang, 2005; Zehra, 2011; Zyoud, 2016) have been prepared to map that literature.

COVID-19, the latest form of the coronavirus gained attention of the scientific and research community of the world since its early spread in China. Research studies are being carried out to control the pandemic. Bibliometricians have started mapping this research in order to identify the patterns of COVID-19 research. (LOU et al., 2020) prepared a bibliometric report to analyze the research output on COVID-19. Authors extracted the data from PubMed database. Study observed that China contributed most of the research data during the outbreak of disease. Study further observed that hospitals being the frontline institutions facing the pandemic are producing the COVID-19 research as well. More than of 40% corresponding authors were found to be affiliated with hospitals. (Dong et al., 2020) observed in their study that clinical characterization, epidemiology and virus transmission are more focused areas of research on COVID-19. Authors further observed that topics like vaccines, therapeutics and genomics accounted for less than 10% of their research on COVID-19.

Using Science Citation Index of Web of Science database (Bonilla-Aldana et al., 2020) observed that USA is taking lead in publishing COVID-19 research followed by China. South Korea and Hong Kong contributed with 10 % of research on disease. Saudi Arabia contributed the most from

Middle East region. (Chahrour et al., 2020) prepared a study on current status of research on coronavirus using PubMed database. Authors observed that Asian countries produced 77% of total publications on the disease. China, being the early epicenter of disease contributed the highest number of publications on COVID-19 research followed by United States of America.

(Hossain, 2020) identified that genetic, epidemiological and zoonotic are major topics that are associated with COVID-19 research. The mean number of authors per document was 3.91, while the mean for citation per document was recorded as 2.47. The study observed the varying progress in different areas of knowledge on COVID-19 research.

(Homolak, Kodvanj, & Virag, 2020) observed that due to overproduction of scientific data on COVID-19, there are possibilities of difficulties in making the information available and research collaborating at start of disease. Authors believed that to find solutions to control the pandemic, the researchers could have used the data efficiently.

Since the scientific literature is coming fast on COVID-19 pandemic, this study tries to include the missed literature by previous studies by incorporating more recently published research. Most of the bibliometric studies have selected a single indexing database to retrieve the research publications. This study used Web of Science and Scopus, two most widely used indexing databases to retrieve results. Selection of two largest indexing and abstracting databases makes this study a unique of its kind with very little chance of missing any published scientific research.

Methodology

For this study, two largest multidisciplinary databases of peer-reviewed literature, Web of Science and Scopus, were used to get maximum coverage of the scholarly publications of Coronavirus (Covid-19) published after the burst of this pandemic. The authors used “Covid 19” as a searching

keyword and set basic search as criteria for these two databases. The time frame was set from beginning to April 6, 2020 with no filter applied with the purpose to retrieve maximum number of records. The data was extracted by both the authors simultaneously using the double extraction method to check the data similarity. Both the authors reviewed the data before starting the analysis. Retrieval of COVID-19 records from the databases was completed within one day to avoid the changes in daily updates of databases. The total 1234 retrieved records from both databases (WOS=250, Scopus=984) were imported in Endnote Desktop software. To identify the relevant records, each record was checked twice by authors. 174 duplicate and irrelevant records were deleted. Finally, 1060 records are included in the research study. Refined 1060 records were exported to MS Access. The authors added some additional fields such as database name, author affiliation, gender and authorship types in MS Access database. Microsoft Excel, Microsoft Access and Endnote software were used for data analysis.

Limitations

The study does not cover everything that is published on COVID-19 as the disease is spreading fast around the world and a lot of literature is yet to be published.

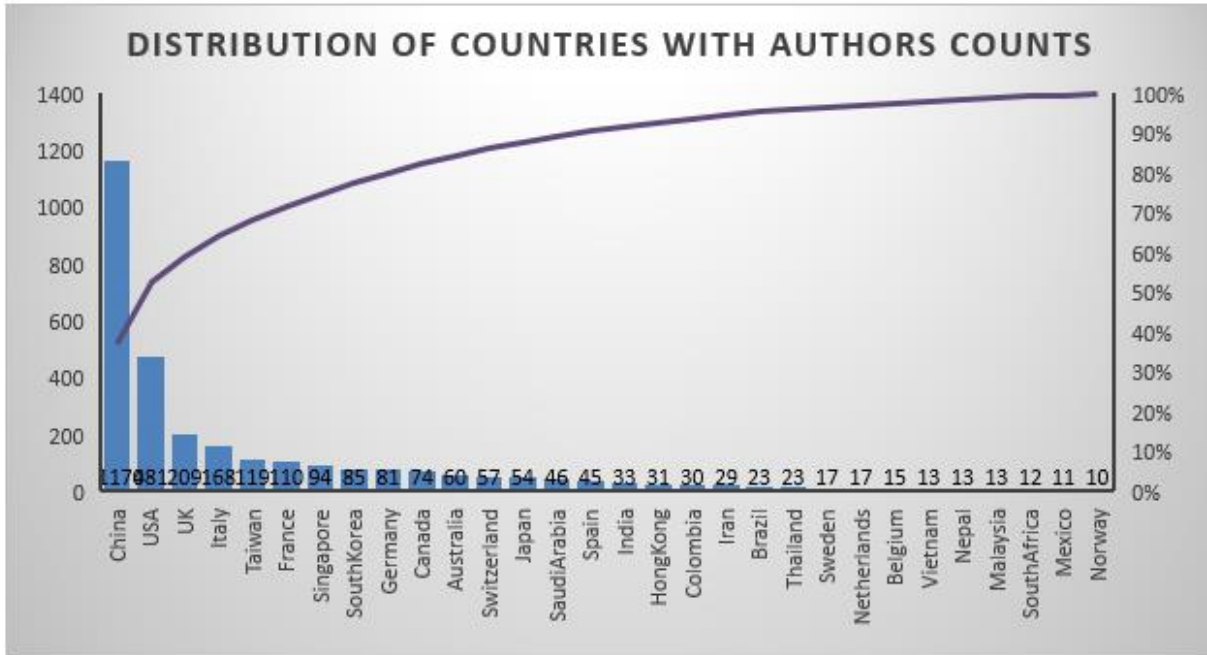
Furthermore, while the Web of Science and Scopus databases are considered to be the most comprehensive multidisciplinary indexing databases of peer-reviewed literature, however, the resources not included in these databases due to indexing and coverage policies are missed.

The study covers COVID-19 research only. The publications on early forms of coronavirus diseases are not included in this study to be focused to showcase COVID-19 research only.

Data Analysis

1060 research studies have been conducted in the early months of COVID-19 pandemic breakout. Most of these research studies are carried out and are published in first quarter of the year 2020. Nearly three quarters of these publications are multi-authored and are collaborative efforts while the rest one fourth are single authored studies. Although these publications are very recent but are being noticed by fellow researchers due to the significance of the topic and concentration of the pandemic. For this reason, these research publications are receiving citations with the onset of their publishing. One fourth of these publications have already been cited so far at least once or more times. These publications have received 1487 citations with an average of 1.4 citations per publication till the time of this study.

To identify the hotspots of research on COVID-19, affiliation country of contributing authors are identified. It was observed that authors of 80 countries are involved in conducting research on different aspects of COVID-19 pandemic. China is leading in producing research on COVID-19 being the early epicenter of disease. Chinese authors have contributed nearly one third of COVID-19 research so far. USA and UK follows China with 13% and 6% contribution respectively. These three countries have produced more than half of COVID-19 research collectively. Other prominent contributors are Italy, Taiwan, France, Singapore, South Korea, Germany, Japan, Canada, Australia and Switzerland. Figure 1 displays top 31 countries producing COVID-19 research with their number of contributing authors.



[Figure 1. Distribution of Countries with Authors Counts]

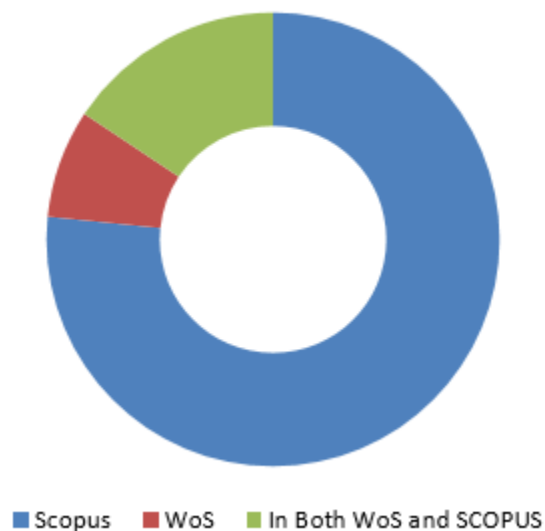
The study observed that research on COVID-19 is being published in top quartile journals. Analysis of most common 20 journals publishing COVID-19 research reveals that 70% journals are ranked in 1st quartile of Web of Science and Scopus databases. 20% of these journals are ranked in 2nd quartile. British Medical Journal -BMJ has published the highest number (118) of research papers with more than 11% of research output on COVID-19 followed by the Lancet and Journal of Medical Virology with 4.72% and 3.40% respectively in Scopus database. BMJ and the Lancet remained the most popular journals in Web of Science database as well with about 4% and 2% of total research on COVID-19 so far. Table 1 displays the most common journals publishing COVID-19 research. Journals quartiles, relevant impact factor and sitescore are provided.

[Table 1. Top 20 Journals Publishing Research on COVID-19]

Journal Title	Publications		Percentage		Quartile		Impact Factor/CiteScore	
	WoS	Scopus	WoS	Scopus	WoS	Scopus	WoS	Scopus
BMJ-British Medical Journal	42	118	3.96	11.13	Q1	Q1	27.604	1.78
The Lancet	18	50	1.70	4.72	Q1	Q1	59.102	10.28
Journal of Medical Virology	6	36	0.57	3.40	Q3	Q2	2.049	1.94
JAMA - Journal of the American Medical Association	-	29	0.00	2.74	Q1	Q1	51.273	6.98
Eurosurveillance	8	26	0.75	2.45	Q1	Q1	7.421	5.05
Travel Medicine and Infectious Disease	-	22	0.00	2.08	Q1	Q1	4.868	1.8
The Lancet Infectious Diseases	-	21	0.00	1.98	Q1	Q1	27.516	6.53
Nature	3	17	0.28	1.60	Q1	Q1	43.07	15.21
Emerging Microbes and Infections	1	18	0.09	1.70	Q1	Q1	6.212	4.36
Science	1	16	0.09	1.51	Q1	Q1	41.063	15.21
New England Journal of Medicine	1	12	0.09	1.13	Q1	Q1	16.1	70.67
Journal of Infection	-	12	0.00	1.13	Q1	Q1	5.099	3.24
Journal of Korean Medical Science	5	12	0.47	1.13	Q2	Q2	1.716	1.6
The Lancet Respiratory Medicine	-	11	0.00	1.04	Q1	Q1	22.992	4.91

Infection Control and Hospital Epidemiology	-	10	0.00	0.94	Q2	Q1	2.856	2.09
Swiss Medical Weekly	2	9	0.19	0.85	Q2	Q2	1.821	1.49
Journal of Microbiology, Immunology and Infection	-	9	0.00	0.85	Q3	Q2	2.455	1.86
The Lancet Global Health	-	8	0.00	0.75	Q1	Q1	15.873	4.51
Radiology	-	8	0.00	0.75	Q1	Q1	7.608	5.83
Chinese General Practice	-	7	0.00	0.66	NA	Q3	NA	0.07

Figure 2 displays the indexing share of COVID-19 research in Scopus and Web of Science databases. Scopus database have indexed more than 90% of research on COVID-19 indicating the broader coverage of database. Web of Science is more selective in journals selection and has indexed nearly a quarter of COVID-19 research. 16% of this research is overlapped in both the selected databases.



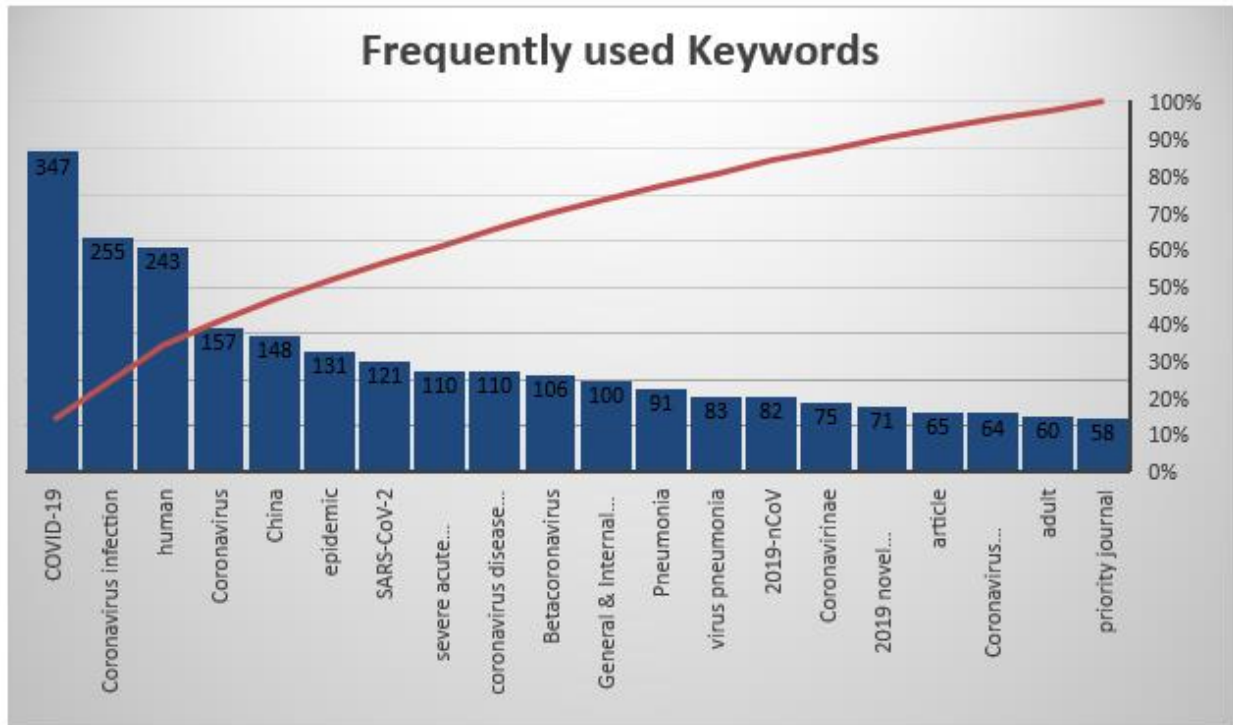
[Figure 2. Share of COVID-19 Research in Web of Science and Scopus Databases]

The most active institutions producing research on the pandemic are identified by checking researchers' institutional affiliations. Most of these institutions are Chinese based universities and research institutes. Huazhong University of Science and Technology hosts the highest number researchers doing research on COVID19 followed by Wuhan University and Fudan University respectively. Table 2 displays top ten institutions involved in COVID-19 research with the number of affiliated authors.

[Table 2. Top Institutes Doing Research on COVID-19]

Institute	Affiliated Authors
Huazhong University of Science and Technology	48
Wuhan University	39
Fudan University	37
Zhongnan Hospital of Wuhan University	26
Department of Medicine	26
Zhejiang University School of Medicine	21
National University Health System	18
University of Hong Kong	18
Chinese Academy of Medical Sciences	17
National Taiwan University College of Medicine	16

The frequently used keywords are presented in Figure 3. There were 20 most used keywords in this list from which 'Covid-19' was the most frequently used keyword (N=347). Similarly, 'Coronavirus infection' was used in 255 publications. The least used keyword in the list was 'priority journal' that were used only in 58 publications.



[Figure 3. Frequently used Keywords]

Conclusion

We expect more research on the topic of much significance and urgency as the pandemic has spread in almost all the regions around the world. Till the time of this study, 1060 research studies have been carried out on COVID-19 pandemic. These publications have been cited 1487 times with an average of 1.4 citations per publication.

China is leading in producing COVID-19 research with 32% of its contribution. The United States of America and the United Kingdom follows China with 13% and 6% of shares respectively.

Top ranked journals categorized in first and second quartiles have published most of the research on COVID-19. BMJ, the Lancet and Journal of Medical Virology are the most preferred journals by the researchers to publish COVID-19 research.

References

- Ahmed, S. F., Quadeer, A. A., & McKay, M. R. (2020). Preliminary Identification of Potential Vaccine Targets for the COVID-19 Coronavirus (SARS-CoV-2) Based on SARS-CoV Immunological Studies. *Viruses*, *12*(254). <https://doi.org/10.3390/v12030254>
- Anderson, R., Heesterbeek, H., & Klinkenberg, D. (2020). How will country-based mitigation measures influence the course of the COVID-19 epidemic? *The Lancet*, *395*(10228). Retrieved from [https://www.thelancet.com/journals/lancet/article/PIIS0140-6736\(20\)30567-5/fulltext?fbclid=IwAR1apByqOLscfnhTdHS4WZLpOo1KZUE80a8F570bjz8mFe_Zq83DE6tlm8Y](https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(20)30567-5/fulltext?fbclid=IwAR1apByqOLscfnhTdHS4WZLpOo1KZUE80a8F570bjz8mFe_Zq83DE6tlm8Y)
- Baldwin, R., Weder, B., & Mauro, D. (2020). *Economics in the Time of COVID-19*. Centre for Economic Policy Research. Retrieved from www.cepr.org
- Bonilla-Aldana, D. K., Quintero-Rada, K., Montoya-Posada, J. P., Ramírez-Ocampo, S., Paniz-Mondolfi, A., Rabaan, A. A., ... Rodríguez-Morales, A. J. (2020). SARS-CoV, MERS-CoV and now the 2019-novel CoV: Have we investigated enough about coronaviruses?-A bibliometric analysis. *Travel Medicine and Infectious Disease*, *33*(January-February). Retrieved from <https://www.ncbi.nlm.nih.gov/pubmed/32007621>
- Chahrour, M., Assi, S., Bejjani, M., Nasrallah, A., Cureus, H. S., & 2020, U. (2020). A Bibliometric Analysis of COVID-19 Research Activity: A Call for Increased Output. *Cureus*, *12*(3). Retrieved from <https://www.cureus.com/articles/29507-a-bibliometric-analysis-of-covid-19-research-activity-a-call-for-increased-output>
- Chen, H., Guo, J., Wang, C., Luo, F., Yu, X., & Zhang, W. (2020). Clinical characteristics and intrauterine vertical transmission potential of COVID-19 infection in nine pregnant women: a retrospective review of medical records. *The Lancet*, *395*(10226). Retrieved from <https://www.sciencedirect.com/science/article/pii/S0140673620303603>
- Chiu, W. T., Huang, J. S., & Ho, Y. S. (2004). Bibliometric analysis of Severe Acute Respiratory Syndrome-related research in the beginning stage. *Scientometrics*, *61*(1), 69–77. <https://doi.org/10.1023/B:SCIE.0000037363.49623.28>
- Coronavirus (COVID-19) events as they happen. (2020). Retrieved April 8, 2020, from <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/events-as-they-happen>
- Dhama, K., Sharun, K., Tiwari, R., Dadar, M., Singh Malik, Y., Pal Singh, K., & Chaicumpa, W. (2020). Human Vaccines & Immunotherapeutics COVID-19, an emerging coronavirus infection: advances and prospects in designing and developing vaccines, immunotherapeutics, and therapeutics. *Taylor & Francis*. <https://doi.org/10.1080/21645515.2020.1735227>
- Dong, M., Cao, X., Liang, M., Li, L., Liu, G., & Liang, H. (2020). Understand Research Hotspots Surrounding COVID-19 and Other Coronavirus Infections Using Topic Modeling. *Medrxiv.Org*. <https://doi.org/10.1101/2020.03.26.20044164>
- Fernandes, N. (2020). *Economic effects of coronavirus outbreak (COVID-19) on the world*

economy. papers.ssrn.com. Retrieved from <https://ssrn.com/abstract=3557504>

Guan, W., Ni, Z., Hu, Y., Liang, W., Ou, C., He, J., ... Zhong, N. (2020). Clinical Characteristics of Coronavirus Disease 2019 in China. *New England Journal of Medicine*. <https://doi.org/10.1056/nejmoa2002032>

Homolak, J., Kodvanj, I., & Virag, D. (2020). Preliminary Analysis of COVID-19 Academic Information Patterns: A Call for Open Science in the Times of Closed Borders. Retrieved from <https://www.preprints.org/manuscript/202003.0443>

Hossain, M. M. (2020). Current Status of Global Research on Novel Coronavirus Disease (COVID-19): A Bibliometric Analysis and Knowledge Mapping. *Papers.Ssrn.Com*. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3547824

Hu, Z., Song, C., Xu, C., Jin, G., Chen, Y., Xu, X., ... Shen, H. (2020). Clinical characteristics of 24 asymptomatic infections with COVID-19 screened among close contacts in Nanjing, China. *Science China Life Sciences*. <https://doi.org/10.1007/s11427-020-1661-4>

Jarneving, B. (2007). The outbreak of SARS mirrored by bibliometric mapping: Combining bibliographic coupling with the complete link cluster method. *Studii de Biblioteconomie Și Știința Informării*, (11), 37–62. Retrieved from <https://www.ceeol.com/search/article-detail?id=173509>

Jiang, F., Deng, L., Zhang, L., Cai, Y., Cheung, C. W., & Xia, Z. (2020). Review of the Clinical Characteristics of Coronavirus Disease 2019 (COVID-19). *Journal of General Internal Medicine*. Springer. <https://doi.org/10.1007/s11606-020-05762-w>

Kostoff, R., & SA Morse. (2011). Structure and infrastructure of infectious agent research literature: SARS. *Scientometrics*, 86(1), 195–209. Retrieved from <https://link.springer.com/article/10.1007/s11192-010-0240-6>

Liu, C., Zhou, Q., Li, Y., Garner, L. V., Watkins, S. P., Carter, L. J., ... Albaiu, D. (2020). Research and Development on Therapeutic Agents and Vaccines for COVID-19 and Related Human Coronavirus Diseases. *ACS Central Science*. <https://doi.org/10.1021/acscentsci.0c00272>

LOU, J., TIAN, S., NIU, S., KANG, X., Lian, H., Zhang, L., & Zhang, J. (2020). Coronavirus disease 2019: a bibliometric analysis and review. *European Review for Medical and Pharmacological Sciences*, 24, 3411–3421. Retrieved from <https://www.europeanreview.org/wp/wp-content/uploads/3411-3421.pdf>

McKibbin, W., & Fernando, R. (2020). The global macroeconomic impacts of COVID-19: Seven scenarios. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3547729

Naming the coronavirus disease (COVID-19) and the virus that causes it. (2020). Retrieved April 8, 2020, from [https://www.who.int/emergencies/diseases/novel-coronavirus-2019/technical-guidance/naming-the-coronavirus-disease-\(covid-2019\)-and-the-virus-that-causes-it](https://www.who.int/emergencies/diseases/novel-coronavirus-2019/technical-guidance/naming-the-coronavirus-disease-(covid-2019)-and-the-virus-that-causes-it)

Promptchara, E., Ketloy, C., & Palaga, T. (2020). Allergy and Immunology Immune responses in COVID-19 and potential vaccines: Lessons learned from SARS and MERS epidemic. *Asian Pacific Journal of Allergy and Immunology*. <https://doi.org/10.12932/AP-200220-0772>

- Stratton, S. J. (2020). COVID-19: Not a Simple Public Health Emergency. *Prehospital and Disaster Medicine*, 35(2). Retrieved from <https://www.cambridge.org/core/journals/prehospital-and-disaster-medicine/article/covid19-not-a-simple-public-health-emergency/2425C669F59CF3B5F07DA33F78DC20E8>
- WHO COVID-19 Dashboard. (2020). Retrieved April 8, 2020, from <https://who.sprinklr.com/>
- Yang, L.-M., & Yang, L.-L. (2005). A Bibliometric Study on SARS in MEDLINE. In *Proceedings of ISSI*. Retrieved from http://issi-society.org/proceedings/issi_2005/Yang2_et_al_ISSI2005.pdf
- Yang, W., Cao, Q., Qin, L., Wang, X., Cheng, Z., Pan, A. (2020). Clinical characteristics and imaging manifestations of the 2019 novel coronavirus disease (COVID-19): A multi-center study in Wenzhou city, Zhejiang, China. *Elsevier*. Retrieved from <https://www.sciencedirect.com/science/article/pii/S0163445320300992>
- Zehra, F. (2011). *LITERATURE ON SEVERE ACUTE RESPIRATORY SYNDROME (SARS) (2003-2011): A BIBLIOMETRIC STUDY*.
- Zhang, J. jin, Dong, X., Cao, Y. yuan, Yuan, Y. dong, Yang, Y. bin, Yan, Y. qin, ... Gao, Y. dong. (2020). Clinical characteristics of 140 patients infected with SARS-CoV-2 in Wuhan, China. *Allergy: European Journal of Allergy and Clinical Immunology*. <https://doi.org/10.1111/all.14238>
- Zyoud, S. H. (2016). Global research trends of Middle East respiratory syndrome coronavirus: A bibliometric analysis. *BMC Infectious Diseases*, 16(1). <https://doi.org/10.1186/s12879-016-1600-5>