Research Article

A Holistic Investigation of Global Outputs of Covid-19 Publications in Neurology and Neurosurgery

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Abstract

Objectives: Neurological and neurosurgical management of the global COVID-19 crisis could only be possible by extending the current literature and rapidly delivering this current data to clinicians. The purpose of this study is to analyze the global outputs of COVID-19 in the field of neuroscience through bibliometric methods and provide a guide to researchers who would like to contribute to the literature by conducting research in this field.

Methods: Bibliometric analysis was performed for all the publications in Web of Science database in Neurosciences Neurology (Clinical Neurology, Neurosciences, Neuroimaging) research areas and included the "COVID-19", "coronavirus", "2019-nCoV", "n-CoV", and "SARS-CoV-2" keywords in their title.

Results: The literature review included 13785 publications in all research areas. Of these publications, 459 were published in the field of Neurosciences Neurology. The top 5 countries that produced the highest number of publications were the USA (139, 30.2%), Italy (110, 23.9%), UK (57, 12.2%), China (49, 10.6%), and Germany (43, 9.3%). The journals that produced the highest number of publications were Brain Behavior and Immunity, Journal of Neurology, Neurological Sciences, Nature Human Behavior and Acta Neurochirurgica. The most commonly investigated topics were stroke, encephalitis, depression, mental health, stress, neurosurgery, Parkinson's disease, Guillain-Barre syndrome, multiple sclerosis, anxiety, and headache.

Conclusion: The present study has the potential to provide a guide that can contribute to the improvement in the literature.

Keywords: Bibliometric analysis, coronavirus, COVID-19, neurology, neurosurgery, SARS-CoV-2

Cite This Article: Kiraz M. A Holistic Investigation of Global Outputs of Covid-19 Publications in Neurology and Neurosurgery. EJMI 2020;4(4):506–512.

After the first coronavirus-related pneumonia cases were reported in Wuhan, China in December 2019, the WHO named this disease as the 2019 novel coronavirus disease (COVID-19).[1] Although the articles written and the explanations made in the early periods of the disease highlighted the respiratory system-related symptoms, the cases indicating the effects on the central nerve system (CNS) were also reported when the prevalence of COVID-19 continued to increase globally.[2] A study involving 214 patients in China concluded that COVID-19 could infect the nerve system and the infected individuals could commonly have neurological symptoms.[3]

Bibliometrics is briefly defined as the analysis of scientific outputs such as articles and books using statistical methods.[4–6] Citation analysis is a way of measuring the relative efficiency of an author, article, or publication, or how many times they have been cited by other publications.[7] Bibliometric analyses enable to reveal the efficiency of a specific author, country, or journal on a specific field by summarizing thousands of publications on a specific topic or
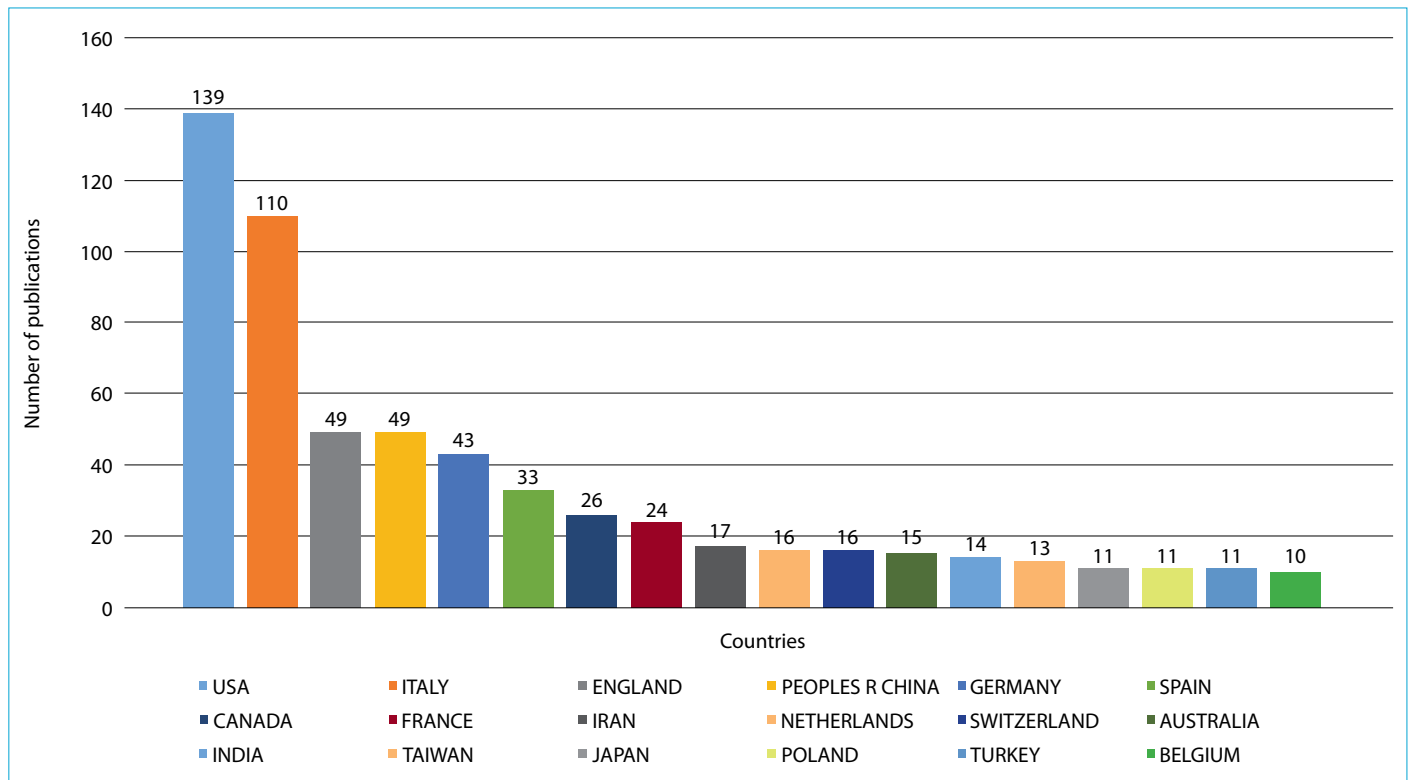

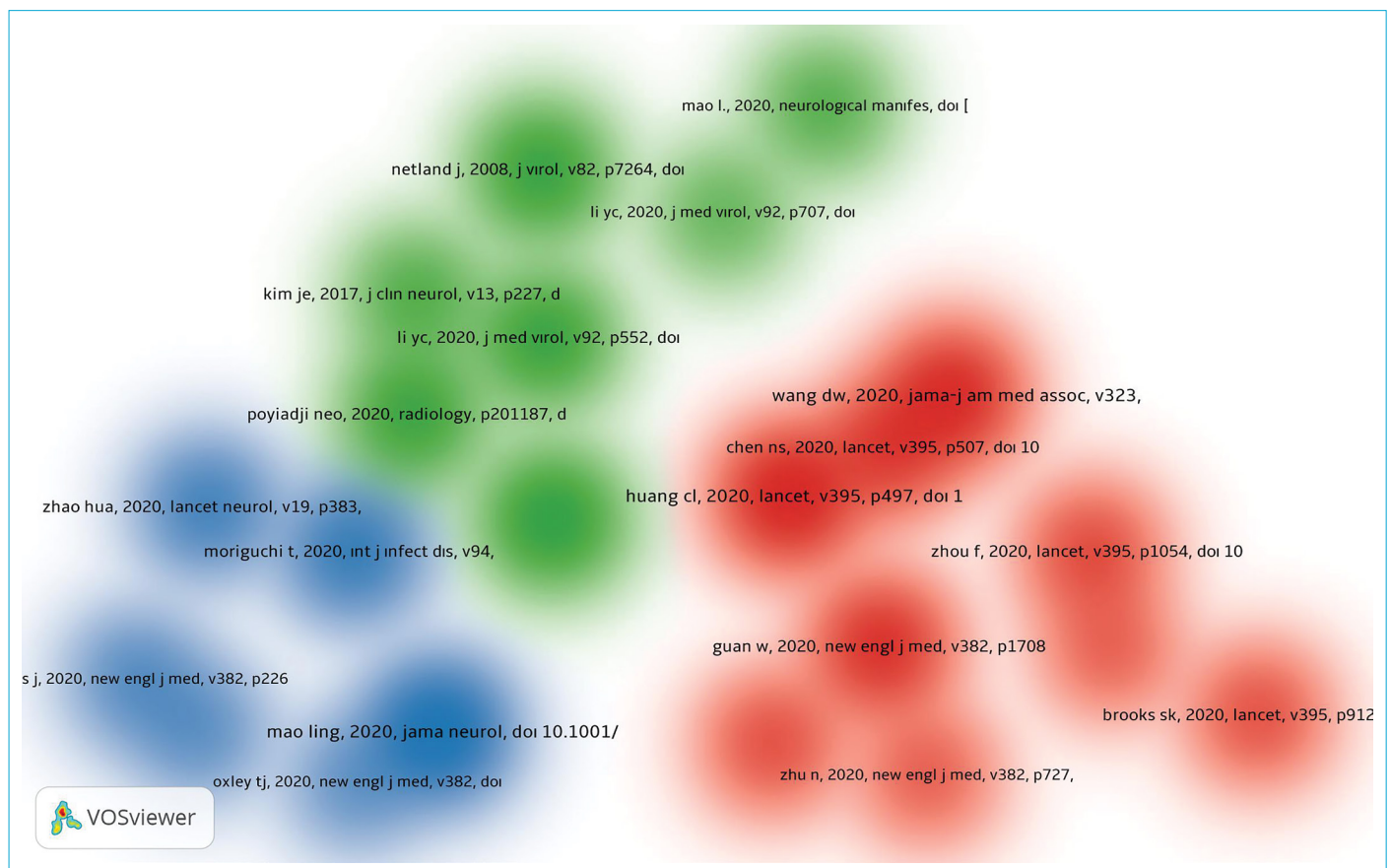**Figure 1.** Active countries on COVID-19 in neuroscience neurology.

Figure 2. Cluster visualization map for co-citation analysis on COVID-19 in neuroscience neurology.
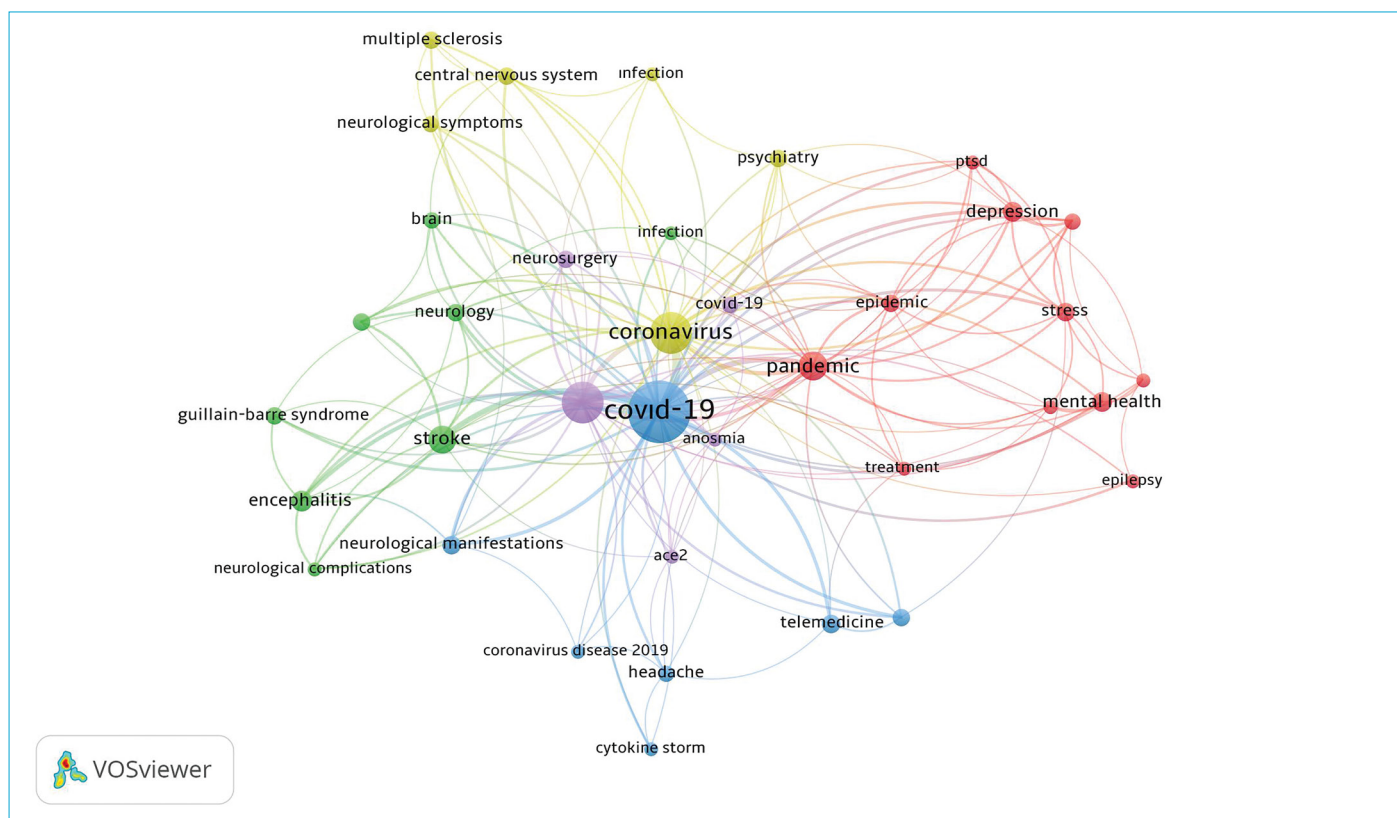
Figure 3. Network visualization cluster map for keyword analysis on COVID-19 in Neuroscience Neurology; Footnote: The colors indicate the cluster of keywords. The size of the circles indicates that the keyword is used frequently. The thickness of the lines indicates the strength of relationship.

research through statistical methods.[8,9] In addition to the technological and developmental levels of the countries, the effects of the pandemic as well have led to an increase in the number of publications in literature every day. Parallel to the increase in the number of publications, the popularity of bibliometric studies has increased in recent years due to the difficulties experienced in the literature review, and many bibliometric studies have been conducted in the field of health.[4–11]

Neurological and neurosurgical management of the global COVID-19 crisis could only be possible by extending the current literature and rapidly delivering this current data to clinicians. The purpose of this study is to analyze the global outputs of COVID-19 in the field of neuroscience through bibliometric methods and provide a guide to researchers who would like to contribute to the literature by conducting research in this field.

Methods

Web of Science (WoS: by Clavariate Analytics) database was utilized for literature review (access date: 01.07.2020). Bibliometric analysis was performed for all the publications published between 2019 and 2020 in WoS database in Neurosciences Neurology (Clinical Neurology, Neuro-

sciences, Neuroimaging) research areas and included the "COVID-19", "coronavirus", "2019-nCoV", "n-CoV", and "SARS-CoV-2" keywords in their title (*"COVID-19" or "SARS-CoV-2" or "2019-nCoV" or "n-CoV" or "coronavirus" Refined by: Research Areas: (Neurosciences Neurology) Timespan: 2019-2020. Indexes: SCI-Expanded, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI).* VoS viewer (Version 1.6.13) package program was utilized for bibliometric network visualizations.[12]

Results

The literature review included 13785 publications in all research areas. Of these publications, 459 were published in the field of Neurosciences Neurology. This study performed the bibliometric analysis of 459 publications in the field of Neurosciences and Neurology. The publication types were distributed as Letters (172, 37.4%), Early Access (145, 31.5%), Articles (123, 26.7%), Editorial Materials (107, 23.3%), Reviews (54, 11.7%) and others (News Item (2, 0.4%), Correction (1, 0.2%). The same study can be tagged in more than one publication category.

Research Areas

The top 5 research areas where the articles were published together with the Neurosciences Neurology research fields included Psychiatry (97, 21.1%), Immunology (61, 13.2%),

Surgery (36, 7.8%), Psychology (21, 4.5%) and Science Technology Other Topics (21, 4.5%) respectively.

Active Countries

The top 5 countries that produced the highest number of publications were the USA (139, 30.2%), Italy (110, 23.9%), UK (57, 12.2%), China (49, 10.6%), and Germany (43, 9.3%) respectively. Figure 1 displays the other countries that produced 10 or more publications.

Active Organization

The top-ten active organization-enhanced that produced the highest number of publications were University of London (21), Harvard University (18), Johns Hopkins University (17), Institut National de la Sante et de la Recherche Medicale (Inserm) (14), University of California System (14), University College London (13), Centre National De La Recherche Scientifique Cnrs (10), University of Brescia (10), Catholic University of the Sacred Heart (9), and Huazhong University of Science Technology (9).

Active Authors

The top 8 authors who produced the highest number of publications (had at least 4 publications) were Schiariti V (6), Tedeschi G (6), Calabresi P (4), Filippi M (4), Fontanella MM (4), Matias-Guiu J (4), Merello M (4), and Sharma VK (4) respectively.

Active Journals

The 459 publications were published in 107 journals. Table 1 displays the total number of citations and the number of citations per publication in the 28 journals that produced at least 5 publications.

Citation Analysis

Table 2 displays the top-cited 10 articles on COVID-19 in the Neuroscience Neurology research area.

Co-Citation Analysis

The references sections of the 459 publications were found to cite 5463 publications. Among these, 22 publications were co-cited in more than 20 publications. Figure 2 displays the co-citation network visualization between these publications. The top 5 publications with top co-citation included Mao et al. (2020) (Number of co-citation, NC: 61) (3), Huang et al.[13] (2020) (NC: 56), Baig et al.[14] (2020) (NC: 49), Wang et al.[15] (2020) (NC: 48), and Guan et al.[16] (2020) (NC: 44).

Trend Topics

There were 546 different keywords used in the 459 publications. The network visualization of the cluster analysis performed with 35 keywords used in 4 different articles is demonstrated in Figure 3. These keywords are also presented in Table 3.

Discussion

Some studies in the literature reported a significant effect of the economic size or developmental levels of countries on academic publication productivity.[4–6] In this study, analysis of the COVID-19 publication distributions of the world

Table 1. Active journals on COVID-19 in neuroscience neurology

Journals	RC	C	AC	Journals	RC	C	AC
Brain Behavior and Immunity	61	125	2.05	Psychiatry and Clinical Neurosciences	8	41	5.13
Journal of Neurology	23	14	0.61	Revue Neurologique	8	9	1.13
Neurological Sciences	23	26	1.13	Developmental Medicine and Child Neurology	7	6	0.86
Nature Human Behaviour	21	30	1.43	Muscle & Nerve	7	5	0.71
Acta Neurochirurgica	17	29	1.71	Annals of Neurology	6	1	0.17
Movement Disorders	16	40	2.50	Journal of Neuro-Oncology	6	4	0.67
European Journal of Neurology	15	31	2.07	European Archives of Psychiatry and Clinical Neuroscience	5	1	0.20
Neurologia	14	12	0.86	Global Spine Journal	5	1	0.20
Journal of the Neurological Sciences	13	27	2.08	Journal of Neurovirology	5	0	0.00
Clinical Neuropsychiatry	12	7	0.58	Journal of Neuroimmune Pharmacology	5	2	0.40
ACS Chemical Neuroscience	11	101	9.18	Journal of Stroke	5	3	0.60
Headache	10	11	1.10	Neurology	5	32	6.40
Frontiers in Neurology	9	4	0.44	Spinal Cord	5	2	0.40
World Neurosurgery	9	2	0.22	Stroke	5	18	3.60

RC: Record count; C: Number of citation; AC: Average citation per document; ACS: American chemical society.

countries showed that the top 5 countries with the biggest economy (the USA, Italy, UK, China, Germany) were among the countries affected by the COVID-19 pandemic most. On the other hand, Spain, France, and Iran were among the top 10 countries that produced the highest number of publications, which indicates that pandemic-related death rates had effects on publication productivity apart from the economic development.

When the articles were analyzed in terms of the total number of citations, the top-cited article was found to be the study entitled "Evidence of the COVID-19 Virus Targeting the CNS: Tissue Distribution, Host-Virus Interaction, and Proposed Neurotropic Mechanisms" written by Baig, AM et al. in the ACS Chemical Neuroscience.[14] This study was followed by the study conducted by Shigemura, J. et al.[17] entitled "Public responses to the novel 2019 coronavirus (2019-nCoV) in Japan: Mental health consequences and target populations" published in the Psychiatry and Clinical Neurosciences.The third top-cited article was the study by Wu, Y. et al. published in the Brain Behavior and Immunity

with the title of "Nervous system involvement after infection with COVID-19 and other coronaviruses".[18] Co-citation analysis results showed that all the articles that were analyzed commonly cited the studies conducted by Mao et al. (2020), Huang et al. (2020), Baig et al. (2020), Wang et al. (2020) and Guan et al.[3,13–16] (2020). Researchers interested in this topic are recommended to read these studies first.

The journals that produced the highest number of publications about COVID-19 in the Neuroscience neurology research area were Brain Behavior and Immunity, Journal of Neurology, Neurological Sciences, Nature Human Behavior and Acta Neurochirurgica respectively. Researchers interested in this topic could consider these journals.

According to the trend keywords analysis results about COVID-19 in the Neuroscience neurology research area, the COVID-19 pandemic had an important effect in Neurosurgery, Neurology, and Psychiatry areas. The most commonly investigated topics were Stroke, encephalitis, depression, mental health, stress, neurosurgery, Parkinson's disease, Guillain-Barre syndrome, multiple sclerosis,

Table 2. The 10 most cited manuscripts on COVID-19 in neuroscience neurology

No	Article	Author	Journal	TC
1	Evidence of the COVID-19 Virus Targeting the CNS: Tissue Distribution, Host-Virus Interaction, and Proposed Neurotropic Mechanisms	Baig, AM. et al.	ACS Chemical Neuroscience	89
2	Public responses to the novel 2019 coronavirus (2019-nCoV) in Japan: Mental health consequences and target populations	Shigemura, J. et al.	Psychiatry And Clinical Neurosciences	30
3	Nervous system involvement after infection with COVID-19 and other coronaviruses	Wu, Y. et al.	Brain Behavior And İmmunity	27
4	Guillain Barre syndrome associated with COVID-19 infection: A case report	Sedaghat, Z. et al.	Journal Of Clinical Neuroscience	15
5	Neurosurgery during the COVID-19 pandemic: update from Lombardy, northern Italy	Zoia, C. et al.	Acta Neurochirurgica	14
6	Central nervous system manifestations of COVID-19: A systematic review	Asadi-Pooya, AA. et al.	Journal Of The Neurological Sciences	13
7	Protected Code Stroke Hyperacute Stroke Management During the Coronavirus Disease 2019 (COVID-19) Pandemic	Khosravani, H. et al.	Stroke	13
8	Acute-onset smell and taste disorders in the context of COVID-19: a pilot multicentre polymeras chain reaction based case-control study	Beltran-Corbellini, A. et al.	European Journal Of Neurology	12
9	Using social and behavioural science to support COVID-19 pandemic response	Van Bavel, JJ. et al.	Nature Human Behaviour	12
10	A longitudinal study on the mental health of general population during the COVID-19 epidemic in China	Wang, C. et al.	Brain Behavior And İmmunity	11

TC: Total citation; ACS: American chemical society.

Table 3. The first trend keywords on COVID-19 in neuroscience neurology

Keyword	O	Keyword	O
covid-19	165	psychiatry	6
coronavirus	62	thrombectomy	6
sars-cov-2	62	anxiety	5
pandemic (s)	27	brain	5
stroke	21	headache	5
encephalitis	10	neurological symptoms	5
depression	9	ace2	4
mental health	9	anosmia	4
neurological manifestations	8	coronavirus disease 2019	4
stress	8	cytokine storm	4
telemedicine	8	epilepsy	4
neurosurgery	7	ınfection	4
parkinson's disease	7	infection	4
central nervous system	6	neurological complications	4
epidemic	6	psychological distress	4
guillain-barre syndrome	6	ptsd	4
multiple sclerosis	6	treatment	4
neurology	6		

O: Number of occurrences.

anxiety, and headache.

The use of only the WoS database rather than other databases such as PubMed and Scopus could be considered as a limitation of the present study. The reason for this limitation could be the fact that the WoS database indexes articles in the journals with higher impact levels and that citation analysis cannot be obtained in databases such as PubMed.[4,5]

Conclusion

The present study is the first study that makes a comprehensive bibliometric analysis of the COVID-19 global outputs in the Neuroscience research area in the Web of Science database. The number of COVID-19 cases continues to increase rapidly worldwide. The increased number of cases has been affecting the neurology and neurosurgery practice more and more every day. We predict that the literature will continue to improve parallel to the increased number of cases. The present study has the potential to provide a guide that can contribute to the improvement in the literature; however, more comprehensive bibliometric studies will be needed as the number of publications in the literature continues to increase.

Disclosures

This article does not contain any studies with human participants or animals performed by any of the authors.

References

1. Yang J, Zheng Y, Gou X, Pu K, Chen Z, Guo Q, et al. Prevalence of comorbidities and its effects in patients infected with SARS-CoV-2: a systematic review and meta-analysis. Int J Infect Dis 2020;94:91–5.
2. Wilson MP, Jack AS. Coronavirus disease 2019 (COVID-19) in neurology and neurosurgery: A scoping review of the early literature. Clin Neurol Neurosurg. 2020;193:105866.
3. Mao L, Jin H, Wang M, Hu Y, Chen S, He Q, et al. Neurologic Manifestations of Hospitalized Patients With Coronavirus Disease 2019 in Wuhan, China. JAMA Neurol 2020;77:683–90.
4. Kiraz M, Demir E. A bibliometric analysis of publications on spinal cord injury during 1980-2018. World Neurosurgery 2020;136:504–13.
5. Demir E, Yaşar E, Özkoçak V, Yıldırım E. The evolution of the field of legal medicine: A holistic investigation of global outputs with bibliometric analysis. J Forensic Leg Med 2020;69:101885.
6. Doğan G, Kayır S. Global Scientific Outputs of Brain Death Publications and Evaluation According to the Religions of Countries. J Relig Health 2020;59:96–112.
7. Doğan G. The Effect of Religious Beliefs on the Publication Productivity of Countries in Circumcision: A Comprehensive Bibliometric View. J Relig Health 2020;59:1126–36.
8. Muslu Ü, Demir E. Development of Rhinoplasty: Yesterday and Today. Med Sci 2019;23:294–301.
9. Yang C, Wang X, Tang X, Bao X, Wang R. Research trends of stem cells in ischemic stroke from 1999 to 2018: A bibliometric analysis. Clin Neurol Neurosurg 2020;192:105740.
10. Demir E, Akmeşe ÖF, Erbay H, Taylan-Özkan A, Mumcuoğlu KY. Bibliometric analysis of publications on house dust mites during 1980-2018. Allergol Immunopathol (Madr) 2020;48:374–83.
11. Akmal M, Hasnain N, Rehan A, Iqbal U, Hashmi S, Fatima K, et al. Glioblastome Multiforme: A Bibliometric Analysis. World Neurosurg 2020;136:270–82.
12. van Eck NJ, Waltman L. Software survey: VOSviewer, a computer program for bibliometric mapping. Scientometrics 2010;84:523–38.
13. Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. Lancet 2020;395:497–506.
14. Baig AM, Khaleeq A, Ali U, Syeda H. Evidence of the COVID-19 Virus Targeting the CNS: Tissue Distribution, Host-Virus Interaction, and Proposed Neurotropic Mechanisms. ACS Chem Neurosci 2020;11:995–8.
15. Wang D, Hu B, Hu C, Zhu F, Liu X, Zhang J, et al. Clinical Char-

acteristics of 138 Hospitalized Patients With 2019 Novel Coronavirus-Infected Pneumonia in Wuhan, China. JAMA 2020;323:1061–9

16. Guan WJ, Ni ZY, Hu Y, Liang WH, Ou CQ, He JX, et al; China Medical Treatment Expert Group for Covid-19. Clinical Characteristics of Coronavirus Disease 2019 in China. N Engl J Med 2020;382:1708–20.

17. Shigemura J, Ursano RJ, Morganstein JC, Kurosawa M, Benedek DM. Public responses to the novel 2019 coronavirus (2019-nCoV) in Japan: Mental health consequences and target populations. Psychiatry Clin Neurosci 2020;74:281–2.

18. Wu Y, Xu X, Chen Z, Duan J, Hashimoto K, Yang L, et al. Nervous system involvement after infection with COVID-19 and other coronaviruses. Brain Behav Immun 2020;87:18–22.