Twenty-Year Span of Global Coronavirus Research Trends: A Bibliometric Analysis

Yi Zhou and Liyu Chen

1. Introduction

A novel virus named severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) emerged in Wuhan, China in December 2019, causing a large global outbreak: the coronavirus disease 2019 (COVID-19) pandemic [1–3]. It has aroused international public concern and has become a major medical issue [4,5]. Within the past two decades, coronavirus infection has broken out recurrently and triggered three widespread epidemics: The severe acute respiratory syndrome (SARS) occurred in China in 2002 [6], the Middle East respiratory syndrome (MERS) emerged in Saudi Arabia in 2012 [7], and now, COVID-19. Pathogens of the above diseases are species in the genus of Betacoronavirus belonging to the family Coronaviridae in the order Nidovirales [8]. Collaborative research from epidemiology and etiology, including identifying pathogens, tracking sources, and clinical prevention and treatment including vaccines and antivirus medicine discovery, are urgent [9,10]. Bibliometrics based on the mapping knowledge domain as a tool to evaluate the research outputs’ characteristics has been widely adopted, and analysis results are capable of providing a comprehensive assessment of the quality and quantity of scientific yields [11,12]. Such research can not only describe the trends and distribution of publications including the impacts and citations but also reflect health policy decisions, the input of medical resources, and further social phenomena [13]. In order to assess the impact of coronavirus research on global scientific research production and contribute to the prevention and control of...
COVID-19, a bibliometric analysis was performed by utilizing the accessible date indexed at the Web of Science database.

2. Materials and Methods

This bibliometric study analyzed a twenty-year span of publications on coronavirus research from 1 January 2000 to 17 March 2020. The data used for analysis were extracted from the Web of Science Core Collection (WoSCC) bibliographic database. The retrieve strategies were as follows: (TS = (coronavirus* OR corona virus)) AND LANGUAGE: (English) AND DOCUMENT TYPES: (Article). Timespan: 2000–2020. Indexes: SCI-EXPANDED (Figure 1).

The retrieved articles were screened by using the software EndNote X9.6 (Clarivate Corporation, Philadelphia, PA, USA). Duplicates and other types of literature including book chapters and conference records were removed from extraction firstly. Articles whose keywords share the same prefix, such as coronary heart disease or coronal section, but do not focus on coronavirus were excluded as well. Profile information of included articles were processed and transferred to a local EndNote database, including the title, the date of publication, the corresponding authors with addresses, the rest of the authors, the journal name with the impact factor (IF) value, affiliations, and the source country. The processes above were accomplished in two days 19–20 March 2020 to avoid potential bias related to database updates. After that, a Standard Competition Rank (SCR) report of most productive journals, countries or territories, institutions, corresponding authors, and most-cited articles were summarized and produced.

Data analysis was performed using the Statistical Package for Social Sciences (SPSS; Version 19.0. IBM corporation, Armonk, NY, USA). The software CiteSpace R3 Version 5.4 (Chaomei Chen, College of
Computing and Informatics, Drexel University, Philadelphia, PA, USA) was used for visualizing international collaborations and internal links of coronavirus research [14]. The threshold was set to 10, and the node size 15. The software VOSviewer (Center for Science and Technology Studies, Leiden University, Leiden, Netherlands) was used for relatively quantifying the frequency and density of coronavirus articles’ core terminologies [15]. Information on the impact factor (IF) value (the average number of citations up to two years after publication) was acquired from the Journal Citation Report (JCR) 2019, Science Edition (Thomson Reuters).

3. Results

3.1. Original Articles Reached

According to the refined retrieve strategies, a detailed search for coronavirus publication obtained 9105 articles from Web of Science, in which seven duplications were deleted, leaving 9098 articles. Afterward, 55 articles were removed due to their unmatched key terms after careful screening. Therefore, a total of 9043 articles were included and saved for the next step in the process (Figure 1).

3.2. Yearly Yields

Among these articles, 611 of them were published in 2004, accounting for 6.757%, the highest percentage, while 136 were published in 2000, accounting for 1.504%, the lowest. Only 235 articles were published in the first two years. After SARS and MERS broke out (yellow arrows shown in Figure 2a), there were two obvious publication bursts two years later. There was a sharp increase two months after the outbreak of COVID-19 as well (Figure 2b).

![ANNUAL PUBLICATIONS](image_url)

Figure 2. Cont.
3.3. An Order of Productive Regions

The retrieved articles were from 123 countries, of which the USA ranked first, followed by China, Germany, and Netherlands (Table 1). China is the country where SARS and COVID-19 broke out and severely struck. Saudi Arabia, ranked 12th, is the country where MERS emerged and attacked. Among the 10 most productive regions, China is the only developing one.

Table 1. The 15 most productive countries or territories contributed to articles on coronavirus research.

| SCR 1 | Country/Territory    | Number | Percentages |
|-------|----------------------|--------|-------------|
| 1st   | USA                  | 3101   | 34.292%     |
| 2nd   | PR China             | 2230   | 24.660%     |
| 3rd   | Germany              | 584    | 6.458%      |
| 4th   | Netherlands          | 502    | 5.551%      |
| 5th   | England              | 480    | 5.308%      |
| 6th   | Japan                | 449    | 4.965%      |
| 7th   | Canada               | 445    | 4.920%      |
| 8th   | South Korea          | 392    | 4.335%      |
| 9th   | China Taiwan         | 361    | 3.992%      |
| 10th  | France               | 348    | 3.848%      |
| 11th  | Italy                | 313    | 3.461%      |
| 12th  | Saudi Arabia         | 291    | 3.218%      |
| 13th  | Singapore            | 274    | 3.030%      |
| 14th  | Australia            | 267    | 2.953%      |
| 15th  | Spain                | 231    | 2.554%      |

1 SCR: standard competition ranking. Equal members have the same ranking number, and a gap is left in the ranking numbers.

3.4. The Visualization of Collaboration

The international collaboration of coronavirus research was analyzed and is visualized here (Figure 3a). The diameter of rainbow circles represents the number of cooperative articles, and the
differently colored layers of circles indicate the time order of publications. The outer layer in red indicates the recent data, while the inner layer in white is relatively old. The colors of lines obey the same principles. Hence, the USA and China ranked first and second in the two large circles. The top six productive countries were isolated and emphasized from the comprehensive network. The yellow lines indicate the internal links between center and remote spots (Figure 3b–g).

Figure 3. The visualization of international collaboration and internal links on coronavirus research. (a) The comprehensive international collaboration network; (b) internal links of the USA with other regions involved in 3101 articles; (c) internal links of China with other regions involved in 2230 articles; (d) internal links of Germany with other regions involved in 584 articles; (e) internal links of Netherlands with other regions involved in 502 articles; (f) internal links of England with other regions involved in 480 articles; (g) internal links of Japan with other regions involved in 449 articles.
3.5. An Order of Productive Journals

Articles of inclusion were published in 1202 different journals, of which the Journal of Virology ranked first (883 articles, 9.764%), followed by Virology (285 articles, 3.152%), and PLoS ONE (242 articles, 2.676%), shown in Table 2. The Journal of Virology, established by the American Society for Microbiology (ASM), is one of the top journals in the field of virus research. Most of these journals focus on discovering vaccines and antivirus agents, and have relatively high IF values, such as PNAS (IF = 9.580) and Emerging Infectious Diseases (IF = 7.185).

Table 2. The 15 most productive journals with coronavirus articles.

| SCR  | Journal Names                                      | Number | Percentages |
|------|---------------------------------------------------|--------|-------------|
| 1st  | Journal of Virology                               | 883    | 9.764%      |
| 2nd  | Virology                                          | 285    | 3.152%      |
| 3rd  | PLoS ONE                                          | 242    | 2.676%      |
| 4th  | Emerging Infectious Diseases                      | 204    | 2.256%      |
| 5th  | Journal of General Virology                       | 188    | 2.079%      |
| 6th  | Virus Research                                    | 175    | 1.935%      |
| 7th  | Advances in Experimental Medicine and Biology     | 169    | 1.869%      |
| 8th  | Archives of Virology                              | 155    | 1.714%      |
| 9th  | Journal of Virological Methods                    | 150    | 1.659%      |
| 10th | Veterinary Microbiology                           | 145    | 1.603%      |
| 11th | Journal of Medical Virology                       | 119    | 1.316%      |
| 12th | Journal of Clinical Microbiology                  | 112    | 1.239%      |
| 13th | PNAS                                              | 108    | 1.194%      |
| 13th | Viruses-Basel                                     | 108    | 1.194%      |
| 15th | Vaccine                                           | 99     | 1.095%      |

1 SCR: standard competition ranking. Equal members have the same ranking number, and a gap is left in the ranking numbers.

3.6. An Order of Productive Institutions

The contributions of the 15 most productive institutions are ranked in Table 3. University of Hong Kong, the publication number of which is 434, ranked first, accounting for 4.578%, followed by the Chinese Academy of Science, 329 (3.638%), and the University of California System, 246 (2.720%). Among these institutions, nine are from the USA, with four from China and one from Netherlands.

Table 3. The 15 most productive institutions that contributed to articles on coronavirus research.

| SCR  | Institution                                             | Number | Percentages |
|------|--------------------------------------------------------|--------|-------------|
| 1st  | University of Hong Kong, China                         | 434    | 4.578%      |
| 2nd  | Chinese Academy of Science                            | 329    | 3.638%      |
| 3rd  | University of California System, USA                   | 246    | 2.720%      |
| 4th  | National Institutes of Health, USA                     | 240    | 2.654%      |
| 5th  | Center for Disease Control and Prevent, USA            | 212    | 2.344%      |
| 6th  | University of North Carolina, USA                      | 209    | 2.311%      |
| 7th  | Utrecht University, Netherlands                        | 201    | 2.223%      |
| 8th  | Univ N Carolina Chapel Hill, USA                       | 172    | 1.902%      |
| 9th  | Chinese Academy of Agricultural Sciences               | 166    | 1.836%      |
| 10th | Chinese University of Hong Kong                        | 164    | 1.814%      |
| 11th | National Institute of Allergy Infectious Disease, USA  | 155    | 1.714%      |
| 12th | University of Iowa, USA                               | 140    | 1.548%      |
| 13th | University of Texas System, USA                       | 139    | 1.537%      |
| 14th | University of Pennsylvania, USA                        | 137    | 1.515%      |
| 15th | Peking Union Medical College, China                    | 133    | 1.471%      |

1 SCR: standard competition ranking. Equal members have the same ranking number, and then a gap is left in the ranking numbers.
3.7. A List of Frequently-Cited Articles

The 10 most cited articles in the field of coronavirus are shown in Table 4. The most frequently cited article was “A novel coronavirus associated with severe acute respiratory syndrome” by Ksiazek et al., published in 2003 in the New England Journal of Medicine, followed by “Identification of a novel coronavirus in patients with severe acute respiratory syndrome” by Drosten et al., published at the same time and in the same journal [16,17]. Both of them are cited more than 1700 times. All of these top articles were published in high-impact journals and share an average citation number of 1265.

Table 4. The 10 most cited articles on coronavirus research.

| SCR | Article Title                                                                 | Authors                                                                 | Journal                                      | Times Cited | Date of Publication | IF |
|-----|-------------------------------------------------------------------------------|-------------------------------------------------------------------------|----------------------------------------------|-------------|---------------------|----|
| 1   | A novel coronavirus associated with severe acute respiratory syndrome         | Ksiazek, T.G.; Erdman, D.; et al. [16]                                   | New England Journal of Medicine              | 1839        | 15 May 2003         | 70.670 |
| 2   | Identification of a novel coronavirus in patients with severe acute respiratory syndrome | Drosten, C.; Gunther, S.; Preiser, W.; et al. [17]                         | New England Journal of Medicine              | 1748        | 15 May 2003         | 70.670 |
| 3   | Characterization of a novel coronavirus associated with severe acute respiratory syndrome | Rota, P.A.; Oberste, M.S.; et al. [18]                                   | Science                                     | 1489        | 30 May 2003         | 41.037 |
| 4   | Coronavirus as a possible cause of severe acute respiratory syndrome          | Peiris, J.S.M.; Lai, ST.; et al. [19]                                    | Lancet                                      | 1444        | 19 April 2003       | 59.102 |
| 5   | Isolation of a Novel Coronavirus from a Man with Pneumonia in Saudi Arabia   | Zaki, Ali Moh; van Boheemen, Sander; et al. [20]                          | New England Journal of Medicine              | 1298        | 8 November 2012     | 70.670 |
| 6   | The genome sequence of the SARS-associated coronavirus                         | Marra, M.A.; Jones, S.J.M.; et al. [21]                                  | Science                                     | 1275        | 30 May 2003         | 41.037 |
| 7   | Clinical progression and viral load in a community outbreak of coronavirus-associated SARS pneumonia: a prospective study | Peiris, J.S.M.; Chu, C.M.; Cheng, V.C.C.; et al. [22]                     | Lancet                                      | 834         | 24 May 2003         | 59.102 |
| 8   | Angiotensin-converting enzyme 2 is a functional receptor for the SARS coronavirus isolation and characterization of viruses related to the SARS coronavirus from animals in Southern China | Li, W.H.; Moore, M.J.; Vasilieva, N.; et al. [23]                          | Nature                                       | 972         | 27 November 2003    | 43.070 |
| 9   | Bats are natural reservoirs of SARS-like coronaviruses                         | Guan, Y.; Zheng, B.J.; He, Y.Q.; et al. [24]                              | Science                                     | 897         | 10 October 2003     | 41.037 |
| 10  |                                                                                  | Li, W.D.; Shi, Z.L.; et al. [25]                                         | Science                                     | 857         | 28 October 2005     | 41.037 |

1 SCR: standard competition ranking. Equal members have the same ranking number, and a gap is then left in the ranking numbers. 2 IF: impact factor. The impact factor value was reported according to the Thomson Reuter Journal Citation Reports (JCR) 2019.

3.8. Terms Analysis and Mapping

In order to analyze keywords or topic terms used in retrieved articles, VOSviewer (Center for Science and Technology Studies, Leiden University, Leiden, Netherlands) as a conventional application of mapping knowledge domain was employed to explore co-cited links and usage frequency. The threshold of term usage was set to 10 before processing. Different clusters are shown in colorful spheres and lines (Figure 4a), while a density map exhibits the research areas (Figure 4b). The front size and color depth of a term reflect its usage density and connections [26]. In Figure 4a, the terms “coronavirus”, “MERS-CoV”, “SARS”, and “SARS-CoV”, which belong to the blue cluster, interact with the terms “prevalence” and “evolution” in the green cluster, “disease” and “diagnosis” in the yellow cluster, “mice” and “central nervous system” in the purple cluster, and “mouse-hepatitis-virus” and “expression” in the red cluster. In Figure 4b, the density of the term “coronavirus” is the highest, followed by “infection”, “SARS”, and “expression”, which reflect the using frequency in articles. The terms “vaccine” and “antiviral agents” are of low frequency.
Figure 4. The visualization of keywords or terms used in coronavirus articles. (a) Different clusters and internal links between different terms contained in the sphere and lines; (b) density map of frequent terms indexed in Web of Science.

Guided by cluster and density map combination, articles containing the above terms were extracted from the local database for exploration of the research hotspots and frontiers. Over the past two decades, research focused on coronavirus mainly includes five clusters. (1) The core cluster is the blue one, and concentrates on the biological and virologic characteristics of coronavirus, including essential factors of infection and transmission routes during the outbreaks of SARS and MERS, as well as clinical features. Infection probably spreads through an air-borne route and through close contact. Cases of infection could involve symptoms such as fever, cough, and consolidation of the lung [27]. (2) The red cluster: Some types of coronavirus spread among animals and humans. Laboratory contamination and particularly animal-to-human transmission could be brought by mouse hepatitis-virus (MHV),
a kind of coronavirus that can cause infection of the central nervous system and suppress the immune system by influencing immunoglobulin excretion from the B cells of Peyer’s Patch, some immune responses of which resemble pneumonia-associated coronavirus [28]. (3) The yellow cluster: Primary infection of coronavirus in mammals and birds is confined to the upper respiratory and gastrointestinal system. Seven different known strains of coronaviruses are capable of infecting humans, in which SARS-CoV, as a publicized human coronavirus, has a unique pathogenesis because it causes both upper and lower respiratory tract infections involving bronchiolitis and pneumonia [29]. (4) The purple cluster: The entrance into human body of SARS-CoV depends on the angiotensin-converting enzyme 2 (ACE2) receptor, while the spike protein functions as the adaptor. Interferon-gamma participate in the immune-response acting as an antiviral agent. Medicine could be discovered according to these features [30,31]. (5) The green cluster: The evolution based on the mutation of coronavirus RNA caused different symptoms to human kind. High-fidelity whole genome sequencing could be a detection method of mutation besides diagnosis of infection. Population of coronavirus epidemics is mainly young children and the elders, who are in the status of hypo responsiveness [32,33].

4. Discussion

SARS-CoV-2 infection was first reported in December 2019, and the infection spread and situation worsened and became a Public Health Emergency of International Concern soon thereafter [34]. Coronavirus infections, including SARS, MERS, and COVID-19, have repeatedly broken out over the last 20 years. To the best of our knowledge, it is the first study to bibliometrically assess the yields of a twenty-year span of publications on coronavirus. Scientific research cannot be considered to promote the advancement of knowledge unless they are published through peer review and editor checks [35]. Our analysis included a total of 9043 original articles on coronavirus that were published over the past two decades, and this amount was enough to relatively reflect the scientific trends and development and certain social phenomena. Our analysis showed that coronavirus research articles were from multiple countries, from which numerous scientists have participated in the defense against coronavirus. The two outbursts of literature immediately after the outbreak of SARS and MERS indicate that response was quick employed and great importance was immediately attached in life sciences, basic medicine, and clinical pharmacy.

The USA and China are the most productive countries, contributing over 5400 articles to coronavirus research. Saudi Arabia and South Korea also ranked high at 13th and 8th places, respectively. These results are not surprising because the USA has been crucial in fostering and engaging in international collaborations on coronavirus research regarding prevention, control, diagnosis, and treatment concerning the possible risk of a global spread due to the strength of its economic implications. Furthermore, China, Saudi Arabia, and South Korea have been seriously attacked by coronavirus, and great effort has been made in basic science and clinical medicine. Internal links forming a comprehensive and extensive network indicate that research collaborations between nations and continents have been extensively carried out. Cooperation as a conventional development modality, which sharing resources, authorities, communication, and even sensation has become a trend in global research [36]. Articles from around the world have been checked, peer-viewed, and eventually published in journals and delivered all over the world. Articles were accepted mainly from specialized journals in the fields of virology and microbiology with high impact factors such as the Journal of Virology, Emerging Infectious Diseases, the Journal of Clinical Microbiology, and PNAS. Information and knowledge as vectors to load experiments and research advances have been found across nations and regions, leading to solutions and progress [37].

Institutions can be classified into several categories: associated government departments, academies, research institutes, universities and affiliated hospitals, the Center for Disease Control and Prevention (CDC), and others. Among the 15 most productive institutions, universities account for more than half of the research output, followed by academies, government departments, and the CDC, indicating them as the most dynamic and creative. However, the most productive institution has been
the University of Hong Kong. This might be ascribed to tremendous losses due to the outbreak of SARS in situ and the easier access to data and specimens [38].

It is apparent that the IF value could be an efficient but relatively controversial tool to quantitively evaluate the performance and influence of a peer-review journal. Not being an absolute criterion of quality, IF as an article citation measurement still reflects the impact that indexed journals have under certain disciplines [39]. The 10 most cited articles on coronavirus were all published on the eminent journals with a high IF including the New England of Medicine, Science, Lancet, and Nature. Reports of the first case of SARS and MERS were cited the most frequently. Clinical studies including characterization and transmission, virologic studies including identification and isolation of pathogen, and molecular studies including genome sequence and infection mechanism have also been cited multiple times [16–25].

Basic science and clinical trials have been widely carried out, and some progress has been made. However, licensed vaccines and medicine to prevent coronavirus infection has still not been discovered, while choices and formulas of clinical treatment are of limitation. Some potential therapies have been put forward by doctors, including the Lopinavir-Ritonavir combination. A trial for hospitalized adults with severe COVID-19 has recently been declared a failure [40]. Preventive methods mainly aim to reduce the chance of getting infected such as cutting transmission routes by disinfection and sterilization, protecting susceptible populations by allocating the wearing of masks, and effective vaccine injections. It is noteworthy that the COVID-19 pandemic has triggered a momentous milestone in coronavirus research, and extensive international cooperation is tackling this situation with quick reaction. Open access to the whole genome sequence group, disease predictive model construction, and the shared service of the nation health database has accelerated the research targeting the control of the outbreak. Further research efforts in prevention and treatment and in the translation of research creation and new findings into valid clinical measures are both urgent [41].

Limitations exist in this study. First, the Web of Science core collection database is the only retrieval source, and it does not index all journals, so articles from other databases such as Scopus and PubMed might have been ignored [42]. Second, bias might also occur as a result of retrieving from a database without the use of other languages, for instance, Chinese and Arabic, the official language in China and Saudi Arabia, in which many cases were published. Third, the latest articles which have been accepted but not published were not included in this study due to the information delay. While these limitations are important, they are not likely to have caused the patterns and trends that we observed in the data. We believe that these patterns and trends are conclusive, despite these limitations.

5. Conclusions

A twenty-year-span of coronavirus research outputs was investigated and analyzed through bibliometric methods based on Web of Science. There were two sharp increases in research yield after the SARS and MERS outbreaks. This research demonstrates that international collaborations have promoted study progress, and universities and academies have acted as the main force participating in basic science and clinical medicine research. High-impact articles, which cover biological features including the genome group, the virulence range, and combine receptors, as well as the pathogenic characteristics including transmission routes, atypical symptoms, and immune response, were published in specialized journals. However, terms such as vaccine and prescription were identified with a low frequency, which indicates that more prevention and treatment research is needed. These findings provide a relatively objective reference for peer scientists, national regimes, and the global health system.

Author Contributions: Y.Z.—Designed and implemented the experiments; Y.Z.—Retrieved and analyzed the data; Y.Z.—Did the math and wrote the paper. L.C.—Improved the paper and guided the project. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Acknowledgments: We are grateful to Junkun Liu from Yale University, USA, for his advice on the language organization and Jie Yu from Changsha Medical University, China, for her assistance with software operation.
Conflicts of Interest: The authors declare no conflict of interest.

References
1. Zhu, N.; Zhang, D.; Wang, W.; Li, X. A novel coronavirus from patients with pneumonia in China. N. Engl. J. Med. 2020, 382, 727–733. [CrossRef] [PubMed]
2. Ghinai, I.; McPherson, T.D. First known person-to-person transmission of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) in the USA. Lancet 2020. [CrossRef]
3. Pung, R.; Chiew, C.J.; Young, B.E. Investigation of three clusters of COVID-19 in Singapore: Implications for surveillance and response measures. Lancet 2020. [CrossRef]
4. Li, Q.; Guan, X.; Wu, P. Early transmission dynamics in Wuhan, China, of novel Coronavirus-infected pneumonia. N. Engl. J. Med. 2020. [CrossRef]
5. Dale, F. The global community needs to swiftly ramp up the response to contain COVID-19. Lancet 2020. [CrossRef]
6. Holmes, V.K. SARS-associated coronavirus. N. Engl. J. Med. 2003, 348, 1948–1951. [CrossRef]
7. Zaki, A. Brief Report: Isolation of a novel coronavirus from a man with pneumonia in Saudi Arabia (vol 367, pg 1814, 2012). N. Engl. J. Med. 2013, 369, 394. [CrossRef]
8. Coronaviridae Study Group of the International Committee on Taxonomy of Viruses. The species severe acute respiratory syndrome-related coronavirus: Classifying 2019-nCoV and naming it SARS-CoV-2. Nat. Microbiol. 2020. [CrossRef]
9. Li, L.; Xu, Q.; Yan, J. COVID-19: The need for continuous medical education and training. Lancet Respir. Med. 2020. [CrossRef]
10. Sun, Z.; Thilakavathy, K.; Kumar, S.; He, G.; Liu, S.V. Potential factors influencing repeated SARS outbreaks in China. Int. J. Environ. Res. Public Health 2020, 17, 1633. [CrossRef]
11. Uuskula, A.; Toompere, K. HIV research productivity and structural factors associated with HIV research output in European Union countries: A bibliometric analysis. BMJ Open 2015, 5, e006591. [CrossRef] [PubMed]
12. Chen, C. Searching for intellectual turning points: Progressive knowledge domain visualization. PNAS 2004, 101, 5303–5310. [CrossRef] [PubMed]
13. Wang, Z.; Chen, Y. A bibliometric analysis of PubMed literature on Middle East Respiratory Syndrome. Int. J. Environ. Res. Public Health 2016, 13, 583. [CrossRef] [PubMed]
14. VOSviewer Manual. Available online: www.vosviewer.com/getting-started (accessed on 10 May 2016).
15. Chen, C. CiteSpace II: Detecting and visualizing emerging trends and transient patterns in scientific literature. J. Am. Soc. Inform. Sci. Technol. 2006, 57, 359–377. [CrossRef]
16. Ksiazek, T.G.; Erdman, D. A novel coronavirus associated with severe acute respiratory syndrome. N. Engl. J. Med. 2003, 348, 1953–1966. [CrossRef] [PubMed]
17. Drosten, C.; Gunther, S. Identification of a novel coronavirus in patients with severe acute respiratory syndrome. N. Engl. J. Med. 2003, 348, 1967–1976. [CrossRef]
18. Rota, P.A.; Oberste, M.S. Characterization of a novel coronavirus associated with severe acute respiratory syndrome. Science 2003, 300, 1394–1399. [CrossRef]
19. Peiris, J.S.; Lai, S.T. Coronavirus as a possible cause of severe acute respiratory syndrome. Lancet 2003, 361, 1319–1325. [CrossRef]
20. Zaki, A. Isolation of a novel coronavirus from a man with pneumonia in Saudi Arabia. N. Engl. J. Med. 2003, 348, 1814–1820. [CrossRef]
21. Marra, M.A.; Jones, S.J. The genome sequence of the SARS-associated coronavirus. Science 2003, 300, 1399–1404. [CrossRef]
22. Peiris, J.S.; Chu, C.M. Clinical progression and viral load in a community outbreak of coronavirus-associated SARS pneumonia: A prospective study. Lancet 2003, 361, 1767–1772. [CrossRef]
23. Li, W.H.; Moore, M.J.; Vasylieva, N. Angiotensin-converting enzyme 2 is a functional receptor for the SARS coronavirus. Nature 2003, 426, 450–454. [CrossRef] [PubMed]
24. Guan, Y.; Zheng, B.J.; He, Y.Q. Isolation and characterization of viruses related to the SARS coronavirus from animals in Southern China. Science 2003, 302, 276–278. [CrossRef] [PubMed]
25. Li, W.D.; Shi, Z.L.; Yu, M. Bats are natural reservoirs of SARS-like coronaviruses. *Science* **2005**, *310*, 676–679. [CrossRef]
26. Peykari, N.; Djalalinia, S. Diabetes research in Middle East countries: A scientometrics study from 1990 to 2012. *J. Res. Med. Sci.* **2015**, *20*, 253.
27. Hu, X.F.; Chen, J.F. CT imaging of two cases of one family cluster 2019 novel coronavirus (2019-nCoV) pneumonia: Inconsistency between clinical symptoms amelioration and imaging sign progression. *Quant. Imaging Med. Surg.* **2020**, *10*, 508–510. [CrossRef]
28. Duhalde, V.M.; Aparicio, J.L. The autoimmune response elicited by mouse hepatitis virus (MHV-A59) infection is modulated by liver tryptophan-2,3-dioxygenase (TDO). *Immunol. Lett.* **2020**, *217*, 25–30. [CrossRef]
29. Forgie, S.; Marrie, T.J. Healthcare-associated atypical pneumonia. *Semin. Respir. Crit. Care Med.* **2009**, *30*, 67–85. [CrossRef]
30. Geller, C.; Varbanov, M.; Duval, R.E. Human coronaviruses: Insights into environmental resistance and its influence on the development of new antiseptic strategies. *Viruses* **2012**, *4*, 3044–3068. [CrossRef]
31. Hoffmann, M.; Kleine-Weber, H. SARS-CoV-2 cell entry depends on ACE2 and TMPRSS2 and is blocked by a clinically proven protease inhibitor. *Cell* **2020**. [CrossRef]
32. Shigemura, J.; Ursano, R.J. Public responses to the novel 2019 coronavirus (2019-nCoV) in Japan: Mental health consequences and target populations. *Psychiatry. Clin. Neurosci.* **2020**. [CrossRef] [PubMed]
33. Heimdal, I.; Moe, N. Human coronavirus in hospitalized children with respiratory tract infections: A 9-year population-based study from Norway. *J. Infect. Dis.* **2019**, *219*, 1198–1206. [CrossRef]
34. Public Health Emergency of International Concern. Available online: www.who.int/news-room/detail/12-02-2020-world-experts-and-funders-set-priorities-for-covid-19-research (accessed on 12 February 2020).
35. Van, R. Measurement of central aspect of scientific research: Performance, interdisciplinarity, structure. *Measurement* **2005**, *3*, 1–19. [CrossRef]
36. Editorial. Communication, collaboration and cooperation can stop the 2019 coronavirus. *Nat. Med.* **2020**, *26*, 151. [CrossRef] [PubMed]
37. Wolski, M.; Gomolinska, A. Data meaning and knowledge discovery: Semantical aspects of information systems. *Int. J. Approx. Reason.* **2020**, *119*, 40–57. [CrossRef]
38. Thomas, S.T.L.; Yu, W.C. The lessons of SARS in Hong Kong. *Clin. Med.* **2010**, *10*, 50. [CrossRef] [PubMed]
39. Amin, M.; Mabe, M. Impact factors: Use and abuse. *Medicina (B. Aires)* **2003**, *63*, 347–354. [CrossRef]
40. Bin, C. A trial of lopinavir–ritonavir in adults hospitalized with severe covid-19. *N. Engl. J. Med.* **2020**. [CrossRef]
41. Zhang, T.Y.; He, Y.D. Clinical trials for the treatment of Coronavirus disease 2019 (COVID-19): A rapid response to urgent need. *Sci. China Life Sci.* **2020**. [CrossRef]
42. Special Column: Infectious Disease Outbreak Research: Insights and Trends. Available online: www.elsevier.com/solutions/scopus/support/webinars?commid=391874 (accessed on 30 March 2020).

© 2020 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (http://creativecommons.org/licenses/by/4.0/).