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# Evidence of a Sharp Increase in Scientific Productivity on COVID-19 by Comparing Publications of the First Quarter with the First Half of 2020

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## ABSTRACT

**Objective:** Coronavirus disease 19 (COVID-19) is a highly contagious disease characterized by severe respiratory infection by SARS-CoV-2 virus. COVID-19 was first appeared in Wuhan, China, in December 2019 and then rapidly became a global pandemic from a local outbreak. The present study aims to present the rapid increase of scientific productivity on COVID-19 by comparing publications of the first quarter with the first half of 2020.

**Materials and Methods:** Web of Science (WoS) software was used for the search and the analysis. To compare scientific productivity of two periods as the first quarter and the first half of the pandemic era, all scientific papers published about COVID-19 included in Science Citation Index Expanded (SCI-E) from January 1<sup>st</sup> to April 5<sup>th</sup> and from January 1<sup>st</sup> to July 9<sup>th</sup> of 2020 were searched using the following terms: “COVID-19”, “2019-n-CoV”, “SARS-CoV-2”, “Coronavirus disease 19” and “2019 novel coronavirus” as nomenclatures of COVID-19.

**Results:** Overall, 337 and 11.704 scientific papers related to COVID-19, indexed by SCI-E, were found in the first quarter and the first half of 2020, respectively. While the biggest contribution for publications was from People’s Republic of China (PRC) in the first quarter and was from the USA in the first half of 2020 for COVID-19.

**Conclusion:** We found a close correlation between the rapid acceleration of scientific papers and turning the disease from a local outbreak to a global pandemic. Since sharing experiences is as important as struggling with these kinds of novel diseases, we believe that encouraging researchers to make scientific publications for others is more important than ever in the circumstances like this.

**Keywords:** COVID-19, 2019-n-CoV, SARS-CoV-2, Coronavirus disease 19, 2019 novel coronavirus

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## INTRODUCTION

Coronavirus was first identified from respiratory infections in 1960 (1). Then, it has led to severe outbreaks in the world: In 2003, Severe Acute Respiratory Syndrome CoV (SARS-CoV) in China (1–3); in 2010, a Severe Fever with Thrombocytopenia Syndrome (SFTS) in China (2); in -2012, Middle East Respiratory Syndrome (MERS-CoV) in Saudi Arabia (1–4) and recently in December 2019, Coronavirus disease 2019 (COVID-19) in China. The new identified coronavirus was named “2019-nCoV”, “SARS-CoV-2” or “2019 novel coronavirus” and the new disease was named “Coronavirus disease 2019” or “COVID-19” (1–4) in different scientific platforms.

A bibliometric analysis can be used for analyzing publication characteristics quantitatively and/or qualitatively according to the researcher’s interest and performed by one of these most well-known databases: PubMed, Scopus, Web of Science (WoS) and Google Scholar (5, 6). The present study aims to report the rapid increase of scientific productivity on COVID-19 by compare publications of the first quarter with the first half of 2020 using the Web of Science (WoS) database.

## MATERIALS and METHODS

WoS software was used for the search and analysis. To compare the scientific productivity of the two periods of first quarter and the first half of the pandemic era, all scientific papers published about COVID-19 included in Science Citation Index Expanded (SCI-E) from January 1<sup>st</sup> to April 5<sup>th</sup> and from January 1<sup>st</sup> to July 9<sup>th</sup> of 2020 were searched using the following terms: “COVID-19”, “2019-n-CoV”, “SARS-CoV-2”, “Coronavirus disease 19” and “2019 novel coronavirus” as scientific nomenclatures of COVID-19. We applied an “Advanced Search” using search operators as AND, OR and NOT to reduce the risk of overlapping of papers in these two different time spans representing the first quarter and the first half of 2020. We further analyzed those two results separately by the “analyze” function of the same software concerning number of papers for each country, type of documentation, number of publications per period, name of journals and authors for each of the searches.

**Table 1.** Comparison of the scientific papers published in SCI-E related to COVID-19 in the first quarter and in the first half of 2020

	COVID-19 research from January 1 to April 5, 2020	COVID-19 research from January 1 to July 9, 2020
Terms used for analysis		“COVID-19” “2019-n-CoV” “SARS-CoV-2” “Coronavirus disease 19” “2019 novel coronavirus”
Number of publications	337	11704
Top languages	English (98.51%) German (0.59%) Czech (0.29%) French (0.29%) Italian (0.29%)	English (97.26%) German (1.18%) French (0.66%) Spanish (0.38%) Hungarian, Portuguese (0.18%)

## RESULTS

Overall, 337 and 11.704 scientific papers related to COVID-19, indexed by SCI-E, were found in the first quarter and the first half of 2020, respectively. Publications were dominantly in English. 98.51% of the publications in the first quarter and 97.26% of the publications in the first half of 2020 were in English (Table 1).

In terms of medical specialties, the most contributions that shared first and second row were the fields of “Medicine General Internal” and “Infectious Diseases”, respectively, for both of the first quarter and the first half of 2020. The biggest contribution for publications was from the People’s Republic of China (PRC) in the first quarter and was from the USA in the first half of 2020. The most contributed countries in both periods were PRC, USA, England and Italy. While the top documentation type was “editorial material” in the first quarter, it was “article” in the first half of the 2020.

Regarding numbers of each authors’ contributions, while Mahase E (n=12) was ranked the first row in the first quarter, Wang Y (n=82) ranked first row as author in the first half of 2020 if we exclude anonymous publications (n=182).

While top five journals that published papers about COVID-19 in the first quarter were British Medical Journal, Lancet, Eurosurveillance, Journal of Medical Virology and Intensive Care Medicine, they were British Medical Journal, Journal of Medical Virology, Journal of Infection, Lancet and Critical Care in the first half of the year (Table 2).

## DISCUSSION

Coronaviruses (CoVs) belong to the family Coronaviridae subfamily Coronavirinae and the order Nidovirales, which are spherical, enveloped, single-stranded positive genomic RNA viruses (1, 4). CoVs constitute a large family of viruses found in nature (1) and they are important pathogens for humans and animals (1, 2, 4). Orthocoronavirinae consists of four genera according to genomic structure and phylogenetic analysis, named Alphacoronavirus, Betacoronavirus, Gammacoronavirus and Deltacoronavirus (1, 4). Among these subfamilies, Alphacoronavirus and Betacoronavirus

infect only mammals and are responsible for respiratory infection in humans and enteritis in animals (1, 4). Two major zoonotic pathogenic coronaviruses, severe acute respiratory syndrome coronavirus (SARS-CoV) and the Middle East Respiratory Syndrome coronavirus (MERS-CoV) belonged to the Betacoronavirusgenus (1, 2, 8). SARS-CoV and the novel coronavirus (SARS-CoV-2) are taken part in Sarbecovirus, one of five subgenuses of Betacoronavirusgenus (1, 8, 9) (Table 3).

In 1960, CoV was first identified from respiratory infections in adults as well as children (1). Outbreaks with coronaviruses were reported in the literature as Severe Acute Respiratory Syndrome CoV (SARS-CoV) in China in 2003 (1–4, 9), a Severe Fever with Thrombocytopenia Syndrome (SFTS) in China in 2010 (2), Middle East Respiratory Syndrome (MERS-CoV) in Saudi Arabia in 2012 (1–4). Unlike SARS, MERS has been active up to date and sporadic outbreaks have also been reported (4). MERS was named as MERS-CoV disease (Coronadisease) in 2012 (10). The most recent outbreak with the novel coronavirus (2019-nCoV) was from Wuhan city of China in late December 2019 (1–4). This newly identified coronavirus was named as “2019-nCoV”, “SARS-CoV-2” or “2019 novel coronavirus”. And thenewdiseaserelatedtothatviruswasnamed as “Coronavirusdisease 2019” and “COVID-19” (1–4). It was also named as SARS-CoV-2 because of the similarity of symptoms to SARS (8) (Fig. 1).

First Quarter of 2020: The availability of 337 published papers in SCI-E journals within the first quarter for COVID-19 can be considered an indicator of a rapid scientific first reaction to this pandemic disease. We determined that most of the publications were from China in the literature in this period. It is understandable since China was the first country with the outbreak of COVID-19. Moreover, it was also one of the countries which have been taken the hardest strike by this disease. On the other hand, beside articles, we noticed that most authors contribute to the literature by editorial materials, letters and reviews to urgently guide others by their clinical experience since the pandemic accelerated sharply in a very short time, so there was not enough time for controlled studies and/or observational studies to make original articles.

**Table 2.** Comparison of the scientific contributions related COVID-19 at the first quarter and first half of the 2020

	<b>COVID-19 research from January 1 to April 5, 2020 represents the first quarter of the year</b>	<b>COVID-19 research from January 1 to July 9, 2020 represents the first half of the year</b>
Web of science categories (Contribution $\geq 5\%$ )	Medicine General Internal (32.04%) Infectious Diseases (9.19%) Medicine Research Experimental (6.82%) Radiology Nuclear Medicine Medical Imaging (5.93%) Critical Care Medicine (5.04%)	Medicine General Internal (15.06%) Infectious Diseases (7.35%) Surgery (6.63%) Public Environmental Occupational Health (6.56%) –
Countries contribution and percent of contribution for each country (Contribution $\geq 5\%$ )	Peoples R China (41.84%) USA (15.13%) England (9.49%) Italy (5.93%) Germany (5.04%)	USA (25.18%) Peoples R China (20.23%) Italy (13.46%) England (10.15%) –
Types of documentations and percentages (Contribution $\geq 5\%$ )	Editorial material (n=114) (33.82%) Article (n=95) (28.19%) Letter (n=62) (48.39%) News item (n=40) (11.86%) Review (n=18) (5.34%)	Article (n=4036) (34.48%) Letter (n=3075) (26.27%) Early Access (n=3062) (26.16%) Editorial material (n=2996) (25.59%) Review (n=1055) (9.01%)
Author's contribution (Contribution $\geq 5$ n for the first quarter of the year)	Mahase E (n=12) Rimmer A (n=6) Chen J, Wang Y, Wiwanitkit V, Zhang W, Zhang Y (n=5)	Wang Y (n=82) Zhang Y (n=65) Li Y (n=61) Li L (n=57)
(Contribution $\geq 50$ n for the first half of the year)	– –	Mahase E, Wang J, Wang L (n=54) Liu Y (n=50)
Journals that published the papers (Contribution $\geq 5$ n for the first quarter of the year)	British Medical Journal (n=47) Lancet (n=27) Eurosurveillance (n=15) Journal of Medical Virology (n=13) Intensive Care Medicine (n=11) Radiology (n=9) Nature Medicine (n=8) Journal of Korean Medical Science (n=7) Annals of Translational Medicine (n=6) Journal of Clinical Medicine (n=6) Canadian Journal of Anesthesia (n=5) European Journal of Nuclear Medicine and Molecular Imaging (n=5) World Journal of Pediatrics (n=5)	British Medical Journal (n=461) Journal of Medical Virology (n=284) Journal of Infection (n=240) Lancet (n=182) Critical Care (n=117) New England Journal of Medicine (n=108) JAMA (Journal of The American Medical Association) (n=105) – –
(Contribution $\geq 100$ n for the first half of the year)		
Author's contribution except anonymous publications for the first half of the year		

First Half of 2020: In the first half of 2020, a sharp increase in published articles continued as a number of 11.704. In the first half of the year, the USA replaced China regarding scientific contributions to the literature. Scientific publications, which were published mostly as editorial materials in the first quarter, were replaced by articles during the first half. In addition, the publications whose authors are known in the first quarter were replaced by anonymous broadcasts in the first half of the year.

The impact factor of the BMJ journal, which published the most publications in both periods, is around 30. In addition, Lancet journal with impact factor 59,1, which ranked 2<sup>nd</sup> row in the first quarter and 4<sup>th</sup> row in the first half, had continued to publish papers in both periods (11). This is also another remarkable output of our study that indicates the importance of sharing related studies by journals by high impact factors with the whole scientific community in such a critical situation.

**Table 3.** Taxonomy of selected coronaviruses (7)

Category	Coronaviruses
Realm	<i>Riboviria</i>
Order	<i>Nidovirales</i>
Suborder	<i>Cornidovirineae</i>
Family	<i>Coronaviridae</i>
Subfamily	<i>Orthocoronavirinae</i>
Genus	<i>Betacoronavirus</i>
Subgenus	<i>Sarbecovirus</i>
Species	<i>Severe acute respiratory syndrome-related coronavirus</i>
Individuum	SARS-CoV Urbani, SARS-CoV GZ-02, Bat SARS-CoV Rf1/2004, Civet SARS-CoVSZ3/2003 SARS-CoV PC4-227, SARSr-CoV BtKY72, SARS-CoV-2 Wuhan-Hu-1, SARSr-CoV RatG13, and so on.

### Limitations

Although the WoS database is updated regularly, the numerical changes in results should be taken into consideration (12, 13). Even most of the citations are received within the first two years after publication, for some disciplines, this period should be longer than two years (14). Additionally, the current WoS software version cannot analyze citations for the number of publications over than 10.000. Other handicap of WoS is “Synonymy problem” and “homonymy problem”. Synonymy problem refers to using different forms of author and institution names as with or without first names, initials, abbreviations or spelling errors and these information also may change over time. On the other hand, the homonymy problem refers that the same name may refer to more than one person or department (14). Despite all these limitations, WoS is still considered a gold standard for bibliometric studies (15). The fact that only SCI-E publications were investigated in this study can be considered as another limitation.

### Conclusion

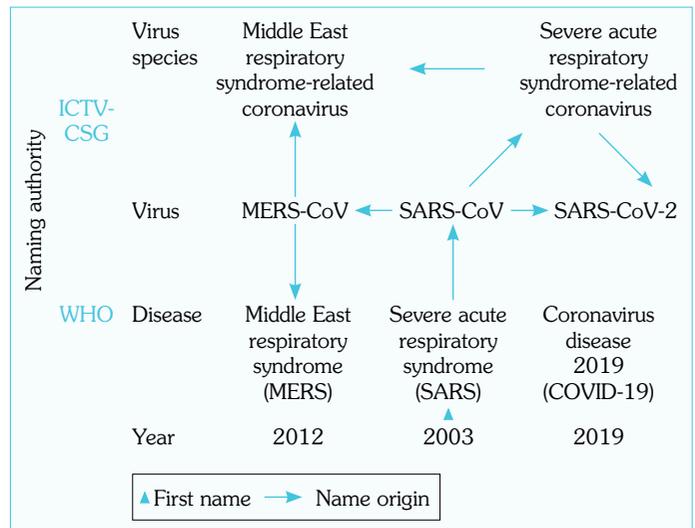
We found a rapid increase in a close correlation between the rapid acceleration of scientific papers and the turning of the disease from a local outbreak to a global pandemic. Since sharing experiences is as important as struggling with these kinds of novel diseases, we believe that encouraging researchers to make scientific publications for others is more important than ever in circumstances like this.

**Peer-review:** Externally peer-reviewed.

**Author Contributions:** Concept – KB, FY; Design – KB, FY; Supervision – KB, FY; Resource – FY, KB; Materials – FY, KB; Data Collection and/or Processing – FY, KB; Analysis and/or Interpretation – FY, KB; Literature Search – KB, FY; Writing – FY, KB; Critical Reviews – KB, FY.

**Conflict of Interest:** The authors have no conflict of interest to declare.

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**Figure 1.** History of naming the coronaviruses and diseases during the outbreaks (7)

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