

## LETTER TO EDITOR

### THE IMPACT OF COVID-19 ON THE SCIENTIFIC PRODUCTION SPREAD: A FIVE-MONTH BIBLIOMETRIC REPORT OF THE WORLDWIDE RESEARCH COMMUNITY

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**Introduction:** The recent COVID-19 pandemic has gained recently a deep increasing of research interest in all fields of the human knowledge due to prevention of the Sars-Cov-2 infection and disease treatment. The present investigation evaluated the topic publications and the citation network analysis during the early phases of COVID-19 pandemic spread.

**Methods:** the Boolean search was performed according to the Pubmed Mesh terms by Scopus Elsevier database. The papers, co-authors, number of citations obtained and scientific journals were recorded.

**Results:** a total of 164 scientific journals were assessed in the present research with a mean impact factor value of  $4.612 \pm 8.705$  (range: 70.67-0; median: 2,687, Q1: 0,701; Q3: 4,928).

**Conclusions:** The studies selected showed the bibliometric research showed an early representation of the research orientation of the research activity about COVID 19. The most represented scientific fields concerned with healthcare and medicine, while for the social and economic fields are gaining interests due to the pandemic spread.

**Keywords:** COVID 19, Sars-Cov-2, scientometric, bibliometric, h index, citations.

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#### Dear Editor,

The novel Covid-19 pandemic is showing an unpredictable rapid spreading of infection that produced, from the last months of 2019, a wide series of implications on human health, care assistance, welfare systems and economic crisis in most countries of the world<sup>(1,2)</sup>.

Although many main etiopathological and transmission characteristics are not fully clarified, the novel coronavirus is showing as a severe multi-organ disease, high virulence rate and resistance on inanimate surfaces at room temperature for up to 9 days, with incubation times between 2-10 days<sup>(2)</sup>.

The high risk of contamination related to the frequent touch surfaces and air droplets diffusion in healthcare and public structures represents a viable source of increased rate of viral transmission.

These characteristics require an effort by the scientific community in the search for new organizational strategies and models for treatment of the disease, individual protection and in the creation of new sustainable economic and security models in a global context of high exchange of human resources.

Bibliometrics represents a research field for the evaluation of scientific production and the phenomena related to the scholar communication of the relative science<sup>(3)</sup>. According to a Boolean strategy, a search on the Scopus electronic database was performed on May 13th 2020

The scientific production related to the topic being studied was evaluated by a scientific production analysis of the contributions, authors and their affiliations and scientific journal. The articles, citations count and journal impact factors were also calculated. The authors self-citations were excluded

| SCIENTIFIC DISCIPLINES                       | NUMBER OF DOCUMENTS |
|--|---------------------|
| Medicine                                     | 358                 |
| Immunology and Microbiology                  | 140                 |
| Biochemistry, Genetics and Molecular Biology | 65                  |
| Pharmacology, Toxicology and Pharmaceutics   | 47                  |
| Agricultural and Biological Sciences         | 17                  |
| Environmental Science                        | 15                  |
| Social Sciences                              | 15                  |
| Health Professions                           | 10                  |
| Neuroscience                                 | 9                   |
| Computer Science                             | 8                   |
| Chemistry                                    | 6                   |
| Nursing                                      | 5                   |
| Business, Management and Accounting          | 4                   |
| Multidisciplinary                            | 4                   |
| Dentistry                                    | 3                   |
| Engineering                                  | 3                   |
| Mathematics                                  | 3                   |
| Arts and Humanities                          | 2                   |
| Chemical Engineering                         | 2                   |
| Physics and Astronomy                        | 2                   |
| Veterinary                                   | 2                   |
| Decision Sciences                            | 1                   |
| Economics, Econometrics and Finance          | 1                   |
| Energy                                       | 1                   |
| Materials Science                            | 1                   |
| Undefined                                    | 7                   |

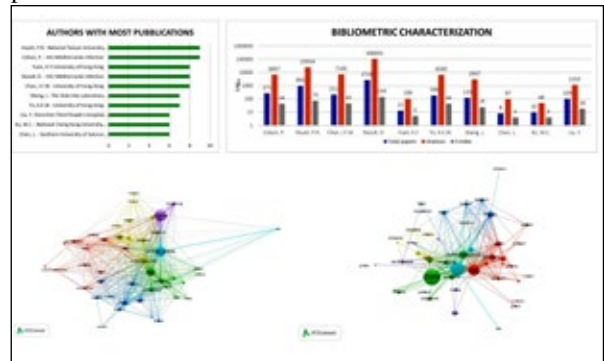
**Table 1:** Scientific disciplines of the papers selected.

| JOURNALS  | NUMBER OF DOCUMENTS |
|---|---------------------|
| Journal Of Medical Virology                                       | 34                  |
| Emerging Microbes And Infections                                  | 15                  |
| Travel Medicine And Infectious Disease                            | 13                  |
| Chinese Traditional And Herbal Drugs                              | 11                  |
| Journal Of Microbiology Immunology And Infection                  | 10                  |
| International Journal Of Biological Sciences                      | 9                   |
| Eurosurveillance  | 8                   |
| International Journal Of Antimicrobial Agents                     | 8                   |
| Journal Of Korean Medical Science                                 | 8                   |
| Communicable Diseases Intelligence 2018                           | 7                   |
| Lancet Infectious Diseases  | 7                   |
| Lancet  | 6                   |
| Viruses   | 6                   |
| European Review For Medical And Pharmacological Sciences          | 5                   |
| Journal Of Clinical Virology                                      | 5                   |
| Journal Of Infection  | 5                   |
| Microbes And Infection  | 5                   |
| Antiviral Research  | 4                   |
| Diabetes And Metabolic Syndrome Clinical Research And Reviews     | 4                   |
| International Journal Of Environmental Research And Public Health | 4                   |
| International Journal Of Infectious Diseases                      | 4                   |
| Journal Of Infection In Developing Countries                      | 4                   |
| Swiss Medical Weekly  | 4                   |
| Bioscience Trends   | 3                   |
| Chinese General Practice  | 3                   |
| Current Medical Science   | 3                   |
| European Journal Of Nuclear Medicine And Molecular Imaging        | 3                   |
| Infection Control And Hospital Epidemiology                       | 3                   |
| International Journal Of Occupational And Environmental Medicine  | 3                   |
| MMWR Morbidity And Mortality Weekly Report                        | 3                   |
| New England Journal Of Medicine                                   | 3                   |
| Pediatric Pulmonology   | 3                   |

**Table 2:** Scientific journal distribution of the papers evaluated and most represented .

| MOST CITED COVID-19 PAPERS  | CITATIONS |
|---|-----------|
| 1) Zhu, N., et al. A novel coronavirus from patients with pneumonia in China, 2019 (2020) New England Journal of Medicine, 382 (8), pp. 727-733.  | 459       |
| 2) Zhou, P., et al. A pneumonia outbreak associated with a new coronavirus of probable bat origin (2020) Nature, 579 (7798), pp. 270-273.   | 266       |
| 3) Lu, R., et al. Genomic characterisation and epidemiology of 2019 novel coronavirus: implications for virus origins and receptor binding (2020) The Lancet, 395 (10224), pp. 565-574.   | 240       |
| 4) Zhou, F., et al. Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study (2020) The Lancet, 395 (10229), pp. 1054-1062.                                   | 102       |
| 5) Chen, H., et al. Clinical characteristics and intra-uterine vertical transmission potential of COVID-19 infection in nine pregnant women: a retrospective review of medical records (2020) The Lancet, 395 (10226), pp. 809-815. | 98        |
| 6) Zou, L., et al. SARS-CoV-2 viral load in upper respiratory specimens of infected patients (2020) New England Journal of Medicine, 382 (12), pp. 1177-1179.   | 80        |
| 7) Wan, Y., et al. Receptor recognition by the novel coronavirus from Wuhan: An analysis based on decade-long structural studies of SARS coronavirus (2020) Journal of Virology, 94 (7), art. no. e0012720,                         | 67        |
| 8) Gao, J., et al. Breakthrough: Chloroquine phosphate has shown apparent efficacy in treatment of COVID-19 associated pneumonia in clinical studies (2020) BioScience Trends, 14 (1), art. no. 1047.                               | 63        |
| 9) Chen, Y., et al. Emerging coronaviruses: Genome structure, replication, and pathogenesis (2020) Journal of Medical Virology, 92 (4), pp. 418-423.  | 62        |
| 10) Chan, J.F.-W., et al. Genomic characterization of the 2019 novel human-pathogenic coronavirus isolated from a patient with atypical pneumonia after visiting Wuhan (2020) Emerging Microbes and Infections, 9 (1), pp. 221-236. | 61        |

**Table 3:** List of the most cited covid-19 papers in the Scopus database.



**Fig. 1:** List of the authors with the highest number of contributions on the research topic. Bar chart with the total papers, citation count and h-index of the authors with the highest number of contributions Visual bibliometric countries network related to the total amount of published papers. Visual bibliometric countries network related to the total citations.

from the data evaluation. The mean, the median and quartiles (Q) of the study variables were calculated. The previously described Gutiérrez-Vela et al. co-authorship index (Coa-Ind) was measured<sup>(4)</sup>.

In our research, a total of 1609 papers and 181 authors were assessed: 784 final full documents and 825 articles in press for a total of 6956 citations (mean: 8.89±19.1; max: 705; min: 0). The papers were categorized into a total of 27 scientific disci-

plines (Tab.1). The mean contribution for scientific discipline was  $199.625 \pm 331.4164137$  (median:7.0; range: 358-1; Q1: 1; Q3: 21).

| ACADEMIC AFFILIATIONS  | NUMBER OF DOCUMENTS |
|--|---------------------|
| Tongji Medical College   | 26                  |
| Huazhong University of Science and Technology                      | 26                  |
| The University of Hong Kong  | 15                  |
| Zhongnan Hospital of Wuhan University                              | 14                  |
| Chinese Academy of Medical Sciences & Peking Union Medical College | 14                  |
| Fudan University   | 12                  |
| Chinese Academy of Sciences  | 12                  |
| Wuhan University   | 12                  |
| Peking Union Medical College Hospital                              | 10                  |
| Sun Yat-Sen University   | 10                  |
| Aix Marseille Université   | 10                  |
| The University of Hong Kong Faculty of Medicine                    | 9                   |
| Ministry of Education China  | 8                   |
| State Key Laboratory of Virology                                   | 8                   |
| Universidade de Macau  | 7                   |
| National Taiwan University College of Medicine                     | 7                   |
| IRD Institut de Recherche pour le Developpement                    | 7                   |
| National Taiwan University Hospital                                | 7                   |
| Renmin Hospital of Wuhan University                                | 7                   |
| IRCCS Foundation Rome  | 7                   |

**Table 4:** List of the most cited covid-19 papers in the Scopus database.

A total of 164 scientific journals were assessed in the present research with a mean impact factor value of  $4.612 \pm 8.705$  (range: 70.67-0; median: 2,687, Q1: 0,701; Q3: 4,928) (Table 1).

The scientific journal with the highest number of contributions was Journal of Medical Virology with a total of 79 papers (mean:  $24.61 \pm 66.15$ ; median: 7.0; range: 79-1; Q1: 1; Q3: 19) (Table 2). The highest journal impact factor was measured for “New England Journal of Medicine” with a value of 70.670. The top 25 more frequent keywords are presented in Table 3. The authors with most publications are presented in Fig. 1. The bibliometric characterization of the authors is presented in Fig 1. The papers with the higher citation count are presented in Table 4.

A total co-authorship index (Coa-Ind) of 0.10 was reported. The most represented affiliations and funding societies were respectively the “Tongji Medical College-Wuhan China” with 75 documents and the “National Natural Science Foundation of China” with a total of 78 contributions. The visual bibliometric countries network based on citations, bibliographic coupling, co-citations, or co-authorship relations is presented in Fig. 1.

The novel coronavirus spread has given a strong impetus to research and academic analysis in an effort to reach a rapid diagnosis, health security and create new models of sustainable socio-economic development. From the bibliometric investigation, the medical aspect appears clearly the predominant side related to the Covid-19 crisis, due to the worldwide pandemic emergency<sup>(1-2)</sup>.

Moreover, tracking the spread of literature and data on Covid-19, showed that the largest amount of research is from China, where the pandemic started and the output of literature then spread to different countries with the spread of the disease. In second instance, the pandemic is touching more fields of life from veterinarians, environmental research on air particles and pollution to economic articles about the impact of the pandemic on global economies.

Rigid protocols of prevention are indicated such as hand-cleaning- and medical-glove-related hand protection, mask- and goggles-related face protection, UV-related technology protection, because eyes, nasal, oral mucosa, ears, and hair represent viable sources of transmission of the viral agents<sup>(5)</sup>.

The novel disease presents in many cases a sub-clinical course with nonspecific symptoms such as fever, coughing, myalgia, mild breathing difficulties, malaise and acute keratoconjunctivitis, which, in severe presentations, can develop into a severe acute respiratory and multi-systemic syndrome<sup>(1-2,5)</sup>.

Covid-19 virus might be able to bind the angiotensin-converting enzyme 2 receptor in humans. Moreover, high levels of interleukin-6 (IL-6), C-reactive protein (CRP) and hypertension were independent risk factors for the severity of the disease<sup>1,2</sup>. Clinical course and risk factors for mortality index of adult Covid-19 positive patients were elder, high SOFA score, and d-dimer greater than  $1 \mu\text{g/mL}$ <sup>(1)</sup>. There is no evidence of intrauterine infection caused by vertical transmission in Covid-19 positive women in late pregnancy<sup>(1,2)</sup>.

The treatment based on chloroquine phosphate administration at high dosages or in combination with the antibiotic azithromycin is currently controversial. Severe side effects such as cardiac arrhythmia, liver and kidney diseases, damage to nerve cells and hypoglycaemia have been reported<sup>(1,2)</sup>.

The heparin treatment of coagulopathy symptoms seems to be effective and a decrease of mortality related to Covid-19<sup>(1,2)</sup>.

ACE2-based peptide, remdesivir, 3CLpro-1 and a novel vinylsulfone protease inhibitor represent potential drug therapies against novel Covid 19<sup>(1,2)</sup>.

Recently in veterinary medicine, two viruses related to the bat-coronavirus have been described: porcine epidemic diarrhoea virus (PEDV) and the severe acute diarrhoea syndrome CoV (SADS-CoV<sup>(1,2)</sup>).

The positive patient tracking, the maintaining of inter-personal distancing and the avoidance of people congregating, are critical points for controlling the pandemic.

High air particulated pollution has been discussed as a potential co-factor for the coronavirus transmission and the increased mortality rate of the virus in Italy.

The bibliometric research showed an early representation of the scientific activity of the research community more concerned with healthcare and medical fields, while for the social and economic aspects it is still early and these need a long-term evaluation of the crisis sequelae.

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### Author Contributions:

*Conceptualization, FL, AS; methodology, AS, FL; software, FL; validation, AS, FL, investigation, FL, AS.; resources, AS; data curation, FL.; writing-original draft preparation, AS, FL.; writing-review and editing, AS, FL. All authors read and approved the final version of the manuscript.*

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