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Characterises of Top-Cited 500 Articles on COVID-19

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Highly cited articles are considered to be extraordinary works and contribute to the development of topics. To identify the characteristics of top-cited 500 articles on COVID 19 the Scopus database was searched and the top-cited 500 articles were identified. Further, an analysis was done to identify the most contributing journals, authors, countries, and prolific authors. Further investigation was done to identify the top-cited ten articles characteristics and most frequently appeared author-supplied keyword. Majority of the articles were contributed by China, USA and the United Kingdom. Wang, Y has contributed the highest numbers of top-cited articles on COVID 19. ***New England Journal of Medicine is the productive journal and majority of the articles were contributed by multiple authors. A large portion of the articles were concerned with*** **COVID treatment, medicine, and psychological problems faced during COVID 19.**

Keywords: *COVID 19, Top-cited articles, Authors, Journals, Author-supplied keywords***.**

1 INTRODUCTION

Highly cited articles analysis can help to get insight into how the particular subject has evolved and grown[1].The articles that receive more citations may likely be extraordinary works on the given topic[2]. Most of the highly cited papers are by authors from the developed countries, such as the USA, UK,

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etc., and published in the subject's core journals[3].Highly cited articles are not like ordinary articles that often resulted from vast numbers of authors and, most of the time, an international collaboration[4]. Highly-cited articles can have an impact on average citation rates in major subfields[5]. Therefore, many authors reported their research findings on the highly cited articles on different topics such as in radiology[1], orthodontics[6], Ramadan and public health[3], emergency medicine journals[7] and endocrinology and metabolism[2].

At the end of 2019, some of the patients with symptoms of most notably dry cough, dyspnea, fever, and bilateral lung in- filtrates on imaging reported in the Wuhan City, Hubei province in China. Later it was named as COVID-19 by the World Health organization[8]. After that, the number of cases has continued to escalate exponentially within and beyond Wuhan, spreading to all 34 regions of China by 30 January 2020 spreading later all over the world. COVID-19 primarily spreads through the respiratory tract, by droplets, respiratory secretions, and direct contact.The research activities on COVID 19 accelerated in exponential manner and many papers have contributed largely for the COVID research. Some of the studies were conducted to reveal the characteristics of the top cited 100 articles only[9]. Hence, there is a need to see the characteristics of the highly cited top 500 articles on COVID 19.

2 OBJECTIVES OF THE STUDY

The specific objectives of the study include: (i) to identify the characteristics of top-cited 500 articles on COVID 19 ; (ii) to find out the most contributing journal; (iii) to identify prolific authors (iv) to find out the country- wise distribution; (v) to reveal the characteristics of top-cited ten articles and (vi) the analysis of author-supplied keywords.

3 METHODOLOGY

A search was conducted on 20th July 2021 in the Scopus database with the keyword "COVID 19" in the article's title. As a result of the investigation, a sum of 121,961 records was found in the database. As the research article reports research findings the search was limited to the research articles only; 73, 847 articles were found in the database. Further, only top cited 500 articles information was downloaded such as authors, title, journal, citations, first author address, corresponding author address, etc. We have used Microsoft excel for analysis of most contributing journals, authors, institutes and countries. Further, we identified, the top ten most cited article and their characteristics and analysed the top most frequently appeared author supplied keywords.

4 ANALYSIS AND RESULTS

41 MAIN INFORMATION ABOUT DATA

The five hundred highly cited articles received 213,191 citations, with an average of 426 citations per article, ranging from 9350 to 169 as of 20th July 2021. It reflects how these works played a vital role in the growth of research on COVID 19. The majority of the articles published in 2020 (497 articles) and 226 journals contributed. Two thousand nine hundred twenty-five authors from 89 countries were involved in producing these 500 highly cited articles with an average of 5.85 per article. One more interesting finding is that twenty articles have been written by a single author and the remaining 480 articles are written by two or more authors.

42 COUNTRY CONTRIBUTION

Table 1 presents the list of countries that produced 15 or more highly cited articles on COVID 19. China has contributed highest numbers of highly cited articles on COVID 19 (223) followed by the USA (178), and United Kingdom (86). These three countries have contributed significant numbers of articles with average citations per article, i.e., 503. 413, and 454. It confirms that countries such as China, the USA, UK, Italy, Germany, France, Canada, Spain, Netherlands, Singapore, and Australia have contributed to the growth of research on COVID 19.

Table 1 Most Contributing Countries with 15 or More Top-cited Articles on COVID 19

CU	TP	TC	TC/TP
China	223	101610	503
United States of America	178	73508	413
United Kingdom	86	39069	454
Italy	57	21779	382
Germany	36	17974	499
France	32	13911	435
Canada	31	12846	414
Spain	26	10728	413
Netherlands	23	11939	519
Singapore	18	9608	534
Australia	15	5418	361

TP= total articles, TC= total citations, TC/TP= average citations per article

43 PROLIFIC AUTHORS

Table 2 presents the most prolific authors with average citations for their articles on COVID 19. WANG, Y., was a most productive author with 19 articles, followed by the Liu, Y., (18) and Li, J., (14). The Zhang, Y., receives the highest average citations, followed by Liu Y., (1071) and Wang, Y (977). Cluster analysis of authors was performed using VOS viewer software (Figure 1). Cluster- 1 formed by the authors such as LI, J., LI, Y., LIU, X., WANG, H., ZHANG, Y. Cluster -2 included with the authors such as CHEN, Y., WANG, J., WANG, W., WANG, Y., and ZHANG, L., and cluster- 3 formed with the authors such as CHEN, J., LIU, L., and LIU, Y. The authors within the cluster have major collaboration in the publication of highly cited articles on COVID 19.

Table 2 Most Prolific Authors With 10 or More Top-Cited Articles on COVID 19.

Author	TP	TC	TC/TP	Institute
Y. Wang	19	18573	977	National Clinical Research Centre for Respiratory Diseases, China
Y. Liu	18	17153	952	Xiamen University, China
J. Li	14	5688	406	Huazhong University of Science and Technology, Wuhan, Hubei, China;
Y. Zhang	14	15004	1071	Jinzhou Medical University, China
L. Zhang	14	5950	425	University of Science and Technology, Wuhan, China;
Y. Chen	12	5592	466	Zhongnan Hospital of Wuhan University, China
Y, Li	12	4204	350	Huazhong University of Science and Technology, China
J. Chen	10	2740	274	Shanghai Public Health Clinical Center, China
L. Liu	10	2983	298	National Clinical Research Center for Infectious Diseases, China
X. Liu	10	4894	489	Huazhong University of Science and Technology, Wuhan, China
J. Wang	10	5571	557	University of Pittsburgh, Pittsburgh, United States
W. Wang	10	4223	422	Second People's Hospital of Yancheng City, China
H.Wang	10	4128	412	National Center for Liver Cancer, China

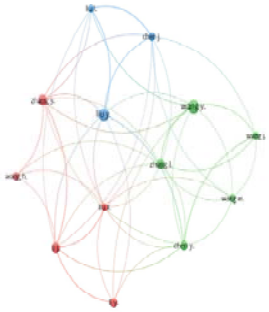

Figure 1 cluster analysis of authors contributed 10 or more top-cited articles on COVID 19

44 PRODUCTIVE JOURNALS

Top contributing journals on COVID 19 have been listed in Table 3. *New England Journal of Medicine* has produced almost 5 % of articles, followed by the Science *of the Total Environment* (3.6%) and *The Lancet (3.6%)*. The journals' impact factor ranges from 70.67 to 2.04. *Science of the Total Environment* has contributed significant numbers of highly cited articles on COVID 19, even though having 5.5 impact factors. This finding indicates that even less impact factor journals can produce substantial numbers of highly cited papers.

Table 3 Most Productive Journals with 6 or more Top-cited Articles on COVID 19

Journal	TP	% (R)	IF 2018
New England Journal of Medicine	25	5 (1)	70.67
Science of the Total Environment	18	3.6 (2)	5.589
The Lancet	18	3.6 (2)	59.102
Science	14	2.8 (4)	41.037
Radiology	12	2.4 (5)	7.608
JAMA - Journal of the American Medical Association	11	2.2 (6)	51.273
Journal of Infection	10	2 (7)	5.099
Nature	10	2 (7)	43.07
Journal of Medical Virology	9	1.8 (9)	2.049
Journal of Thrombosis and Haemostasis	9	1.8 (9)	4.662
Brain, Behavior, and Immunity	8	1.6(11)	6.17
Clinical Infectious Diseases	8	1.6(11)	9.055
JAMA Cardiology	8	1.6(11)	11.866
Cell	6	1.2 (14)	36.216

TP= total articles, %= percentage of 500 articles

45 CHARACTERISTICS OF TOP TEN HIGHLY CITED ARTICLES

Table 4 presents the top ten most cited articles from the 500 highly cited articles data set. Out of ten articles, five articles were first author and corresponding authors belonging to China, followed by the USA, each one from France and United Kingdom. Nine articles were published in 2020 and one article in 2021. The average year of publication of these articles is 0.9 years. The average number of citations per article is 3054, and the average number of authors per document is 21.7. All the papers are multi- authored.

Table 4 Top Ten Most Cited Articles on COVID 19

Rank	Article title	TC	FA	CA
1	Zhou, F., Yu, T., Du, R., Fan, G., Liu, Y., Liu, Z., … Cao, B. (2020). Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. The Lancet, 395, 1054–1062	9350	China	China
2	Xu, Z., Shi, L., Wang, Y., Zhang, J., Huang, L., Zhang, C., … Wang, F.-S. (2020). Pathological findings of COVID-19 associated with acute respiratory distress syndrome. *The Lancet Respiratory Medicine*, *8*, 420–422	3512	China	China
3	Richardson, S., Hirsch, J. S., Narasimhan, M., Crawford, J. M., Mcginn, T., & Davidson, K. W. (2020). Presenting Characteristics, Comorbidities, and Outcomes Among 5700 Patients Hospitalized With COVID-19 in the New York City Area, *10022*, 2052–2059.	2905	USA	USA
4	Gautret, P., Lagier, J.-C., Parola, P., Hoang, V. T., Meddeb, L., Mailhe, M., … Raoult, D. (2020). Hydroxychloroquine and azithromycin as a treatment of COVID-19: results of an open-label non-randomized clinical trial. *International Journal of Antimicrobial Agents*, *56*.	2479	France	France

5	Wang, C., Pan, R., Wan, X., Tan, Y., Xu, L., Ho, C. S., & Ho, R. C. (2020). Immediate Psychological Responses and Associated Factors during the Initial Stage of the 2019 Coronavirus Disease (COVID-19) Epidemic among the General Population in China. *International Journal of Environmental Research and Public Health*, *17*, 1–24.	2468	China	China
6	Cao, B., Wang, Y., Wen, D., Liu, W., Wang, J., Fan, G., … Wang, C. (2020). A trial of lopinavir-ritonavir in adults hospitalized with severe covid-19. *New England Journal of Medicine*, *382*, 1787–1799.	2421	China	China
7	Ai, T., Yang, Z., Hou, H., Zhan, C., Chen, C., Lv, W., … Xia, L. (2020). Correlation of Chest CT and RT-PCR Testing for Coronavirus Disease 2019 (COVID-19) in China: A Report of 1014 Cases. *Radiology*, *296*, E32–E40	2038	China	China
8	Lauer, S. A., Grantz, K. H., Bi, Q., Jones, F. K., Zheng, Q., Meredith, H. R., … Lessler, J. (2020). The incubation period of coronavirus disease 2019 (CoVID-19) from publicly reported confirmed cases: Estimation and application. *Annals of Internal Medicine*, *172*, 577–582.	1912	USA	USA
9	Beigel, J. H., Tomashek, K. M., Dodd, L. E., Mehta, A. K., Zingman, B. S., Kalil, A. C., … for the ACTT-1 Study Group Members. (2020). Remdesivir for the treatment of COVID-19 — Final report. *New England Journal of Medicine*, *383*, 1813–1826.	1770	USA	USA
10	Horby, P., Lim, W. S., Emberson, J. R., Mafham, M., Bell, J. L., Linsell, L., … Landray, M. J. (2021). Dexamethasone in hospitalized patients with covid-19. *New England Journal of Medicine*, *384*, 693–704.	1687	UK	UK

TC= total citations, FA= first author article, CA= corresponding article.

46 ANALYSIS OF AUTHOR SUPPLIED KEYWORDS

The author-supplied keywords can denote the actual content of the article. Table 5 presents the most frequently appeared author-supplied keywords in the highly cited top 500 articles on COVID 19. Most appeared keywords were COVID 19, followed by the Sars-cov-2, Coronavirus, and Pneumonia. Some important keywords such as anxiety, depression, mental health and stress indicate that significant numbers of highly cited articles were related to the psychological problems faced during COVID 19. Few articles were related to mortality and hydroxychloroquine.

Table 5 Most Frequently Appeared Author- Supplied Keywords.

Author keyword	Number of times appeared	% of 748
COVID 19	189	25
Sars-cov-2	76	10
Coronavirus	71	9
Pneumonia	21	3
Pandemic	21	3
Anxiety	18	2
Mortality	16	2
Depression	15	2
Mental health	10	1
Hydroxychloroquine	10	1
China	10	1
Stress	9	1
Epidemic	8	1
2019-ncov	8	1
CT	6	1

5 CONCLUSION

In this study, an analysis of top cited 500 articles on COVID 19 has been performed. Most of the articles were published in the year 2020. A few articles were single authored. Large number of highly cited papers were contributed by the authors from China, followed by the USA. Many prolific authors were also from China. High impact factor journals such as New *England Journal of Medicine, Lancet, Science, JAMA- Journal of the American Medical Association, nature, and Cell* have significantly contributed to the COVID 19 research. A significant portion of the research that has become highly cited concerns COVID treatment, medicine, and psychological problems faced during COVID 19.

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