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GLOBAL RESEARCH OUTPUT ON 'CORONAVIRUS DISEASE-2019' (COVID-19)

Seema Parmar
seemaparmar9@gmail.com

suman ghalawat
sahrawat_s@yahoo.com

Ashwani Kumar
CCSHAU,Hisar, ashwanirana1980@gmail.com

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Dr. Seema Parmar
Assistant Librarian, Nehru Library,
CCS Haryana Agricultural University, Hisar, Haryana
Seemaparmar9@gmail.com
Dr. Suman Gahlawat
Assistant Professor, Dept of MBA
CCS Haryana Agricultural University, Hisar, Haryana
sahrawat_s@yahoo.com
Dr. Ashwani Kumar
Sr. Lecturer, Dept. of Oral Pathology and Microbiology
Rajasthan dental College, Rajasthan University of Health Sciences (RUHS), Jaipur, Rajasthan.
ashwanirana1980@gmail.com

Abstract

Purpose: The present study reflects the trend and growth of publications on COVID-19 viral disease spreading around the world. With the emergence of COVID-19 in Wuhan, China in December 2019, scholars started publishing their researches in form of different kind of publications.

Methodology: The data has been extracted from the Scopus database using key TERMS Covid-19 and corona virus 2019.

Findings: During six month period around ten thousand publications are contributed by scientists around the globe. The literature produced in different fields but highest output is made in the field of Medicine. BMJ and Journal of Medical Virology journals produced highest amount of research on COVID. Highest numbers of publications have been contributed by China based two institutions viz. Huazhong University of Science and Technology and Tongji Medical College, China. Mahase, E. of UK contributed maximum papers followed by Wiwanitkit, V. of China.

Keywords: COVID-19, nCov, Coronavirus 2019, Bibliometrics, Research output, COVID Literature.

1. INTRODUCTION

Nowadays almost whole world is fighting against Novel Coronavirus or COVID-19 and efforts are being done by all the scientists of the world to develop the vaccine to get rid of the disease. COVID-19 stands for **CO**rona**VI**rus **D**isease which emerged in the year 2019. It is also popular by names of n Cov, Corona, Covid. At the end of 2019, multiple patients reported with pneumonia of unknown origin in Wuhan city of China and the causes were linked to sea food and wet animal market in Wuhan. On sampling from lower respiratory tract Zhu, etal identified

novel corona virus as source of infection.[2] Corona virus is basically a RNA virus and till date seven corona viruses are identified namely:

1. "229E (alpha coronavirus)
2. NL63 (alpha coronavirus)
3. OC43 (beta coronavirus)
4. HKU1 (beta coronavirus)
5. MERS-CoV (the beta coronavirus that causes Middle East Respiratory Syndrome, or MERS)
6. SARS-CoV (the beta coronavirus that causes Severe acute respiratory syndrome, or SARS)
7. 2019 Novel Coronavirus (2019-nCoV)".[3,5]

"The pathogenic infectivity of nCov requires the binding of S1 subunit of the spike (S) to the human Angiontensin Converting Enzyme (ACE2). After binding with ACE2 recepter the virus penetrates in to the human cell that require cleavage of S1–S2 subunits to expose S2 for fusion to cell membrane via host proteases like cathepsins, cell surface transmembrane protease/serine (TMPRSS) proteases, furin, trypsin and factor Xa).[1]

The nCov spreads primarily through contact with infected persons via respiratory droplets or nasal and oral discharge. Symptoms of Covid-19 include shortness of breath, fever, cough, weakness and diarrhea. . Sometimes it may more severe and may lead to pneumonia, difficulty in breathing and more rarely the disease can be fatal in older individual and people with preexisting medical conditions.

"A real-time reverse transcription PCR (RT-PCR) assay was used as diagnostic methods to detect viral RNA by targeting a consensus RdRp region of pan β-CoV. Virus isolation from the clinical specimens was performed with human airway epithelial cells and Vero E6 and Huh7 cell lines."[5]

COVID "has triggered an avalanche of scientific research, both within and outside the medical domain, in order to help communities overcome this challenge by minimizing its adverse impacts. Research on Coronaviruses in general dates back to 1960's and the literature on this topic is quite well established. The sub-domain of this academic field of research focusing on COVID19, however, is understandably just an emerging and fast developing field"[6]. In the

present study effort has been made to highlight the total research output of six months i. e December 2019-May 2020 on COVID-19 along with other like prolific authors, institutions, keywords, countries, subjects, etc.

2. OBJECTIVES OF THE STUDY

The main objective of this study is to analyze the research output on COVID-19 produced by different scholars and scientists. The specific objectives are:

1. To analyze the year-wise research output on COVID-19.
2. To find subjects wise research output on COVID-19.
3. To identify the most prolific authors conducted research on COVID-19.
4. To study the top sources preferred by authors for publishing COVID-19 research.
5. To know the top institutional research output on COVID-19.
6. To identify the top countries conducting research on COVID-19.
7. To identify the top used keywords in research publications on COVID-19.

3. METHODOLOGY

Data for the present study has been extracted from World's largest database of peer reviewed literature i.e. Scopus. The study covers data from December 2019 to May 2020 for the Pandemic disease 'Covid-19' spreading worldwide. Data obtained from Scopus on COVID-19 was extracted using key words -COVID-19, Novel Corona virus Disease 2019. After exporting data from Scopus database to excel sheet, it was encircled in definite to summarize outputs and place into tabular form.

4. DATA ANALYSIS AND FINDINGS

4.1 Yearly Distribution of Research Publications on COVID-19

Table 1 shows the year-wise distribution of research publications during the period under study. In the year 2019 only a fewer publications appeared on COVID-19 during December 2019 which increased drastically from 07 in 2019 to 9947 publications in 2020 till May. It may be due to as "On 29th Jan WHO declared nCov 2019 as public health emergency of international concern. The disease was christened as COVID 19 by WHO on 11th Feb 2020"[3]. It is also notable in table that highest citations (27806) were recorded in the year 2020 whereas in 2019 only 16 citations were credited to 7 papers. The table reflects that in a total period of 6 months

of pandemic (Dec 2019-May 2020) a total of 9954 research publications were appeared at global level ACPP of which was 2.79.

Table 1: Year-wise distribution of research literature on COVID

Year	TP	TC	ACPP
2020	9947	27806	2.79
2019	7	16	2.28
Total	9954	27822	2.79

(TP=Total Publications; TC=Total Citations; ACPP= Average Citation Per Paper)

4.1 Subject-wise distribution of Research publications

Subject-wise distribution of research publications on COVID-19 is clearly depicted in table 4.2. It is evident that majority of publications on COVID-19 were produced in the field of 'Medicine' (68.74%) which was distantly followed by 'Biochemistry, genetics and molecular biology' (7.40%). 'Immunology and microbiology' contributed 828 publications (6.79%) whereas Social sciences contributed nearly half of it i.e. 388 (3.18%) publications. With a very small gap 'Nursing' and 'Neuroscience' contributed almost similar percentage of publications on the disease i.e. 373 (3.06%) and 355 (2.91%) respectively. 'Pharmacology, toxicology and pharmaceutics' field contributed 310 (2.54%) publications to its credit followed by 'Environmental science i.e. 245 (2.01%). Last but not the least 'health professionals' also contributed their ideas in 217(1.59%) publications for the awareness of public. 'Psychology' discipline at 10th position contributed 194(1.59%) papers.

Table 2: Subject wise publication output

Subject	**TP**	**Percentage (%)**
Medicine	8384	68.74
Biochemistry, Genetics and Molecular Biology	902	7.40
Immunology and Microbiology	828	6.79
Social Sciences	388	3.18
Nursing	373	3.06
Neuroscience	355	2.91
Pharmacology, Toxicology and Pharmaceutics	310	2.54
Environmental Science	245	2.01
Health Professions	217	1.78
Psychology	194	1.59
Total	12196	100.00

4.3 Type of Research Publications

Nearly half of the research output on Covid-19 was published in the form of articles i.e. 49.81%, followed by letters (21.05%). The next type was the editorial notes (10.28%) followed by review, note, short survey, erratum, conference paper and finally data papers i.e. 8.74%, 8.00%, 1.07%, 0.5%, 0.42%, and 0.09% respectively.

Table 3: Type of publications

Type	TP	Percentage (%)
Article	4959	49.81
Letter	2096	21.05
Editorial	1024	10.28
Review	870	8.74
Note	797	8.00
Short Survey	107	1.07
Erratum	50	.50
Conference Paper	42	.42
Data Paper	9	.09
Total	9954	100.00

4.4 Preferred Sources for Publications on COVID-19

Top twenty sources preferred for publications on COVID-19 are listed in table 4. These twenty sources published nearly 1725(17.32%) publications during six months. It is very apparent from table 4 that *BMJ Clinical Research Ed* has published maximum articles i.e. 12.81%, followed by Journal of Medical Virology (11.36%). A very small gap was there in *BMJ and Lancet* regarding the publications i.e. 7.94% & 7.59% respectively followed by *Infection Control and Hospital epidemiology* (5.04%). *Psychiatry Research* at 20th position published 2.84%. It is also found that publications on COVID-19bwere published in many Impact factor journals. There were 3.42 percent publications published in highest IF journal *New England Journal of Medicine* (IF-70.670), Lancet (IF-59.102) and Journal of The American Medical Association (IF-51.273).

It is notable that majority of the journals belongs to medicinal and disease and perfectly matches with COVID-19 disease.

Table 4: Top twenty sources published on COVID- 19

Sources	Publisher	Country	TP	Percentage	TR-IF

				(%)	2019
BMJ Clinical Research Ed	BMJ Pub. Group	UK	221	12.81	-
Journal of Medical Virology	John Wiley & Sons	USA	196	11.36	2.049
BMJ	BMJ Pub. Group	UK	137	7.94	27.604
Lancet	Lancet Pub Group	UK	131	7.59	59.102
Infection Control and Hospital Epidemiology	Cambridge University Press	UK	87	5.04	2.856
Journal of Infection	W.B Saunders Co. Ltd	UK	85	4.92	5.099
Travel Medicine And Infectious Disease	Elsevier BV	Netherland	85	4.92	4.868
Clinical Infectious Diseases	Oxford Univ. Press	UK	82	4.75	9.055
Lancet Infectious Diseases	Lancet Pub Group	UK	73	4.23	27.516
Science of The Total Environment	Elsevier BV	Netherland	71	4.11	5.589
JAMA-Journal of The American Medical Association	American Medical association	United States	68	3.94	51.273
International Journal of Environmental Research And Public Health	Multidisciplinary Digital Publishing Institute	Switzerland	60	3.47	2.468
New England Journal of Medicine	Massachusetts Medical Society	United States	59	3.42	70.670
Dermatologic Therapy	Blackwell Oublishing Inc.	UK	58	3.36	1.740
Brain Behavior and Immunity	Elsevier Inc.	United States	57	3.30	6.170
International Journal of Infectious Diseases	Elsevier BV	Netherland	55	3.18	3.538
Anesthesia and Analgesia	Lippincott Williams & Wilkins Ltd.	United States	52	3.01	3.489
Journal of The American Academy of Dermatology	Mosby Inc.	United States	50	2.89	7.102
Head and Neck	John Wiley & Sons	USA	49	2.84	2.442
Psychiatry Research	Elsevier B.V	Netherland	49	2.84	2.208
Total	-	-	1725	17.32	-

(TR-IF: Thomson Reuter's Impact Factor)

4.5 Institutional Contribution on COVID-19

Top twenty institutions that contributed highest research publications on COVID-19 during the period under study are listed in table 5. These top institutions collectively contributed 2470 (24.81%) publications on COVID-19. Highest numbers of publications among top twenty institutes were contributed by Huazhong University of Science and Technology (10.72%) and Tongji Medical College (10.64% publications). University at 20th position viz. Fudan University, contributed 85 publications. It is also apparent that out of top twenty institutions, nine institutions were from China.

Hence it can be concluded that worldwide universities have participated for providing the literature on this pandemic disease COVID-19.

Table 5: Research output of top twenty institutions

Institutions	Country	TP	Percentage (%)
Huazhong University of Science and Technology	China	265	10.72
Tongji Medical College	China	263	10.64
Harvard Medical School	USA	178	7.20
Inserm	Paris	139	5.62
UniversitÃ degli Studi di Milano	Italy	130	5.26
University of Toronto	Canada	123	4.97
University College London	UK	120	4.85
UniversitÃ degli Studi di Roma La Sapienza	Italy	120	4.85
IRCCS Foundation Rome	Italy	107	4.33
University of Oxford	UK	104	4.21
Chinese Academy of Medical Sciences & Peking Union Medical College	China	103	4.17
University of California, San Francisco	USA	101	4.08
The University of Hong Kong	China	95	3.84
Zhongnan Hospital of Wuhan University	China	94	3.80
Brigham and Women's Hospital	USA	92	3.72
Chinese University of Hong Kong	China	89	3.60
NHS Foundation Trust	UK	88	3.56
Wuhan University	China	88	3.56
Renmin Hospital of Wuhan University	China	86	3.48
Fudan University	China	85	3.44
Total		2470	24.81

4.6 Most Prolific Authors

The list of top seven authors who produced highest contribution to research output on COVID-19 s listed in Table 6. These top seven authors collectively published 183 papers on COVID-19. In terms of publications, Mahase, E. contributed maximum i.e. 48 papers followed by Wiwanitkit, V. (29) and Lippi, G. (28) respectively. Three authors have contributed exactly same number of publications i.e. 20 each for COVID-19. On the other hand, Goldust, M contributed 18 publications. Lippi, G had higher H –index i.e 67 followed by Rodriguez-Morales, A.J. (30). Out of top seven authors three were from UK.

Table: 6 Top prolific authors

Top Authors	Affiliation	Country	TP	H index
Mahase, Elisabeth	BMJ	UK	48	5
Wiwanitkit, Viroj	Hainan Medical University	China	29	5
Lippi, Giuseppe	Univ. of Verona,	Italy	28	67
Iacobucci, Gareth	Medical Schools Council	UK	20	1
Rimmer, Abi	BMJ	UK	20	5
Rodriguez-Morales, A.J.	Universidad Tecnológica de Pereira, Pereira	Colombia	20	30
Goldust, Mohamad	Department of Dermatology, University Hospital Basel, Basel	Switzerland	18	14
			183	

4.7Top Countries Research Contribution

A research contribution of top twenty countries on COVID-19 is mentioned in Table.4.8. United States is on the first position with 2216 (22.26%) publications followed by China, Italy and United Kingdom in publications regarding COVID-19 and the corresponding values were 1977(19.86) , 1162(11.67%) ,1002 (10.07%) respectively. India's share of contribution is at fifth

position with 470 (4.72%) publications to its credit. Four countries France, Canada, Germany and Australia have contributed more 3 to 4 percent output on COVID. Next most contributing countries viz. Spain, Switzerland, Iran, Brazil and Singapore and Netherland which produced more than 2 percent publications on the disease. Another six top countries, Hong Kong, South Korea, Japan and Turkey also contributed remarkably. Hence it can be concluded that U.S., China, Italy, U.K. and India were more active countries in terms of publishing on COVID-19.

Table: 7 Top twenty countries research contribution

Top Countries	TP	Percentage (%) (N=9954)
United States	2216	22.26
China	1977	19.86
Italy	1162	11.67
United Kingdom	1002	10.07
India	470	4.72
France	433	4.35
Canada	393	3.95
Germany	383	3.85
Australia	345	3.47
Spain	296	2.97
Switzerland	277	2.78
Iran	258	2.59
Brazil	216	2.17
Singapore	214	2.15
Netherlands	199	2.00
Hong Kong	142	1.43
South Korea	136	1.37
Japan	134	1.35
Turkey	130	1.31
Belgium	126	1.27

4.8 Most Preferred Keywords used for Research on COVID

The most popular keywords that appeared in research publications on COVID-19 during period of six months are listed in table 8. The top fifteen keywords were appeared 27182 times in total publications published during the period under study. The frequently used keyword in the publications on nCov disease was COVID-19 used in 3235 papers followed by Human and coronavirus Disease 2019 i.e. in 2836, and 2355 papers respectively. On the other hand two terms Pandemic and coronavirus Infection used in similar number of papers i.e. 2100 and 2097 respectively. Three related terms Virus Pneumonia, corona virus Infections, Pneumonia, viral

and humans used in similar percentage i.e. 6.53%, 6.23% and 6.19 respectively. Another six terms Pandemics, Betacoronavirus, Severe Acute Respiratory Syndrome Coronavirus 2, Coronavirus, Priority Journal and SARS-CoV-2 were also used in publications and the corresponding number was 5.31%, 5.28%, 5.28%, 5.13%, 4.63%, and 4.14% respectively. Hence it can be said that keyword COVID-19 is popularly used in most of the papers globally.

Table 8: Top 15 keywords used in publications on COVID-19

Keywords Used	TP	Percentage (%)
COVID-19	3235	11.90
Human	2836	10.43
Coronavirus Disease 2019	2355	8.66
Pandemic	2100	7.72
Coronavirus Infection	2097	7.71
Virus Pneumonia	1776	6.53
Corona virus Infections	1712	6.29
Pneumonia, Viral	1683	6.19
Humans	1646	6.05
Pandemics	1445	5.31
Betacoronavirus	1436	5.28
Severe Acute Respiratory Syndrome Coronavirus 2	1395	5.13
Coronavirus	1259	4.63
Priority Journal	1128	4.14
SARS-CoV-2	1079	3.96
Total	27182	

5. SUMMARY AND CONCLUSIONS

The study focused on the six months (December 2019 –may 2020) research output on COVID-19 worldwide. It indicates that a total number of 9954 papers were published which has received 27822 citations during period under study. It was evident that medicine subject was on the top as COVID-19 is also a disease or we can say pandemic and the corresponding publications was 8384 i.e. 68.74% followed by biochemistry, genetics and molecular biology was 902 i.e. 7.40% only. Majority of the research publication was in the form of articles i.e. 49.81%, followed by nearly half in the form of letter i.e. 21.05% reflect about COVID-19. The next type was in the editorial form i.e.10.28% followed by review, note, short survey, erratum, conference paper and finally data paper i.e. 8.74%, 8.00%, 1.07%, 0.5%, 0.42%, and 0.09%

respectively. *BMJ Clinical Research Ed* has contributed maximum i.e. 12.81% maximum, followed by Journal of Medical Virology i.e. 11.36%. A very small gap was there in *BMJ and Lancet* regarding the publications i.e. 7.94% & 7.59% respectively followed by *Infection Control and Hospital epidemiology* contributed i.e. 5.04%. Total fifteen keywords constitute 27182 publications to its credit. The frequently used word was COVID-19 i.e. 3235 times followed by Human and coronavirus Disease 2019 i.e. 2836, and 2355 respectively. The top ten institutions have contributed 2470 towards publication regarding COVID-19. It was also observed that among ten top Institutions which contributed highest research output on COVID-19 were Huazhong University of Science and Technology and Tongji Medical College i.e. 265 and 263 publications. In terms of publications, Mahase, E. contributed maximum i.e. 48 followed by Wiwanitkit, V. Lippi, G. i.e. 29 and 28 respectively. Three authors have contributed exactly same number of publications i.e. 20 each for COVID-19. United States is on the first position with 2216 publications followed by China, Italy and United Kingdom in publications regarding COVID-19 and the corresponding value was 1977, 1162, 1002 respectively. India's share of contribution is at fifth position with 470 publications to its credit. The study clearly reflects that research work on COVID-19 was very less in the last year or December 2019 but increased as COVID-19 becomes pandemic worldwide. Major research output took place in January 2020-May 2020especially during spread of COVID-19.

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