Note

COVID-19 research in India: A quantitative analysis

Manohar Pathak*

Directorate of Education, GNCT Delhi, New Delhi-110 054, Delhi, India

In this paper we attempt to identify the coverage of publication on SARS-CoV-2 (COVID-19) in different academic databases. Analysis of Indian publications in Dimension has been carried out to identify the authors, institutions, keywords, and journals. Dimension indexes from India 742 publications with 196 citations as on 11th May 2020. All India Insitute of Medical Sciences is the most productive organization with 65 publications. Preprint servers such as MedRXiv and BiorXiv are the leading databases where Indian authors have made available their research output.

Novel coronavirus pandemics have become the most lethal problems of the year 2020. The outbreak of COVID-19 started from the Wuhan city of China in the end of 2019 and spread all over the world. Rarely any country is unaffected with this global pandemic infection. Seeing its severity World Health Organization declared it as public health emergency of International concern on 30th of January 2020. 4, 088, 848 cases and 2, 83, 153 deaths were reported by WHO as on 12th May 2020 (https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200512-COVID-19-sitrep-113.pdf?sfvrsn=feac3b6d_2). India is the 12th worst affected country due to COVID-19 and infected cases crossed the 75000 mark with more than 2500 deaths. Economic activities were forced to its minimum level across the globe to minimize its effect. In India a total lockdown was announced by Government of India w.e.f 24th March 2020 initially for 3 weeks which were further extended in two phases. Due to lockdown all economic activity were suspended except the supply chain of essential commodities such as medicine and food. Researchers have shown concern about novel corona-virus 2019, and are investigating clinical, epidemiological, diagnostic and therapeutic aspects of it. Researchers across the globe are leaving no stone unturned in search of remedies to overcome this menace and publications output of COVID-19 is increasing by leaps and bounce. The abundance of publications needs to be analysed in order to measure its impact in research community. Bibliometric method is the most widely used to assess the research impact, collaboration, funding agencies, authors, journals *etc*. statistically. Lou *et al.* (2020) performed bibliometric analysis and review of COVID-19 results using PubMed data. Kausha & Thelwall (2020) highlighted the number of publications in various academic databases. The objective of this paper is to investigate the coverage of COVID-19 related publications from India and to identify the authors, Institutes, international collaboration, keywords and productive journals preferred by Indian researchers to publish their research output.

Methodology

In this paper we looked into 7 academic databases *viz*. Google scholar, Microsoft Academic, Lens, Dimensions, Scopus, PubMed and Web of Science (WoS) on date 10th of May 2020. Search string ("COVID -19" OR "CoV-19" OR "2019-nCoV" OR "SARS-CoV-2") in topic field was used to retrieve data. For Indian publication in COVID-19 four databases *i.e*. WoS, PubMed, Lens and Dimension were searched. Database Dimension provides comprehensive set of literature on COVID-19 at one place which were exported as Excel file and further analysed. To identify network and keyword from Web of Science e Vosviewer software was used.

Results and Analysis
Number of publications in databases

However, Google scholar is the most comprehensive database but it does not give option of filtering data

*Correspondence:
E-mail: manoharpathak@gmail.com

and exporting the metadata. It has maximum number of publication 51230 followed by Dimension with 27886 publications all over the world (https://covid-19.dimensions.ai/) Database Lens contains 236832 number of records, Microsoft Academic indexes 15637, Pubmed retrieved 10487 records, Scopus 7004 and Web of Science have the least number of records with 2848 publications. For India's publications in COVID-19 database Dimensions have maximum 742 records, followed by PubMed having 423 record, Lens with 194 records, and Web of Science have 100 publications from India.(Figs. 1 & 2).

The first citation database *i.e.* Web of science started in 1976 is considered to be the most prestigious and impactful database as it have high standard for induction of journals into it and also it takes some time to appear articles in the database after publication. On the contrary the Database Dimension
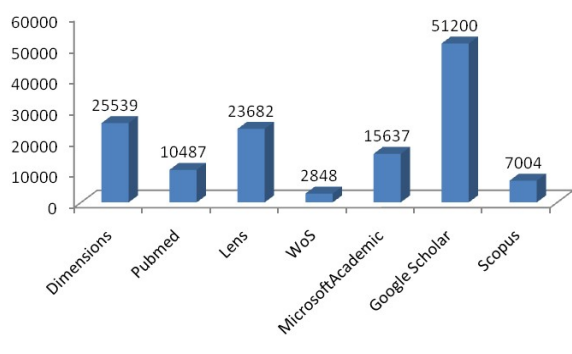

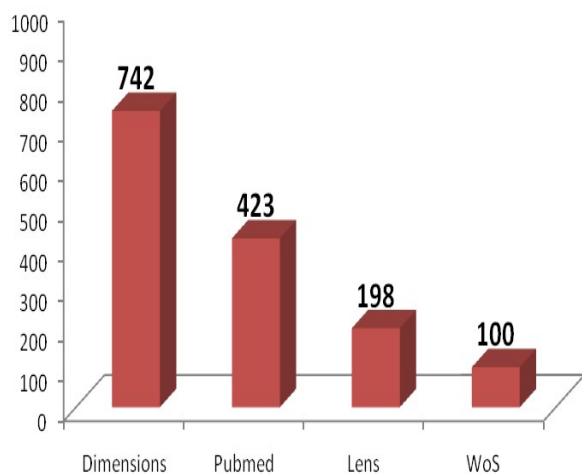Fig. 1 Coverage of Global Publication output in various databases

Fig. 2 — Coverage of Indian Publication output in various databases

has very wide coverage, it also indexes preprint publications because of this number of publication in the database shows the maximum number of records.

Most contributing Organizations

While analysing the contributing organization on COVID-19 publication it was found that there are 751 national and international organizations which have contributed these 742 publications. Table 1 represents the list of organizations with more than 10 publications which contributed 50% of total published research. All India Institutes of Medical Sciences is the most productive organizations with 68 publications. (8.7%), followed by Dr D Y Patil Vidyapeeth, Pune with 49 publications (6.6%), PGIMER Chandigarh, 42 publications (5.6%), King George Medical University, Lucknow with 32 publications (4.3%). There are more than 500 institutions which have contributed only a single paper. Among the international institutes collaborating with Indian organizations Hainan Medical University, China is the most preferred organization with 38 publications.

Source of Publications

Table 2 enlists the sources which published more than 10 publications. Interestingly, Preprint servers MedRxiv and BioRxiv are top two sources where these research have been published with 78 (10.5%) publications and 40 publications (5.3%), respectively. There are 105 publications (14.2%) which have been published either as book chapters, reports and any other type of publications which do not have proper source titles.

Table 1 — Organizations with more than 10 Publications		
Organizations	Publications	%age
All India Institute of Medical Sciences	65	8.76
Dr. D.Y. Patil Vidyapeeth, Pune	49	6.60
Post Graduate Institute of Medical Education and Research	42	5.66
King George's Medical University	32	4.31
Indian Council of Medical Research	20	2.70
University of Delhi	16	2.16
Manipal University	16	2.16
National Institute of Mental Health and Neurosciences	15	2.02
Sanjay Gandhi Post Graduate Institute of Medical Sciences	14	1.89
National Institute of Virology	14	1.89
Indian Veterinary Research Institute	14	1.89
Maulana Azad Medical College	12	1.62
Indraprastha Apollo Hospitals	12	1.62
Tata Memorial Hospital	12	1.62

These sources along with the source titles mentioned in (Table 2) comprises 408 publications which is more than 55% of total Publications, there are total 256 source items which have been preferred for publications by Indian researchers.

Authors

There are 6 Indian authors (Table 3) who have contributed 10 or more publications. There are total 2690 Authors including the authors from foreign organizations who have contributed in COVID-19 publications from India. Wiwanitkit, Viroj from Dr. D. Y. Patil Vidyapeeth Pune is the most productive author with 50 publications, followed by Shailendr K Saxena from King George's Medical University, Lucknow with 17 publications, Nivedita Gupta from Indian Council of Medical Research with 14 publicaitons, Gangakhedkar, Raman R from Indian Council of Medical Research with 12 publications, Raju Vaishya from Indraprastha Apollo Hospital with 11 publications, Kuldeep Dhama from Indian Veterinary Institute with 10 publications.

Keywords

There are 239 preferred keywords related with COVID-19 publications used by Indian researchers. COVID-19, corona-virus, SARS-CoV-2 are the most prevalent keywords with 28, 17 and 13 number of frequency, respectively, (Fig. 3) depicts the network of Keywords related with COVID-19. These

Table 2 —List of sources with more than 10 Publications

Source Titles	Publications
MedRxiv	78
BioRxiv	40
Research Square	34
Asian Journal of Psychiatry	31
SSRN Electronic Journal	31
The Indian Journal of Medical Research	26
Diabetes & Metabolic Syndrome Clinical Research & Reviews	20
Indian Pediatrics	17
Journal of Biomolecular Structure and Dynamics	13
The Science of The Total Environment	13

Table 3 — List of authors with more than 10 Publications

| Authors	Organizations	Publications
Wiwanitkit, Viroj	Dr. D.Y. Patil Vidyapeeth, Pune	50
Saxena, Shailendra K.	King George's Medical University, Lucknow	17
Gupta, Nivedita	Indian Council of Medical Research	14
Gangakhedkar, Raman R	Indian Council of Medical Research	12
Vaishya, Raju	Indraprastha Apollo hospital	11
Dhama, Kuldeep	Indian Vetrinary research Insitute	10
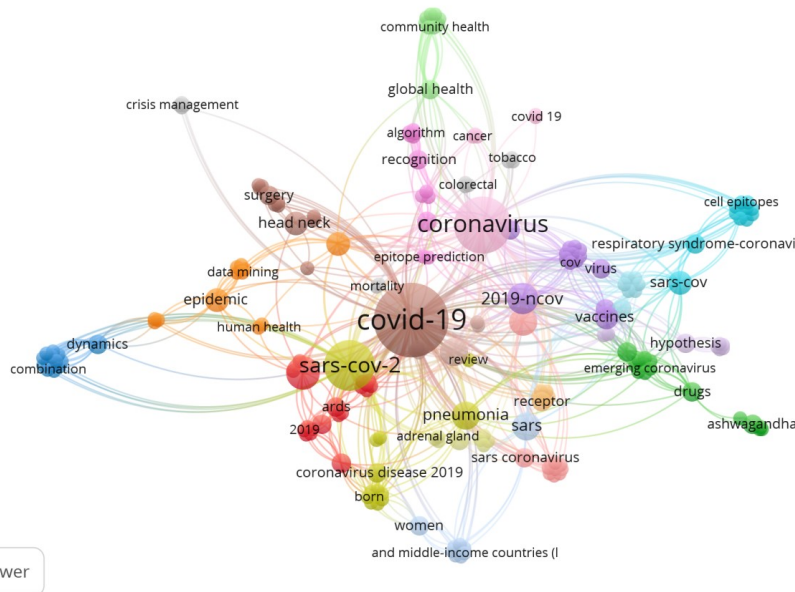
Fig. 3 — Keyword network of COVID-19 Publications (Source: WOS)

keywords have been grouped into 22 clusters. Clusters 1 having the 19 items, cluster 2 have 15 items, Cluster 3, 4 & 5 having 14 items each, Cluster 6 & 7 have 13 items each, Cluster 8 & 9 have 12 items each, and cluster 10 & 11 have 11 items in each.

Highly cited publications

Table 4 highlights the publications with more than 10 citations, there are 23 publications having more than 10 citations. The most highly cited publications entitled Clinical, laboratory and imaging features of COVID-19: A systematic review and meta-analysis by

Rodriguez-Morales *et al.* published in *Travel medicine and Infectious Disease* have 48 citations, followed by A review of coronavirus disease-2019 (COVID-19) by Tanu Singhal in *Indian Journal of Paediatrics* with 28 citations, The COVID-19 outbreak: Crucial role the psychiatrists can play by Debanjan Banerjee in *Asian journal of psychiatry* with 26 citations, Considerations for Patients with Diabetes in Times of COVID-19 Epidemic by Gupta *et al.* in *Diabetes & Metabolic Syndrome Clinical Research & Reviews* with 22 citations are the most cited publications.

Table 4 — Highly cited publications

Authors	Title	Source title	Times cited
Rodriguez-Morales, *et al.*	Clinical, laboratory and imaging features of COVID-19: A systematic review and meta-analysis	Travel Medicine and Infectious Disease	48
Singhal, Tanu	A Review of Coronavirus Disease-2019 (COVID-19)	The Indian Journal of Pediatrics	28
Banerjee, Debanjan	The COVID-19 outbreak: Crucial role the psychiatrists can play	Asian Journal of Psychiatry	26
Gupta, Ritesh *et al.*	Considerations for Patients with Diabetes in Times of COVID-19 Epidemic	Diabetes & Metabolic Syndrome Clinical Research & Reviews	26
Naicker, Saraladevi *et al.*	The Novel Coronavirus 2019 Epidemic and Kidneys	Kidney International	22
Malik, Yashpal *et al..*	Emerging novel coronavirus (2019-nCoV)—current scenario, evolutionary perspective based on genome analysis and recent developments	Veterinary Quarterly	22
Goyal, Kapil; *et al.*	Fear of COVID 2019: First suicidal case in India!	Asian Journal of Psychiatry	18
Phua, Jason *et al.*	Intensive care management of coronavirus disease 2019 (COVID-19): challenges and recommendations	The Lancet Respiratory Medicine	16
Chiu, Philip *et al.*	Practice of endoscopy during COVID-19 pandemic: position statements of the Asian Pacific Society for Digestive Endoscopy (APSDE-COVID statements)	Gut	15
Joob, Beuy and Wiwanitkit, Viroj	COVID-19 can present with a rash and be mistaken for Dengue	Journal of the American Academy of Dermatology	15
Baruah, Vargab and Bose, Sujoy	Immunoinformatics-aided identification of T cell and B cell epitopes in the surface glycoprotein of 2019-nCoV	Journal of Medical Virology	15
Bhattacharya, Manojit; *et al.*	Development of epitope-based peptide vaccine against novel coronavirus 2019 (SARS-COV-2): Immunoinformatics approach	Journal of Medical Virology	14
Muralidharan, Nisha; *et al.*	Computational studies of drug repurposing and synergism of lopinavir, oseltamivir and ritonavir binding with SARS-CoV-2 protease against COVID-19	Journal of Biomolecular Structure and Dynamics	13
Pradhan, Prashant *et al.*	Uncanny similarity of unique inserts in the 2019-nCoV spike protein to HIV-1 gp120 and Gag	BioRxiv	13
Sarma, Phulen; *et al.*	*In silico* homology assisted identification of inhibitor of RNA binding against 2019-nCoV N-protein (N terminal domain)	Journal of Biomolecular Structure and Dynamics	12
Khan, Rameez Jabeer; *et al.*	Targeting SARS-CoV-2: a systematic drug repurposing approach to identify promising inhibitors against 3C-like proteinase and 2′-O-ribose methyltransferase	Journal of Biomolecular Structure and Dynamics	12

(Contd.)

Table 4 — Highly cited publications

Authors	Title	Source title	Times cited
Mandal, Sandip; *et al.*	Prudent public health intervention strategies to control the coronavirus disease 2019 transmission in India: A mathematical model-based approach.	The Indian Journal of Medical Research	12
Gupta, Manoj Kumar *et al.*	*In silico* approaches to detect inhibitors of the human severe acute respiratory syndrome coronavirus envelope protein ion channel	Journal of Biomolecular Structure and Dynamics	11
Bansal, Manish	Cardiovascular disease and COVID-19	Diabetes & Metabolic Syndrome Clinical Research & Reviews	11
Singh, Awadhesh *et al.*;	Chloroquine and hydroxychloroquine in the treatment of COVID-19 with or without diabetes: A systematic search and a narrative review with a special reference to India and other developing countries	Diabetes & Metabolic Syndrome Clinical Research & Reviews	10
Joob, Beuy and Wiwanitkit, Viroj	Traumatization in medical staff helping with COVID-19 control	Brain Behavior and Immunity	10
Prajapat, Manisha *et al..*	Drug targets for corona virus: A systematic review.	Indian Journal of Pharmacology	10
Sarin, Shiv K *et al.*	Liver diseases in the Asia-Pacific region: a Lancet Gastroenterology & Hepatology Commission	The Lancet Gastroenterology & Hepatology	10

Conclusion

The results of this study suggest that Indian researchers are fairly doing well in COVID-19 research. There are various research institutions which have collaborated internationally with China, USA, England and 67 other countries in COVID-19 research. The research output number is changing every day and India is among top 10 countries in COVID-19 research. A more comprehensive study on COVID-19 using other databases is needed to find out new insights in novel corona-virus research from Indian scientists.

Conflict of interest

All authors declare no conflict of interest.

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