

Ophthalmic Manifestations of Covid-19: A Bibliometric Assessment of Global Scientific Literature

Kanu Chakraborty^{1*}, BM Gupta², Manashree Chakraborty³, Rajpal Walke⁴

¹Indian Institute of Technology (B.H.U.), Varanasi, Uttar Pradesh, INDIA.

²CSIR-NISTADS, New Delhi, INDIA.

³Apex College of Nursing, Varanasi, Uttar Pradesh, INDIA.

⁴CSIR-NPL, New Delhi, INDIA.

ABSTRACT

Purpose: The Covid-19 pandemic has significantly impacted world healthcare, with ophthalmology being one of the most severely affected area. The study aims to perform a bibliometric analysis of global literature published on “Ophthalmic Manifestations of Covid-19” to explore the scientific productivity and trends in research in this field. **Methods:** Bibliometric methods have been used to analyze global literature on this topic using quantitatively and qualitatively indices from the Scopus database up to 20th September 2021. The keywords related to “Covid-19” and “ophthalmology” are used in search strategy through the boolean operator. Primary data were exported in CSV and BibTxt file format for further analysis using different software. The literature on “Ophthalmic Manifestations of Covid-19” was assessed using a variety of metrics. **Results:** A total of 3453 publications were published on “Ophthalmic Manifestations of Covid-19”, which received 32935 citations, averaging 9.54 citations per paper. Of the total publications, 557 received external funding support and registered 10802 citations. The U.S.A. and India published the most significant number of papers among countries. The U.S.A. and U.K. occupied the top position in international collaborative publications. Medicine and Neurosciences were the most productive areas. The *Indian Journal of Ophthalmology* is the most productive source. A total of 46

high-cited papers have been identified on this topic, which are published in 35 journals, with the U.S.A. contributing the most papers. **Conclusion:** In this study, the bibliometric assessment presents a quantitative and qualitative matrix of research in the field “Ophthalmic Manifestations of Covid-19.” The study gives proof of the enhanced global collaboration that global researchers have created in order to combat the epidemic. The authors have used various bibliometric metrics and tools to present this study efficiently. This study will be helpful for the scholars who were researching in this field.

Key words: Covid -19, SARS-CoV-2, Ophthalmology, Global publications, Bibliometrics, Scientometrics.

Correspondence

Mr. Kanu Chakraborty,

Indian Institute of Technology (B.H.U.), Varanasi-221005, IIT-BHU, Uttar Pradesh, INDIA.

Email id: kchakraborty.lib@iitbhu.ac.in

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INTRODUCTION

The Covid-19 virus enters the body through different organs in different ways, as established during the research world over. The impact of Covid-19 on different body organs is also increasing over time, as reflected in research output. The eye is a vital part exposed to the environment for easy transmission of the novel coronavirus. SARS-CoV-2 could use the human ocular surface as an additional entry point and infection hub.¹

Since December 2019, Coronavirus disease 2019 (Covid-19) has become a global pandemic caused by the highly transmissible severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2).² Initially, there were several reports of eye redness and irritation in Covid-19 patients, both anecdotal and published, suggesting that conjunctivitis is an ocular manifestation of SARS-CoV-2 infection. Reports continue to emerge on further associations of Covid-19 with uveitic, retinovascular, and neuro-ophthalmic diseases.³

Early studies postulated that ocular manifestations of Covid-19 were rare. More recent data, however, have supported a much higher incidence of ocular signs and symptoms. The potential of infection through ocular secretions is currently unknown, and it remains unclear how SARS-CoV-2 accumulates in ocular secretions. Possible theories include direct inoculation of the ocular tissues from respiratory droplets or aerosolized viral particles, migration from the nasopharynx via the nasolacrimal

duct, or even hematogenous spread through the lacrimal gland.⁴ The prevalence of ocular manifestations in patients with Covid-19 ranges from 2% to 32%.⁵

Ocular manifestations of Covid-19 have most commonly presented with conjunctivitis otherwise indistinguishable from other viral etiologies. Differential diagnosis includes a broad range of common ocular manifestations of eye redness and increased tearing: (i) Other viral conjunctivitis (e.g., adenovirus), (ii) Bacterial conjunctivitis, (iii) Allergic conjunctivitis, (iv) Herpes simplex virus keratitis, (v) Anterior uveitis, (vi) Corneal abrasion, (vii) Foreign body, (viii) Dry eye syndrome, (ix) Exposure keratopathy in an intubated patient and (x) Chemosis in a critically ill patient.

Although several studies have been conducted that explore the Covid-19 effect on lungs, kidney, skin and liver, only a few bibliometric studies have been published on the effect of Covid-19 on eyes. That is why a bibliometric analysis of Covid-19 research in ophthalmology is required. This quantitative examination of the data will provide useful information for future ophthalmic research. The paper presents a bibliometric analysis of the scientific literature published globally on “Ophthalmic Manifestations of Covid-19”, as covered in the Scopus database. The analysis specific objectives include overall research output of globally

ophthalmology disease complications in a patient with Covid – 19 infections in terms of most important countries, organizations, authors, journals and their collaborative interrelationship and important subject areas of focus. The Covid-19 pandemic has demonstrated the value of data and science in restoring more resilient health systems and accelerating equitable progress toward our shared global goals.

Literature Review

A few bibliometric studies on “Ophthalmic Manifestations of Covid-19” are available, but these studies have undertaken a limited analysis and are not up-to-date. Among them, Kalra, Kaur, Ichhpujani, Chahal and Kumar⁶ examined 616 global publications on Covid-related research on ophthalmology involving 2308 authors from 63 sources using the Web of Science database till 22th February 2021. Different softwares were used to visualize metrics to quantify geographical distribution, source, author, document, keyword matrices. Jin, Trope, Graham, El-Defrawy, Liu and Buys⁷ examined Covid-19 research publications by ophthalmologists/researchers in terms of publication numbers, journals and author countries and to detail key findings. A total of 21,364 articles were registered in Lit Covid on June 12, 2020. Of these, 308 were found in the initial search for ophthalmology-focused publications. Du Reiting, Jain, and Suh⁸ examined the effects of Covid-19 on ophthalmology, using publications from PubMed each month from January 2020 to August 2020. In addition, the authors examined new clinical trials within multiple databases (Clinicaltrials.gov, University Hospital Medical Information Network, Australian New Zealand Clinical Trials Registry, and International Standard Randomized Controlled Trial Number Registry) using the keywords “ophthalmology” or “eye diseases.” Sen, Honavar, Sharma, Namrata and Sachdev⁹ reviewed the literature on ophthalmologic manifestation of Covid-19, using data from 1 January 2020 to 31 January 2021 from different databases. The studies reviewed include 46 case reports, 8 case series, 11 cross-sectional/cohort observational studies, 5 prospective interventional studies, 3 animal model/autopsy studies and 6 reviews and meta-analysis. Conjunctivitis is the most common manifestation and can develop at any stage of the disease. Direct effect due to virus, immune-mediated tissue damage, activation of the coagulation cascade and prothrombotic state included by the virtual infection, the associated comorbidities and drugs used in the management are responsible for the findings in the eye. Due to the present shifting landscape within medical literature and insufficient information on the topic “Ophthalmic Manifestations of Covid-19”, the authors investigated the trends and implications of Covid-19 on ophthalmology. In this paper, the authors have analyzed 3453 global records, which received 32935 citations up to September 20th 2021.

METHODS AND MATERIALS

The authors used bibliometric methods to analyze global literature on “Ophthalmic Manifestations of Covid-19” from literature indexed in the Scopus database (<https://scopus.com>).¹⁰ The search query used was as follows:

(TITLE (“Covid 19” or “2019 novel coronavirus” or “coronavirus 2019” or “coronavirus disease 2019” or “2019-novel CoV” or “2019 ncov” or Covid 2019 or Covid19 or “corona virus 2019” or ncov-2019 or ncov2019 or “nCoV 2019” or 2019-ncov or covid-19 or “Severe acute respiratory syndrome coronavirus 2” or “SARS-CoV-2”) or KEY (“Covid 19” or “2019 novel coronavirus” or “coronavirus 2019” or “coronavirus disease 2019” or “2019-novel CoV” or “2019 ncov” OR covid 2019 or covid19 or “corona virus 2019” or ncov-2019 or ncov2019 or “nCoV 2019” OR 2019-ncov or covid-19 or “Severe acute respiratory syndrome

coronavirus 2” or “SARS-CoV-2”) and KEY (Eye* or optical* or ophth* or conjunct* or glaucoma* or visual*)).

Primary data were exported in CSV and BibTxt file format for analysis through the Bibliometrix R library (Biblioshiny app),¹¹ Vosviewer, and Spreadsheet. The literature on “Ophthalmic Manifestations of Covid-19” was assessed using a variety of metrics, as detailed in the result and analysis section.

Analysis and Results

Overall Data

In all a total of 3453 publications were retrieved from the Scopus database on “Ophthalmic Manifestations of Covid-19” during 2019 to 2022 (2019=1, 2020=1648, 2021=1798 and 2022=6). These publications have received 32935 citations, with citations per paper of 9.54. Of the 3453 publications on this theme, 557 received external funding support and received 10802 citations, averaging 19.39 citations per paper. The major funding agencies along with their output are: National Natural Science Foundation of China (98 papers), National Institutes of Health (97 papers), Research to Prevent Blindness (40 papers), U.S. Department of Health and Human Services (36 papers), National Aeronautics and Space Administration (27 papers), National Science Foundation (27 papers), European Commission (24 papers), National Key Research and Development Program of China (24 papers), Novartis (24 papers), National Institute for Health Research (23 papers).

Among document types, articles constituted the largest number (1937), followed by letters (553), reviews (437), conference papers (180), editorials (170), notes (152), short surveys (13), book chapters (10), data paper (1).

Geographic distribution

In all 117 countries participated in research on “Ophthalmic Manifestations of Covid-19”: 66 countries contributed 1-10 papers each, 14 countries 11-20 papers each, 26 countries 21-100 papers each, 6 countries 108-156 papers each and 5 countries 329-818 papers each.

The top 10 countries individually published 116 to 818 papers and together accounted 85.46% share (2951 papers) and more than 100% share (37218 citations) of global publications and citations. On further analysis, it was observed that; (i) Four countries registered publications above the group average (295.1) of the top 10 countries: U.S.A. (818 papers), India (435 papers), U.K. (345 papers) and China (336 papers); and (ii) Four countries registered citation per paper and relative citation index above the top 10 countries group average (12.61 and 1.32): China (23.7 and 2.48), Canada (17.16 and 1.80), U.S.A. (14.14 and 1.48) and Italy (12.88 and 1.35). The international collaborative publications share of top 10 countries varied from 17.74% to 49.14%, with an average of 32.87%; and five countries registered percentage share of international collaborative publications above the group average (32.87%) of top 10 countries: Canada (49.14%), U.K. (47.83%) Germany (47.62%), France (40.69%) and China (33.33) (Table 1).

The collaborative linkages among the top 10 countries are shown in Table 2. The highest collaborative linkages (263, 244 and 162) among the top 10 countries are made by the USA, U.K. and Italy. The individual country-to-country collaborative linkages varied from 1 to 52. The highest country to country collaborative linkages (52) is registered by USA - U.K. and USA - China, followed by USA - Germany (27 linkages), USA - Italy (26 linkages), etc. (Table 2). The collaborative linkages between top countries are depicted in Figure 1-2.

The nodes indicate countries, and the size of the nodes reflects the frequency of collaboration publishing. The edges represent the country links, and the width of the edges reflects the frequency of node co-

Table 1: Bibliometric Profile of Top 10 Countries.

S.No	Name of the country	TP	TC	CPP	ICP	%ICP	RCI
1	USA	818	11567	14.14	266	32.52	1.48
2	India	435	2553	5.87	87	20.00	0.62
3	UK	345	4076	11.81	165	47.83	1.24
4	China	336	7963	23.70	112	33.33	2.48
5	Italy	329	4237	12.88	81	24.62	1.35
6	Spain	156	1458	9.35	51	32.69	0.98
7	Germany	147	1183	8.05	70	47.62	0.84
8	France	145	1548	10.68	59	40.69	1.12
9	Turkey	124	643	5.19	22	17.74	0.54
10	Canada	116	1990	17.16	57	49.14	1.80
	Total of 10 countries	2951	37218	12.61	970	32.87	1.32
	Global total	3453	32935	9.54			
	Share of top 10 countries in global total	85.46					

TP - Total Publications, TC - Total Citations, CPP - Citations per Paper, HI - Hirsch Index, ICP - International Collaborative Publications, RCI - Relative citation impact

Table 2: The Extent of Collaborative Linkages among Top 10 Countries.

Sl.No	Name of the country	Number of collaborating linkages	Total collaborative linkages
1	USA	2(36), 3(52), 4(52), 5(26), 6(18), 7(27), 8(21), 9(7), 10(24)	263(9)
2	India	1(36), 3(22), 4(6), 5(2), 6(4), 7(14), 8(5), 9(2), 10(3)	94(9)
3	U.K.	1(52), 2(22), 4(24), 5(38), 6(24), 7(31), 8(28), 9(8), 10(17)	244(9)
4	China	1(52), 2(6), 3(24), 5(11), 6(11), 7(13), 8(10), 9(7), 10(12)	146(9)
5	Italy	1(26), 2(2), 3(38), 4(11), 6(21), 7(19), 8(22), 9(11), 10(12)	162(9)
6	Spain	1(18), 2(4), 3(24), 4(11), 5(21), 7(17), 8(20), 9(10), 10(8)	133(9)
7	Germany	1(27), 2(14), 3(31), 4(13), 5(19), 6(17), 8(18), 9(10), 10(11)	160(9)
8	France	1(21), 2(5), 3(28), 4(10), 5(22), 6(20), 7(18), 9(10), 10(14)	148(9)
9	Turkey	1(7), 2(2), 3(8), 4(7), 5(11), 6(10), 7(10), 8(10), 10(6)	71(9)
10	Canada	1(24), 2(3), 3(17), 4(12), 5(12), 6(8), 7(11), 8(14), 9(6)	107(9)

occurrence. A broader edge indicates a stronger relationship or a higher co-occurrence frequency. The colour of nodes indicates which group they belong to, with nodes in the same group being more similar to each other than nodes in other groups. The Betweenness Closeness represents the close collaboration pattern among the countries. Six clusters have been shown in Figures 1-2. The U.S.A., India, UK, China and Italy show a significant collaboration pattern and bibliographic coupling.

Subject Wise Distribution

Table 3 shows the subject-wise distribution of publications on "Ophthalmic Manifestations of Covid-19". 'Medicine' was observed to be the most productive area (with 78.95% publication share), followed by Neurosciences (8.49% share), Computer Science (7.27% share), etc. In terms of impact, Immunology and Microbiology registered the highest citation impact per paper (15.67) followed by Biochemistry, Genetics and Molecular Biology (11.67) and Neurosciences (11.24); and Computer Science the least (1.71) (Table 3).

Top 20 Organisations

A total of 847 organizations participated in research on this topic: 478 organizations contributing 1-5 papers each, 229 organizations 6-10

papers each, 106 organizations 11-20 papers each, 33 organizations 21-50 papers each, and 1 organization 63 papers.

The top 20 organizations individually published 24 - 63 papers each and together published 18.65% (644 papers) share and 39.70% (13075 citations) share in global publications and citations. On further analysis, it was observed that; (i) Five organizations contributed papers above the group average (32.20) of 20 organizations: Harvard Medical School, U.S.A. (63 papers), All India Institute of Medical Sciences, New Delhi (48 papers), Moorfields Eye Hospital N.H.S. Foundation Trust, U.K. (47 papers), INSERM, France (35 papers) and Basecom Palmer Eye Institute, U.S.A. (33 papers); and (ii) Four organizations registered citation per paper and relative citation index (20.3 and 2.13) above the group average of 20 organizations: Tongji Medical College, China (126.59 and 13.27), Huazhong University of Science and Technology, China (103.09 and 10.81), National University of Singapore (23.27 and 2.44) and Harvard Medical School, U.S.A. (21.05 and 2.21)(Table 4).

Top 20 Authors

In all 2496 authors participated in research on this topic: 1545 authors contributed 1 paper each, 678 authors 2 papers each, 97 authors 3 papers each, 68 authors 4 papers each, 35 authors 5 papers each, 53 authors 6-10 papers each and 20 authors 11-20 papers each.

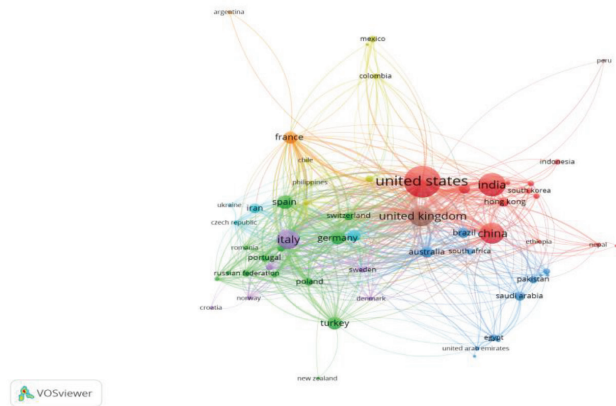


Figure 1: Collaboration network by country.

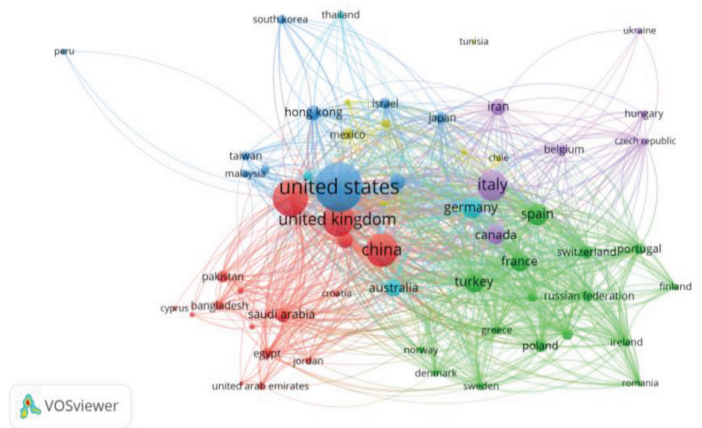


Figure 2: Bibliographic coupling of Collaborative linkages.

Table 3: Subject-Wise Distribution of Papers.

S.No	Name of the Subject	TP	TC	CPP	% TP
1	Medicine	2726	27541	10.10	78.95
2	Neurosciences	293	3294	11.24	8.49
3	Computer Science	251	430	1.71	7.27
4	Biochemistry, Genetics and Molecular Biology	235	2733	11.63	6.81
5	Engineering	189	797	4.22	5.47
6	Immunology and Microbiology	175	2743	15.67	5.07
7	Environment Science	148	1177	7.95	4.29
8	Social Sciences	135	339	2.51	3.91
9	Pharmacology, Toxicology and Pharmaceutics	115	695	6.04	3.33
10	Health Professions	87	496	5.70	2.52
	Global total	3453	32935	9.54	

TP - Total Publications, TC - Total Citations, CPP - Citations per Paper

Table 4: Bibliometric Profile of Top 20 Organizations.

S.No	Name of the Organization	TP	TC	CPP	HI	ICP	%ICP	RCI
1	Harvard Medical School, USA	63	1326	21.05	14	21	33.33	2.21
2	All India Institute of Medical Sciences, New Delhi, India	48	252	5.25	8	2	4.17	0.55
3	Moorfields Eye Hospital NHS Foundation Trust, U.K.	47	815	17.34	12	22	46.81	1.82
4	INSERM, France	35	508	14.51	13	14	40.00	1.52
5	Basecom Palmer Eye Institute, USA	33	166	5.03	8	5	15.15	0.53
6	University of Miami, Leonard M Miller School of Medicine, USA.	32	203	6.34	8	5	15.63	0.66
7	Huazhong University of Science and Technology, China	32	3299	103.09	12	10	31.25	10.81
8	Universita degli studi di Milano, Italy	31	289	9.32	9	9	29.03	0.98
9	L.V.Prasad Eye Institute, Hyderabad, India	30	266	8.87	9	6	20.00	0.93
10	Massachusetts Eye and Ear Infirmary, USA	29	153	5.28	6	12	41.38	0.55
11	University of Toronto, Canada	29	184	6.34	6	15	51.72	0.66
12	University of Health Sciences, Turkey	29	191	6.59	6	2	6.90	0.69
13	Postgraduate Institute of Medical Sciences, Chandigarh, India	27	288	10.67	9	7	25.93	1.12
14	Tongji Medical College, China	27	3418	126.59	12	9	33.33	13.27
15	John Hopkins School of Medicine, USA.	26	193	7.42	6	9	34.62	0.78
16	National University of Singapore	26	605	23.27	9	17	65.38	2.44
17	Sapienza Universita di Roma, Italy	26	253	9.73	8	4	15.38	1.02
18	University College London, U.K.	25	354	14.16	9	12	48.00	1.48
19	University of Sydney, Australia	25	216	8.64	9	20	80.00	0.91
20	Aravind Eye Hospital, India	24	96	4.00	5	4	16.67	0.42
	Total of 20 countries	644	13075	20.30	8.9	205	32.73	2.13
	Global total	3453	32935	9.54				1.00
	Share of top organizations in global total	18.65	39.70					

TP - Total Publications, TC - Total Citations, CPP - Citations per Paper, HI - Hirsch Index, ICP - International Collaborative Publications. RCI - Relative citation impact

The top 20 authors individually contributed 8 to 20 papers and together published 208 papers and received 1964 citations, constituting 6.02% and 5.96% share in global publications and citations. On further analysis, it was observed that: (i) Five authors have contributed more than the group average of top 20 authors: A. Sharma (20 papers), R. Shetty (16 papers), R. Burgos-Blasco (15 papers), K.K.K. Li (13 papers) and N. Guemes - Villahoz (12 papers); (ii) Six authors registered citation per paper and relative citation index above group average (9.44 and 0.99) of 20 authors: R. Agarwal (39.6 and 4.15), K.K.K. Li (19.77 and 2.07), M. Sachdev (15.56 and 1.63), V. Gupta (13.63 and 1.43), F. Bandello (13.5 and 1.42) and A. Loewen Stein (13.25 and 1.39) (Table 5).

Figure 3 visualizes the co-authorship pattern of the authors. There are six clusters of authors that are formed in the visualization. The different colour represents the segregation of the authors. The red, blue and yellow clusters are inter-twined, showing that they have excellent collaboration among the authors.

Source Distribution

Among the 3453 papers, 3269 papers are published in journals, 144 in conference proceedings, 35 in book series, 4 in trade journals and 1 in book. The 3269 journal papers are published in 515 journals: 406 journals contributed 1-5 papers each, 63 journals 6-10 papers each, 30 journals 11-20 papers each, 14 journals 21-50 papers each and 2 journals 57-167 papers each.

Table 6 shows the top 20 journals individually contributed 19 to 167 papers and together published 762 papers, constituting 23.31% share of total papers in journals. The top 6 most productive journals are: *Indian Journal of Ophthalmology* (167 papers), *Eye (Basingstoke)* (57 papers), *Graefes' Archive for Clinical and Experimental Ophthalmology* (50 papers), *JAMA Ophthalmology* (44 papers), *Clinical Ophthalmology* (41 papers) and *Ocular Immunology and Inflammation* (37 papers). The top 6 most impactful journals in terms of citations per paper are: *The Lancet* (148.47), *Journal of Medical Virology* (42.0), *Otolaryngology - Head and Neck Surgery (United States)* (18.05), *JAMA Ophthalmology* (16.61), *Ocular Immunology and Inflammation* (16.03) and *Journal of Clinical Medicine* (13.08).

Figure 4 presents co-citation data on information sources. Every circle in the Figure represents a journal whose size represents the number of publications the journal has. The journals that are closely located to each other are related to each other in terms of co-citation. The Figure has segregated the sources into six clusters that are closely related.

High-Cited Papers

Of the 3453 papers, only 46 papers are high-cited papers and received 105 to 2585 citations. These 46 high-cited papers have received 13369 citations, registering citations per paper. Of the 46 high cited papers, 25 papers have received 105-195 citations, 3 papers 231-265 citations, 6 papers 511-887 citations and 2 papers 1131-2585 citations

Table 5: Bibliometric Profile of Top 20 Authors.

S.No.	Name of the author	Affiliation of the author	T.P.	TC	CPP	HI	ICP	% ICP	RCI
1	N. Sharma	AIIMS, New Delhi	20	143	7.15	7	1	5.00	0.75
2	R. Shetty	Narayana Nethralaya, Bangalore	16	119	7.44	6	1	6.25	0.78
3	R.Burgos-Blasco	Universidad Complutense de Madrid, Spain	15	82	5.47	6	1	6.67	0.57
4	K.K.K. Li	United Christian Hospital, Hong Kong	13	257	19.77	6	3	23.08	2.07
5	N. Guemes-Villahoz	Universidad Complutense de Madrid, Spain	12	74	6.17	6	1	8.33	0.65
6	R. Agrawal	National Healthcare Group Eye Institute, Singapore	10	396	39.6	6	10	100.00	4.15
7	S.C.L. Au	Tung Wah Eastern Hospital, Hong Kong	10	13	1.3	2	0	0.00	0.14
8	F.Bandello	Universita Vita-Salute San Raffaele, Italy	10	135	13.5	6	1	10.00	1.42
9	B.Gurnani	Aravind Eye Hospital, India	10	20	2	3	1	10.00	0.21
10	K. Kaur	Aravind Eye Hospital, India	10	20	2	3	1	10.00	0.21
11	S.Rizzo	Universita Cattolica del Sacrocuore, Campus di Roma, Italy	9	85	9.44	5	2	22.22	0.99
12	M.Sachdev	AIIMS, New Delhi	9	140	15.56	7	1	11.11	1.63
13	J.Garcia-Feijoo	Universidad Complutense de Madrid, Spain	8	30	3.75	3	1	12.50	0.39
14	G.Glannaccare	Universita degli studi Catanzaro, Italy	8	74	9.25	5	1	12.50	0.97
15	V.Gupta	PGIMER, Chandigarh	8	109	13.63	6	7	87.50	1.43
16	A.Loewen Stein	Tel Aviv Sourrasky Medical Center, Israel	8	106	13.25	4	6	75.00	1.39
17	S.Sanjay	Narayana Nethralaya, Bangalore	8	8	1	2	1	12.50	0.10
18	M.C.Savastano	Universita Cattolica del SacroCuore, Campus di Roma, Italy	8	70	8.75	4	2	25.00	0.92
19	R.Sinha	AIIMS, New Delhi	8	47	5.88	6	1	12.50	0.62
20	B.Vidal-Villagas	Universidad Complutense de Madrid, Spain	8	36	4.5	3	1	12.50	0.47
	Total of 20 authors		208	1964	9.44	96	43	20.67	19.85
	Global total		3453	32935	9.54			0.00	1.00
	Share of top 20 authors in global total		6.02	5.96				0.00	0.00

TP - Total Publications, TC - Total Citations, CPP - Citations per Paper, HI - Hirsch Index, ICP - International Collaborative Publications, RCI - Relative citation impact

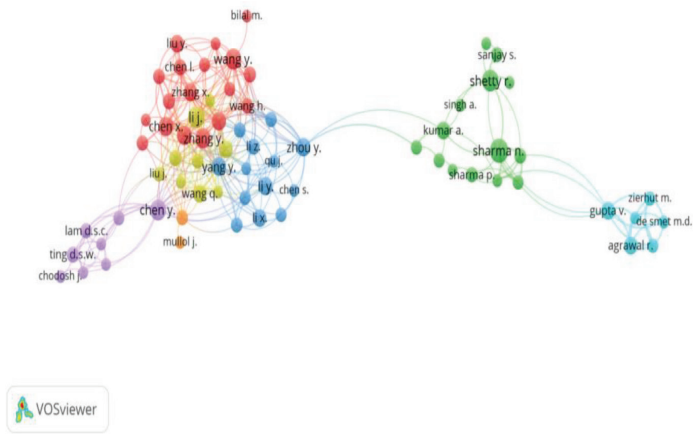


Figure 3: Co-authorship profile of top authors.

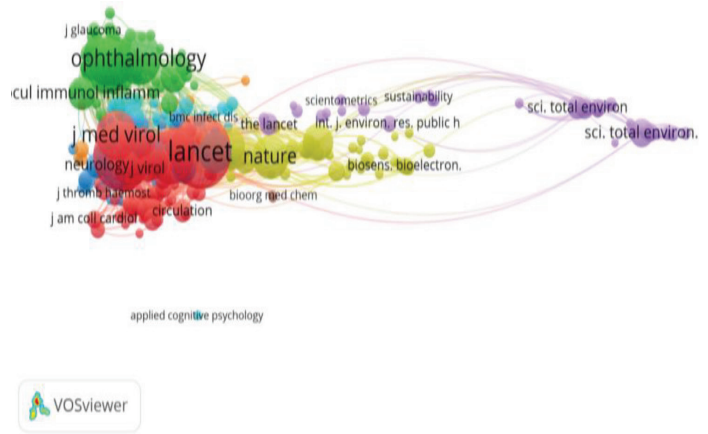


Figure 4: Co-citation network of sources.

Table 6: Bibliometric Profile of Top 20 Journals.

S.No	Name of the journal	TP	TC	CPP
1	Indian Journal of Ophthalmology	167	909	5.44
2	Eye (Basingstoke)	57	529	9.28
3	Graefe's Archive for Clinical and Experimental Ophthalmology	50	624	12.48
4	JAMA Ophthalmology	44	731	16.61
5	Clinical Ophthalmology	41	94	2.29
6	Ocular Immunology and Inflammation	37	593	16.03
7	International Journal of Environmental Research and Public Health	34	186	5.47
8	Journal of Medical Virology	33	1386	42
9	Journal FrancaisD'ophthalmologie	31	103	3.32
10	Ophthalmology	30	385	12.83
11	European Journal of Ophthalmology	30	124	4.13
12	Ophthalmology	30	385	12.83
13	American Journal of Ophthalmology	28	146	5.21
14	B.M.J. Case Reports	26	54	2.08
15	Journal of Clinical Medicine	24	314	13.08
16	Otolaryngology - Head And Neck Surgery (United States)	21	379	18.05
17	Journal Of Glaucoma	21	60	2.86
18	Canadian Journal Of Ophthalmology	20	150	7.5
19	Journal Of Medical Internet Research	19	33	1.74
20	Lancet	19	2821	148.47
	Total of 20 journals	762	10006	13.13
	Global total	3269		
	Share of top 20 journals in global total	23.31		

TP - Total Publications, TC - Total Citations, CPP - Citations per Paper

Among 46 high-cited papers, the U.S.A. contributed the largest number of papers (19), followed by China (14 papers), Singapore and U.K. (4 papers each), Italy and Hong Kong (3 papers each), Canada and France (2 papers each), Lebanon, Sweden, Brazil, Egypt, India, Iran, Malaysia, Greece, Spain and Philippines (1 paper each).

The 46 high-cited papers (27 articles, 9 letters, 6 reviews, 3 editorials and 1 note) have 10 non-collaborative papers and 36 involve 2 or more organizations (27 national collaborative and 9 international collaborative).

The 46 high-cited papers are published in 35 journals with 4 papers in *the Lancet*, 3 papers in *Journal of Medical Virology*, 2 papers each in *JAMA*, *British Journal of Ophthalmology*, *Journal of Infection*, *New England Journal of Medicine* and *Nature Medicine* and 1 paper each in 28 other journals.

SUMMARY AND CONCLUSION

The quest for quick responses to influence global policy has radically impacted the scientific community. In society, Covid-19 has affected

rapidly in all aspects. These effects have been visible in the world of research publications, with a remarkable rise in Covid-19-related articles across a wide range of specializations. The authors looked at the implications of Covid-19 on ophthalmic publication patterns because of the present shifting landscape in medical literature and the lack of understanding about the impact of these changes on ophthalmology literature. A total of 3453 publications were retrieved from the Scopus database on “Ophthalmic Manifestations of Covid-19” from 2019-2022, and most of the document types are articles. Of the total publications, 557 are external funded which have received 10802 citations. The most important funded agency is the National Natural Science Foundation of China (98 papers). In this area, a total of 117 countries unevenly participated; the U.S.A. is the top country per the number of publications and citations received. India is in the second position as per the total number of publications (435) with 2553 citations. In terms of citation per paper, China leads in global rank.

The USA has maximum collaboration linkages (263 with 9 organizations) followed by UK (244 linkages with 9 organizations) and Italy (162 linkages with 9 organizations). The USA, U.K. and India are seen as the most prominent countries in the collaboration network having most collaboration with other countries. The 78.95% share of total documents are from the ‘Medicine’ field, which contributed most of the research in “Ophthalmic Manifestations of Covid-19”. A total of 847 organizations participated in this research on this topic, with Harvard Medical School, USA, contributing the largest number of publications. A total of 2496 authors participated in research on this topic, with N. Sharma (AIIMS New Delhi) being the most productive author. In terms of the international collaborative publications, R. Agrawal (National Healthcare Group Eye Institute, Singapore) occupied the top rank. The source metrics total of 515 journals published research articles and *Indian Journal of Ophthalmology* is the most productive source. Out of 3453 papers, only 46 are high-cited papers and received 109 to 2629 citations published in 35 journals. The USA contributed the largest number of documents. Remarkably, all the documents were published in 2020, and all are in open access. This offers an insight into research on this topic and it is likely to help scholars who were researching in this field and policy-makers in identifying the potential areas of research on Covid-19 and Ophthalmology

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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