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A Scientometric Mapping of Global Research on 'COVID-19 and Medical Oxygen'

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The oxygen levels need to be maintained at an optimum value in treatment of patients suffering from the COVID-19 infection to prevent serious complications. Prone positioning is an extremely beneficial strategy to improve oxygenation and ventilation during home isolation or a hospital stay while the patient is undergoing virus treatment. The present study analysed the performance of the research on the topic 'COVID-19' with 'Covid-19' throughout the article on the indexed publication in Web of Science database during 2020-2021.The study analysed 1610 global publications originating from 96 countries, involving 4040 organisations and 15469 authors, receiving 33310 citations and published in 698 journals from 2020 to 2021.

1 INTRODUCTION

The COVID-19 pandemic has accelerated global demand for oxygen and has led to its increased global production and urgent delivery to the consumers. Oxygen is essential and is used in the care of patients at all levels of the healthcare system, including surgery, trauma, heart failure, asthma, pneumonia and maternal and child care. The need for oxygen has increased to 1.1 million oxygen cylinders in low-to middle-income countries alone. WHO and associated partners have distributed over 30,000 oxygen concentrators and 40,000 pulse oximeters and patient monitors in 121 countries, including 37 fragile ones. WHO is also supporting with technical advice and in some places, procurement of oxygen sources at scale. This includes pressure swing

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absorption plants that would be able to cover higher oxygen demand in larger health facilities. In addition to helping COVID-19 patients, WHO is providing oxygen support to the organisations involved in the treatment of other diseases, leading to an overall strengthening of health systems[1].

Scientometrics is the quantitative study of science. It aims to analyse and evaluate science, technology, and innovation. Major research includes measuring the impact of publications in, countries, institutes, authors and journals using data on citation. The present study examines for the first time, publications on 'Covid-19 and Medical Oxygen', as indexed in Web of Science database from 2020 to 2021.

11 REVIEW OF LITERATURE

There are a number of studies carried out on bibliometric assessment of coronavirus and Covid-19 in particular. Among such studies, Muthuraj, Balasubramani, R. and Amsaveni[2]examined 1658 global records (originating from 78 countries and receiving 4804 citations) on COVID-19 research output from January to April 2020, using Web of Science database. The analyses focus on global publication share, patterns of research communication, the most productive sources, authors and institutions. Surulinathi, Sankaralingam and Jayasuriya[3] analysed 1000 highly-cited papers (cited at least 100 times) published on Covid-19 during 1989-2020, which have participation of 72 countries and cumulatively received 227766 Citations.

Gupta, Dhawan, Ahmed and Mamdapur[4] evaluated the global research output (103,054 records) on Covid-19, based on quantitative and qualitative indicators. It presents a bibliometric profile of most influential countries, organisations, authors and journals and their collaborative linkages, besides identifying broad subject areas of research, most significant keywords and highly-cited papers related to Covid-19.

Surulinathi et al[5] examined 1648 global publications on oxygen therapy research in India during 1991-2021, using Web of Science database. All the publications were downloaded for analysing using Histcite, VosViewer and Biblioshiny.

Since there is no available bibliometric study on "COVID-19 and Medical Oxygen", as a result we decided to undertake the present study.

2 OBJECTIVES

The main objective of this study is to analyse the research performance of the field 'Covid-19 and Medical Oxygen', as reflected in the publications and citations output during 2020-21. In particular, the study focuses on publication

productivity, citation impact and international collaboration aspects publications data. It also focuses on: (i) the country-wise distribution; (ii) the institution-wise distribution; (iii) the most preferred journals; (iv) the most prolific authors; (v) the highly-cited papers; (vi) collaborative linkages between countries, organisations and authors

3 DATA SOURCE AND METHODS

The relevant publications along with their bibliographical details were identified and downloaded from Web of Science database on ‘’Covid-19 and Medical Oxygen’ using a search strategy, which placed the two keywords “Covid-19” and “Oxygen” in Topic Tag and joined by a Boolean operator “and”, yielding 1610 publications and 33310 citations during 2020-21. The Histcite and VoS viewer software were used to analyse the data as per objectives of the study.

4 DATA ANALYSIS AND INTERPRETATIONS

The study analysed 1610 publications on ‘Covid-19 and Medical Oxygen’, which received 33310 citations. These 1610 publications involved15469 authors scattered in 698 journals for the period 2020-21. The collected publications data are analysed and presented in the following sections.

41 GEOGRAPHICAL DISTRIBUTION

96 countries unevenly participated in the global research on the topic ‘Covid-19 and Medical Oxygen’ during 2020-21: 6 countries published 104-454 publications each, 28 published 11-78 publications each and 50 countries 1-5 publications each. The largest global publication share (28.2%) came from the USA, followed by China, Italy and the U.K. (from 10.5% to 15.03%), Spain and France (7.20% and 6.46%), Germany, Canada and India (4.47% to 4.84%) and Brazil, Iran, Australia, South Korea, Turkey and Japan (from 2.55% to 3.98%). The publication output of top 15 countries varied from 41 to 454 and together contributed more than 100% each to global publications and citations. Seven out of 15 countries registered citation per paper and relative citation index above their group average (39.39 and 1.90): South Korea (86.22 and 4.17), U.K. (71.64 and 3.46), Australia (59.94 and 2.90), Japan (59.85 and 2.89), Germany (50.05 and 2.42), Canada (47.37 and 2.29) and China (46.35 and 2.24) (Table 1). The collaborative network of top 20 countries with largest number of collaborative linkages is shown in Table 2 and Figure 1.

Table 1: Geographical Distribution of Publications on 'Covid-19 and Medical Oxygen'

S.No	Name of the country	TP	%TP	TC	CPP	RCI
1	USA	454	28.20	17595	38.76	1.87
2	China	242	15.03	11216	46.35	2.24
3	Italy	226	14.04	7089	31.37	1.52
4	UK	169	10.50	12108	71.64	3.46
5	Spain	116	7.20	3618	31.19	1.51
6	France	104	6.46	2783	26.76	1.29
7	Germany	78	4.84	3904	50.05	2.42
8	Canada	73	4.53	3458	47.37	2.29
9	India	72	4.47	364	5.06	0.24
10	Brazil	64	3.98	394	6.16	0.30
11	Iran	59	3.66	319	5.41	0.26
12	Australia	49	3.04	2937	59.94	2.90
13	South Korea	46	2.86	3966	86.22	4.17
14	Turkey	46	2.86	233	5.07	0.24
15	Japan	41	2.55	2454	59.85	2.89
	Total of 15 countries	1839		72438	39.39	1.90
	Global total	1610		33310	20.69	

Table 2. Top 20 Countries with Largest Collaborative Linkages

Country	Documents	Citations	Total link strength
USA	454	17595	3320
Italy	226	7089	1948
England	161	12077	1910
Peoples are China	243	11216	1541
Spain	116	3618	990
Germany	78	3904	986
France	104	2783	860
Canada	73	3458	849
South Korea	46	3966	691
Netherlands	37	3940	648
Australia	49	2937	566
Singapore	28	2928	493
Denmark	28	3408	453
Brazil	64	394	438
Japan	41	2454	403
India	72	364	378
Switzerland	32	800	335
Scotland	18	1762	333
Saudi Arabia	24	1791	294
Mexico	29	1531	278

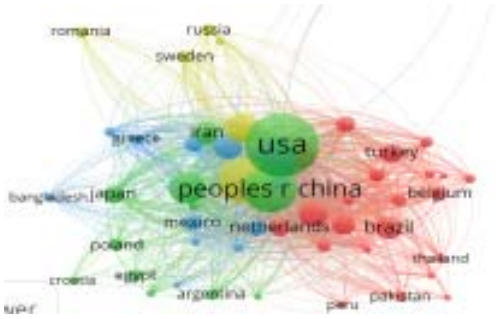

Figure 1 Collaborative Linkages Network among top 20 Countries

42 MOST PRODUCTIVE ORGANISATIONS

A total of 4040 organisations participated in global research on 'Covid-19 and Medical Oxygen' during 2020-21. 72 organisations contributed 10-50 publications each and 3968 organisations 1-9 publications each. The largest global publication share (3.11%) came from Huazhong University of Science and Technology, China, followed by University Milan, Italy (2.17%) and all other 8 organisations contributed between 1.37% to 1.99% publications.

Table 3: Profile of Most Productive Organisations

S.No	Name of the Organization	TP	% TP	%TP	TC	CPP	RCI
1	Huazhong University of Science & Technology, China	50	3.11	3.11	3247	64.94	3.14
2	University Milan, Italy	35	2.17	2.17	1967	56.20	2.72
3	Harvard Med School, USA	32	1.99	1.99	1015	31.72	1.53
4	University of Paris, France	29	1.80	1.80	1719	59.28	2.86
5	Wuhan University , China	28	1.74	1.74	1310	46.79	2.26
6	University Toronto, Canada	27	1.68	1.68	2182	80.81	3.91
7	Columbia University, USA	25	1.55	1.55	3576	143.04	6.91
8	Kings College London, U.K.	22	1.37	1.37	2051	93.23	4.51
9	Massachusetts General Hospital, USA	22	1.37	1.37	1833	83.32	4.03
10	University Oxford, U.K.	22	1.37	1.37	4913	223.32	10.79
	Total of top 10 organisations	292	18.14	18.14	23813	81.55	3.94
	Global total	1610			33310	20.69	
	Share of top 10 organisations in global total	18.14			71.49		

The publication output of top 10 organisations varied from 22 to 50 and together contributed 18.14% share and 71.49 % share respectively in global publications and citations. Four out of 10 organisations registered citation per paper and relative citation index above their group average (81.55 and 3.94): University Oxford, U.K. (223.32 and 10.79), Columbia University, USA (143.04 and 6.91), Kings College London, U.K.(93.23 and 4.51) and Massachusetts General Hospital, USA (83.32 and 4.03) (Table 3). The collaborative network of top 20 organisations with largest number of collaborative linkages is shown in Table 4 and Figure 2.

Table 4. Top 20 Organisations with the Largest Collaborative Linkages

Organization	Documents	Citations	Total link strength
univ oxford	20	4912	471
univ lancaster	5	4678	398
univ milan	32	809	354
chinese acad med sci	10	3259	325
huazhong univ sci & technol	50	3247	317
univ cambridge	8	3203	310
capital med univ	15	3307	297
beijing univ chinese med	6	3177	273
china japan friendship hosp	5	3146	267
tsinghua univ	5	3138	267
kings coll london	21	2050	264
univ vita salute san raffaele	16	660	251
northwell hlth	10	2511	215
peking univ	10	2200	210
univ nottingham	10	2409	210
univ paris	25	681	209
harvard med sch	30	969	208
brigham & womens hosp	15	914	207
columbia univ	19	847	184
univ birmingham	6	1685	170

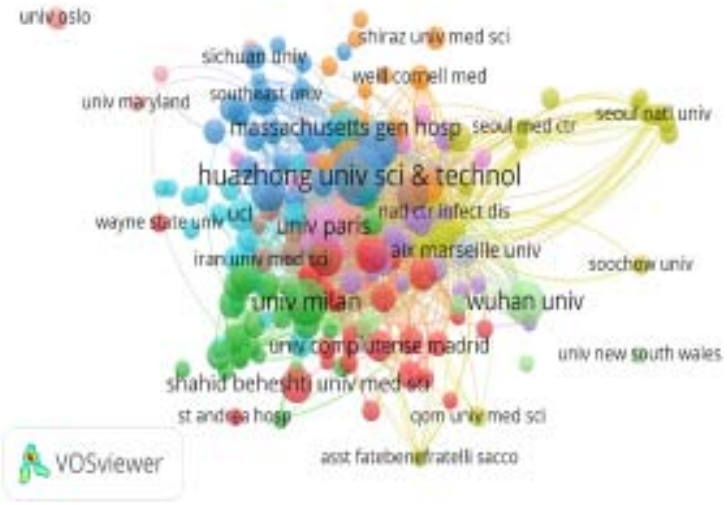

Figure 2 Collaborative Linkages Network among Top 20 Organisations

43 MOST PREFERRED JOURNALS

The global publication output in research on 'Covid-19 and Medical Oxygen' was scattered in 698 journals. The top 24 journals contributed 10 to 44 publications and other 674 journals 1-9 publications. The top 10 journals individually contributed 15 to 44 papers and together contributed 15.47% and 4.15% share in global publications and citations. On further analysis, it was observed that only three journals contributed papers above their group average (24.9): *Trials* (44 papers), *PLOS* One (43 papers) and *International Journal of Infectious Diseases* (26 papers).Three journals registered average citation per paper above their group average (5.56): *Journal of Medical Virology* (13.5), *International Journal of Infectious Diseases* (9.46) and Critical Care (9.05) (Table 5).The collaborative network of top 20 journals with largest number of collaborative linkages is shown in Table 4 and Figure 3.

Table 5: List of Top 10 Most Preferred Journals

S.No.	Name of the Journal	TP	TC	CPP
1	Trials	44	155	3.52
2	PLOS One	43	235	5.47
3	International Journal of Infectious Diseases	26	246	9.46
4	Journal of Clinical Medicine	23	89	3.87
5	BMC Infectious Diseases	22	39	1.77
6	Critical Care	20	181	9.05
7	Journal of Medical Virology	20	270	13.50
8	Medical Hypotheses	18	93	5.17
9	Scientific Reports	18	57	3.17
10	BMJ Open	15	19	1.27
	Total of top 10 journals	249	1384	5.56
	Global total	1610	33310	20.69
	Share of top 10 journals in global total	15.47	4.15	

Table 6. Top Journals with Largest Collaborative Linkages

Source	Documents	Citations	Total link strength
new england journal of medicine	11	7316	211
jama-journal of the american medi...	11	3953	101
bmj-british medical journal	7	870	54
plos one	43	235	41
critical care	20	181	40
journal of clinical medicine	23	89	37
lancet rheumatology	6	579	35
journal of medical virology	20	270	33
lancet	5	1218	30
international journal of infectious ...	26	246	28
bmc infectious diseases	22	39	27
bmj open	15	19	27
lancet respiratory medicine	6	234	27
scientific reports	18	57	24
european respiratory journal	14	162	23
british journal of anaesthesia	13	167	21
mayo clinic proceedings	6	113	20
internal and emergency medicine	12	56	18
journal of korean medical science	14	163	18
anesthesiology	5	319	17

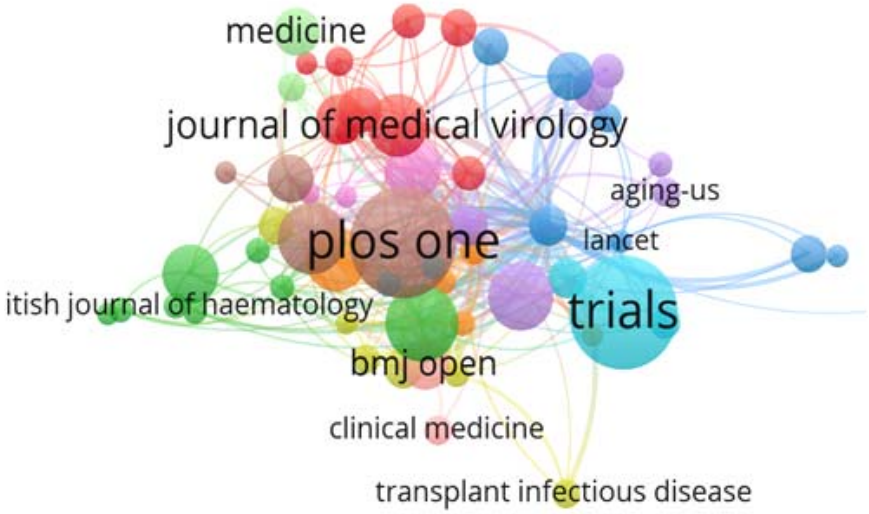

Figure 3 Citation Network of Journals

44 MOST PROLIFIC AUTHORS

A total number of 15469 authors have contributed to global research on 'COVID-19 and Medical Oxygen'. Of these 13667 authors have contributed 1 paper each, 1796 authors 2 to 9 papers and 6 authors have contributed 10 to 14 papers. The profile of top 10 most prolific and most cited authors are presented in Table 5. The 10 most prolific contributed 9 to 14 papers and together account for 6.71% and 43.54% share respectively in global publications and citations on this subject. The top 10 most cited authors contributed 2 to 13 papers and together account for 3.60% and more than 100.0% share each in global publications and citations (Table 7)

Table 7: Most Prolific and Cited Authors

S.No.	Name of the Author	TP	TC	CPP	S.No.	Name of the Author	TP	TC	CPP
1	J. Li	14	134	9.57	1	F.G. Hayden	4	4866	1216.50
2	Y. Li	13	155	11.92	2	T. Jaki	4	4678	1169.50
3	Y. Zhang	13	3182	244.77	3	K. Wang	6	3533	588.83
4	Y. Wang	12	3343	278.58	4	Y. Wang	12	3343	278.58
5	X. Li	10	2226	222.60	5	P.W. Horby	4	3230	807.50
6	H. Wang	10	44	4.40	6	Y. Zhang	13	3182	244.77
7	H. Li	9	2218	246.44	7	C. Wang	4	3140	785.00
8	J. Liu	9	35	3.89	8	F. Zhou	6	3139	523.17
9	D.C. Lye	9	2286	254.0	9	B. Cao	3	3138	1046.00
10	B.E. Young	9	879	97.67	10	H.D. Li	2	3136	1568.00
	Total of top 10 authors	108	14502	134.28		Total of top 10 most cited authors	58	35385	610.09
	Global total	1610	33310	20.69		Global total	1610	33310	20.69
	Share of top 10 authors in global total	6.71	43.54	6.49		Share of top 10 most cited authors in global total	3.60		

45 HIGHLY CITED PAPERS

On the theme 'Covid-19 and Medical Oxygen', only 5 papers have reported more than 1000 citations each, 52 papers with 100 or more citations and 561 papers with nocitations. A list of top 10 high-cited papers is given in Table 9.

Table 8: List of Top 10 Highly-cited Papers

S.No	Name of the authors	Title of the paper	Source	Citations
1	S. Richardson, J.S. Hirsch et al	Presenting characteristics, comorbidities and outcomes among 5700 patients hospitalized with COVID-19 in the New York City Area	JAMA-Journal of the American Medical Association 26 May2020, 323(20), 2052-2059	2259
2	B. Cao, Y. Wang et al	A trial of Lopinavir-Ritonavir in adults hospitalized with severe Covid-19	New England Journal of Medicine 7 May 2020, 382 (19), 1787-1799	2062
3	P. Horby, W.S. Lim et al	Dexamethasone in hospitalized patients with Covid-19	New England Journal of Medicine 25 February 2021, 384 (8), 693-704	1538
4	J.H. Beigel, K.M. Tomashek et al	Remdesivir for the treatment of Covid-19. Final report	New England Journal of Medicine 5 November 2020, 383 (19), 1813-1826	1345
5	Y.M. Wang, D.Y. Zhang et al	Remdesivir in adults with severe COVID-19: A randomised, double-blind, placebo-controlled, multicentretrial	Lancet 16 May 2020, 395 (10236), 1569-1578	1074
6	J. Grein, N. Ohmagari et al	Compassionate use of Remdesivir for patients with severeCovid-19	New England Journal of Medicine 11 June 2020, 382 (24), 2327-2336	991
7	X.L. Xu, M.F. Han MF, et al.	Effectivetreatment of severeCOVID-19 patients with Tocilizumab	Proceedings of the National Academy of Sciences of the United States of America 19 May 2020, 117 (20), 10970-10975	946
8	F. Pan, T.H. Ye, et al.	Time course of Lung changes a Chest CT during recovery from CoronavirusDisease 2019	Radiology June 2020, 295 (3), 715-721	909
9	W. Alhazzani, M.H. Moller, et al.	SurvivingSepsis campaign: Guidelines on the management of criticallyilladults with CoronavirusDisease 2019	Intensive Care MedicineMay 2020, 46 (5), 854-887	865
10	W. Alhazzani, M.H. Moller, et al.	SurvivingSepsis campaign: Guidelines on the management of criticallyIlll adults with CoronavirusDisease 2019	Critical Care Medicine June 2020, 48 (6), E440-E469	865

5 SUMMARY AND CONCLUSION

The study provides a bibliometric overview of research on 'COVID-19 and Medical Oxygen' based on analysis of 1610 global publications indexed in Web of Science database during 2020-21. The USA contributed the highest publication share (28.2%) in global output, followed by China (15.0 %), Italy (14.0 %) and UK (10.5%). The most cited countries are: USA (with 17595 Citations), UK (with 12108 Citations) and China (with 11216 Citations). The most productive organisations are: Huazhong University of Science and Technology, Chinawith global share of 3.1%, followed by University Milan, Italy (2.2%), Harvard Medical School, USA (2.0%) share. The overall H-index is 75 and average citation per paper reported for global publications in this area is 20.15.

REFERENCES

1. WHO. The life-saving power of medical oxygen. 25 February 2021. https://www.who.int/news-room/feature-stories/detail/the-life-saving-power-of-medical-oxygen
2. Muthuraj, Surulinathi; Balasubramani, R. and Amsaveni, N. "COVID-19 research output in 2020: The global perspective using scientometric Study" (2020). Library Philosophy and Practice (e-journal). 4196. https://digitalcommons.unl.edu/libphilprac/4196
3. A. Senthamilselvi , M., Surulinathi, R., Sankaralingam and T. Jayasuriya. Highly cited works In Covid-19. The global perspective (2020). Library Philosophy and Practice (e-journal). 4337. https:// digitalcommons.unl.eu/libphilprac/4337
4. Gupta, B. M, Dhawan, S.M, Mueen Ahmed, KK and, Mamdapur, GModin. Global research on Covind-19 disease: A scientific assessment of publications during 2020-21. International Journal of Medicine and Public Health. 2021, 11(2), 76-84.
5. Muthuraj, S, Jayasuriya, T, Duraipandi, R and Senthamilselvi, A. Oxygen therapy: A scientometric mapping of Indian publications. (2021). Library Philosophy and Practice (e-journal). 5757.https://digitalcommons.unl.edu/libphilprac/5757