

Covid-19 and Aged People: A Scientometric Analysis of High-Cited Publications

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ABSTRACT

Background: The study analyzed and evaluated the scientific research on "Covid-19 and Aged People" to find out the current status of research and to identify significant players (countries, organizations and authors) and important topics from the 469 high-cited publications receiving 100 and more citations using bibliometric methods. **Methods:** High-cited publications published from December 2019 to June 2021 were identified and analyzed. A list keywords were identified for Covid-19 ("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 Aged People ("Aged" or "Elderly" or "Old" or "Very Elderly") and these keywords are used for search on the topic of study (the title, abstract, keywords). **Results:** A total of 469 high-cited publications were obtained on this topic, which registered 449.5 citations per paper and witnessed the participation of 64 countries, with China, USA and U.K. leading in global publication productivity (with 189, 162 and 70 publications each) and China (687.25), Singapore (409.20) and Switzerland (396.41) leading in citation impact per paper. The 2123 organizations and 5896 authors participated in these 469 high-cited publications. Huazong University of Science and Technology, China, Wuhan University, China and University of Oxford, U.K. leads in publications productivity (with 66, 37 and 20 publications each) and Capital Medical University, China, University of Hong Kong (1454.6) and Shanghai Jiao Tong University, China leads in

citations impact per paper. L. Liu, J. Chen and Y. Hu leads in publications productivity (with 16, 13 and 13 publications each) and Y. Liu (17100.5), Y.Hu (15395.5) and L. Zhang (15079.0) leads in citations impact per paper. *New England Journal of Medicine, Lancet and JAMA - Journal of the American Medical Association* leads in both publication productivity and citations impact per paper. The keywords that appeared most were "Covid-19" and "Aged People" which had a strong links with "mortality," "hospitalization," "hypertension," "respiratory failure," "diabetes mellitus," "chronic kidney failure," "anxiety," "depression" and "mental health". **Conclusion:** The current bibliometric analysis provides information about the quantity and quality of research in this area based on published literature. It provides information on current status of research in this area to decision-makers and practicing scholars and provides important clues about upcoming research topics for future research.

Key words: Covid-19, Aged People, Global publications, High-Cited Publications, Scientometrics, Bibliometrics.

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INTRODUCTION

The Covid-19 pandemic is impacting the global population in drastic ways. In many countries, older people are facing the most threats and challenges at this time. Although all age groups are at risk of contracting Covid-19, older people face significant risk of developing severe illness if they contract the disease due to physiological changes that come with ageing and potential underlying health conditions. Elderly people are also at a higher risk of Covid-19 infection due to their decreased immunity and body reserves, as well as multiple associated comorbidities like diabetes, hypertension, chronic kidney disease and chronic obstructive pulmonary disease. Also, course of disease tends to be more severe in case of elderly people resulting in higher mortality.

Literature Review

The progressive aging of the population requires increasingly greater efforts to better understand and address age-related health problems. Although a large number of bibliometric studies exists on specific diseases associated with older people, few studies have attempted to provide a more comprehensive vision of the area. Moreover, those that

exist are often limited to publications in the area of Geriatrics and Gerontology.¹ Different bibliometric studies have taken "aging" as the topic of research to examine literature, which has considered this variable in association with "healthy aging," a concept describing optimal physical, mental and social well-being.^{2,3} Some scholars have analyzed the evolution of scientific literature, the contributions and citation by country, taking as publications in the journals specializing in Geriatrics and Gerontology.^{4,5} Other scholars have studied specific diseases that are generally associated with the elderly population, especially dementias, like Alzheimer's disease,⁶ among others. However, only a bibliometric study⁷ based on the analyses of 784 global records cover literature from December 2019 to 17 March 2021 has been published on impact of "Covid-19 on elderly population". Since no comprehensive study on total output and also on high-cited publications exists on this topic, the authors decided to undertake a bibliometric study of high-cited papers on "Covid-19 and Aged People" covering literature from December 2019 to 16 June 2021, using Web of Science database.

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The present study utilized scientometric methods to study the performance of overall research in this area. Traditionally the scientometric method is being used in librarianship and information science field to analyze the citation characteristics, content analysis, etc. but presently it is widely being used for measuring country, institutional and author performance using publications output, citation impact and collaboration data.

Objectives

The major aim of this study is to study the overall characteristics and trends of research as reflected in international scientific literature on “Covid-19 and Aged People” during 2019-21, with a focus on: (i) to identify of key players (countries, organizations, authors and journals) in research and to study their network collaborative linkages, and (ii) to identify the main subject areas and significant keywords reflecting the trends of research in this topic.

Data Source and Methods

For studying the global literature on “Covid-19 and Aged people”, the authors retrieved and downloaded global publications data from the Web of Science database on 16 June 2021, using a well-defined search strategy, where a set of keywords related to “Covid-19” and “Aged People” were used, as shown below.

TS= (“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 TS= (Aged or Elderly or Old or Very Elderly or “Aged”)

The search strategy used resulted in 469 high-cited publications, which was further refined to get statistics on global output by country, organization, author and journal. Citations to publications were counted from date of their publication till 16 June 2021.

Data Analysis and Results

Overall Output

In all 469 high-cited papers are published on “Covid-19 and Aged People”, which have received 210834 citations, averaging 449.54 citations per paper. Of the 469 high-cited papers, 319 papers are in citation range 100-300, 77 papers in 301-500 citation range, 39 papers in 501-1000 citation range, 28 papers in 1001-5000 citation range and 6 papers have more than 5000 citations. About 60% share of 469 high-cited papers have received funding support by external agencies. The largest contribution by funding agency along with their output came from U.S. Department of Health and Human Service (with 60 papers), followed by National Institute of Health, USA (56 papers), National Natural Foundation of China (55 papers), etc. Of the 469 high-cited papers, article constituted the largest share (81.9%), followed by reviews (12.8%), letters (2.6%), editorial materials (2.3%) and others (0.4%).

Table 1: Publication Profile of Top 20 Countries.

S.No	Name of the country	TP	TC	CPP	RCI	% TP	TLS
1	China	189	129890	687.25	1.53	40.30	1606
2	USA	162	49518	305.67	0.68	34.54	1020
3	U.K.	70	24287	346.96	0.77	14.93	560
4	Italy	60	17843	297.38	0.66	12.79	467
5	Germany	36	11835	328.75	0.73	7.68	261
6	France	33	9184	278.30	0.62	7.04	259
7	Spain	25	6844	273.76	0.61	5.33	177
8	Switzerland	22	8721	396.41	0.88	4.69	223
9	Netherlands	20	6087	304.35	0.68	4.26	213
10	Australia	19	4545	239.21	0.53	4.05	204
11	Canada	18	5276	293.11	0.65	3.84	170
12	Belgium	16	5320	332.50	0.74	3.41	148
13	Brazil	12	4169	347.42	0.77	2.56	126
14	Singapore	10	4092	409.20	0.91	2.13	63
15	India	9	2261	251.22	0.56	1.92	34
16	South Korea	8	1610	201.25	0.45	1.71	56
17	Austria	7	1830	261.43	0.58	1.49	56
18	Denmark	7	1770	252.86	0.56	1.49	64
19	Iran	7	1479	211.29	0.47	1.49	53
20	Russia Republic	7	1305	186.43	0.41	1.49	33
	Total of 20 countries	737	297866	404.16			
	Global total	469	210834	449.54			
	Share of top 20 in global total						

TP=Total papers; TC=Total citations; CPP=Citations per paper; RCI=Relative citation index; TLS=Total collaborative linkages

Top 20 Countries

In all, 64 countries unevenly participated in global high-cited papers on this topic: 18 countries contributed 1 paper each, 32 countries 2-9 papers each and 14 countries 10-189 papers each. The top 20 countries individually contributed 7-189 papers and together contributed more than 100% global publications (737) share and more than 100% global citations (297866) share. On further analysis, it was observed that only four countries contributed the publications above the average productivity (36.85) of all 20 countries: China (189 papers and 40.30% share), USA (162 papers and 34.54% share), U.K. (70 papers and 14.93% share) and Italy (600 papers and 12.69% share). Only two countries registered average citation per paper and relative citation index more than average (404.16 and 0.90) of top 20 countries: China (687.25 and 1.53) and Singapore (409.20 and 0.91).

Figure 1 presents the visual picture of the collaborative network linkages among top 20 countries. The Figure depicts the data in different clusters: Cluster 1=Red (with 9 items); Cluster 2=Green (with 8 items); Cluster 3=Blue (with 4 items)). Among the top 20 countries, USA leads with 276 linkages followed by England (220), Germany (166), Italy (157), France (148), China (145), and Canada (125) and among others. The highest number of country to country collaborative linkages (35) are between China - USA, followed by USA-UK (28 linkages), USA-Germany and USA-Italy (16 linkages each), China-UK (15 linkages), USA-Spain

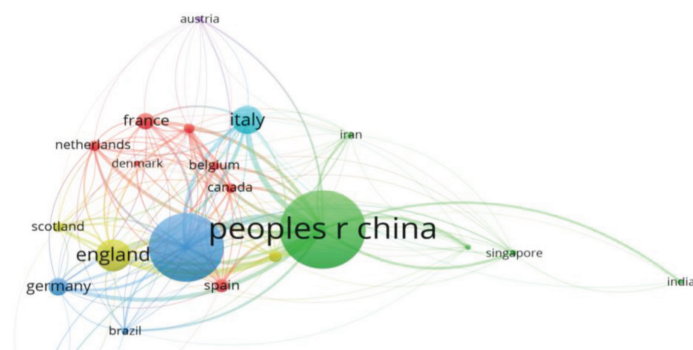


Figure 1: Collaboration Visualization Network of Linkages among Top Countries.

Table 2: Subject-Wise Distribution of Literature on “Covid-19 and Aged People”.

S.No	Broad Subject Areas	TP	%TP	TC	CPP
1	Public Environment and Public Health	55	8.30	217	3.95
2	Ophthalmology	52	7.85	286	5.50
3	Pediatrics	46	6.94	1272	27.65
4	Psychiatry	46	6.94	1137	24.72
5	Immunology	43	6.49	783	18.21
6	Medicine-General Internal	39	5.88	366	9.38
7	Infectious Diseases	33	4.98	264	8.00
8	Pharmacology Pharmacy	33	4.98	260	7.88
9	Biochemistry Molecular Biology	32	4.83	110	5.00
10	Medicine Research Experimental	32	4.83	311	9.72
	Global total	469		210834	

TP=Total papers; TC=Total citations; CPP=Citations per paper

(14 linkages), USA-Netherland (13 linkages), UK-Italy (12 linkages), UK-Netherland (12 linkages) and USA-Canada (12 linkages).

Subject-Wise Distribution

Based on the analysis of subject categories as defined in Web of Science database, the largest number of papers (np=55, 8.30%) was in subject category Public Environmental Occupational Health, followed by Ophthalmology (np=52; 7.85%), Pediatrics (np = 46; 6.94 %), Psychiatry (np = 46;6.94%), Immunology (np = 43; 6.49 %), etc. In terms of impact, Pediatrics registered the highest impact per paper (24.72), followed by Psychiatry (24.72), Immunology (18.21), Medicine Research Experimental (9.72), etc. (Table 2)

Significant Keywords

Table 5 shows the author keyword co-occurrences (of words with more than > 9 frequency). Among the author keywords, the most relevant keywords associated with “Covid-19 and Aged People” were complications (265), mortality (265), hospitalization (210), hypertension (136), genetics (95), respiratory failure (83), intensive care unit (51), etc. (Table 3).

Top 20 Organizations

In all, 2123 organization participated in research on this topic: 1313 organizations contributed 1 paper each, 389 organizations 2-9 papers each and 421 organizations 10-66 papers each. The contribution of top 20 organizations varied from 10 to 66 papers and together they contributed 72.07% share (338) in global output and more than 100.0% (257230) share in global citations. On further analysis, it was observed that: (i) Only 3 organizations registered productivity above the average (16.9) of all 20 organizations: Huazhong University of Science and Technology, China (66 papers), Wuhan University, China (37 papers) and University of Oxford, U.K. (20 papers) and (ii) Eight organizations have registered average citation per paper and relative citation index above the average (761.04 and 1.69) of all 20 organizations: Capital Medical University, China (1885.47 and 4.19), University of Hong Kong (1454.60 and 3.24), Shanghai Jiao Tong University, China (1395.650 and 3.10), Zhejiang University, China (1156.54 and 2.57), Guangzhou Medical University, China (1140.09 and 2.54), Wuhan University, China (1103.22 and 2.45),

Table 3: List of Significant Keywords appearing in High-Cited Literature on “Covid-19 and Aged People”.

S.No	Name of Keyword	Frequency	S.No	Name of Keyword	Frequency
1	Virus Pneumonia	268	11	Chronic Kidney Failure	36
2	Complications	265	12	Chronic Obstructive Lung Disease	34
3	Mortality	263	13	Anxiety	32
4	Hospitalization	210	14	Vaccines	34
5	Hypertension	136	15	Depression	29
6	Genetics	95	16	Psychology	45
7	Respiratory Failure	83	17	Mental Health	29
8	Intensive Care Unit	51	18	Social Isolation	11
9	Diabetes Mellitus	104	19	Loneliness	11
10	Cardiovascular Disease	42	20	Dementia	9

Table 4: Bibliometric Profile of Top 20 Organizations.

S.No	Name of the organization	TP	%TP	TC	CPP	RCI
1	Huazhong University Science and Technology, China	66	7.89	54946	832.52	1.85
2	Wuhan University , China	37	4.26	40819	1103.22	2.45
3	University Oxford, U.K.	20	3.20	9560	478.00	1.06
4	Capital Medical University, China	15	3.20	28282	1885.47	4.19
5	Imperial College London, U.K.	15	3.20	4828	321.87	0.72
6	University Hong Kong	15	2.99	21819	1454.60	3.24
7	Fudan University, China	14	2.99	6291	449.36	1.00
8	Harvard Medical School, USA	14	2.99	5710	407.86	0.91
9	University Cambridge, U.K	14	2.99	5833	416.64	0.93
10	University Paris, France	14	2.77	3908	279.14	0.62
11	Sun Yat-Sen University, China	13	2.77	13891	1068.54	2.38
12	University of California, USA	13	2.77	2988	229.85	0.51
13	Zhejiang University, China	13	2.56	15035	1156.54	2.57
14	Kings College London, U.K.	12	2.35	4375	364.58	0.81
15	Guangzhou Medical University, China	11	2.35	12541	1140.09	2.54
16	Peking University, China	11	2.35	2099	190.82	0.42
17	University Washington, USA	11	2.13	3987	362.45	0.81
18	Columbia University, USA	10	2.13	2662	266.20	0.59
19	London School of Hygiene and Tropical Medicine, U.K.	10	2.13	3701	370.10	0.82
20	Shanghai Jiao Tong University, China	10	2.13	13955	1395.50	3.10
	Total of 20 organizations	338	72.07	257230	761.04	1.69
	Global total	469		210815	449.54	1.00
	Share of top 20 in global total					

TP=Total papers; TC=Total citations; CPP=Citations per paper; RCI=Relative citation index

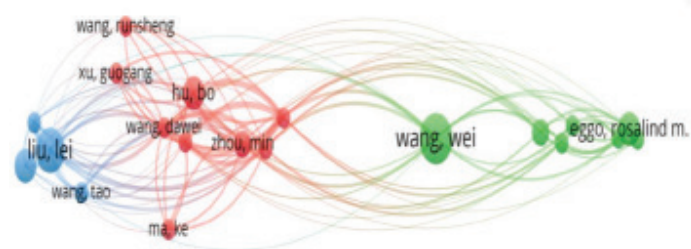


Figure 2: Collaboration Visualization Network of Linkages among Top Organizations.

Sun Yat-Sen University, China (1068.54 and 2.36) and Huazhong University of Science and Technology, China (832.52 and 1.85) (Table 4).

Figure 2 depicts the visual representation of collaborative network linkages amongst top 30 organizations. The collaborative linkages are depicted in three clusters: (i) First cluster in red colour (containing 8 organizations), (ii) Second cluster in green colour (containing 7 organizations); and Third cluster in blue colour (containing 4 organizations). Huazhong University Science and Technology, China leads with highest number of collaboration link strength (501) followed by Wuhan University, China (430 link strength), Capital Medical University, China (261 link strength) and Shanghai Jiao Tong University, China (196).

Top 20 Authors

The 5896 authors participated in 469 high-cited papers. Of these, 4977 authors had published 1 paper each, 910 authors 2-8 publications each and 9 authors 10-16 publications each. The contribution of top 20 authors varied from 6 to 16 papers and together they contributed 38.81% share (182) in global output and more than 100.0% (245622) share in global citations. On further analysis, it was observed that: (i) Only 9 authors registered productivity above the average (9.1) of all 20 authors and (ii) 9 authors have registered average citation per paper and relative citation index above the average (1349.6 and 3.0) of all 20 authors (Table 5)

Figure 3 shows the visual representation of collaborative linkages among top 20 authors on “Covid-19 and Aged People”. Among the top 20 authors, the largest number of collaborative linkages are between Wei Wang and M. Rosalind.

Top 20 Journals

In all 187 journals participated in research on this topic: 105 journals contributed 1 paper each, 74 journals 2-9 papers each and 8 journals 10-28 papers each. The top 20 journals contributed 4-28 papers and together contributed 19.83% (93 papers) share in the total output (469). The most five most productive journals are: *Lancet* (28 papers), *New England Journal of Medicine* (25 papers), *JAMA-Journal of the American Medical Association* (20 papers), *BMC -British Medical Journal* (12 papers) and *Lancet Infectious Diseases* (12 papers).The five most impactful journals

Table 5: Bibliometric Profile of Top 20 Authors.

S. No	Name of the author	Affiliation of the Author	TP	%TP	TC	CPP	RCI
1	L. Liu	Shanghai PublHlth Clin Ctr, Shanghai, China	16	3.4	14533	7266.50	16.16
2	J. Chen	Shanghai Publ Hlth Clin Ctr, Shanghai, China	14	3.0	4636	2318.00	5.16
3	Y. Hu	HuazhongUniv Science and Technology, Tongji Med Coll, Wuhan, China	13	2.8	30791	15395.50	34.25
4	Y. Liu	Wuhan Institute of Technology, China	13	2.8	34201	17100.50	38.04
5	L. Wang	Wuhan University, Renmin Hospital, Wuhan, China	11	2.3	3335	1667.50	3.71
6	Y. Zhang	Peking Union Med Coll ege and Hospital, Beijing, China	11	2.3	13194	6597.00	14.68
7	J. Liu	Jiangnan Univ, Peoples Hospital ,Wuxi, Jiangsu, China	10	2.1	12000	6000.00	13.35
8	W. Wang	First Peoples Hosp ital., Yancheng City, China	10	2.1	4020	2010.00	4.47
9	Y. Wang	Wuhan University, Renmin Hospital, Wuhan, China.	10	2.1	4464	2316.50	5.15
10	J. Wang	Huazhong University of Science and Technology, Tongji Medical College, Wuhan, China.	8	1.7	1977	988.50	2.20
11	L. Zhang	Huazhong University of Science and Technology, Tongji Medical College, Wuhan, China.	8	1.7	30158	15079.00	33.54
12	Z. Chen	First Peoples Hospital, Yancheng City, China	7	1.5	11478	5796.00	12.89
13	H. Li	First Hospital Changsha, Hunan, China	7	1.5	29698	14849.00	33.03
14	L. Li	China Pharmaceutical University, Big Data Research Institute, Nanjing, China	7	1.5	11828	5914.00	13.16
15	Y. Yang	Univ Macau, Institute of Translatational Medicine, Taipa, Macao, China	7	1.5	8809	4404.50	9.80
16	L. Chen	Shenzhen Eye Hospital, Shenzhen, China.	6	1.3	2574	1371.50	3.05
17	J.X. Li	Southern University of Science and Technology, Shenzhen Key Lab Pathogen and Immun, Natl Clin Res Ctr Infect Dis, Shenzhen, China	6	1.3	2838	1476.00	3.28
18	Y. Li	Huazhong Univ Sci and Technol., TongjiHosp, Wuhan, Hubei, China	6	1.3	2087	1128.00	2.51
19	Y. Ling	Shanghai Publ Hlth Clin Ctr, Shanghai China.	6	1.3	1903	951.50	2.12
20	M. Liu	Harvard Medical School, Brigham and Womens Hosp, Boston, MA, USA	6	1.3	21098	10633.50	23.65
Total of top 20 authors			182	38.81	245622	1349.6	3.00
Global total			465		210815	449.54	

TP=Total papers; TC=Total citations; CPP=Citations per paper; RCI=Relative citation index

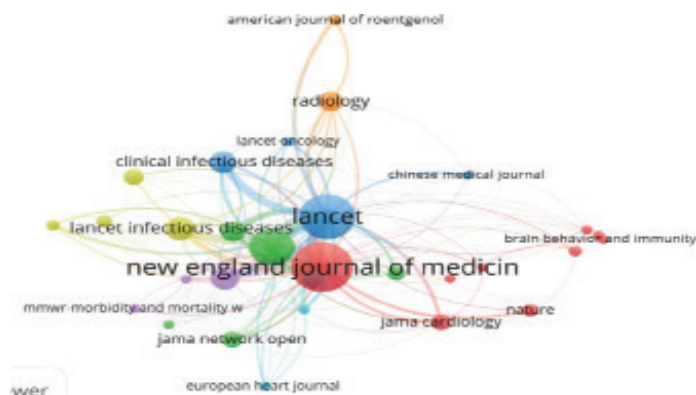


Figure 3: Collaboration Visualization Network of Linkages among Top Authors.

in terms of citations per paper are: *Lancet* (1693.52), *New England Journal of Medicine* (1024.25), *JAMA - Journal of American Medical Association* (1020.2), *JAMA Cardiology* (560.38) and *Lancet Infectious Disease* (513.17) (Table 6).

RESULTS AND SUMMARY

The bibliometric analysis presented above provides information about the quantity and quality of research in this area based on published publications. It provides important clues to decision-makers and practicing scholars about current research trends, present status and upcoming research topics for future research.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

Table 6: Bibliometric Profile of Top 20 Journals.

S. No	Name of the journal	IF	TP	%TP	TC	CPP
1	New England Journal of Medicine	74.69	28	6.0	28679	1024.25
2	Lancet	60.39	25	5.3	42088	1683.52
3	JAMA - Journal of the American Medical Association	56.27	20	4.3	20404	1020.20
4	BMJ - British Medical Journal	39.89	12	2.6	5887	490.58
5	Lancet Infectious Diseases	25.07	12	2.6	6038	503.17
6	Clinical Infectious Diseases	8.31	11	2.3	3263	296.64
7	Journal of Infection	4.60	10	2.1	3081	308.10
8	Radiology	11.10	10	2.1	3527	352.70
9	JAMA Internal Medicine	21.87	9	1.9	3918	435.33
10	JAMA Cardiology	14.67	8	1.7	4483	560.38
11	JAMA Network Open	8.48	8	1.7	2931	366.38
12	Lancet Public Health	21.64	8	1.7	1971	246.38
13	Journal of Medical Virology	2.04	7	1.5	1715	245.00
14	Nature	42.77	6	1.3	1895	315.83
15	Science	41.84	6	1.3	1384	230.67
16	American Journal of Roentgenology	3.95	5	1.1	1853	370.60
17	Lancet Psychiatry	27.08	5	1.1	1136	227.20
18	Nature Medicine	53.44	5	1.1	1308	261.60
19	Annals of Internal Medicine	25.39	4	0.9	1326	331.50
20	Brain Behavior and Immunity	6.63	4	0.9	823	205.75
	Total of 20 journals		93			

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