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SCIENTOMETRIC ANALYSIS OF CARDIO VASCULAR DISEASES RESEARCH PERFORMANCE: A GLOBAL PERSPECTIVE

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Abstract
This paper discuss on Scientometric analysis of cardiovascular diseases research performance: A global perspective, objectives of the study; to find out year wise publications on cardiovascular diseases research, to examine growth publications, to identify document types wise cardiovascular diseases research, to examine authorship pattern, to find out top twenty institutions contributed on cardiovascular diseases research, to identify top ten countries contributed on cardiovascular diseases research publications. The data have been collected from the Web of Science database; the study period from 2011 to 2020, 28789 records were retrieved. The study reveals that, totally 28789 publications were published during the study period; cardiovascular diseases research publications have shown increasing trends. Totally seventeen document types are contributed in this research, Among the top twenty authors, Drexel H has first position with 157 contributions, Vonbank A has second place with 137 contributions, Leiherer A has third place with 135 contributions. 28789 papers were contributed by 90723 authors. Among the authorship pattern, six and above authors collaborative contributions are 41.82 percentage, five authors collaborative contributions are 27.95 percentage. 28789 papers are contributed in nineteen languages, totally 15079 institutions contributed in the cardiovascular diseases research during the study period.

Keywords: Cardiovascular diseases (CVDs), Ischemic stroke, cerebrovascular disorders, Strokes.

Introduction

Cardiovascular diseases (CVDs) are a group of disorders of the heart and blood vessels. There are no symptoms of the underlying disease of the blood vessels. A heart attack or stroke may be the first sign of underlying disease. Cardiovascular diseases (CVDs) are the leading cause of death globally. An estimated 17.9 million people died from CVDs in 2019, representing 32% of all global deaths. Of these deaths, 85% were due to heart attack and stroke (World Health Organization 2021). Cardiovascular disease (CVD) is a global public health problem with significant morbidity and mortality (Benjamin EJ, Muntner P, Alonso A, et al.). The annual number of deaths from CVD will rise from 17.5 million in 2012 to 22.2 million by 2030 (World Health Organization 2016). The field of cerebrovascular disease encompasses both ischemic strokes and strokes due to brain hemorrhage, regardless of cause (John R. Absher, Mahmoud Rayes). Cerebrovascular disease in children manifests in many forms, all of which have devastating and long-lasting effects. Cerebrovascular disease is 1 of the top 10 causes of death in infants younger than 1 year. More than 95% of children with ischemic stroke have an underlying thrombus occluding an artery or a vein, and our understanding of clot pathogenesis in children is increasing. (Bowers, Deveber, Donna Ferriero, et al.). Cerebrovascular disorders represent one of the most prevalent and devastating diseases of adults. The field of cerebrovascular disease encompasses both ischemic strokes and strokes due to brain hemorrhage, regardless of cause. One in every 10 deaths worldwide is due to stroke and more than half of stroke survivors are left dependent on others for everyday activities (Vijay K. Sharma).

Methodology

The data have been collected from the Web of Science database; the study period is during (2011-2020). The search string was used 'Cardiovascular diseases' in the Title search box, field was used, and the time span field was select from 2011 to 2020. A total of 28789 records were retrieved, the data downloaded and analyzed using MS office-Excel as per objectives of the present study.

Relative Growth Rate (RGT) and Doubling Time (DT)

The relative growth rate is the increase in the number of publications/pages per unit of time. Here, one year is taken as the unit of time. The mean relative growth rate R (1-2) over a specified period of interval can be calculated from the following equation suggested by Mahapatra (1985).

$$R(1-2) = \frac{W2 - W1}{T2 - T1}$$

Where,

R = Mean relative growth rate over the specific period of interval;
W1 = log w1 (Natural log of initial number of publications/ pages);
W2 = log w2 (Natural log of initial number of publications/pages);
T2-T1 = Unit difference between the initial time and final time.
Therefore,
R (a) = Relative growth rate per unit of publications per unit of time (year)
R (p) = Relative growth rate per unit of pages per unit of time (year)

Doubling Time (DT)

A direct equivalence exists between the relative growth rate and doubling time. If the number of publications/pages of a subject double during a given period, then the difference between the logarithms of the numbers at the beginning and at the end of the period must be the logarithms of the number 2. This difference has a value of 0.693. Thus, the corresponding doubling time for publication and pages can be calculated by the following formula:

$$\text{Doubling time (Dt)} \frac{0.693}{R}$$

Therefore,

$$\text{Doubling time for publications Dt (a)} \frac{0.693}{R(a)}$$

Objectives

The following objectives are framed for the present study;

1. To find out year wise publications on cardiovascular diseases research
2. To identify document types wise cardiovascular diseases research publications
3. To examine authorship pattern on cardiovascular diseases research
4. To find top twenty authors contributions on cardiovascular diseases research
5. To find out top twenty institutions contributed on cardiovascular diseases research
6. To find top twenty sources contributions on cardiovascular diseases research
7. To identify top ten countries contributed on cardiovascular diseases research

Analysis and Interpretation

Table 1-year wise publications on cardiovascular diseases research

Sl. No.	Publication Years	No. of Records	Percentages
1	2011	2032	7.06
2	2012	2229	7.74
3	2013	2475	8.60
4	2014	2411	8.38
5	2015	2598	9.02
6	2016	2878	10.00
7	2017	3121	10.84
8	2018	3407	11.83
9	2019	3679	12.78
10	2020	3959	13.75
	Total	28789	100.00

Table 1 shows that year wise publications on cardiovascular diseases research from 2011 to 2020, totally 28789 publications were published during the study period, the year 2020 13.75 percent of papers were published, in 2019 have published 12.78 percent of papers, in 2018 have published 11.83 percent of papers, in 2017 have published 10.84 percent of papers, in 2016 have published 10.00 percent of papers, in 2015 have published 9.02 percent of papers, in 2013 have published 8.60 percent of papers, in 2014 have published 8.38 percent of papers, in 2012 have published 7.74 percent of papers, and in the year 2011 have published 7.06 percent of publications on cardiovascular diseases research. It found that from the year 2015 onwards cardiovascular diseases research publications have shown increasing trends.

Table 2 Relative Growth Rate and Doubling Time of cardiovascular diseases research

Sl. No.	Publication Years	No. of Records	Cumulative	W1	W2	W2 - W1(Ra)	Mean (Ra) W2-W1	Doubling Time	Mean Dt (a)
1	2011	2032	2032		7.61				
2	2012	2229	4261	7.61	7.7	0.09		7.70	
3	2013	2475	6736	7.7	7.81	0.11		6.30	
4	2014	2411	9147	7.81	7.78	-0.03		-23.10	
5	2015	2598	11745	7.78	7.86	0.08	0.06	8.66	-0.11
6	2016	2878	14623	7.86	7.96	0.1		6.93	
7	2017	3121	17744	7.96	8.04	0.08		8.66	
8	2018	3407	21151	8.04	8.13	0.09		7.70	
9	2019	3679	24830	8.13	8.21	0.08		8.66	
10	2020	3959	28789	8.21	8.28	0.07	0.08	9.90	8.37
	Total	28789					0.07		4.03

Table 2 shows that Relative Growth Rate and Doubling Time of cardiovascular diseases research, the value of average relative growth rate of publications [R(a)] increased and decreased gradually from 0.09

to 0.07 during 2011 to 2020 and the corresponding mean doubling time [Dt(a)] for the period increased from -0.11 to 8.37.

Table 3 document type wise research publications on cardiovascular diseases

Sl. No.	Document types	No. of Records	Percentages
1	Articles	12253	43.57
2	Meeting Abstracts	7433	25.82
3	Review Articles	4912	17.06
4	Editorial Materials	2198	7.64
5	Letters	1207	4.19
6	Corrections	367	1.28
7	Proceedings Papers	122	0.42
8	Book Chapters	112	0.39
9	News Items	102	0.35
10	Early Access	49	0.17
11	Reprints	11	0.04
12	Retractions	11	0.04
13	Retracted Publications	5	0.02
14	Data Papers	3	0.01
15	Book Reviews	2	0.01
16	Biographical-Items	1	0.003
17	Expression Of Concern	1	0.003
	Total	28789	100.00

Table 3 shows that document types wise papers publications on cardiovascular diseases, totally seventeen document types are contributed in this research, Articles are highly contributed 43.57 per cent of publications. Meeting abstracts has 25.82 percent contributions, Review articles are contributed 17.06 per cent, Editorial Materials are contributed 7.64 per cent, Letters articles are contributed 4.19 per cent, Corrections are contributed 1.28 per cent, Proceedings Papers are contributed 0.42 per cent, Book Chapters are contributed 0.39 per cent, News Items are contributed 0.35 per cent, Early Access are contributed 0.17 per cent, Reprints and Retractions are contributed 0.04 per cent respectively, Retracted Publications are 0.02 per cent, Data Papers and Biographical-Items are contributed 0.01 per cent respectively, and Biographical-Items, and Expression Of Concern are contributed 0.003 per cent respectively. It reveals that, document types wise papers publications on cardiovascular diseases Articles are highly contributed with 43.57 per cent of publications. Meeting abstracts has 25.82 percent, Review articles are contributed 17.06 per cent, and Editorial Materials are contributed 7.64 per cent remaining document types contributed below 5 percent contributions.

Table 4 top twenty authors contributed on cardiovascular diseases

Sl. No.	Authors	No. of Records	% of 28789
1	Drexel H	157	0.55
2	Vonbank A	137	0.48
3	Leiherer A	135	0.47
4	Nasir K	130	0.45
5	Tousoulis D	124	0.43
6	Saely C H	111	0.39
7	Blaha M J	103	0.36
8	Lloyd-jones D M	99	0.34
9	Muendlein A	99	0.34
10	Sattar N	98	0.34
11	Zhang Y	97	0.34
12	Manson J E	96	0.33
13	Virani SS	96	0.33
14	Blumenthal R S	94	0.33
15	Mader A	93	0.32
16	Yusuf S	93	0.32
17	Pitsavos C	92	0.32
18	Wang Y	87	0.30
19	Michos E D	84	0.29
20	Chrysohoou C	82	0.29
21	Hu F B	81	0.28
22	Panagiotakos D B	79	0.27
23	Li J	78	0.271

Totally 90723 authors were contributed in cardiovascular diseases research during 2011 - 2020, top twenty authors were listed in the table 4. Among the top twenty authors, Drexel H has first position with 157 contributions, Vonbank A has second place with 137 contributions, Leiherer A has third place with 135 contributions, followed by Nasir K has 130 with fourth place, Bhandari Tousoulis D has fifth place with 124 contributions Saely CH has sixth place with 111 contributions, Blaha MJ has seventh place with 103 contributions, Lloyd-jones DM and Muendlein A has eighth place with 99 contributions respectively, Sattar N A has ninth place with 98 contributions, Zhang Y has tenth place with 97 contributions, Manson J E and Virani S S has eleventh place with 96 contributions, Blumenthal R S has twelfth place with 94 contributions, Mader A and Yusuf S has thirteenth place with 93 contributions respectively, has fourteenth place with 92 contributions, Pitsavos C has fifteenth place with 87 contributions, Michos E D has sixteenth place with 84 contributions, Chrysohoou C has seventeenth place with 82 contributions, Hu F B has eighteenth place with 81 contributions, Panagiotakos D B has nineteenth place with 79 contributions, and Li J has twentieth place with 78 contributions. It reveals that, 90723 authors were contributed in cardiovascular diseases research, among the authors Drexel H has first position, Vonbank A has second place, Leiherer A has third place, Nasir K, Tousoulis D fourth and fifth position respectively.

Table 5 authorship pattern on cardiovascular diseases publications

Sl. No.	Authorship pattern	No. of papers	Percentages
1	Single	241	0.84
2	Double	981	3.41
3	Three	2317	8.05
4	Four	5164	17.94
5	Five	8047	27.95
6	Six and Above	12039	41.82
	Total	28789	100.00

Table 5 shows that authorship pattern on cardiovascular diseases research performance, 28789 papers were contributed by 90723 authors. Among the authorship pattern, six and above authors collaborative contributions are 41.82 percentage, five authors collaborative contributions are 27.95 percentage, four authors collaborative contributions are 17.94 percentage, three authors collaborative contributions are 8.05 percentage papers, double authors collaborative are 3.41 percentage papers, and Single author contributions are below one percentage (0.84) papers. It reveals those collaborative contributions high compare with single author contributions.

Table 6 language wise research performance on cardiovascular diseases

Sl. No.	Languages	No. of Records	Percentages
1	English	28219	98.02
2	Russian	138	0.479
3	German	131	0.455
4	Spanish	121	0.42
5	French	54	0.188
6	Portuguese	53	0.184
7	Polish	31	0.108
8	Hungarian	11	0.038
9	Chinese	6	0.021
10	Italian	6	0.021
11	Korean	6	0.021
12	Japanese	4	0.014
13	Czech	3	0.01
14	Danish	1	0.003
15	Icelandic	1	0.003
16	Serbian	1	0.003
17	Slovenian	1	0.003
18	Turkish	1	0.003
19	Welsh	1	0.003
	Total	28789	99.99

Table 6 shows that language wise research publication on cardiovascular, 28789 papers are contributed in nineteen languages, among the nineteen languages 28219 papers ware contributed in English language, 138 papers were contributed in Russian language, 131 papers were contributed in German language, in Spanish 121 papers have been published, 54contributions were contributed in French language, 53 papers are in Portuguese languages, 31 papers are in Polish, 11 contributions are in Hungarian, 6 papers are contributed in Chinese, Italian, and Korean languages respectively, 4 papers are Japanese languages, 3 contributions are in Czech, Danish, Icelandic, Serbian, Slovenian, Turkish and Welsh languages have contributed single contributions respectively. 28219 papers ware published in nineteen languages among them English language have contributed 98.02 per cent publications.

Table 7 top twenty institutions contributed on cardiovascular diseases

Sl. No.	Institutions Name	No. of Records	% of 28789
1	Harvard University	1624	5.64
2	University of California System	1099	3.82
3	University of London	998	3.47
4	Brigham Womens Hospital	896	3.11
5	Johns Hopkins University	680	2.36
6	University College London	565	1.96
7	U S Department of Veterans Affairs	564	1.96
8	Veterans Health Administration – V H A	554	1.92
9	Harvard Medical School	551	1.91
10	National Institutes of Health - NIH, USA	485	1.69
11	University of Sydney	483	1.68
12	Pennsylvania Commonwealth System of Higher Education -PCSHE	471	1.64
13	Harvard t h Chan School of Public Health	463	1.61
14	University of Texas System	462	1.61
15	University of Toronto	436	1.51
16	Karolinska Institutet	435	1.51
17	Imperial College London	427	1.48
18	University of Washington	398	1.38
19	Institut National de la Sante et de la Recherche Medicale -INSERM	395	1.37
20	University of Washington Seattle	393	1.37

Table 7 shows that top twenty institutions contributed in cardiovascular diseases research publications, totally 15079 institutions contributed in the cardiovascular diseases research during the study period, among the 10579 institutions, Harvard University has first position with 1624 contributions, University of California System has second place with 1099 contributions, University of London has third place with 998 contributions, followed by Brigham Womens Hospital has 896 with fourth place, Johns Hopkins University has fifth place with 680 contributions, University College London has sixth place with 565 contributions, U S Department of Veterans Affairs has seventh place with 564 contributions, Veterans Health Administration (VHA) has eighth place with 554 contributions, Harvard Medical

School has ninth place with 551 contributions, National Institutes of Health - NIH, USA has tenth place with 485 contributions, University of Sydney has eleventh place with 483contributions , Pennsylvania Commonwealth System of Higher Education (PCSHE) has twelfth place with 471contributions, Harvard t h Chan School of Public Health has thirteenth place with 463 contributions, University of Texas System has fourteenth place with 462 contributions, University of Toronto fifteenth place with 436 contributions, Karolinska Institutet has sixteenth place with 435 contributions, Imperial College London has seventeenth place with 427 contributions, University of Washington has eighteenth place with 398 contributions, Institut National de la Sante et de la Recherche Medicale (INSERM) has nineteenth place with 395 contributions , University of Washington Seattle has twentieth place with 393 contributions. It found that institutions contributed in the cardiovascular diseases research, totally 15079 institutions contributed, among the institutions; Harvard University has first position with 1624 contributions, University of California System has second place, University of London has third place, followed by Brigham Womens Hospital has fourth place, Johns Hopkins University has fifth place, the remaining institutions were contributed below 2 per cent contributions.

Table 8 top twenty sources contributed in cardiovascular diseases

Sl. No.	Source titles	No. of Records	% of 28789
1	Circulation	1587	5.51
2	European Heart Journal	1035	3.60
3	Journal of the American College of Cardiology	791	2.75
4	Plos One	493	1.71
5	Atherosclerosis	459	1.59
6	International Journal of Cardiology	377	1.31
7	Journal of the American Heart Association	364	1.26
8	European Journal of Preventive Cardiology	274	0.95
9	Nephrology Dialysis Transplantation	262	0.91
10	Journal of Hypertension	259	0.90
11	Annals of the Rheumatic Diseases	245	0.85
12	Diabetes	245	0.85
13	Heart	244	0.85
14	Value in Health	230	0.80
15	BMJ Open	198	0.69
16	American Journal of Cardiology	195	0.68
17	Diabetologia	186	0.65
18	Arthritis Rheumatology	175	0.61
19	FASEB journal	152	0.53
20	Journal of the American Medical Association (JAMA	148	0.51
21	Arteriosclerosis Thrombosis and Vascular Biology	142	0.49

Table 8shows that top twenty sources contributed in cardiovascular diseases research publications; totally 2666 sources were contributed 28789 papers on cardiovascular diseases research. Among the 2666 sources, Circulation has first position with 1587 records, European Heart Journal has second position with 1035 records, Journal of the American College of Cardiology has third position with 791, followed by Plos One is fourth position with 493 records, Atherosclerosis is fifth place with 459 records, International Journal of Cardiology has sixth place with 377 records, Journal of the American Heart Association has seventh position with 364, European Journal of Preventive Cardiology has eighth position with 274 records, Nephrology Dialysis Transplantation has ninth position with 262 records, Journal of Hypertension has tenth position with 259 records, Annals of the Rheumatic Diseases, and Diabetes has eleventh position with 245 records respectively, Heart has twelfth position with 244 records, Value in Health has thirteenth position with 230 records, BMJ Open has fourteenth position with 198 records, American Journal of Cardiology has fifteenth position with 195 records, Diabetologia has sixteenth position with 186 records, Arthritis Rheumatology has seventeenth position with 175 records, FASEB journal has eighteenth position with 152 records,

Journal of the American Medical Association (JAMA has nineteenth position with 148 records, and Arteriosclerosis Thrombosis and Vascular Biology has twentieth position with 142 records, the remaining 2645sources were occupies different position.

Table 9 top ten countries contributed on cardiovascular diseases

Sl. No.	Countries/Regions	No. of Records	% of 28789
1	USA	9924	34.47
2	England	3016	10.48
3	Peoples R China	2287	7.94
4	Italy	1764	6.13
5	Canada	1579	5.49
6	Australia	1520	5.28
7	Netherlands	1480	5.14
8	Germany	1475	5.12
9	Japan	1324	4.60
10	Spain	1179	4.10

Totally 187 countries were contributed on cardiovascular diseases during 2011 – 2020, table 9 shows that top ten countries contributed on cardiovascular diseases research, among the ten countries, USA occupies first position with 9924 publications, England has second place with 3016 contributions, Peoples R China has third place with 2287 contributions, Italy has fourth place with 1764 contributions, Canada has fifth place with1579 contributions, Australia has sixth place with1520contributions, Netherlands has seventh place with 1480contributions, Germany has eight place with1475contributions, Japan has ninth place with 1324 contributions Spain has tenth place with1179 contributions. The remaining 177 countries were contributed below 4 percentage contributions in this research.

Conclusion

Conclude from the present study, the cardiovascular diseases research publications have shown increasing trends. The seventeen document types are contributed in this research, Articles are highly contributed with 43.57 per cent of publications, Totally 90723 authors were contributed in the cardiovascular diseases research, among the top twenty authors, Drexel H has first position with 157 contributions, Vonbank A has second place, Leiherer A has third place, the collaborative contributions are high compare with single author contributions, nineteen languages are contributed , among the nineteen languages 28219 papers ware contributed in English language, among the 10579 institutions, Harvard University has first position with 1624 contributions, the reminding authors were contributed below 4 percent contributions. Totally 2666 sources were contributed 28789 papers on cardiovascular diseases research, Circulation has first position with 1587 records, 187 countries were contributed on cardiovascular diseases during 2011 – 2020, top ten countries contributed on cardiovascular diseases research, among the ten institutions.

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