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Cardiovascular system research output: A scientometrics study

K Dhanalakshmi
Ph.D. Research Scholar, Department of Library Information Science, Annamalai University, Tamil Nadu, India

Abstract
This study assesses cardiovascular system research carried out in different parts of the world during 2007-2016, using different bibliometric measures. Data have been downloaded from Web of Science database for the above period. Using the keywords 'cardiovascular system' in the title and abstract fields. The study examined the pattern of growth of the output, its year wise distribution, authorship pattern of degree of collaboration, language wise distribution, word wise distribution, ranking of research area on publications, etc. The Article, followed by the Review and Article proceedings are published the highest number of papers. The majority of the articles are in the language of English, followed by Russian and German.

Keywords: bibliometric, cardiovascular system, web of science, scientometrics

Introduction
The circulatory system is our heart and blood vessels, and it's essential to keeping our body functioning. The Cardiovascular System can be thought of as the transport system of the body. Our heart works as a pump that pushes blood to the organs, tissues, and cells of our body. Blood delivers oxygen and nutrients to every cells and removing the carbon dioxide and waste products made by those cells. Blood is carried from our heart to the rest of our body through a complex network of arteries, arterioles, and capillaries. Blood is returned to our heart! through venues and veins. If all the vessels of this network were laid end to end, they would extended for about 60,000 miles (more than 96,500 kilometers), which is far enough to circle the planet Earth more than twice.

Cardiovascular Diseases
According to the World Health Organization (WHO), cardiovascular diseases (CVDs) are the leading cause of deaths all over the world - more people die from CVDs than anything else. Interruptions, blockage, or diseases that affect how our heart or blood vessels pump blood can cause complications such as heart disease or stroke. Heart failure, Heart valve disease, congenital heart disease, Heart muscle disease, Pericardial disease, Aorta disease and Vascular disease (blood vessel disease),It's the leading cause of death in the U.S. It's important to learn about our heart to help prevent it. If we have it, we can live a healthier, more active life by learning about our disease and taking care of our self.

Scientometrics Study
The 'Scientometrics', often used synonymously as 'bibliometrics', which originated in Russia, is a quantitative method of application in measuring science. The measurement involves counting artifacts to the production and use of information and arriving conclusion form of counts. The terms like 'Librometrics', 'Bibliometrics', 'Informetrics' and 'Scientometrics' have been used synonymously in order to study the growth of literature in a discipline and other aspects of literature quantitatively. The bibliometrics has transpired as a thrust area of research, subsuming different branches of human knowledge. There are prominent laws of Bibliometric i.e. Lotka's Law (1926) [1] of scientific abundance, Bradford's Law (1934) of scattering and Zips Law (1949) [3] on word occurrence. But the Bibliometric studies started in late sixties.

Objective
The main objectives of the study are:
- To find out the Year wise research output on cardiovascular system.
- To study the authorship pattern and the degree of collaboration.
- To analysis the high frequency keywords occur in this research output.
- To identify the language wise distribution of research output.
- To examine the area about Cardiovascular System research output.

Data analysis

Table 1: Year wise distribution of publications

#	Publication Year	Publications	%	TLCS	TGCS
1	2007	680	7.9	1208	25159
2	2008	718	8.4	864	20772
3	2009	735	8.6	914	19637
4	2010	743	8.7	764	20656
5	2011	831	9.7	659	14737
6	2012	832	9.7	647	15214
7	2013	928	10.8	455	11850
8	2014	964	11.3	412	8985
9	2015	1041	12.2	152	5725
10	2016	1095	12.8	38	2379
	Total	8567	100		

Table 1 exhibit that the year wise distribution of

cardiovascular system research output. The study analysis the annual distribution and growth pattern of articles for the period 2007-2016, in the year 2007 the publication output is 680(7.9%) with 1208 TLCS, 25159 TGCS and it is a substantial increase in every year. Total 8567 research publications during 2007-2016 were published with an average 857 articles per year.

Table 2: Shows Authorship Pattern of Degree of collaboration

Authors	Publications	Cum. Publications	%
Single Author	582	582	6.79
Multiple Authors	7985	8567	93.21
Total	8567		
Degrees of collaboration			0.93

The table 2 shows the details about the degree of collaboration. Individual contribution is just 6.79 percents in the field of Cardiovascular System research output. Multi author's contribution is 93.21 percents of the Cardiovascular System research output. The study interpreted that single author contributed papers maintained the low profile among Cardiovascular System research scientists. It could be seen clearly from the above discussion that the degree of collaboration in producing research output on Cardiovascular System research has shown an increasing trend during the study period since it is a new discipline. Based on this study, the result of the degree of collaboration C = 0.93.i.e, 93 percent of collaborative authors' articles published during the study periods. The degree of collaboration is calculated by using the following formula (K. Subramanyam, 1982):

The formula is where

C= Degree of Collaboration

Nm = Number of multiple authors

Ns = Number of single authors

C= Nm ÷ (Nm + Ns)

C=7985÷ (582+7985)

=0.93

In the present study the value of C is C= 0.93

As a result, it was found that the degree of collaboration in the Cardiovascular System is 0.93, which openly indicates its dominance upon multiple contributions.

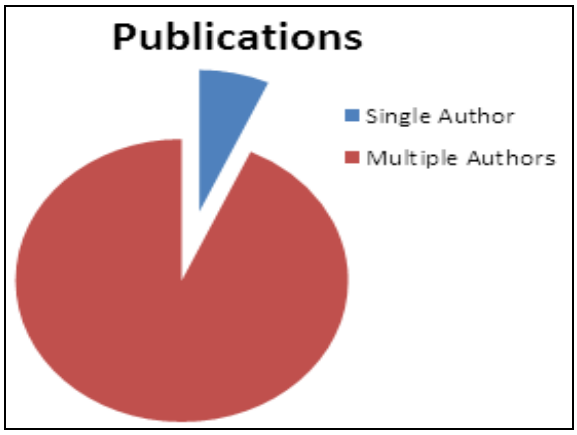

Fig 1

Table 3: Language wise distribution of Publications

#	Language	Records	Percent
1	English	8132	94.92
2	Russian	117	1.37
3	German	77	0.91
4	Polish	56	0.66
5	Portuguese	47	0.55
6	Spanish	39	0.46
7	French	35	0.41
8	Turkish	23	0.27
9	Chinese	7	0.08
10	Serbian	7	0.08
11	Japanese	5	0.05
12	Lithuanian	5	0.05
13	Italian	4	0.05
14	Slovene	4	0.05
15	Czech	2	0.02
16	Greek	2	0.02
17	Ukrainian	2	0.02
18	Croatian	1	0.01
19	Hungarian	1	0.01
20	Korean	1	0.01
	Total	8567	100

Table 3 indicates that maximum number of articles is published in English language (94.92%), followed by Russian (1.37%), German (0.91%), remaining (2.8%) of the articles are published in 17 languages like Polish, Portuguese, Spanish and French, etc.

Table 4: Word Wise distribution of Publications

#	Word	Recs	Percent	TLCS	TGCS
1	Cardiovascular	2140	25.0	2382	40437
2	System	1142	13.3	1483	18542
3	Effects	780	9.1	595	12105
4	Heart	757	8.8	542	11532
5	Cardiac	633	7.4	449	9679
6	Disease	580	6.8	469	14446
7	Patients	509	5.9	111	4369
8	Vascular	437	5.1	393	9586
9	Blood	413	4.8	268	5058
10	Induced	407	4.8	253	5664
11	Receptor	397	4.6	380	7418
12	Role	395	4.6	317	7948
13	Rats	380	4.4	297	3418
14	Function	369	4.3	271	6192
15	Endothelial	367	4.3	292	8038

The table 4 shows the high frequency keywords will enable us to understand the various aspects of cardiovascular system output under study. The high frequency keywords were: Cardiovascular 2140 (25.0%, TLCS 2382, TGCS 40437), System 1142 (13.3%, TLCS 1483, TGCS 18542), Effects 780 (9.7 %, TLCS 595, TGCS 12105), Heart 757 (8.8%, TLCS 542, TGCS 11532) and Cardiac 633 (7.4%, TLCS 449, TGCS 9679). Analysis of the keywords appeared either on the title or assigned by the indexer or the author himself will help in knowing in which direction the knowledge grows.

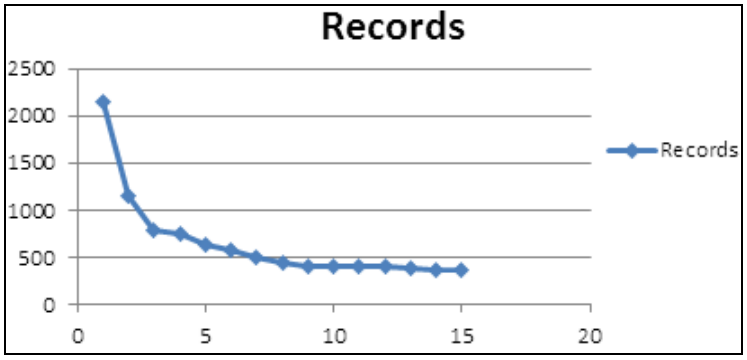

Fig 2

Table 5: Ranking of Research Area on publications

#	Research Areas	records	% of 8570
1.	Cardiovascular System Cardiology	1693	19.755
2.	Pharmacology Pharmacy	1089	12.707
3.	Physiology	800	9.335
4.	Biochemistry Molecular Biology	732	8.541
5.	Endocrinology Metabolism	573	6.686
6.	Engineering	511	5.963
7.	Cell Biology	501	5.846
8.	General Internal Medicine	481	5.613
9.	Neurosciences Neurology	424	4.947
10.	Research Experimental Medicine	415	4.842
11.	Science Technology Other Topics	318	3.711
12.	Toxicology	268	3.127
13.	Biophysics	215	2.509
14.	Hematology	179	2.089
15.	Chemistry	166	1.937
16.	Life Sciences Biomedicine Other Topics	162	1.890
17.	Public Environmental Occupational Health	154	1.797
18.	Urology Nephrology	152	1.774
19.	Sport Sciences	148	1.727
20.	Obstetrics Gynecology	144	1.680

The 6 table indicates top twenty area wise publications of Cardiovascular research output. The 8567 records were published in 117 research areas. Among 117 areas Cardiovascular System Cardiology (1693) area has highest records; followed by Pharmacology Pharmacy area has 1089 records, Physiology area has 800 records, Biochemistry Molecular Biology area has 732 records.

Conclusion

The present study describes the scientometrics analysis of the cardiovascular research output during 2007 - 2016 as reflected in Web of Science Database. Conclusion from this study that, the year wise research publication shows increasing gradually during the study period. The collaborative work has been recognized compare to individual contribution in CVS research. Among 117 areas Cardiovascular System Cardiology (1693) area has highest records. The high frequency keywords were: Cardiovascular 2140. In 20 languages contributed in this study, English has published 8132 records with 94.1%.

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