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Research Productivity and Author Collaboration of Cardiology Research

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Abstract

The study presents the field of Cardiology literature records retrieved form MEDLINE database for the period 1991-2010. This research shows that maximum number of records 829 was during 2000, followed by 826 in 2003 and 789 in 2002. Relative Growth Rate (RGR) and Doubling Time (Dt) was found to be an increasing and decreasing trend shown during the period of study. The paper reveals a study of the authorship pattern and collaborative research in the field of Cardiology. The degree of collaboration mean score is 0.70 and highest score is 0.88 in 1991 exhibits during the period of study.

Keywords/Descriptors: Cardiology; MEDLINE; Relative Growth Rate (RGR); Doubling time (Dt); Degree of collaboration

Introduction

Bibliometrics is a quantitative study of written communication and it is essential for the effective management of libraries within their budget provisions. The quantitative data is used to keep control over the cost of library collection and essential books and periodical collections that satisfy the needs of the readers. The major focus of the study is to apply the bibliometric analysis with a view to analyze the performance of research output in Cardiology Literature. It aims to examine the emergence of research areas, research groups and countries with a view to map the cognitive or intellectual structure of research. Further, this study spells out the relation ship between authors, institutions, journals and articles and other means of insisting the peer review procedure King (1973). Bibliometric studies prove that bibliometric indicators play an important role in the policy decisions and in evaluation of research performance. It is observed that there is considerable evidence that bibliometric indicators play an important role in the evaluation of research Performance of individual scientists and research groups Maria and Ervin (1963).

Price (1963) on the basis of survey of Chemical Abstracts, observed a steady trend towards multiple authorship and thereby holding that if it continues at the present rate, by 1980 the single author papers will be extinct. Though the above postulation may not hold true a decline in the number of scientific papers published by single author evident. Bibliometric analysis of diabetes literature indexed the MEDLINE database for the period 1995-2004 shows that maximum number of records (13244) was during 2003, followed by 12690 in 2002 and 11061 in 2001. Relative Growth Rate (RGR) was found to be decreasing year wise. The doubling time (Dt) was found to increase every year. Ranking of the journals based on the quantum of research output on diabetes during 1995-2004 shows that USA in the largest contributor of literature on diabetes research. Mahapatra and Das Bhagwan (2000) have analyzed the derive nature of growth of literature in Geology during 1987 to 1996, type of collaboration among authors and the trend of growth during this period, degree of collaboration among various categories of authors,

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correlation of the growth of various categories of authors and impact of collaboration on growth of literature. From the study of five very old journals of Geology it was noticed that the increase in collaboration and simultaneously decrease in the amount of publication verifies that subject Geology is a quite a fully developed field of study. It is therefore, concluded that in a highly developed field, although the number of collaborative publications are more, the rate of growth of publications is low. Sangam and Keshava (2003) explained the growth of world Social Science literature in the six sub disciplines viz., Anthropology, Economics, History, Psychology, Political Science and Sociology were derived from the CD-Rom version of the Wilson Social Science Abstracts for the period 1983–1998. Determines the rate of growth of the Social Science literature by calculating relative growth rates and doubling time for publications. Fits both modified exponential curve and logistic curve for the original publications. Study the criteria on which growth models are to be selected for their possible application in the six sub disciplines of Social Sciences. Ezhilrani et al. (2008) An Investigation was made on the authorship pattern in Aquaculture Journals, based on the data collected from Aquatic Sciences and Fisheries Abstracts Part I (ASFA I) for a period of 3 years i.e. 1991, 1996 and 2001. In all the years, multiple authored contributions were more than that of single authors in all broad areas of aquaculture as the values of contributions of multiple authors ranged from 57.1% to 90.8% in different aspects of Aquaculture. The degree of collaboration was found to be 0.85 for all the three years and it ranged from 0.83 (1991) to 0.86 (1996 and 2001). The research productivity of diabetes conforms to Bradford's Law of scattering Krishnamoorthy et al.(2009). Studies related to authorship trend and collaborative researches are considered an important fact of modern science. The paper presents a study of the authorship pattern and collaborative research in the field of psychology.. Zafruninnsha et al. (2009) explains the degree of collaboration in psychology is 0.53. USA defences first by producing 42.28% of cited journals. Majority of the cited journals of psychology (95.54) are in English languages.

Objectives of the study

The specific objectives of the present study are to determine the,

1. To study growth of literature in the field of Cardiology
2. To analyses Relative Growth Rate (RGR) and Doubling Time (DT) of cardiology literature over the study period
3. To measure single Vs multi-authored papers in this study
4. To observe degree of collaboration of authors in Cardiology

Methodology

The records of published during 1991-2010, the data were retrieved in the field of cardiology which are covered in the MEDLINE CD ROM database was searched the bibliographic details like author, title, publication type, language, year, address of the contributors, country of publication, source etc. were colleted. The retrieved records were converted into visual FoxPro and loaded in SPSS for the purpose of analysis. The data was also analysed with the toolbox named as Bibexcel developed by Olle Pearson, Inforsk, Umea Univ (Sweeden). Relative Growth Rate (RGR) and doubling time (Dt) of Cardiology in particularly records recovered in G8 countries. It is also identify the author affiliation of these records for observing the authorship pattern and degree of collaboration which extracting the number of records available in the MEDLINE database.

Analysis

Quantum of Cardiology research productivity

The Cardiology research productivity includes in MEDLINE for the period 1991 to

Table 1: Quantum of Cardiology research productivity in G8 Countries

Year	No.of output	Percent	Cumulative
1991	318	2.64	318
1992	357	2.97	675
1993	402	3.37	1077
1994	542	4.51	1619
1995	534	4.44	2153
1996	547	4.55	2700
1997	624	5.19	3324
1998	619	5.15	3943
1999	692	5.75	4635
2000	829	6.89	5464
2001	757	6.3	6221
2002	789	6.56	7010
2003	826	6.87	7836
2004	753	6.26	8589
2005	532	4.42	9121
2006	638	5.31	9759
2007	587	4.88	10346
2008	524	4.36	10870
2009	602	5.01	11472
2010	543	4.51	12015
Total	**12015**	**100**	

Relative Growth Rate (RGR)

The Relative Growth Rate (RGR) is the increase in number of articles/ pages per unit of time. This definition is derived from the definition of relative growth rates in the study of growth analysis of individual plants and effectively applied in the field of Botany Hunt (1919), Blackman (1919) defined, which in turn had its origin from the study of the rate of interest in the financial investment. The mean Relative Growth rate (R) over the specific period of interval can be calculated from the following equation.

$$R_{1-2} = \frac{Log_{e\ 2}W - log_{e\ 1}W}{2^T - 1^T}$$

Whereas

R_{1-2} = *mean relative growth rate over the specific period of interval*

$log_{e\ 1}W$ = *log of initial number of articles*

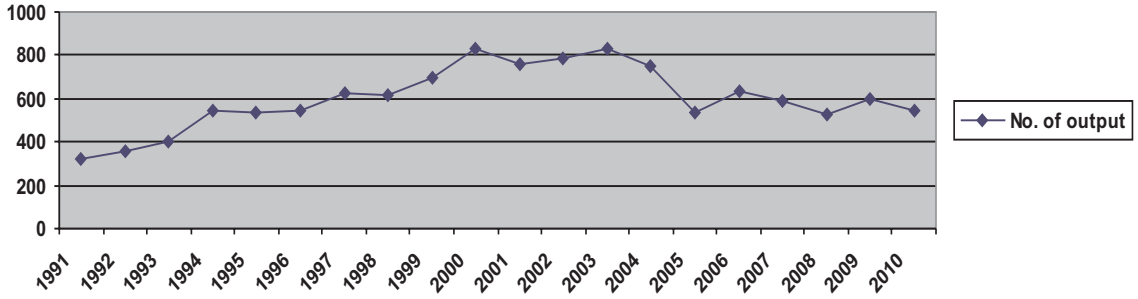


Fig 1: Quantum of Cardiology research productivity

2010 databases of Cardiology literature is shown in Table 1. Total of 12015 records are covered in the database. It is found that the maximum number of records 829 was published during 2000, followed by 826 in 2003 and 789 in 2002.On the whole, it is noticed that from 1991 onwards there is a gradual increase and quietly decreased and increased trend from 2004 to 2010 (Figure 1) .

$Log_{e\ 2}W$ = *log of final number of articles after a specific period of interval*

$2^T - 1^T$ = *the unit difference between the initial time and final time*

The year can be taken here as the unit of time. The RGR for articles is hereby circulated.

Therefore

1-2 (aa-1 year-1) can represent the mean relative growth rate per unit of year over a specific period of interval.

Doubling Time (Dt)

There exists a direct equivalence between the relative growth rate and the doubling time. If the number of articles/ pages of subject double during a given period then the difference the logarithms of numbers at the beginning and end of this period must be logarithms of number 2. If natural logarithm is used this difference has a value of 0.693. Thus the corresponding doubling time for each specific period of interval and for both articles and pages can be calculated by the formula,

$$\text{Doubling time (Dt)} = \frac{0.693}{1\text{-}2\ R\ (aa\text{-}1\ year\ -1)}$$

Therefore,

$$\text{Doubling time} = \frac{0.693}{R}$$

and

$$\text{Doubling time for pages Dt (p)} = \frac{0.693}{1\text{-}2\ R\ (aa\text{-}1\ year\ -1)}$$

Relative growth rate (RGR) and Doubling time (Dt)

It is seen from Table 2 that RGR has been decreasing from 1991 (0.10) to 2010 (0.09). On the other hand, the doubling time (Dt) has shown decreasing and decreasing trend. The data in table 2 reveals that doubling time has increased form 0.69 in the year 1991 to 6.93 in the year 1995.

Table 2: RGR and Dt for Cardiology research Output

Year	No. of Output	Cumulative	W1	W2	RGR	Doubling time (Dt)
1991	318	318		5.76		
1992	357	675	5.76	5.87	0.11	6.3
1993	402	1077	5.87	5.99	0.12	0.57
1994	542	1619	5.99	6.29	0.3	2.31
1995	534	2153	6.29	6.28	0.01	69.3
1996	547	2700	6.28	6.30	0.02	34.65
1997	624	3324	6.30	6.43	0.13	5.33
1998	619	3943	6.43	6.42	0.01	69.3
1999	692	4635	6.42	6.53	0.11	6.3
2000	829	5464	6.53	6.72	0.19	3.64
2001	757	6221	6.72	6.62	0.1	69.3
2002	789	7010	6.62	6.67	0.05	13.86
2003	826	7836	6.67	6.71	0.04	17.32
2004	753	8589	6.71	6.62	0.09	7.7
2005	532	9121	6.62	6.27	0.35	1.98
2006	638	9759	6.27	6.45	0.18	3.85
2007	587	10346	6.45	6.37	0.08	8.66
2008	524	10870	6.37	6.26	0.11	6.3
2009	602	11472	6.26	6.02	0.24	2.88
2010	543	12015	6.02	6.29	0.27	2.56

Single Vs multiple authorship pattern

Table 3 highlights the analysis of single Vs multiple authored pattern of Cardiology research productivity as observed in this study. The analysis reveals that the multi authored papers account for more than 40.14 percent of single authored papers during the period of study. It can be showed that there is an increasing trend towards multiple authored. It can inferred from the analysis that cardiologists more attention with team research. It can be seen that maximum number of papers are two authored and there is a decreasing trend in the number of authors in team of research as depicted in Fig 2.

Table3: Single Vs. multiple authorship in Cardiology research productivity

Year	Single authored	Multi authored	Total no. of output	percent
1991	35	283	318	2.64
1992	72	285	357	2.97
1993	174	228	402	3.34
1994	212	330	542	4.53
1995	217	317	534	4.44
1996	186	361	547	4.55
1997	162	462	624	5.19
1998	89	530	619	5.19
1999	264	428	692	5.78
2000	239	590	829	6.89
2001	268	489	757	6.32
2002	278	511	789	6.51
2003	294	534	826	6.87
2004	229	532	753	6.26
2005	198	334	532	4.42
2006	224	414	638	5.33
2007	140	447	587	4.88
2008	112	412	524	4.36
2009	106	496	602	5.02
2010	98	445	543	4.51
Total	**3597**	**8418**	**12015**	**100**

Degree of Author collaboration co-efficient

Subramanyam (1982) proposed a mathematical formula for calculating author's degree of collaboration in a discipline. The degree of collaboration among authors is the ratio of the number of multi-authored papers published to the total number of papers published in a discipline during certain period of time. The degree of collaboration coefficient among authors is measured mathematically as,

$$C = \frac{N_m}{N_m + N_s}$$

Where, c= degree of collaboration

N_m = *number of multi authored papers*

N_s = *number of single authored papers*

The degree of collaboration in different years is calculated as per the equation proposed by Subramaniam and it's presented in the Table 4. The degree of collaboration over the years from 1991-2010 is calculated and it varies from 0.56 to 0.88 the mean value is found to be 0.70.It has been shown increasing and decreasing trend on author collaboration in Fig 3.

Fig 2: Single Vs. multiple authorship in Cardiology research productivity

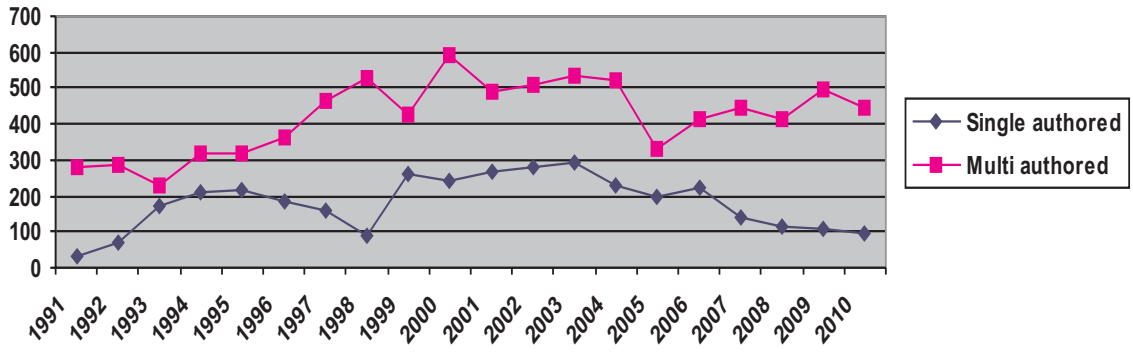
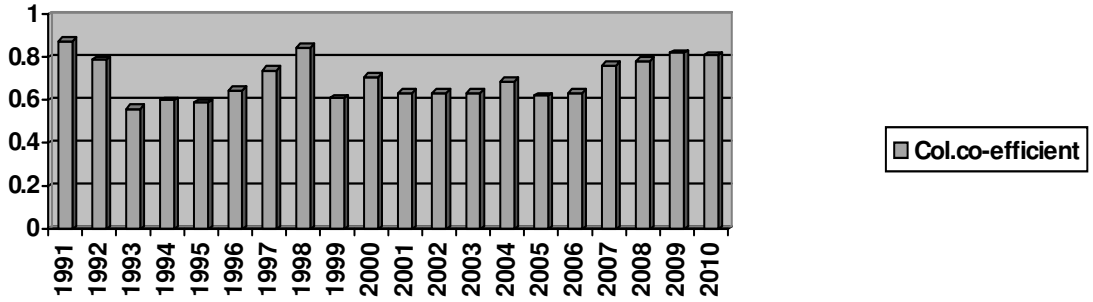


Table 4- Degree of author collaboration

Year	Single Authored (NS)	Percent	Multi authored (Nm)	Percent	Total no. of papers (NS+Nm)	Degree of collaboration Nm C=-------- Ns+Nm
1991	35	0.97	283	3.36	318	0.88
1992	72	2	285	3.38	357	0.79
1993	174	4.83	228	2.7	402	0.56
1994	212	5.89	330	3.92	542	0.60
1995	217	6.03	317	3.76	534	0.59
1996	186	5.17	361	4.28	547	0.65
1997	162	4.5	462	5.48	624	0.74
1998	89	2.47	530	6.29	619	0.85
1999	264	7.33	428	5.08	692	0.61
2000	239	6.64	590	7	829	0.71
2001	268	7.33	489	5.8	789	0.64
2002	278	7.72	511	6.07	789	0.64
2003	294	8.17	532	6.31	826	0.64
2004	229	6.36	524	6.22	753	0.69
2005	198	5.5	334	3.96	532	0.62
2006	224	6.22	414	4.91	638	0.64
2007	40	3.89	447	5.31	587	0.76
2008	112	3.11	412	4.89	524	0.78
2009	106	2.94	496	5.89	602	0.82
2010	98	2.72	445	5.28	543	0.81
Total	**597**	**29.93**	**8418**	**70.07**	**12015**	**0.70**

Fig 3- Degree of collaboration of G8 cardiology publication



Conclusion

This study investigates the degree of author collaboration in the Cardiology literature at G8 counties level. The study reflects a considerable upward trend seen from 1991-2000 in collaborative cardiology research output. It is confined that this study indicates towards collaborative research. The data suggests that there was significant research trend in the field of cardiology research during the study period. It could be observed highest score of Relative Growth Rate (RGR) is 0.35 and Doubling Time (Dt) is 69.3 were found during the study period. It has been observed multi authored papers account for more than 40.14 percent of single authored papers during the period of study.

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