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Bibliometric analysis of literature on diabetes (1995 – 2004)

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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. The research productivity of diabetes conforms to Bradford's Law of Scattering.

Introduction

Bibliometrics has become a standard tool of science policy and research management in the past decades. All significant compilations of science indicators, to a large extent rely on publication and citation statistics and other bibliometric techniques.

Many extensive bibliometric studies of important science fields have appeared during the last two decades. The aims of these studies were to measure national research performance in the international context or to describe the development of a science field with the help of bibliometrics.

Bibliometric analysis of the literature on a few diseases exists. Ramesh Babu and Ramakrishnan studied Indian contributions to the field of Hepatitis (1984-2003) and used Bradford Law to identify the core journals[1]. Patra and Prakash Chand[2] studied HIV/AIDS research in India. They also used Bradford's Law to identify core journals.

Diabetes mellitus is a syndrome characterized by disordered metabolism and abnormally high blood sugar (hyperglycaemia) resulting from low levels of the hormone insulin with or without abnormal resistance to insulin's effects.

Arunachalam and Gunasekaran[3] mapped diabetes research in India and China, based on papers published during 1990–1999 and indexed in PubMed, Science Citation Index (SCI) and Biochemistry and Biophysics Citation Index (BBCI) and citations to each one of these papers up to 2000. They have identified institutions carrying out diabetes research, journals used to publish the results, subfields in which the two countries have published often, and the impact of the work as seen from actual citations to the papers. They have also assessed the extent of international collaboration in diabetes research in these two countries, based on papers indexed in SCI and BBCI. There is an enormous mismatch between the disease burden and the share of research performed in both countries. Apoor and others[4] studied author self-citation in the diabetes literature. Nearly one-fifth of all citations to articles about diabetes mellitus in clinical journals in the year 2000 were author self-citations. Lewin[5] studied diabetes mellitus publication patterns from 1984 – 2005. PubMed searches were conducted to determine the number of publications for each year from 1984 to 2005. This study examined patterns of publication of diabetes literature indexed in MEDLINE. It is noticed that the diabetes publications represent a larger portion in 2005 than they did in 1984.

Although a few bibliometric studies on diabetes have been carried out as discussed above, these are based on the PubMed database. The present study is based on the MEDLINE database. Further, Relative Growth Rate (RGR) and Doubling Time (Dt) of diabetes literature have also been calculated which have not been done in the earlier studies on diabetes that have been reviewed here.

Objectives of the study

The objectives of this study are:

1. To study the growth of literature in the field of diabetes as reflected in the MEDLINE database, and

2. To identify the core journals in the field of diabetes.

Methodology

The records published during 1995-2004 in the field of diabetes which are covered in the MEDLINE CD ROM database was searched and bibliographic details like author, title, publication type, language, year, address of the contributors, country of publication, source etc. were collected. The retrieved records were converted into FoxPro and loaded in SPSS for the purpose of analysis. The data was also analysed with the toolbox named as Bibexcel developed by Olle Persson, Inforsk, Umeå Univ (Sweden)[6]. The data was analyzed in terms of growth rate and core journals in the field of diabetes. Relative Growth Rate (RGR) and Doubling time (Dt) of diabetes literature have also been calculated. Bradford's Law of scattering was used to identify the core journals in field of diabetes. The keyword 'Diabetes' has been used for extracting the number of records available in the above said database.

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[7], which in turn, had its origin from the study of the rate of interest in the financial investment[8]. The mean Relative Growth Rate (R) over the specific period of interval can be calculated from the following equation:

$$1\text{-}2^{\bar{R}} = \frac{Log_{e\ 2}W - log_{e\ 1}W}{{}_2^{T} - {}_1^{T}}$$

whereas

$1\text{-}2\ \bar{R}$	=	mean relative growth rate over the specific period of interval
$log_{e\ 1}W$	=	log of initial number of articles
$log_{e\ 2}W$	=	log of final number of articles after a specific period of interval
${}_2T - {}_1T$	=	the unit difference between the initial time and the final time

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

Therefore

$1 - 2^{R}$ (aa −1 year −1) can represent the mean relative growth rate per unit of articles 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[9]. If the number of articles/pages of a subject doubles during a given period then the difference between 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:

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

Therefore,

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

and

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

Analysis

Quantum of diabetes research productivity

The research productivity on 'diabetes' covered in MEDLINE for the period 1995 to 2004 database is shown

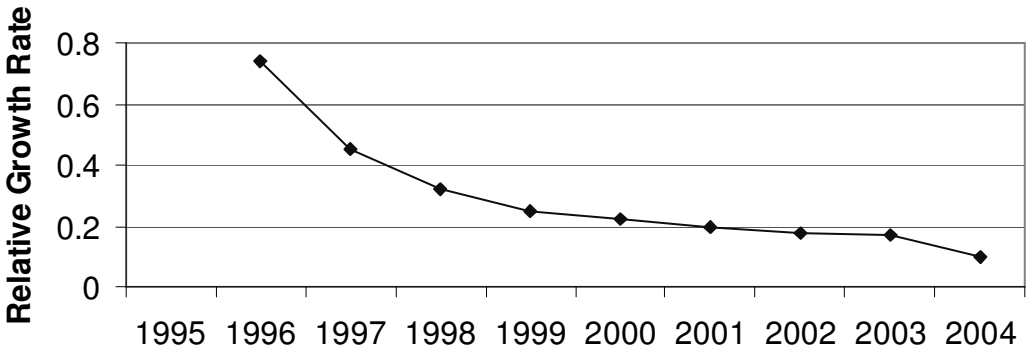

Fig. 1 — Relative growth rate for research output in diabetes

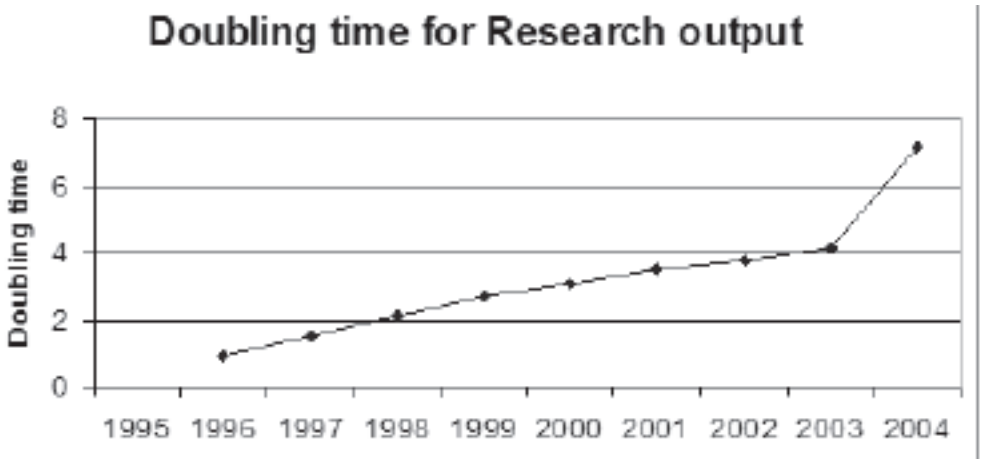

Fig. 2 — Doubling time for research output in diabetes

Table 1 — Quantum of literature published on 'Diabetes' year-wise

S. No.	Years	Records on diabetes	Total no. of records	Percentage
1.	1995	7075	409785	1.73
2.	1996	7646	419024	1.82
3.	1997	8484	430526	1.97
4.	1998	8710	445333	1.96
5.	1999	9222	456123	2.02
6.	2000	9982	482635	2.07
7.	2001	11061	499059	2.21
8.	2002	12690	515377	2.46
9.	2003	13244	535447	2.47
10.	2004	9340	371687	2.51
Total		97454	4564996	2.13

Table 2 — Publication type

Publication type	Total	%
Journal articles	79023	81.09
Clinical trials	6167	6.33
Comments	2262	2.32
Letters	1667	1.71
Editorials	609	0.62
Practice-Guidelines	228	0.23
Others	7498	7.70
Total	97454	100%

Table 3 — RGR and Dt for diabetes research output by year-wise

Year	Quantum of output	Cumulative total of output	W_1	W_2	RGR $1-2^{\bar{R}^{(aa^{-1}\ year^{-1})}}$	Dt(a)
1995	7075			8.86		
1996	7646	14721	8.86	9.60	0.74	0.94
1997	8484	23205	9.6	10.05	0.45	1.53
1998	8710	31915	10.05	10.37	0.32	2.16
1999	9222	41137	10.37	10.62	0.25	2.72
2000	9982	51119	10.62	10.84	0.22	3.12
2001	11061	62180	10.84	11.04	0.20	3.50
2002	12690	74870	11.04	11.22	0.18	3.78
2003	13244	88114	11.22	11.39	0.17	4.16
2004	9340	97454	11.39	11.49	0.10	7.13

in Table1. Total of 97454 records are covered in the database MEDLINE on diabetes. It is found that the maximum number of records (13244) was published during 2003, followed by 12690 in 2002 and 11061 in 2001. On the whole, it is noticed that from 1995 onwards there is a gradual increase of diabetes research productivity every year.

Publication types of diabetes research

Table 2 reveals that 81.09% are journal articles, 6.33% are clinical trials and 2.33% are comment. The literature published as other bibliographic forms such as editorials and practice guidelines is less than 10%.

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

It is seen from Table 3 and Fig. 1 that RGR has been decreasing from 1995 (0.74) to 2004 (0.10). On the other hand, the Doubling Time (Dt) has shown an increasing trend. The data in Table 3 reveals that Doubling time has increased from 0.94 in the year 1995 to 7.13 in the year 2004 (Figure 2).

Ranking of journals in diabetes research

Ranking of the journals along with the country of origin based on the research output on diabetes for the year 1995-2004 is given Table 4. *Diabetes Care* and *Diabetes* both published from USA are the top two leading journals that publish the maximum articles.

Distribution of journals in diabetes based on Bradford Law of Scattering

As per the Bradford Law[9], the journals are grouped into three zones producing similar number of articles. The distribution of journal by zone wise is given in the Table 5. It is seen from Table 5 that 42 core journals grouped in zone 1 published 32286 articles accounting for one third of the total output. Similarly, the second zone comprises of 312 journals and 3565 journals are grouped in third zone. The Bradford's Law states that the number of periodicals in zones, the first zone and second zone will be 1: n: $n^{2\cdots}$ Accordingly the relationship is the zone will be 42: 312: 3565. On comparison with the data in Table 5, it is clear that the trend of research publication confirms the implication of Bradford's Law.

Conclusion

Bibliometric analysis is a reliable tool to evaluate the development and quality of scientific production. It can be inferred from this study that Diabetes is a developing branch in Health Sciences. The data suggest that there

Table 4 — Ranking of journals in diabetes research

S.No.	Name of the journal	No. of records	%	Country of origin	Rank
1	*Diabetes Care*	4729	4.85	USA	1
2	*Diabetes*	3650	3.75	USA	2
3	*Diabetic Medicine*	1900	1.95	England	3
4	*Diabetologia*	1860	1.91	Germany	4
5	*Diabetes Research and Clinical Practice*	1172	1.20	Ireland	5
6	*Journal of Clinical Endocrinology and Metabolism*	1074	1.10	USA	6
7	*Nippon-Rinsho*	1034	1.06	Japan	7
8	*Experimental and Clinical Endocrinology & Diabetes*	985	1.01	Germany	8
9	*Metabolism : Clinical and experimental metabolism*	902	0.93	USA	9
10	*Diabetes and Metabolism*	867	0.89	France	10
11	*Transplantation Proceedings*	809	0.83	USA	11
12	*Journal of Biological Chemistry*	750	0.77	USA	12
13	*Lancet*	577	0.59	England	13
14	*Circulation*	574	0.59	USA	13
15	*Journal of Diabetes and its Complications*	555	0.57	USA	14
16	*Diabetes Educator*	543	0.56	USA	15
17	*American Journal of Cardiology*	509	0.52	USA	16
18	*American Journal of Kidney Diseases*	477	0.49	USA	17
19	*Transplantation*	473	0.49	USA	17
20	*Nephrology Dialysis Transplantation*	467	0.48	England	18
21	*BMJ*	459	0.47	USA	19
22	*Journal of Clinical Investigation*	450	0.46	USA	20
23	*Proceedings of the National Academy of Sciences of the United States of America*	448	0.46	USA	20
24	*Kidney International*	439	0.45	USA	21
25	*JAMA*	421	0.43	USA	22
26	*Diabetes Technology & Therapeutics*	408	0.42	USA	23
27	*Biochemical and Biophysical Research Communications*	401	0.41	USA	24
28	*Annals of the New York Academy of Sciences*	394	0.40	USA	25
29	*Diabetes Obesity & Metabolism*	388	0.39	England	26
30	*Journal of Pediatric Endocrinology and Metabolism*	386	0.39	England	26
31	*Endocrinology*	374	0.38	USA	27
32	*Hormone and Metabolic Research*	366	0.38	Germany	27
33	*New England Journal of Medicine*	364	0.37	England	28
34	*American Journal of Physiology*	360	0.37	USA	28
35	*Diabetes Forecast*	359	0.37	USA	28
36	*International Journal of Obesity and Related Metabolic Disorders*	357	0.37	England	28
37	*Diabetes/Metabolism Research and reviews*	349	0.36	England	29
38	*Archives of Internal Medicine*	343	0.35	USA	30
39	*Journal of the American College of Cardiology*	333	0.34	USA	31
40	*Journal of Immunology*	333	0.34	USA	31
41	*Journal of the American Society of Nephrology*	327	0.33	USA	32
42	*Atherosclerosis*	320	0.32	Ireland	33

Table 5 — Distribution by zone of cited journals and references in diabetes

Zone	No. of journals		No. of papers	
	No.	(%)	No.	(%)
Zone 1	42	1.07	32286	33.13
Zone 2	312	7.96	32515	33.36
Zone 3	3565	90.97	32653	33.51
Total	3919	100	97454	100

was a significant research activity in the field of Diabetes during the study period. The contributors of authors to published literature and countries indicate the healthy pattern of progress in this field. The Indian contribution to the body of literature on Diabetes could be improved with more contentious efforts by the researchers. Further the research productivity of Diabetes conforms to the implications of Bradford's Law of Scattering.

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