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Growth of Malaria Research Output in Scopus Data Base: A Study

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Abstract – **This study evaluates malaria research carried out in different parts of the world during 1974–2013 using different bibliometric indicators. Data have been downloaded from Scopus database for the period 1974–2013 using the keywords malaria in the title and abstract fields. The study examined the pattern of growth of the output, its geographical distribution, profile of different countries in different subfields. The study Malaria vaccine research output is gradually increasing. The USA, followed by the UK and Australia contributed the highest number of papers. The majority of the prolific institutions are located in the USA, the UK, France and Australia. The last two decades have witnessed considerable growth in research output in this field, interestingly the countries like the USA, the UK and Australia**

Keywords: **Ethnic Group, Common Property, Dependency, Management Institution, Conflict Resolution**

I. Introduction

Malaria was eliminated from the United States and from most of Europe during the first half of the twentieth century as a result of changes in land use, agricultural practices and house construction and some targeted vector control. The development of the highly effective, residual insecticide DDT initiated a global eradication programme in the 1950s and 1960s which was initially very successful in many countries such as India, Sri Lanka and the former Soviet Union. However, this success was not sustained because of the costs of the programme, the resistance of many communities to repeated spraying of their houses and the emergence of resistance to DDT. The past decade has seen a pronounced re-awakening of interest in the research on malaria in the richer countries of the world. Statements on the need for greater efforts to control malaria have been made at a number of high profile medical conferences. This resulted in global research output in malaria research.

II. Bibliometric Study

Bibliometric analysis is employed by researchers to study the growth of literature in given field. Pritchard (1969) defined the term Bibliometric as the application of statistical and mathematical methods to books and other communication. The bibliometrics has emerged as a thrust area of research, incorporating different branches of human knowledge. There are famous Laws of Bibliometric i.e. Lotka's law (1926) of scientific productivity, Bradford's law (1934) of scattering and Zips law (1949) on frequency of words. But the Bibliometric studies started in late sixties.

III. Review of Related Literature

Few bibliometric studies dealing with malaria research have been reported in the literature in the past. Maclean *et al*. and Lewison *et al*. estimated the financial resources going into malaria research. Garg *et al*. estimated the quantum of malaria research output during 1990 and 2000 using PubMed (the online edition) and the Commonwealth Agricultural Bureaux International (CABI) CD-ROM incorporating the Tropical Disease Bulletin (TDB). Lewison and Srivastava mapped the malaria research output during the years 1980–2004 using the Science Citation Index (SCI) and malaria vaccine research. However, none of these studies deals with the status of malaria research other than the medical data bases, which constitutes approximately 9% of the total malaria research output.

IV. Objectives

The main objectives of the study are:

1. To examine the worldwide research production in Malaria research;
2. To identify the document type of the publications in Malaria research;
3. To identify the organizations conducting the research in Malaria research;
4. To study the country-wise distribution of research output;
5. To study the subject-wise distribution of research output;

To study the Relative growth rate of research output.

V. Hypothesis

The following hypotheses will be formulated for this study based on objectives.

a. There exists substantial literature on Malaria research.
b. Growth of publications in Malaria research is comparatively higher in developed countries.
c. There exists domination of collaborative research in Malaria research.
e. The research productivity in Malaria research is dominated by English language.
d. Journals are major source of publications for Malaria research.
f. There exists steady growth in publication production in Malaria research.

VI. Methodology

For this study, the literature on malaria research data has been downloaded from 'Scopus', multidisciplinary online database, which is an international indexing and abstracting database, using the search term "Malaria research". For this study, publications commencing from 1974-2013 (40 years) has been downloaded from the database. A total of 74171 data has been identified.

The collected data has been classified by using Excel and the same was loaded in to SPSS (Statistical Package for Social Sciences) for the purpose of analysis. Statistical tools such as frequency distribution and percentage analysis and Scientometric techniques such as Authorship pattern, Relative Growth Rate (RGR), Doubling time (dt) citation analysis etc will be used for the study.

VII. Data Analysis

Table I Year-Wise Distribution of Malaria Research Output

S.No.	Year	No. of Research Output	Percentage	Cummulative No.of Research Output	Cummulative Percentage
1	1974	602	0.81	602	0.81
2	1975	520	0.70	1122	1.51
3	1976	508	0.68	1630	2.20
4	1977	493	0.66	2123	2.86
5	1978	560	0.76	2683	3.62
6	1979	648	0.87	3331	4.49
7	1980	557	0.75	3888	5.24
8	1981	645	0.87	4533	6.11
9	1982	789	1.06	5322	7.17
10	1983	779	1.05	6101	8.22
11	1984	847	1.14	6948	9.37
12	1985	903	1.22	7851	10.58
13	1986	881	1.19	8732	11.77
14	1987	979	1.32	9711	13.09
15	1988	1078	1.45	10789	14.54
16	1989	1149	1.55	11938	16.09
17	1990	1380	1.86	13318	17.95
18	1991	1464	1.97	14782	19.93
19	1992	1499	2.02	16281	21.95
20	1993	1487	2.00	17768	23.95
21	1994	1575	2.12	19343	26.08
22	1995	1496	2.02	20839	28.09
23	1996	1592	2.15	22431	30.24
24	1997	1825	2.46	24256	32.70
25	1998	1851	2.50	26107	35.20
26	1999	2002	2.70	28109	37.90
27	2000	2089	2.82	30198	40.71
28	2001	2118	2.86	32316	43.57
29	2002	2444	3.30	34760	46.86
30	2003	2665	3.59	37425	50.46
31	2004	2848	3.84	40273	54.30
32	2005	3156	4.26	43429	58.55
33	2006	3291	4.44	46720	62.99
34	2007	3506	4.73	50226	67.71
35	2008	3665	4.94	53891	72.66
36	2009	3752	5.06	57643	77.71
37	2010	4188	5.65	61831	83.36
38	2011	4530	6.11	66361	89.47
39	2012	4696	6.33	71057	95.80
40	2013	3114	4.20	74171	100.00
	Total	74171	100.00		

TABLE II BLOCK YEAR-WISE DISTRIBUTION AND RATIO OF GROWTH

S.No.	Block year	No. of Research Output	%	Ratio of Growth
1	1974-1978	2683	3.62	1.00
2	1979-1983	3418	4.61	1.27
3	1984-1988	4688	6.32	1.75
4	1989-1993	6979	9.41	2.60
5	1994-1998	8339	11.24	3.11
6	1999-2003	11318	15.26	4.22
7	2004-2008	16466	22.20	6.14
8	2009-2013	20280	27.34	7.56
		74171	100	

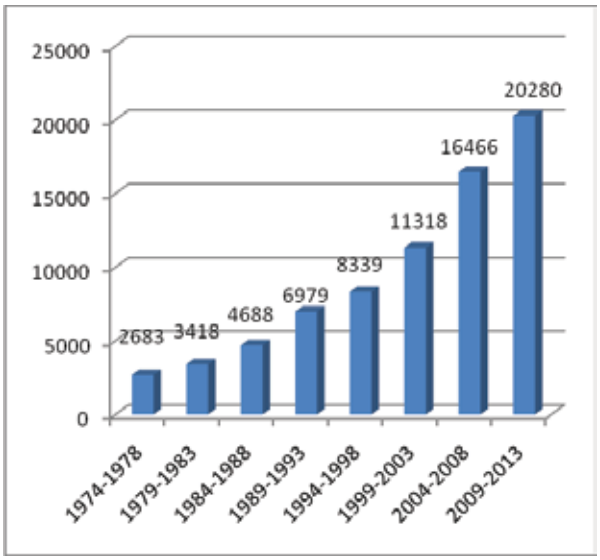

Fig.1 Block year wise growth

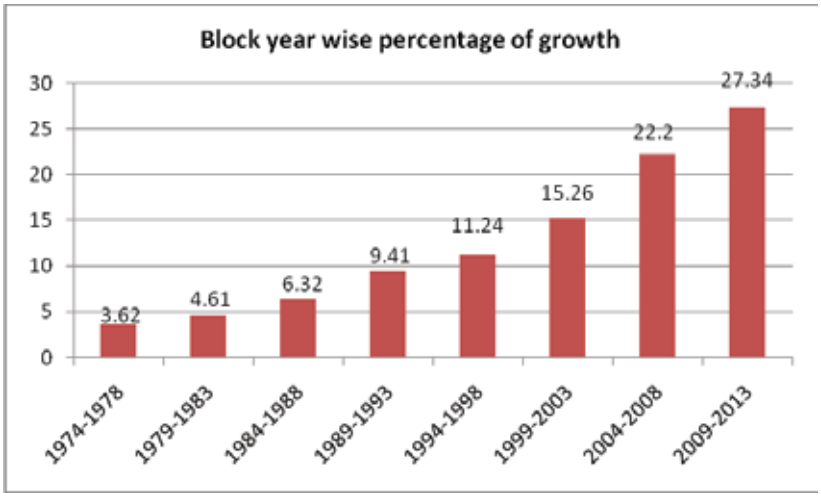

Fig 2. Block year wise percentage of growth

Their exist uniform and study growth of publication in malaria research year after year. Hence it can be stated that there exist a linear growth of publication out put in the field of research of malaria.

The forty years were further divided into five years block in order to identify the growth rate of malaria publications. The data were shown in table II. Further the ratio of growth has also been calculated with base block year 1974-78 and the same is shown in table.

The block year-wise growth also shows the linear trend. There exists a substantial increase in every block year. Doubling of the publication can be seen in every decade.

Nine times of growth of articles on malaria research can be seen in eight block years. This indicates that the decise malaria has still persist and there needs exhaustive research in eradicating the same.

The output can be seen in thirteen different bibliographic formats. Nearly 68.79% of publications are published has journal articles. It is followed by Review papers (11.78%) and Letters (4.41%). The book article account to 0.02% only in malaria research.

Table III Document Type Wise Distribution of Research Output

S.No.	Description	No. of Records	Percentage
1	Article	51019	68.79
2	Review	8734	11.78
3	Letter	3271	4.41
4	Conference Paper	2399	3.23
5	Undefined	2350	3.17
6	Note	2230	3.01
7	Short Survey	1889	2.54
8	Editorial	1601	2.16
9	Article in Press	362	0.49
10	Erratum	236	0.31
11	Book Chapter	45	0.06
12	Conference Review	19	0.03

Table IV Country-Wise Distribution

S.No.	Country	Research Output	%	Growth
1	United States	17366	23.41	1.00
2	United Kingdom	10649	14.36	0.61
3	France	5505	7.42	0.32
4	India	4568	6.16	0.26
5	Germany	3510	4.73	0.20
6	Australia	3371	4.54	0.19
7	Switzerland	3331	4.49	0.19
8	Thailand	2541	3.43	0.15
9	Kenya	2192	2.96	0.13
10	Netherlands	2087	2.81	0.12
11	Nigeria	1765	2.38	0.10
12	Brazil	1758	2.37	0.10
13	Italy	1706	2.30	0.10
14	Japan	1514	2.04	0.09
15	Canada	1384	1.87	0.08
16	Tanzania	1297	1.75	0.07
17	South Africa	1293	1.74	0.07
18	Sweden	1241	1.67	0.07
19	Spain	1187	1.60	0.07
20	Belgium	1082	1.46	0.06
21	Others	4824	6.51	0.28
Total		74171	100.00	4.27

Nearly 50% of the outputs were provided by four countries such as USA, United Kingdom, France and India. The top 20 countries provide nearly 93.49% of the total contribution in Malaria Research. USA contributes nearly 23.41%. It is followed by United Kingdom (14.36%) and France (7.42%). India stands fourth place with the contribution of 6.16%. The contributions were compared with USA has base country and the ratio is also shown in Table IV. It can be seen that nearly 8 countries are providing nearly two times of the contribution equivalent to USA. India contributes 26% of USA contributions.

Table V Top Institutions That Has 500 Above Publications

S.No.	Institution Name	Research Output	%
1	London School of Hygiene & Tropical Medicine	2393	3.23
2	Mahidol University	1710	2.31
3	Liverpool School of Tropical Medicine	1170	1.58
4	Organisation Mondiale de la SantÃc	1161	1.57
5	National Institute of Allergy and Infectious Diseases	1126	1.52
6	Centers for Disease Control and Prevention	1038	1.40
7	Kenya Medical Research Institute	977	1.32
8	Walter Reed Army Institute of Research	927	1.25
9	University of Oxford	923	1.24
10	Institut Pasteur, Paris	803	1.08
11	Johns Hopkins Bloomberg School of Public Health	704	0.95
12	Imperial College London	701	0.95
13	Nuffield Department of Clinical Medicine	671	0.90
14	Schweizerisches Tropeninstitut	656	0.88
15	National Institute of Malaria Research India	633	0.85
16	Others	58578	78.97
	Total	74171	100

21.03% of the contributions were published by 15 institutions. Among the top 15, London School of Hygiene & Tropical Medicine tops the list. National Institute of Malaria Research India ranks 15.

Table VI Relative Growth Rate and Doubling Time

S.No.	Year	Research Output	w1	w2	RGR	Dt
1	1974	602		6.400	6.400	0.108
2	1975	520	6.400	6.254	-0.146	-4.733
3	1976	508	6.254	6.230	-0.023	-29.682
4	1977	493	6.230	6.201	-0.030	-23.121
5	1978	560	6.201	6.328	0.127	5.438
6	1979	648	6.328	6.474	0.146	4.748
7	1980	557	6.474	6.323	-0.151	-4.580
8	1981	645	6.323	6.469	0.147	4.724
9	1982	789	6.469	6.671	0.202	3.439
10	1983	779	6.671	6.658	-0.013	-54.330
11	1984	847	6.658	6.742	0.084	8.281
12	1985	903	6.742	6.806	0.064	10.824
13	1986	881	6.806	6.781	-0.025	-28.097
14	1987	979	6.781	6.887	0.105	6.570
15	1988	1078	6.887	6.983	0.096	7.194

16	1989	1149	6.983	7.047	0.064	10.865
17	1990	1380	7.047	7.230	0.183	3.783
18	1991	1464	7.230	7.289	0.059	11.728
19	1992	1499	7.289	7.313	0.024	29.332
20	1993	1487	7.313	7.305	-0.008	-86.220
21	1994	1575	7.305	7.362	0.057	12.053
22	1995	1496	7.362	7.311	-0.051	-13.467
23	1996	1592	7.311	7.373	0.062	11.142
24	1997	1825	7.373	7.509	0.137	5.074
25	1998	1851	7.509	7.523	0.014	48.989
26	1999	2002	7.523	7.602	0.078	8.837
27	2000	2089	7.602	7.644	0.043	16.291
28	2001	2118	7.644	7.658	0.014	50.266
29	2002	2444	7.658	7.801	0.143	4.841
30	2003	2665	7.801	7.888	0.087	8.005
31	2004	2848	7.888	7.954	0.066	10.435
32	2005	3156	7.954	8.057	0.103	6.749
33	2006	3291	8.057	8.099	0.042	16.545
34	2007	3506	8.099	8.162	0.063	10.951
35	2008	3665	8.162	8.207	0.044	15.625
36	2009	3752	8.207	8.230	0.023	29.539
37	2010	4188	8.230	8.340	0.110	6.304
38	2011	4530	8.340	8.418	0.078	8.828
39	2012	4696	8.418	8.454	0.036	19.256
40	2013	3114	8.454	8.044	-0.411	-1.687
Total		74171				

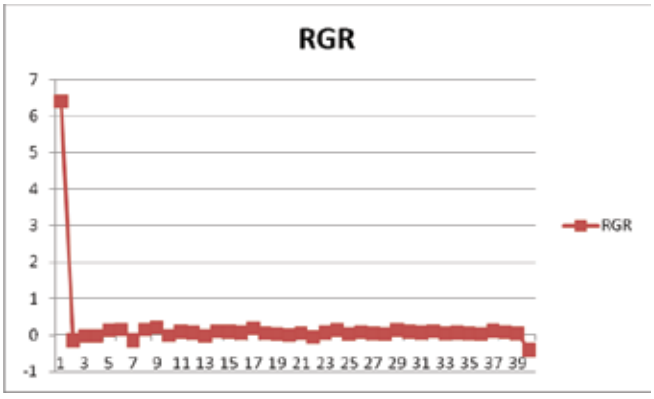

Fig.3 Relative Growth Rate

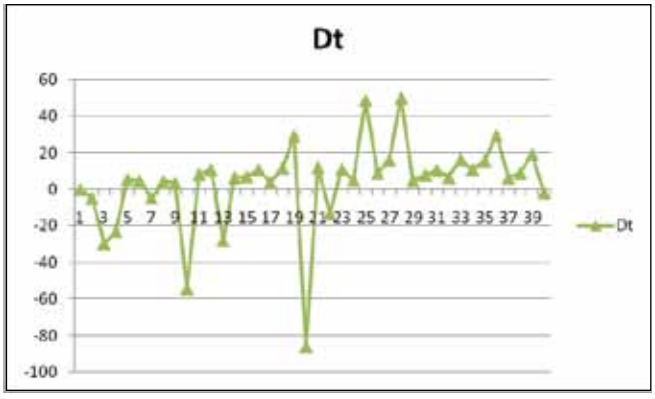

Fig.4 Doubling time

The graph shows the relative growth rate is linear in nature. There exists negative growth in RGR. Similarly the doubling time also shows linear trend and few exceptions.

Table VII Authors Who Have More Than 200 Contributions

S.No.	Author Name	Research Output	%
1	White, N.J.	586	0.79
2	Greenwood, B.M.	465	0.63
3	Looareesuwan, S.	453	0.61
4	Marsh, K.	362	0.49
5	Kremsner, P.G.	345	0.47
6	Collins, W.E.	317	0.43
7	Miller, L.H.	309	0.42
8	Nosten, F.	296	0.40
9	Snow, R.W.	293	0.40
10	Hoffman, S.L.	280	0.38
11	Rosenthal, P.J.	253	0.34
12	Le Bras, J.	231	0.31
13	Druilhe, P.	221	0.30
14	Hill, A.V.S.	218	0.29
15	Tanner, M.	213	0.29
16	Rogier, C.	210	0.28
17	Deloron, P.	204	0.28
	others	68915	92.89
	Total	74171	100

Nearly 17 authors contributed more than 200 articles in malaria research accounting to 7.11%. Out of the top 17, White, N.J.(586), Greenwood, B.M (465) and Looareesuwan, S (453) occupies the first three positions.

Table VIII Subject Area Covered in The Publication

S.No.	Subject Area	No. of Output
1	Medicine	48296
2	Immunology and Microbiology	26355
3	Biochemistry, Genetics and Molecular Biology	12935
4	Pharmacology, Toxicology and Pharmaceutics	6328
5	Agricultural and Biological Sciences	5565
6	Chemistry	2415
7	Multidisciplinary	1854
8	Environmental Science	1442
9	Social Sciences	1353
10	Veterinary	1238
11	Undefined	1104
12	Neuroscience	562
13	Nursing	560
14	Engineering	515
15	Chemical Engineering	497
16	Mathematics	450
17	Earth and Planetary Sciences	442
18	Computer Science	397
19	Health Professions	391
20	Arts and Humanities	264
21	Physics and Astronomy	253
22	Psychology	253
23	Economics, Econometrics and Finance	242
24	Materials Science	179
25	Decision Sciences	118
26	Business, Management and Accounting	116
27	Energy	49
28	Dentistry	28
	Total	114201

74171 articles cover 28 topics. Of which majority of the articles covers the subject such as Medicine, Immunology and Microbiology, Biochemistry, Genetics and Molecular Biology and Pharmacology, Toxicology and Pharmaceutics

VIII. Conclusion

Reports of malaria are increasing in many countries and in areas thought free of the disease. One of the factors contributing to the reemergence of malaria is human migration. People move for a number of reasons, including environmental deterioration, economic necessity, conflicts, and natural disasters. These factors are most likely to affect the poor, many of whom live in or near malarious areas. Identifying and understanding the influence of these population movements can improve prevention measures and malaria control programs. Till such time the eradication of malaria fully in a global environment, there will be a research publication persist in the field of malaria research.

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