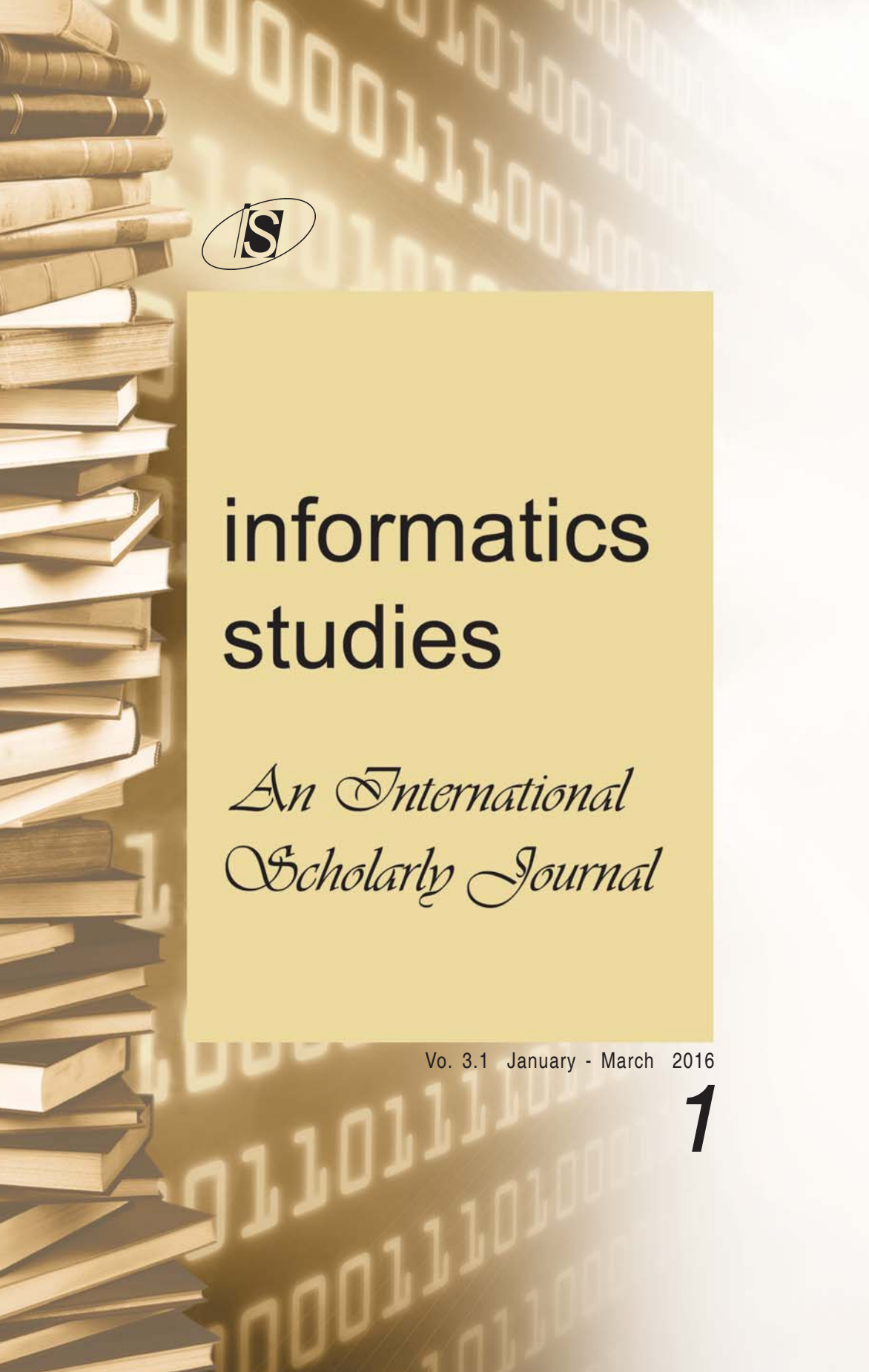

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Japanese Encephalitis: A Scientometric Analysis of Publications, 2003-12

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Abstract

The paper presents a analysis of 2496 papers on Japanese encephalitis as indexed in Scopus database during 2003-12, witnessing an annual average growth rate of 7.41% and citation impact per paper of 5.26. The Japanese encephalitis publication output came from 79 countries, of which the top 10 (United States, India, China, Japan, etc) accounted for 88.90% global publication share during 2003-12. Japanese Encephalitis output came from 419 organizations and several authors, of which the top 20 contributed 28.61% and 21.67% share respectively during 2003-12. The largest publication share (65.06%) of output on Japanese Encephalitis came from medicine, followed by immunology & microbiology (40.71%), biochemistry, genetics & molecular biology (18.55%), pharmacology, toxicology & pharmaceutics (9.33%), veterinary science (9.13%), neurosciences (6.69%), agricultural & biological sciences (5.05%) and environment science (1.40%) during 2003-12. Six countries, namely UK (2.01), USA (1.91), France (1.27), Thailand (1.19), Australia (1.15) and South Korea (1.04) have achieved relative citation rate above 1.

1. INTRODUCTION

Japanese Encephalitis (JE) is a mosquitoes-borne viral infection and is a leading cause of viral infection of the nerve cells (neurons) of the brain.. It belongs to a group of viruses commonly known as arboviruses (transmitted by arthropods) and classified under the Flavivirus genus within the family Flaviviridae. Mosquitoes of the genus Culex, namely *Culex tritaeniorhynchus, Culex Vishnue, Culex gelidus and Culex annulus* are the primary vectors of the Japanese Encephalitis virus. The virus exists in a zoonotic transmission cycle among mosquitoes, pigs, bats, and water birds belonging to the family Ardeidae. Humans become infected when bitten by an infected mosquito and are a dead-end host because of low viremia, preventing the virus from being transmitted further. Pigs are the main contributors in the transmission cycle with respect to human infection, because these animals often stay close to human dwellings. Birds belonging to family Ardeidae (egrets, herons, storks, etc) are believed to be most important hosts of the virus in nature and migratory birds are especially important in virus dispersal[1].

The majority of cases of JE are asymptomatic or non-specific. Children and the elderly most commonly suffer a clinical illness, which can be severe. Approximately one in 250 infections is estimated to become clinically apparent; some will experience a febrile illness with headache, and encephalitis is estimated to occur in 1 in 300 patients. Although symptomatic JE is rare, the case-fatality rate

among those with encephalitis can be as high as 30%. Permanent neurologic or psychiatric sequelae can occur in 30%–50% of those with encephalitis. There is no cure for the disease. Safe and effective vaccines are available to prevent JE. WHO recommends JE vaccination in all regions where the disease is a recognized as a public health problem[2]. 24 countries in the South-East Asia and Western Pacific regions have endemic JE transmission, exposing more than 3 billion people to risks of infection. The annual incidence of clinical disease varies both across and within countries, ranging from <10 to >100 per 100 000 population. The World Health Organization (WHO) estimates that JE causes at least 67,000 cases of clinical disease occur annually in 24 JE endemic countries (annual incidence 1.8 per 100,000 population), mostly among children under 15 years of age, resulting in about 10,000 deaths and 15,000 cases of long-term, neuropsychiatric sequelae.). China (excluding Taiwan) accounts for 50% of cases, and globally 75% of cases occur in children aged 0-14 years (annual incidence of 5.4 per 100,000 populations)[2-3].

1.1 Literature Review

Only two studies are reported dealing with bibliometric analysis of Japanese encephalitis literature. Ganguly[4] studied research profile of 85 Indian research organizations in tropical diseases (including Japanese encephalitis) and 28 research organizations were also studied for their publications and patents in all major tropical diseases. The publication analysis includes research output, citations received, impact factor of journals where papers are published and h-index during 2001-10. The author evaluated the strength and weakness of research of various Indian organizations in different diseases. Garg, Dwivedi and Kumar[5] analyzed 2074 papers on Japanese encephalitis indexed in Science Citation Index Expanded during 1991-2010. Authors studied growth in research output, geographical distribution of research output, focus of research and research profile of different countries, pattern of citation output and citation impact of different countries using various indices, and identification of most productive institutions. However, other studies are conducted dealing with global assessment of research publications in measles[6], cataract[7], bone morrow[8], glaucoma[9], tuberculosis[10], malaria[11], malaria vaccine[12] and dengue[13].

2. OBJECTIVES

The main objectives of this study are to analyze the research performance in Japanese encephalitis research during 2003-12, based on publications output, as indexed in Scopus database. In particular, the study focuses on the following objectives:

1. To study the global research output, its growth and citation impact
2. To study the contribution & citation impact of top 10 most productive countries;
3. To examine the distribution of citations of the global research output;
4. To study the international collaboration share in publication output of top 10 most productive countries and the extent of inter-country collaborative linkages between them;
5. To study the distribution of global research output by broad subject areas and the priorities assigned by top 10 most productive countries in these subject fields;
6. To study the publication productivity and citation impact of leading institutions and authors; and
7. To study the characteristics of the high cited papers

3. Methodology

The study retrieved and downloaded the publication data of the world and of 10 most productive countries in Japanese encephalitis research from the Scopus

database (http://www.scopus.com) for 10 years during 2003-12. The keyword "Japanese encephalitis" was used in "title, abstract and keyword" tag and restricting it to the period 2003-12 in "date range tag" was used for searching the global publication data in the study and this was the main search string. When the main search string with restricted to India and other 9 most productive countries in "country tag", as shown below, the publication data on India and 9 other most productive countries were obtained. When the main search string is further restricted to "subject area tag", "country tag", "source title tag", "author name" and "affiliation tag", we got information on distribution of publications by subject, collaborating countries, author name wise and organization-wise, etc. For citation data, the three years, two years, one year citation window was used for publications during 2003-10, 2011 and 2012. In addition, citations of publications was also collected from date of publications till the end of 18 August 2014 for sections 4.1 and 4.8. In this study, we restricted to only top 10 most productive countries, as they contributed 89.98% of the world output. Similarly, the analysis was restricted to 20 most productive organizations and 20 authors journals, as they contributed 28.61% and 21.67% share of total Japanese Encephalitis research output.

(TITLE-ABS-KEY(Japanese encephalitis) AND PUBYEAR > 2002 AND PUBYEAR < 2013)

(TITLE-ABS-KEY(Japanese encephalitis) AND PUBYEAR > 2002 AND PUBYEAR < 2013 AND (LIMIT-TO (AFFIL COUNTRY," India")))

4. Analysis

A total of 2496 papers have been published globally on Japanese encephalitis (JE) during the last ten years from 2003-12.Of the total publications, 68.35% appeared as articles, 20.99% as reviews, and the rest as letters, short surveys, conference papers, editorial, book chapter, etc. The number of world publications on Japanese encephalitis has increased from 213 in 2003 to 377 in 2012, witnessing an annual average growth rate of 7.41%. The cumulative number of publication on Japanese encephalitis has increased from 962 papers during 2003-07 to 1534 papers during 2008-12, registering a growth of 59.46%. The total publications (2496) on Japanese encephalitis during 2003-12 have received 13136 citations on a three year citation window, leading to citation impact per paper of 5.26, increasing from 5.15 during 2003-07 to 5.34 during 2008-12. The h-index registered by total publications during 2003-12 on Japanese encephalitis was 70 (Table 1).

4.1 Citation Pattern of Research Output

Citations of papers since their publication were also examined from 2003 till 15 August 2014. Only 18.15% of the total papers did not get any citations (zero citation) and rest of the 81.85% papers were cited one or more times. Of the total cited papers, 5.85% papers (receiving more than 50 citations) contributed 41.88% citations share, 6.25% papers (receiving citations from 31 to 50) contributed 15.58% citations share, 24.40% papers (receiving citations from 11 to 30) contributed 28.98% citation share and the rest 15.35% papers (receiving citations from 1 to 10) contributed 13,55% citations share.

4.2 Global Publication Share & Citation Impact of Top 10 Most Productive countries

The total research output in Japanese Encephalitis originated in 79 countries during 2003-12. Table 3-4 lists the output of 10 most productive countries that produced 88.90% of the total world output in Japanese Encephalitis. The global publication share of 10 most productive countries on Japanese encephalitis varied from 4.97% to 21.11%, with highest publication share (21.11%) registered by USA,

Table 1. Number of publications & citations received, 2003-12

Publication Year	No. of Publications	No. of Citations*	Average Citation Per Year
2003	213	932	4.38
2004	176	983	5.59
2005	183	752	4.11
2006	174	1092	6.28
2007	216	1193	5.52
2008	270	1564	5.79
2009	286	1954	6.83
2010	292	1798	6.16
2011	309	1865	6.04
2012	377	1003	2.66
2003-07	962	4952	5.15
2008-12	1534	8184	5.34
2003-12	2496	13136	5.26

* Citations are collected on a three years citations window

followed by India (16.23% share), Japan (14.70% share), China (9.17% share), UK (6.25% share), Taiwan (5.49% share), Australia (4.97% share), South Korea (3.85% share), France (3.53% share) and Thailand (3.61% share) during 2003-12. The publication share has increased by 7.69% in China, followed by India (2.26%), Thailand (1.31%) and Japan (0.79%), as against decrease by 2.39% in Taiwan, Australia (2.22%), South Korea (1.34%), USA (0.94%), France (0.68%) and U.K. (0.30%) from 2003-07 to 2008-13 (Table 2). The global citation share of 10 most productive countries on Japanese encephalitis varies from 4.48% to 40.35%, with highest citation share (40.35%) registered by USA, followed by Japan (13.68%), UK (12.55%), India (11.94%), China (5.88%), Australia (5.71%), Taiwan (5.33%), France (4.48%), Thailand (4.28%) and South Korea (4.00%) during 2003-12. The citation share has increased by 5.49% in China, followed by India (4.91%), France (3.18%) and Thailand (2.78%), as against decrease by 5.79% in Japan, South Korea (5.06%), Australia (2.89%), U.K. (2.42%), Taiwan (2.31%) and USA (1.39%) from 2003-07 to 2008-12. In terms of average citation per paper registered by top 10 most productive countries during 2003-12, the highest (10.56) is achieved by UK, followed by USA (10.06), France (6.69), Thailand (6.24), Australia (6.04), South Korea (5.47), Taiwan (5.11), Japan (4.90), India (3.87) and China (3.38). The largest increase in average citation per paper was reported in France by 6.04, followed India (1.23), China (0.66), USA (0.48) and Taiwan (0.21), as against decrease by 4.51 in South Korea, Japan (2.16), U.K. (1.10) and Australia (0.10) from 2003-07 to 2008-13. In terms of relative citation rates, 6 out of 10 most productive countries have achieved high citation rates (1 and above) during 2003-12. The highest relative citation rate (2.01) was achieved by UK, followed by USA (1.91), France (1.27), Thailand (1.19), Australia (1.15) and South Korea (1,04). The other 4 countries citation rate are Taiwan (0.97), Japan (0.93), followed by India (0.74) and China (0.64). The relative citation rate has increased by 1.10 in France, followed by Thailand (0.39%), India (0.21),

China (0.10) and USA (0.02), as against decrease by 0.90 in South Korea, Japan (0.45), U.K. (0.29) and Australia (0.06) from 2003-07 to 2008-12 (Table 3).

4.3 International Collaboration

The highest share (63.33%) of international collaborative papers among the 10 most

Table 2. Number of papers & citations and citation impact by top 10 most productive countries in Japanese Encephalitis, 2003-12

Sl. No	Country	Number of Papers			Number of Citations*			Average Citation Per Paper		
		2003-07	2008-12	2003-12	2003-07	2008-12	2003-12	2003-07	2008-12	2003-12
1	USA	209	318	527	2041	3259	5300	9.77	10.25	10.06
2	India	143	262	405	440	1129	1569	3.08	4.31	3.87
3	Japan	137	230	367	856	941	1797	6.25	4.09	4.90
4	China	43	186	229	122	651	773	2.84	3.50	3.38
5	UK	62	94	156	696	952	1648	11.23	10.13	10.56
6	Taiwan	67	70	137	335	365	700	5.00	5.21	5.11
7	Australia	61	63	124	372	378	750	6.10	6.00	6.05
8	South Korea	45	51	96	354	171	525	7.87	3.35	5.47
9	Thailand	27	63	90	126	436	562	4.67	6.92	6.24
10	France	38	50	88	124	465	589	3.26	9.30	6.69
Other countries (69)		130	143	277						
World		962	1530	2496	4952	8184	13136	5.15	5.35	5.26

* Citation data has been collected on a three-years citation window

Table 3. Share of papers & citations and relative citation index by top 10 most productive countries in Japanese Encephalitis, 2003-12

S.No	Country	Share of Papers			Share of Citations			Relative Citation Index		
		2003-07	2008-12	2003-12	2003-07	2008-12	2003-12	2003-07	2008-12	2003-12
1	USA	21.73	20.78	21.11	41.22	39.82	40.35	1.90	1.92	1.91
2	India	14.86	17.12	16.23	8.89	13.80	11.94	0.60	0.81	0.74
3	Japan	14.24	15.03	14.70	17.29	11.50	13.68	1.21	0.77	0.93
4	China	4.47	12.16	9.17	2.46	7.95	5.88	0.55	0.65	0.64
5	UK	6.44	6.14	6.25	14.05	11.63	12.55	2.18	1.89	2.01
6	Taiwan	6.96	4.58	5.49	6.76	4.46	5.33	0.97	0.97	0.97
7	Australia	6.34	4.12	4.97	7.51	4.62	5.71	1.18	1.12	1.15
8	South Korea	4.68	3.33	3.85	7.15	2.09	4.00	1.53	0.63	1.04
9	Thailand	2.81	4.12	3.61	2.54	5.33	4.28	0.90	1.29	1.19
10	France	3.95	3.27	3.53	2.50	5.68	4.48	0.63	1.74	1.27
World		100	100	100	100	100	100	1.00	1.00	1.00

productive countries on Japanese encephalitis during 2003-12 was registered by Thailand, followed by UK (62.18%), France (50.0%), USA (44.02%), South Korea (36.46%), Australia (34.68%), China (25.76%), Japan (18.53%) and India (11.115). In terms of inter-country collaboration among the top 10 counties, the highest inter-country collaborative linkages are depicted by USA (200 linkages with all 10 countries), followed by UK (95 linkages with 8 countries), Thailand (68 linkages with 9 countries), France (66 linkages with 9 countries), China (61 linkages with 9 countries), etc. The highest number of inter-country collaborative linkages (37) was between USA and UK, followed by USA-Thailand (28 linkages), USA-China and USA-South Korea (25 linkages each), USA-Japan and USA-France (20 linkages each), USA-Australia (19 linkages), UK-France and USA-Taiwan (16 linkages each), UK-Australia (11 linkages), Japan-China and UK-Thailand(10 linkages each), etc.

4.4 Subject-Wise Distribution

The world's publication output in Japanese encephalitis research during 2003-12 has been published in the context of eight sub-fields (as reflected in Scopus database classification), with highest publication output coming from medicine (65.06% share), followed by immunology & microbiology (40.71%), biochemistry, genetics & molecular biology (18.55%), pharmacology, toxicology & pharmaceutics (9.33%), veterinary science (9.13%), neurosciences (6.69%), agricultural & biological sciences (5.05%) and environment science (1.40%) during 2003-12. On analyzing the trends using activity index, it was found that research activity has increased in medicine (activity index from 90.11 to 106.48), biochemistry, genetics & molecular activity (activity index from 70.61 to 118.74), pharmacology, toxicology & pharmaceutics (activity index from 79.06 to 113.43), neurosciences (activity index from 87 to 108.43), agricultural & biological sciences (activity index from 90.6 to 106.17) and environment science (activity index from 59.31 to 125.85), as against decrease in veterinary science (activity index from 109.2 to 99.5) from 2003-07 to 2008-12. In terms of citation impact per paper, it was found that pharmacology, toxicology & pharmaceutics had scored the highest citation impact (8.42), followed by immunology & microbiology (6.30), biochemistry, genetics & molecular biology (5.65), veterinary science and neurosciences (5.29), agricultural & biological sciences (4.75), medicine (4.40) and environment science (2.54) during 2003-12 (Table 4).

4.5 Subject Priorities in Top Most Productive Countries

Data was analyzed to identify the major focus of study in terms of sub-fields in top 10 most productive countries using activity index concept during 2003-12 (Table 5). It was found that different countries emphasized on different sub-fields and on more than one sub-field. Medicine has received more attention in Thailand (131.5), Japan (116.0) and UK (108.4), Immunology & Microbiology in China (167.4), Taiwan (152.4), Thailand (141.9), South Korea (133.1) and USA (120.3), Biochemistry, Genetics & Microbiology in China (195.4), Taiwan (153.5) and India (118.5). Pharmacology, toxicology and pharmaceutics in USA (172.8) and France (158.25), Veterinary science in South Korea (193.9), Japan (164.06), Australia (158.9), France (136.84), Thailand (133.8) and China (119.5), Neurology in India (195.6) and Japan (195.48),Agricultural & biological sciences in Australia (319.5), France (157.58) and India (141.8) and Environment science in Australia (230.0) and India (176.1).

4.6 Profile of Top 20 Most Productive World Organizations

The world Japanese Encephalitis output was published from 419 organizations, of which the top 20 published 22 or more papers each and together contributed 28.61% share in

Table 4. Subject-Wise break-up of world publications in Japanese Encephalitis, 2002-12

Subject	Number of Papers			Activity Index	
	2003-07	2008-12	2003-12	2003-07	2008-12
Medicine	564	1060	1624	90.11	106.48
Immunology & Microbiology	388	628	1016	99.08	100.84
Biochemistry, Genetics & Molecular Biology	126	337	463	70.61	118.74
Pharmacology, Toxicology & Pharmaceutics	71	162	233	79.06	113.43
Veterinary Science	96	132	228	109.2	94.448
Neurosciences	56	111	167	87	108.43
Agricultural & Biological sciences	44	82	126	90.6	106.17
Environment Science	8	27	35	59.31	125.85
Total of World	962	1530	2496	100	100

Table 5. Sub-fields of focus by different countries during 2003-12

Country	Sub-discipline of research activity (in terms of Activity Index)
US	Pharm (172.8), Immu (120.3)
India	Neur (195.6), Envi (176.1), Agri (141.8), Bioc (118.5)
Japan	Neur (195.48), Vete (164.06), Medi (116.0)
China	Bioc (195.4), Immun (167.4), , Vete (119.5)
UK	Medi (108.4)
Taiwan	Bioc (153.5), Immun (152.4),
Australia	Agri (319.5), Envi (230.0), Vete (158.9)
South Korea	Vete (193.9), Immun (133.1)
Thailand	Immun (141.9), Vete (133.8), Medi (131.5)
France	Phar (158.25), Agri (157.58), Vete (136.84)

Medi=Medicine; Immu= Immunology & Microbiology; Neur= Neurosciences; Envi= Environment Science; Agri=Agricultural & Biological sciences; BIOC= Biochemistry, Genetics & Molecular Biology; Vete= Veterinary Science; and Phar= Pharmacology, Toxicology & Pharmaceutics

the cumulative world publications output during 2003-12. Eight organizations have registered higher publication productivity per organization than the group average (35.7). Nine organizations have registered higher citation impact per paper than the group average (6.43) during 2003-12. Eight organizations have achieved higher h-index value than the group's average (12.70) during 2003-12. Seven organizations have achieved higher international collaborative papers (ICP) share than the group's average (31.80%) during 2003-12. Nine organizations have achieved relative citation index above 1: Osaka University, Japan (3.73), University of Texas, Medical Branch, Galveston, USA (3.23), National Brain Research Center, India (2.06), Institute of

Biomedical Sciences, Academia Sinica, Taiwan (1.71), National Defense Medical Center, Taiwan (1.63), Armed Forces Research Institute of Medical Sciences, Thailand (1.58), Center for Disease Control & Prevention, USA (1.43), Kobe University, Japan (1.38) and University of Queensland, Brisbane, Australia (1.36). Among the organizations receiving relative citation index more than 1, 2 each were from USA and Taiwan, 1 each from Japan, Thailand, India, Australia and UK. (Table 6)

Table 6. Scientometric profile of top 20 world organizations in Japanese Encephalitis during 2003-12

Sl. No	Name of Institute	TP	TC	ACPP	h-index	ICP	%ICP	RCI
1	National Institute of Infectious Diseases, Tokyo, Japan	73	310	4.25	17	14	19.2	0.81
2	Center for Disease Control & Prevention, USA	63	473	7.51	18	38	60.3	1.43
3	Chinese Center for Disease Control & Prevention	50	172	3.44	10	10	20	0.65
4	Mahidol University, Thailand	43	137	3.19	12	27	62.8	0.61
5	National Institute of Virology, Pune, India	43	138	3.21	12	2	4.65	0.61
6	University of Queensland, Brisbane, Australia	41	293	7.15	15	7	17.1	1.36
7	Sanjay Gandhi Postgraduate Institute of Medical Sciences, Lucknow, India	39	136	3.49	11	3	7.69	0.66
8	Kobe University, Japan	38	144	3.79	12	9	23.7	0.72
9	University of Liverpool, UK	35	254	7.26	14	28	80	1.38
10	National Brain Research Center, Manesar, India	33	358	10.8	16	12	36.4	2.06
11	Nagasaki University, Japan	31	114	3.68	9	14	45.2	0.7
12	University of Texas, Medical Branch, Galveston, USA	30	510	17	16	17	56.7	3.23
13	National Defense Medical Center, Taiwan	28	240	8.57	14	4	14.3	1.63
14	National Institute of Immunology, New Delhi, India	26	133	5.12	12	2	7.69	0.97
15	Institute of Biomedical Sciences, Academia Sinica, Taiwan	25	225	9	14	2	8	1.71
16	Indian Institute of Science, Bangalore, India	24	101	4.21	12	3	12.5	0.8
17	Armed Forces Research Institute of Medical Sciences, Thailand	24	199	8.29	11	22	91.7	1.58
18	National Chung Hsing University, Taiwan	23	100	4.35	10	6	26.1	0.83
19	Osaka University, Japan	23	451	19.6	11	7	30.4	3.73
20	Chang Gung University, Taiwan	22	101	4.59	8	0	0	0.87
Total of 20 organizations		714	4589	6.43	12.7	227	31.8	1.32
Total of the world		2496						
Share of top 20 organizations in global output		28.61						
Average productivity per organization		35.7						

TP=Total Papers; TC=Total Citations; ACPP=Average Citation Per Paper; ICP=International Collaborative Papers; RCI=Relative Citation Index

4.7 Profile of Top 20 Most Productive Authors in Japanese Encephalitis

The top 20 productive authors involved in Japanese encephalitis research have published 15 or more papers each and together contributed 21.67% (541 papers) in the cumulative world publications output during 2003-12. Eight authors have registered higher publication productivity per author than the group average of 27.05 Seven authors have registered higher citation impact per paper than the group average (5.89) during 2003-12. Eight authors have registered h-index more than the average h-index (6.87) of all authors during 2003-12. Seven authors have achieved higher international collaborative papers (ICP) share than the group's average (22.18%) during 2003-12. Ten authors have achieved value of relative citation index more than 1: C.L. Liao (2.36), F. Guirakhoo (2.13), A. Basu (2.03), J.S.Mackenzie (1.81), Tom Solomon (1.80), S. Yoksan (1.52), A.F. Van Den Hurk (1.33), S.A. Ritchie (1.10), C.W. Lin (1.08) and I. Kurane (1.05). Three Australian authors have achieved relative citation index more than 1, followed by 2 authors from Taiwan, 1 author each from UK, Japan, India, Thailand and USA (Table 7).

Table 7. Scientometric profile of 20 most productive authors in Japanese Encephalitis research, 2003-12

S.No	Name	Affiliation	TP	TC	ACPP	h-index	ICP	% ICP	RCI
1	G.D. Liang	Chinese Center for Disease Control & Prevention	51	188	3.6863	11	8	15.69	0.7
2	Tom Solomon	University of Liverpool, Walton Center for Neurology & Neurosciences, UK	40	378	9.45	18	31	77.5	1.8
3	H.Y. Wang	Chinese Center for Disease Control & Prevention	39	133	3.4103	10	5	12.82	0.65
4	S.H. Fu	Chinese Center for Disease Control & Prevention	39	121	3.1026	10	5	12.82	0.59
5	I. Kurane	National Institute of Infectious Diseases, Tokyo, Japan	35	194	5.5429	15	9	25.71	1.05
6	E. Konishi	Kobe University, School of Medicine, Japan	35	141	4.0286	12	9	25.71	0.77
7	A. Basu	National Brain Research Center, Manesar, India	34	364	10.706	16	2	5.882	2.03
8	T. Takaraki	National Institute of Infectious Diseases, Tokyo, Japan	33	140	4.2424	13	2	6.061	0.81
9	U.K.Misra	Sanjay Gandhi Postgraduate Institute of Medical Sciences, Lucknow, India	26	112	4.3077	8	3	11.54	0.82

S.No	Name	Affiliation	TP	TC	ACPP	h-index	ICP	% ICP	RCI
10	J.Kalita	Sanjay Gandhi Postgraduate Institute of Medical Sciences, Lucknow, India	25	109	4.36	8	3	12	0.83
11	S. Vrati	National Institute of Immunology, New Delhi, India	23	109	4.7391	12	1	4.348	0.9
12	J.S. Mackenzie	Curtin University of Technology, Perth, Australia	22	210	9.5455	14	3	13.64	1.81
13	A.F. Van Den Hurk	University of Queensland, Brisbane, Australia	20	140	7	10	1	5	1.33
14	K. Morita	Nagasaki University, Japan	19	70	3.6842	8	12	63.16	0.7
15	C.L. Liao	National Defense Medical Center, Taiwan	17	211	12.412	13	4	23.53	2.36
16	S.A. Ritchie	Queensland Health, Australia	18	104	5.7778	10	2	11.11	1.1
17	S. Yoksan	Mahidol University, Thailand	17	136	8	10	12	70.59	1.52
18	C.W. Lin	National Hsing-Hua University, Taiwan	17	97	5.7059	10	1	5.882	1.08
19	W.J. Chen	Chang Gung Universersity, Taiwan	16	60	3.75	8	0	0	0.71
20	F. Guirakhoo	Acambis Inc, Cambridge, MA., USA	15	168	11.2	9	7	46.67	2.13
	Total of 20 authors		541	3185	5.8872	11.25	120	22.18	1.12
	Total of the world		2496						
	Share of top 20 authors in global output		21.67%						

*Average productivity per author=27.05

TP=Total Papers; TC=Total Citations; ACPP=Average Citation Per Paper; ICP=International Collaborative Papers; RCI=Relative Citation Index

4.8 High Cited Papers

Of the 45 high cited papers (receiving citations since their publications till 18 August 2014) , 33 papers received citations from 100 to 194, 5 papers from 208 to 291 citations, 1 paper 369 citations, 3 papers from 418 to 498 citations, and 3 other papers from 553 to 1368 citations. Nineteen countries contributed to these high cited papers. United States contributed 26 high cited papers, followed by UK (7), Japan and France (4 each), India, Australia and Switzerland (3 each), South Korea, Thailand and Canada (2 each) and Argentina, Israel, Austria, Hungary, Czech Republic, Taiwan, Germany, Singapore and South Africa (1 each). Of the 45 high cited papers, 19 involve international collaboration, 25 national collaboration and 13 zero collaboration. Of the 45 high cited papers, 24 were reviews, 21 articles and 1 short

survey. These 45 high cited papers are published in 36 international journals, including 5 papers in *Nature*, 2 paper each in *Nature Review of Microbiology, Neurology, Antiviral Research, Journal of Virology and Emerging Infectious Diseases,* and 1 paper each in 30 other journals. A list of top 10 high cited papers are listed in Table 8.

5. Summary & Conclusion

The global output (2496 papers) on Japanese encephalitis during 2003-12, increased annually from 213 to 377 from 2003 to 2012, with an annual average growth rate of 7.41%. These publications registered a citation impact per paper of 5.26 during 2003-12,

Table 8. List of Top 10 High Cited Papers

S.No	Name of Authors	Title of the Paper	Source	No. of Citations
1	Kato, H., et al	Differential roles of MDA5 and RIG-I helicases in the recognition of RNA viruses (Article).	Nature, 2006, 441 (1), pp. 101-105	1368
2	Whitehead, K.A., Langer, R., Anderson, D.G	Knocking down barriers: Advances in siRNA delivery (Review)	*Nature Reviews Drug Discovery*, 2009, 8 (2), pp. 129-138	855
3	Mackenzie, J.S., Gubler, D.J., Petersen, L.R.	Emerging flaviviruses: The spread and resurgence of Japanese encephalitis, West Nile and dengue viruses (Review).	*Nature Medicine,* 2004, 10(12 SUPPL.), pp. S98-S109	553
4	Morens, D.M., Folkers, G.K., Fauci, A.S.	The challenge of emerging and re-emerging infectious diseases (Review).	*Nature*, 2004, 430 (6996), pp. 242-249	498
5	Kumar, P., et al.	Transvascular delivery of small interfering RNA to the central nervous system (Article).	*Nature*, 2007, 448 (7149), pp. 39-43.	496
6	Mukhopadhyay, S., Kuhn, R.J., Rossmann, M.G	A structural perspective of the Flavivirus life cycle (Review).	*Nature Reviews Microbiology*, 2005, 3 (1), pp. 13-22.	369
7	Tenembaum, S., Chitnis, T., Ness, J., Hahn, J.S.	Acute disseminated encephalomyelitis (Review).	*Neurology*, 2007, 68 (16 SUPPL. 2), pp. S23-S36..	291
8	Krishnan, M.N., et al.	RNA interference screen for human genes associated with West Nile virus infection (Article).	*Nature*, 2008, 455 (7210), pp. 242-245	244
9	Weaver, S.C., Reisen, W.K	Present and future arboviral threats (Review)	*Antiviral Research*, 2010, 85 (2), pp. 328-345	251
10	Plotkin, S.A.	Correlates of vaccine-induced immunity (Review).	*Clinical Infectious Diseases*, 2008, 47 (3), pp. 401-409.	243

increasing from 5.15 to 5.34 from 2003-07 to 2008-12. Japanese Encephalitis research output originated in 79 countries, of which the top 10 contributed 88.90% share of the total global output. United States alone produced more than one fifth of the output, followed by India, China and Japan, etc. Six out of 10 most productive countries have achieved relative citation rates above 1, namely UK (2.01), USA (1.91), France (1.27), Thailand (1.19), Australia (1.15) and South Korea (1.04). The highest share (63.33%) of international collaborative papers among ten most productive countries was registered by Thailand, followed by UK (62.18%), France (50.0%), USA (44.02%), South Korea (36.46%), Australia (34.68%), China (25.76%), Japan (18.53%) and India (11.115). Among them, the highest inter-country collaborative linkages has been achieved by USA, followed by UK, Thailand, France, China, etc.

The highest share (65.06%) of publication output in Japanese Encephalitis came from medicine, followed by followed by immunology & microbiology (40.71%), biochemistry, genetics & molecular biology (18.55%), pharmacology, toxicology & pharmaceutics (9.33%), etc during 2003-12. Medicine received more attention in Thailand, Japan and UK; immunology & microbiology in China, Taiwan, Thailand, South Korea and USA; biochemistry, genetics & microbiology in China, Taiwan and India; pharmacology, toxicology and pharmaceutics in USA and France; veterinary science in South Korea, Japan, Australia, France, Thailand and China; neurology in India and Japan; agricultural & biological sciences in Australia, France and India (141.8); and environment science in Australia and India.

The total research output on Japanese Encephalitis came from 419 organizations and several authors, of which the top 20 contributed 28.61% and 21.67% share each of total papers during 2003-12. The average citation impact, relative citation index, h-index and share of international collaborative papers registered by these 20 most productive organizations was 6.43, 1.36, 12.70 and 31.80% during 2003-12. Nine (2 each from USA and Taiwan, 1 each from Japan, Thailand, India, Australia and UK) out of 20 most productive organizations have registered relative citation index above 1. Ten authors (3 from Australia, 2 from Taiwan and 1 each from UK, Japan, India, Thailand and USA) have achieved relative citation index more than 1.

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First Quarterly Issue. January – March, 2016. P 62

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