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Scientific Publication of Dengue Fever Research in India based on the Web of Science Database

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This study investigated the research productivity of dengue fever literature in India extracted from the Web of Science (WoS) core collection database with the purpose of giving Scientometric description on numerous parameters which include subject explosion, ranks and publications, citation impact, global collaborative papers, most productive journals, authors and countries with their citation, on dengue fever research of Indian publications. There were 960 publications during 2009-2018. A result of the research shows an average citation of 11.25 per paper. The degree of collaboration has been arrived at 0.96 at some stage. The value of Co-Authorship Index (CAI) for single author papers suggests a declining mode from one year period to every other block. On the other hand, it is greater than two authored papers; the co-Authorship Index displays a growing trend.

Keywords: Authorship pattern; Dengue fever; Degree of Collaboration; Doubling time; India; Relative growth rate.

Dengue fever is a common infection having symptoms of high fever, extreme body aches and severe headaches. It is the most common disease that once in a while occurs in the form of an infection[1]. Delhi and parts of North India experienced a large number of dengue fever cases in 1996, 2003 and 2006. The disease is more severe in young children compared to adults.

Dengue is an arboreal disease transmitted by the bite of the infected female Aedes aegypti mosquito. It has mainly affected tropical and subtropical areas as it has recently shifted from rural to semi-urban and urban areas[2]. The World Health Organization has reported an increase in the number of dengue fever-affected countries. Dengue fever is spread across more than 128 countries in all regions of the WHO, particularly in Southeast Asia and the Western Pacific[3]. Dengue fever is a major public health challenge in Delhi. Outbreaks have been reported during 2006, 2010, 2013 and 2015; it is quite evident that a gap between outbreak years is decreasing[4].

Scientometrics is the study of the quantitative aspects of science as a discipline or economic activity. It is part of the sociology and has application to science coverage – making. In recent years it has come to play a major role in the measurement and assessment of research performance[5]. In this review we consider: indicated literature growth rate and pattern in macro and

micro levels; measure the publication pattern of all forms of written communication; provides evaluative measures to indicate individual countries output; level and nature of collaboration between scientists and disciplines; provides quantitative evaluation of publication patterns of all macro and micro subject[6].

Literature Review

A former study on dengue research was done worldwide and in Arab publications. Data related to dengue were collected from the past to December 31, 2015. Totally 19581 data have been founded in the database. The result shows the upward trend with a peak in the year 2014. The Arab countries produced lower publications with lower quality when compared to other world countries[7]. A bibliometric analysis of dengue research from 1991 to 2014 examines the relationship between dengue and scientific publications. Most documents are classified under tropical medicine, virology, infectious diseases, parasitology or immunology. India will soon overtake Thailand in the rankings as well. Overall, global collaboration plays a significant role in dengue research[8]. Another paper contributed to future discussions, decision-making and planning on dengue R&D and public health techniques by providing the scientific community, policymakers and public health practitioners with a map of the dengue scientific landscape worldwide. The results showed a significant increase in dengue publications over time – a rise in publications in the USA in general, tropical medicine, virology and infectious diseases, with the USA, Brazil and Thailand being the most relevant countries[9]. Bibliometric analysis of DESIDOC Journal of Library & Information Technology between 2006 and 2010 analyzed the number of articles, authorship pattern, subject matter, distribution of articles, the average number of citations per article, forms of documents cited, annual distribution of cited journals, etc[10].

A study on present research topics related to dengue fever in India is being conducted based on the Web of Science Databases. Although some research has already been done on dengue fever, there are some different analysis and findings from this research compared to previous research. A scientific quantitative analysis of hepatocellular carcinoma Magnetic Resonance Imaging (HCCMRI) for the period of 2008–2017 is studied. In 2008, the number of published articles was 37 and in 2017 it was 117. Journal of Magnetic Resonance Imaging has an impact factor of 3.612 in 2017 and it has published a maximum number of publications which is 79. HCCMRI research papers have been published in 162[11].A study to identify the relative research emphasis of India and world output on theoretical, experimental and applied aspects of Laser research during the period 1970-1994 was conducted. They found out that Indian scientists had published 952 publications during the study period[12]. The Scientometric analysis of malariaresearch performance for the period 2010 to 2014 reveals that the collaborative index was 6.07 during the study period. Co-authorship (CAI), Average authors per paper (APP), productivity per paper (PPP) and authorship pattern were also calculated[13].

Objective of Study

• To analyze the growth of the publication of dengue fever in India during 2009-2018

• To analyses the level of authorship pattern and collaboration. i.e. Single Vs. Multiple authors in the field of dengue fever in Indian research.

• To find out the relative growth Rate (RGR) and doubling Time (DT) of dengue fever in Indian research.

• To analyze the Co-Author Index (CAI) in field of Literature on Dengue fever in Indian Publication; and

• To identify the country-wise research, highly productive journals and institutions with their impact in dengue fever in Indian publication.

Research Methodology

The study based on Web of Science database from 2009 to 2018. A total of 960 bibliographic data had been extracted from web of science database (http://www.webofknowledge.com). The search strategy used the key-word "Dengue fever" in the "Title", the abstract and key phrases area alongside with "India" in the country field, and the time period "2009 to 2018" was used for looking out the major publication data used in the study. Each document includes title, country, author name, year of publication, journal, institution, keyword, abstract, and more. HistCite and MS-Excel software package were used for data analyses in this evaluation. HistCite is an analysis and tabulation tool that helps to find more productivity in any area of research. MS-

Excel software was used to tabulate the picture of the analysis and simple statistical techniques were used. In order to analyses the scientific productivity of India the following indicators were used: Relative Growth Rate and Doubling Time, TP- Total Publication, TC- Total citation, ACPP- Average citation per publication,AAPP -Average Authors per Paper, PPA - Productivity per Author, Co- Authorship Index etc.

Data Analysis and Findings

Annual Research Publication of Dengue fever Research in India

Figure 1 indicates the year-wise distribution of publication on dengue fever of Indian output during the period 2009-2018. Total 960 publications have been published. The study indicates that the highest number and lowest productivity acquired during the year of 2018 and 2009 respectively.

On analyzing the average citation impact per paper registered by India's research in dengue research, during the year 2010 the highest citation impact is (26.30 citation per paper), followed by 2012 (18.22 citation per paper), 2009 and 2011 (15 citation per paper), 2015 (13.16 citation per paper), 2014 (11.71 citation per paper), 2013 (10.67 citation per paper), 2016 (7.99 citation per paper), 2017 (5.94 citation per paper) and least during the

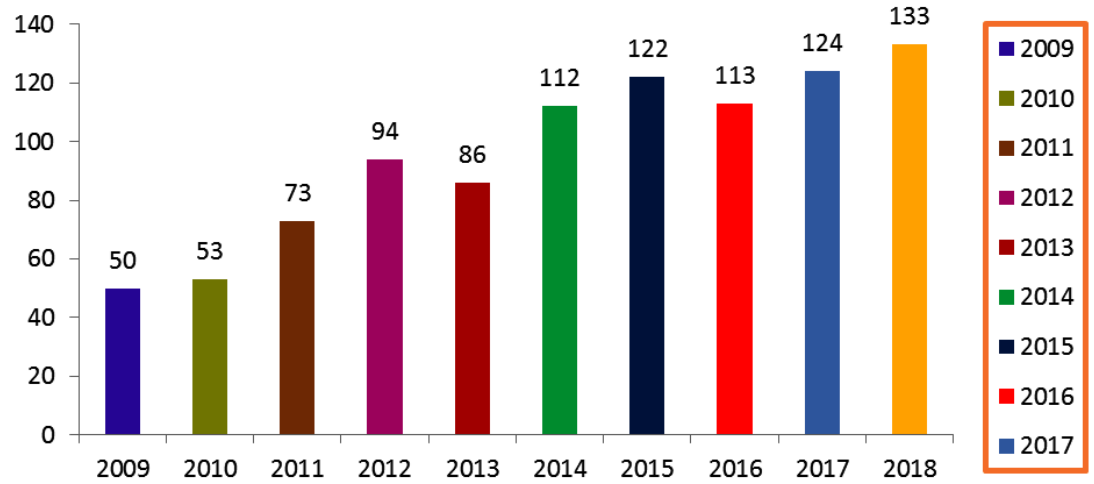

Fig. 1. Annual Research Publication of Dengue Fever Research in India

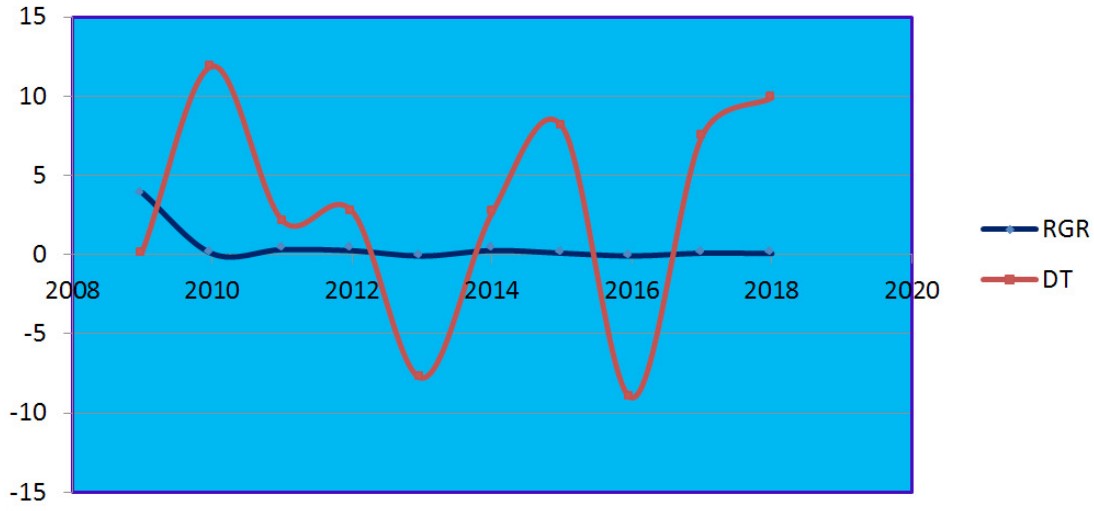

Fig. 2. Relative Growth Rate and Doubling Time

year of 2018 (2.05 citation per paper). Out of 930 publications, a maximum of 133 scholarly articles were published in 2018, while a minimum number of 50 articles were published in 2009.

Relative Growth Rate and Doubling time of Dengue fever Research in India

The RGR is described as the increase in the number of articles per unit of time. The doubling time (TD) is directly associated to the relative growth rate (RGR) and is defined as the time required for articles to double over the present amount. Figure 2 indicates the sequential distribution of RGR and doubling time of dengue fever research from 2009-to 2018. The RGR decreased from 3.91 to 0.15 correspondingly, and the doubling time of the publication progressively increased from 0.18 in 2009 to 4.65 in 2018.

Table 1 shows the documents wise publication pattern, a total of 960 records registered in dengue fever exploration, 628 articles (13.82 citation per publication) published in journals. Letter 149 with citation 545 (3.66 citation per publication) followed by Meeting Abstract 82 (0.27 Citation per paper), Review 47 (26.68 Citation per paper), Editorial Material 45 (4.27 citation per publication), Article; Proceedings Paper 5 (20.60 Citation per publication) and correction 4 (0.75 Citation per publication).

Table 2 indicates the details about the Author productivity in dengue fever research. In last 10 years (2009-18), the contribution by total authors is 4930 and total publications are 960 in the field of dengue fever research. The most contributing authors were in 2017 with 788. The publications were increased repetitively from 2009 to 2018. The Average Authors per Paper (AAPP) increased from 6.35 in 2017. It indicated

Table 1. Document-wise of Contributionof dengue fever research in India

No.	Document Type	TP	TC	ACPP
1	Article	628	8677	13.82
2	Letter	149	545	3.66
3	Meeting Abstract	82	22	0.27
4	Review	47	1254	26.68
5	Editorial Material	45	192	4.27
6	Article; Proceedings Paper	5	103	20.60
7	Correction	4	3	0.75
Total		960	10796	70.05

*Note:*TP- Total Publication, TC- Total citation, ACPP-Average citation per publication

Table 2. Author Productivityof dengue fever research in India

No	Year	Total no. of publications	Cumulative no. of publications	Total no. of authors	Cumulative No. of authors	AAPP	PPA
1	2009	50	50	185	185	3.70	0.27
2	2010	53	103	253	438	4.77	0.21
3	2011	73	176	321	759	4.40	0.23
4	2012	94	270	455	1214	4.84	0.21
5	2013	86	356	419	1633	4.87	0.21
6	2014	112	468	498	2131	4.45	0.22
7	2015	122	590	686	2817	5.62	0.18
8	2016	113	703	605	3422	5.35	0.19
9	2017	124	827	788	4210	6.35	0.16
10	2018	133	960	720	4930	5.41	0.18

Note: AAPP -Average Authors per Paper, PPA - Productivity per Author

that, the PPA is decreased from 0.27 to 0.18 correspondingly.

Table 3 degree of collaboration in dengue fever research has been measured with the help of no. of authors. It's shown that the degree of collaboration levels from 0.92 to 0.97. The mean value determined to be 0.96.

It is observed from table 4 that the value of CAI for single author papers in 2009 were the highest (178.60) it began to decline in other years. Correspondingly, for two authored papers, for the period of 2009**,** the CAI was **(**162.54), and started declining in other years. The CAI for more than twoauthored papers was lowest **(**84.90) in the 2011 year and enhanced to (111.89) in the period from 2018.

Table 5 depicts most productive 20 authors who have published more research papers in dengue fever research. The twenty authors together contributed 420 papers during 2009-2018. The analysis shows that the first three highest productive authors identified are: Agarwal N (contributed 39 papers); Arya SC (contributed 37 Papers); and Benelli G (contributed 29 papers). The twenty highest productive authors have received a total of 7958 citations for 420 papers with an average of 18.94 citations per paper.

It has been identified that nine author have recorded higher average citation per publication (ACPP) than the group average. These authors are Panneerselvam C (45.31 citations), Dinesh D (45.08 citations), Benelli G (33.21 citations),

Table 3. Degree of Collaborationof dengue fever research in India

No	Year	Single Author	Two Author	Three Author	Four Author	Five Author	Six Author	More) Author (>6	Total output	DC
1	2009	4	16	6	7	7	6	4	50	0.92
2	2010	1	14	6	9	7	5	11	53	0.98
3	2011	4	22	9	13	5	6	14	73	0.95
4	2012	6	18	12	18	15	11	14	94	0.94
5	2013	2	21	11	24	6	12	16	92	0.98
6	2014	2	29	18	13	16	7	22	107	0.98
7	2015	8	18	19	16	16	11	34	122	0.93
8	2016	7	15	21	12	14	7	37	113	0.93
9	2017	5	20	16	21	10	13	39	124	0.96
10	2018	4	16	21	21	18	13	39	132	0.97
Total		43	189	139	154	114	91	230	960	0.96

Table 4. Co- Authorship Indexof dengue fever research in India

No	Year	Single Author	CAI	Two Author	CAI	More than two author	CAI	Total output/ year
1	2009	4	178.60	16	162.54	30	79.12	50
2	2010	1	42.12	14	134.17	38	94.55	53
3	2011	4	122.33	22	153.08	47	84.90	73
4	2012	6	142.50	18	113.48	70	98.20	94
5	2013	2	48.53	21	115.94	69	98.90	92
6	2014	2	41.73	29	137.67	76	93.66	107
7	2015	8	146.40	18	74.94	96	103.77	122
8	2016	7	117.50	15	57.29	91	90.23	133
9	2017	5	90.02	20	81.93	99	105.28	124
10	2018	4	67.65	16	61.57	112	111.89	132
Total		43		189		728		960

Table 5. Most Productive Authors and their Impactof dengue fever research in India

Name of the Author	Rank	TP	TC	ACPP	Rank
Agarwal N	1	39	45	1.15	1
Arya SC	2	37	45	1.22	2
Benelli G	3	29	963	33.21	3
Murugan K	4	27	889	32.93	4
Swaminathan S	5	26	550	21.15	5
Khanna N	6	25	519	20.76	6
Kumar S	7	25	269	10.76	7
Shah PS	8	22	574	26.09	8
Cecilia D	9	21	558	26.57	9
Jain A	10	21	410	19.52	10
Alagarasu K	11	19	255	13.42	11
Garg RK	12	19	271	14.26	12
Chakravarti A	13	15	232	15.47	13
Sharma S	14	15	219	14.60	14
Govindarajan M	15	14	429	30.64	15
Kumar A	16	14	107	7.64	16
Tyagi BK	17	14	322	23.00	17
Kumar R	18	13	171	13.15	18
Panneerselvam C	19	13	589	45.31	19
Dinesh D	20	12	541	45.08	20

Note: TP- Total Publication, TC- Total citation, ACPP-Average citation Per publication

Table 6. Country-wise distribution of Dengue fever Research in India

Name of the Country	TP	TC	ACPP	Rank
India	956	10761	11.26	1
USA	52	1207	23.21	2
Saudi Arabia	32	641	20.03	3
Italy	30	972	32.40	4
Taiwan	16	324	20.25	5
Thailand	16	220	13.75	6
UK	16	260	16.25	7
Peoples R China	15	152	10.13	8
Malaysia	13	233	17.92	9
Singapore	13	258	19.85	10
France	11	213	19.36	11
Japan	11	297	27.00	12
Germany	10	270	27.00	13
Brazil	9	256	28.44	14
Switzerland	9	331	36.78	15
Indonesia	8	289	36.13	16
Australia	7	199	28.43	17
Nigeria	7	20	2.86	18
South Korea	7	62	8.86	19
Myanmar	6	219	36.50	20

Note: TP- Total Publication, TC- Total citation, ACPP-Average citation Per Publication

Table 7. Institutions wise distribution of Dengue fever Research in India

Name of the Institution	TP	TC	ACPP	Rank
International Centre Genetics Engineering Biotechnology, Italy	37	720	19.46	1
St Parmanand Hospital, New Delhi	36	45	1.25	2
All India Institute Medical Science , New Delhi	35	507	14.49	3
National Institute of Virology, Pune, Maharashtra, India	34	765	22.50	4
Bharathiar University, Coimbatore	32	917	28.66	5
University Pisa, Italy	29	963	33.21	6
Indian Council Medical Research, New Delhi	25	399	15.96	7
Maulana Azad Med College, New Delhi	23	253	11.00	8
King Saud University, Saudi Arabia	22	438	19.91	9
Annamalai University, Chidambaram, Tamil Nadu	19	460	24.21	10
Christian Medical College & Hospital, Vellore, Tamil Nadu	15	157	10.47	11
Defence Research & Development Establishment, Gwalior, India	15	135	9.00	12
Postgrad Institute Medical Education & Research, Pondicherry	14	165	11.79	13
King Georges Medical University, Lucknow	13	118	9.08	14
University Delhi, New Delhi	13	174	13.38	15
National Institute Malaria Research, New Delhi	11	68	6.18	16
National Taiwan Ocean University, Taiwan	10	283	28.30	17
Sanjay Gandhi Postgrad Institute Medical Science, Lucknow	10	123	12.30	18
Translational Health Science and Technology Institute, Haryana	10	248	24.80	19
University College Medical Science, New Delhi	10	48	4.80	20

Note: TP- Total Publication, TC- Total citation, ACPP-Average citation per publication

Murugan K (32.93 citations), Govindarajan M (30.64 citations), Cecilia D (26.57 citations) Shah PS (26.09 citations), Tyagi BK (23 citations), and Swaminathan S (21. 15 citations).

Geographical Distribution of Dengue Fever Research

Table 6 shows the distribution of dengue research output using geographical regions, it illustrates the collaboration of different countries. It has been found that 1336 publications came from 58 countries. The majority collaborative contributions was from India, and so is the most productive country with 956 publications and received 10761 citations, the second highest publications dengue fever research output records by USA with 52 publications and received 1207 citations, followed by Saudi Arabia, 32 publications received 641citations, Italy 30 publications received 972 citations, Taiwan 16 publications received 324 citations, Thailand 16 publications received 220 citations respectively.

It has been identified that nine countries have the highest average citation per publication (ACPP). These countries are Switzerland (36.78 citation per publication); Myanmar (36.5 citation per publication); Indonesia (36.13 citation per publication); Australia (28.43 citation per publication); Brazil (28.44 citation per publication); Japan and Germany (27 citation per publication); and USA (23. 21 citation per publication). The remaining top 20 countries have registered less than 20 citations per publication.

Top Most Productive Institutions in Dengue fever Research in India

Table 7 indicating the highly productive institutions. Top twenty most productive institutions contributed on dengue fever research have acquired a total of 6986 citations for 413 papers with an average of 16.91 citations. Table 7 indicates that maximum numbers of publications are contributed by International Centre Genetics Engineering Biotechnology, Italy, with 37 publications and received 720 citations is ranked number one in productivity. Second highest productivity is by St Parmanand Hospital, New Delhi with 36 publications which received 45 citations, followed by All India Institute Medical Sciences, New Delhi with 35 publications and received 507 citations, fourth place is National Institute of Virology with 34 publications and received 765 citations, and fifth position is Bharathiar University contributed 32 papers with 917 citations.

The average citation per publication (ACPP) registered by using the total papers of these twenty institutions per publication based on the citation received via these institutions' publications. The most citations per publication was received by University of Pisa, Italy, followed by National Taiwan Ocean University with 28.30 citations per publication; Bharathiar University with 28.66 citations per publication, Annamalai University received 24.21 citations per publication, Translational Health Science and Technology Institute with 24.80 citations and National Institute of Virology 22.50 citation per publication. Remaining institutions among the top 20 have registered less than 20 citations per publication. In countries like Italy, Taiwan and Saudi Arabia only four institutions are included in the top twenty institutions, while the remaining sixteen are Indian institutions.

DISCUSSION

It is found that the growth of literature in Dengue fever research during the study period. A total of 10796 citations had been received to the 960 publications with an average of 11.25 citations per publication. It is observed that the value of CAI for single authored and two authored papers is the highest authored index in the year of 2009, more than two authored papers is the highest authored index in the year of 2018.

Out of the total research literature output in dengue fever research, 628 papers with citation 8677, (13.82 citations per publication) is in the form of articles followed by 47 papers; 1254 Citations; 26.68 citation per papers in the form of reviews. The number of research articles on dengue has increased exponentially since 2013 compared to the results showed a significant increase in dengue publications over time mostly due to the rise of USA publications (Mota, et al., 2017).

The Journal wise distribution of Dengue fever Research shows that the majority of research papers appeared in the Journal of Vector Borne Diseases followed by Parasitology Research, International Journal of Infectious Diseases, Indian Journal of Medical Research and Indian Journal of Pediatrics. There were very few publications of scholarly articles in virology, infectious diseases, parasitology or immunology (Ho, Siu, and Chuang, 2016)

CONCLUSION

The present study evaluated the growth of dengue fever research literature output with a scientometric approach, published from 2009-to 2018. The researcher conducted the study comprehensively to recognize the growth rate, author's productivity and geographical distribution. This study explores the traits of dengue fever research in India from 2009-to 2018 based on the web of science database. This study evidenced that the highest number of publications is in the year 2018 with 133 documents having a citation of 272 averages per paper of 2.05; the highest number of citations is in the year 2015 with 122 documents having a citation of 1606 average per paper of 13.16. The RGR decreased from 3.91 to 0.07 correspondingly, and the doubling time of the publication gradually increased from 0.18 in 2009 to 9.89 in 2018. The present scientometric study about Dengue fever research carried out from 2009-to 2018. Similar research can be carried out for specific study periods. The present day research was once confined to the publications included on the Web of Science database. Further, research can be carried out using different bibliographic databases like Scopus or Google Scholar. In addition, a comparative study of research output via a number of databases can be carried out.

Based on global sampling data, 33 million clinically apparent dengue cases occur in India annually, contributing to one-third of the worldwide dengue burden (Bhatt et al., 2013)[12]. Therefore, research on dengue fever in India can be enhanced by the Department of Biotechnology and Translational Health Sciences and Technology Institute, Government of India. Greater awareness of dengue research among people in India can help to reduce dengue fever.

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Conflict of Interest

None.

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