Scientometric Analysis of Indian Research Output on Polio Literature During 1994-2018

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Abstract

The paper aims to undertake a Scientometric study on Indian publications on polio research output. The data required for the study was sourced from Web of Science database. The study period was limited to 1994-2018. Histcite software was used to anayze the data. The study reveals that : India has published 488 records on polio research during 1994-2018 as indexed in Web of Science database. All the 488 records are in English language and they were all published in journals. Year 2017 has witnesses the most number of Indian publications (44). Two third of Indian research papers on polio are articles. A majority of 111 (22.75%) records had 1-10 cited references followed by 107 (21.93%) records with 11-20 cited references and 98 records with 21-30 cited references. More than half of the Indian publications (255, 52.25%) received 1-10 global citations.

Keywords

: Polio research, India, authorship pattern, productive journals, local and global citations.

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1. Introduction

Pritchard (1969) defined the term 'Bibliometrics' as 'the application of mathematical and statistical methods to books and other communication medium. Nalimov and Mulchenko (1969) defined 'Scientometrics' as 'the application of those quantitative methods which are dealing with the analysis of science viewed as an information process'.Polio, short for poliomyelitis, or infantile paralysis, is an infectious disease caused by the poliovirus.(https://en.wikipedia.org /wiki/Polio). Poliomyelitis (polio) is a highly infectious viral disease, which mainly affects young children. The virus is transmitted by person-to-person spread mainly through the faecal-oral route or, less frequently, by a common vehicle (e.g. contaminated water or food) and multiplies in the intestine, from where it can invade the nervous system and can cause paralysis.Initial symptoms of polio include fever, fatigue, headache, vomiting, stiffness in the neck, and pain in the limbs. In a small proportion of cases, the disease causes paralysis, which is often permanent. There is no cure for polio, it can only be prevented by immunization (https://www.who.int/topics/poliomyelitis/en/).

2. Review of Literature

Vellaichamy & Jeyshankar (2014) were analysedthe quantitative study of research output on anemia disease. Data of the present study is obtained from Scopus (http:// www.scopus.com) online multidisciplinary database for the period 1993-2013. study reveals that lowest number (0.56%) of citations received in the year 2013. The study also focused on authorship pattern, degree of collaboration, most productive authors, subject pattern, major collaborative partners in India, most productive journals, active institutions and highly cited papers. Keywords: Bibliometrics; Anemia; Publication output; citation analysis, India. Jeyshankar & Vellaichamy (2016)analysed 13079 global literature on Autism, indexed in Scopus database during 2007-2011. Totally 70 countries contributed to the literature, majority of the papers coming from USA (49.24%), followed byUnited Kingdom (15.61%), Germany (4.93%) etc. The study analysed that Indian scientists together have published 134papers on Autism research during 2007-11. India ranks 17th among the other countries in Autism research with a globalpublications share of 1.01% during 2007-11. In depth, this study analysed that majority of the publications are published in the form of articles

(64.76%) and majority (79%) of the scientists preferred to publish their research papers in jointauthorship. The study also analysed that majority of the autism research appeared in Journal of Autism and DevelopmentalDisorders (7.19%) followed by Research in Autism Spectrum Disorders (2.34%) and Autism (1.87%). "Nature" has highestnumber of citations (822) followed by "Science" (717) and "Annals of the New York Academy of Science" (628).

Ram (2018) traced thegrowth of literature in leishmaniosis research for fifty years focusing the contribution andresearch impact made by India over global research. research has quitegood impact and has been ranked fifth. Indian Institute of Chemical Biology was mostproductive Indian institute, but Banaras Hindu University Institute of Medical Scienceswas most impact full. Gupta & Gupta (2018)examined 436 Indian publications in Sickle Cell disease, as indexed in Scopus database during 2008-17Among various 243 organizations and 594 authors contributing to Indian Sickle Cell disease research, the 10 most productive global organizations and authors together contributed 42.89% and 41.28% respectively as their share of global publication output and more than 100% and 23.71% respectively as their share of global citation output during 2008-17.Gupta, Kaur, Baidwan & Gupta (2018)examined 2094 Indian publications on asthma research, as covered in Scopus database during 2007-16 which have registered an annual average growth rate of 12.14%, global share of 2.72%, qualitative citation impact averaged to 10.857citations per paper and international collaborative publication share of 13.51%. The top 12 most productive countries individually contributed global share from 2.72% to31.27%, with largest global publication share coming from USA (31.27%), followed by U.K. (10.45%), Germany (5.60%), Canada (5.44%), etc. Together, the 12 most productive countries accounted for 83.80% share of global publication output during 2007-16.Medicine, among subjects, accounted for the highest publications share (61.32%), followed by pharmacology, toxicology & pharmaceutics (35.05%) and biochemistry, genetics & molecular biology (20.25%). Among different type of asthma, allergic asthma contributed the highest number of publications.

Gupta, Ritu, Ashok & Madhu (2018)examined 1744 Indian publications on rheumatoid arthritis research, as covered in Scopus database during 2007-16. The output experienced anannual average growth rate of 8.19% and qualitative citation impact averaged to 9.23 citations per paper. India's share in global output was 3.05%during 2007-16, which increased from 2.46% to 3.61% from 2007-11 to 2012-16. Ahmed, Gupta & Gupta (2018)examined 1970 Indian publications on Leishmaniasis research, as covered in Scopus database during 2008-17, registering an annual average growth rate of 17.68%, global publication share of 12.32%, international collaborative publication share of 26.85% and qualitative citation impact averaged to 17.28 citations per paper. The top 10 most productivecountries individually contributed global share from 4.13% to 22.95% with largest global publication share coming from Brazil (22.95%). Gupta, Gupta & Kumar (2018)examined 581 Indian acute pancreatitis research publications, as indexed in Scopus database during 2007-16. Indian Journal of Gastroenterology and Journal of the Pancreas, contributed the largest number of papers (27 papers each), followed Pancreatology (21 papers), Journal of Gastroenterology & Hepatology Australia (20 papers), etc. during 2007-16. There were only top 7 highly cited publications, which registered citations from 105 to 611 during 2007-16 and they together received 1343 citations, which averaged to 191.86 citations per paper. Gupta & Gupta (2018)examined India's research output on anemia research on a series of bibliometric indicators. Anemia research consisting of 105145 global and 5723 Indian publications were derived from Scopus database and studied during 10 years (2008-2017). The leading journals contributing to Indian research in anemia research are : Journal of Clinical and Diagnostic Research (306 publications), followed by Indian Journal of Pediatrics (186 publications) and Indian Journal of Hematology and Blood Transfusion (160 publications). Narzary & Murugan (2018)explored the Colorectal Cancer research scholarly communications publishedby Indian researchers based on the data available in web of science database for the period of 12years (2005- 2016). The analysis revealed that thereis an increasing trend in total CRC research publications and majority of the publications are inthe form of articles both in case of India and world. Total citations and average citation per paperin case of India also shows increasing trend except in 2009 and 2012. India's highest collaborating country is USA 15.6% of the total collaborative works undertaken.Sanyal SN is the most productive author contributing (2.2%) ofarticles. Authorship pattern shows that 10 and more than 10 authors contributed more papers.Panjab University has the maximum number of publications

with 62 records having a TotalLocal Citation Score 80 and Total Global Citation Score 551. Highest subject wise distribution isOncology with 386 papers and 31.56% share. Tumor biology is the most preferred journal with(47) 3.9% of the total periodical literature output during the period under study.

3.Objectives of the Study

- To examine the year-wise distribution of Indian polio research literature output during 1994-2018
- To examine the document type-wise distribution of Indian polio research literature output
- To examine the range of cited references in Indian polio research output
- To examine the range of total citations in web of science core collection in Indian polio research output
- To examine the range of local citation scores in Indian polio research output
- To examine the range of local cited references in Indian polio research output
- To examine the authorship pattern of Indian polio research output
- To enlist the most prolific authors and most productive journals in Indian polio research output

4. Materials and Methods

The data on polio research literature output for a period of 25 years i.e from 1994 to 2018 is downloaded from the Web of Science database. A total of 488 records were downloaded in plain text format. The data was analyzed using Histcite software.

5. Data Analysis and Interpretation

India has published 488 records on polio research during 1994-2018 as indexed in Web of Science database. All the 488 records are in English language and they were all published in journals.

Table 1: Total 488 records

Year	No. of Records	%	Cum total	Cum %
1994	4	0.82	4	0.82
1995	9	1.84	13	2.66
1996	6	1.23	19	3.89
1997	8	1.64	27	5.53
1998	7	1.43	34	6.97
1999	6	1.23	40	8.20
2000	6	1.23	46	9.43
2001	8	1.64	54	11.07
2002	15	3.07	69	14.14
2003	14	2.87	83	17.01
2004	12	2.46	95	19.47
2005	15	3.07	110	22.54
2006	10	2.05	120	24.59
2007	24	4.92	144	29.51
2008	42	8.61	186	38.11
2009	28	5.74	214	43.85
2010	19	3.89	233	47.75
2011	25	5.12	258	52.87
2012	33	6.76	291	59.63
2013	28	5.74	319	65.37
2014	37	7.58	356	72.95
2015	27	5.53	383	78.48
2016	32	6.56	415	85.04
2017	44	9.02	459	94.06
2018	29	5.94	488	100.00
	488	100.00		

Table 1 shows the year-wise distribution of research output on polio by Indian researchers during 1994-2018. India has been continuously contributing research papers on polio from 1994 to 2018. We could observe a fluctuation in the number of research papers published over a period of 25 years. The number of records was in single digits from 1994 to 2001. The productivity varied between 10 and 15 during 2002-2006. The most productive year of publications is 2017 with 44 records and 2008 with 42 records. It is followed by the years 2014, 2012 and 2016 with 37, 33 and 32 records respectively. The first 13 years (1994 to 2006) have produced one fourth of total publications i.e. 120 records constituting 24.59%. The next 12 years (2007-2018) have produced two third of total publications. The last years (2016-2018) have produced 22% total polio research output from India.

Table 2: Document Type

Document Type	No. of Records	%
Article	317	64.96
Article : proceedings paper	3	0.61
Editorial Material	46	9.43
Letters	68	13.93

Meeting abstract	14	2.87
Note	1	0.20
Review	38	7.79
Unknown	1	0.20
Total	**488**	**100.00**

Table 2 and Fig. 1 showthe document types of Indian contribution in world polio research output. Two third of Indian research papers on polio are articles (317, 64.96%). Letters (68), editorial materials (46) and reviews (38) are other forms of communications used by the Indian Researchers. Thus, journal articles are the most preferred form of research communication among researchers from India.

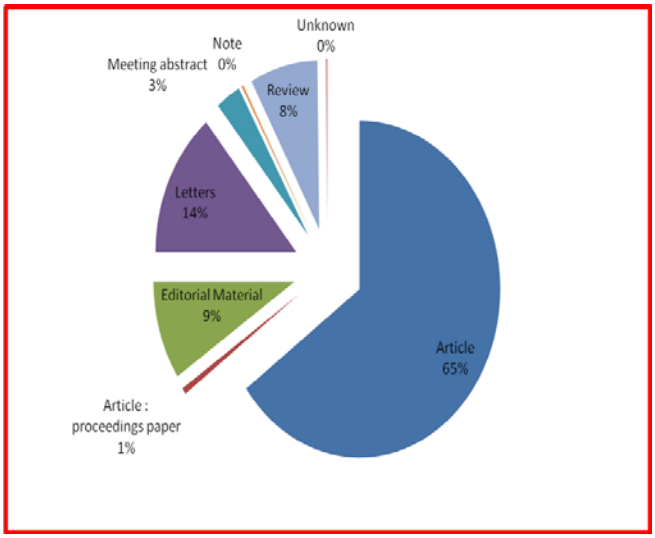

Figure 1: *Document type-wise distribution of Indian polio research output*

Table 3: Document Type-wise Year-wise Distribution

Year	Article	Article; Proceedings Paper	Editorial Material	English	Letter	Meeting Abstract	Note	Review	Total
1994	1				2		1		4
1995	7				2				9
1996	3		1		2				6
1997	6	1			1				8
1998	6				1				7
1999	4				2				6
2000	3		1		2				6
2001	4				4				8
2002	13				2				15
2003	13				1				14
2004	8		1		2			1	12
2005	9		1		5				15
2006	2		4		2			2	10
2007	11		4		8			1	24
2008	17		13		7	5			42
2009	16		5		5			2	28
2010	11		3		3	1		1	19
2011	17	1			3	1		3	25
2012	20		4		4	1		4	33
2013	20		1		1			6	28
2014	31			1	1			4	37

2015	17		3		3			4	27
2016	22		5		3	1		1	32
2017	33	1			2	5		3	44
2018	23							6	29
Grand Total	317	3	46	1	68	14	1	38	488

Table 3 shows the year-wise distribution of document types of Indian contribution in polio research literature during 1994-2018. Out of 317 articles published, a majority of 33 articles were published in 2017 followed by 31 articles in 2014, 23 articles in 2018 and 22 articles in 2016. While 20 articles each were published in 2012 and 2013, 17 articles each were published in 2008, 2011 and 2015. Single digit journal articles were found during 11 years. The publication trend of articles shows an increasing trend, with few fluctuations then and there. A majority of 13 editorial materials were found in the year 2008 while a majority of six reviews were found in 2013 and 2018. Articles and letters were two document types which are found throughout the study period.

Table 4: Range of Cited References in Indian PRO

Range of Cited References	No. of Records	%
0 cited references	24	4.92
1-10	111	22.75
11-20	107	21.93
21-30	98	20.08
31-40	61	12.50
41 -50	44	9.02
51-100	28	5.74
More than 100	14	2.87
Total	**488**	**100.00**

Table 4 shows the range of cited references included in 488 publications of India on polio research. 24 records did not have any cited reference while 14 records had more than 100 cited references. A majority of 111 (22.75%) records had 1-10 cited references followed by 107 (21.93%) records with 11-20 cited references and 98 records with 21-30 cited references. While 61 records had 31-40 cited references, 44 records had 41-50 cited references and 28 records had 51-100 cited references.

Table 5: Range of Total Citations in Web of Science Core Collection in Indian PRO

Range of Total Citations	No. of Records	%
0	**98**	20.08
1-10	**255**	52.25
11-20	**52**	10.66
21-30	**39**	7.99
31-40	**14**	2.87
41 -50	**7**	1.43
51-100	**19**	3.89
More than 100	4	0.82
Total	**488**	**100.00**

Table 5 shows the range of total global citations received by 488 Indian research output on polio during the study period. On the one extreme, 98 records did not receive even a single global citation and on the other extreme, 4 records received more than 100 global citations. More than half of the Indian publications (255, 52.25%) received 1-10 global citations followed by 52 records with 11-20 citations, 39 records with 21-30 global citations. 19 records received 51-100 global citations while 14 records received 31-40 global citations.

Table 6: Range of LCS in Indian PRO

Range of LCS	No. of Records	%
0	**242**	49.59
1-10	**194**	39.75
11-20	**26**	5.33
21-30	**10**	2.05
31-40	**5**	1.02
41 -50	**3**	0.61
51-100	**7**	1.43
More than 100	1	0.20
Total	**488**	**100.00**

Table 6 and Fig.2 showthe local citations received by 488 papers published by India on polio research

literature during the study period. About half of the publications (242, 49.59%) did not get even a single local citation while just one record got more than 100 local citations. About 40% of the publications (194, 39.75%) got 1-10 local citations followed by 26 records with 11-20 local citations, 10 records with 21-20 local citations and 7 records with 51-100 local citations. While five indian publications got 31-40 local citations, just 3 records got 41-50 local citations.

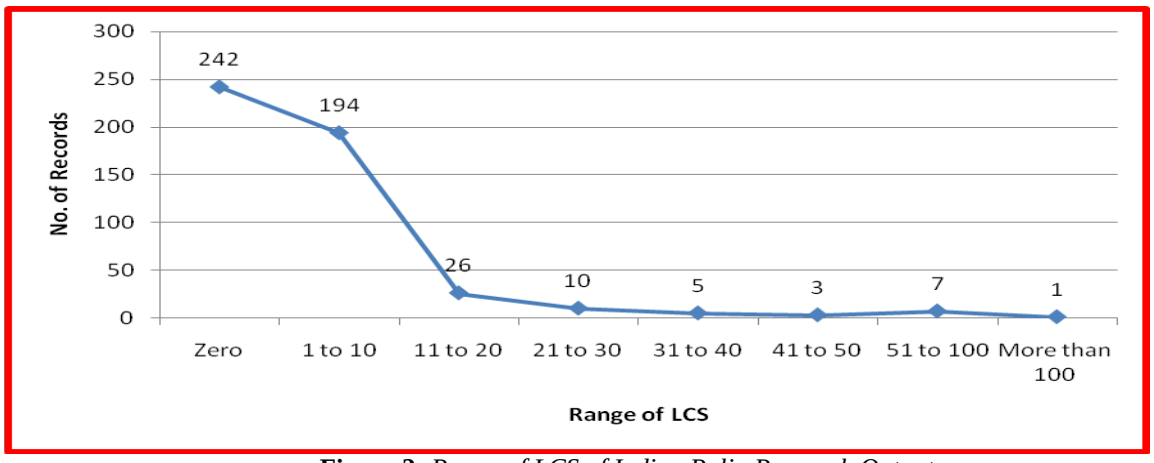

Figure 2: *Range of LCS of Indian Polio Research Output*

Table 7: Range of LCR in Indian PRO

Range of LCR	No. of Records	%
0	**103**	21.11
1-10	**321**	65.78
11-20	**50**	10.25
21-30	**11**	2.25
Above 30	**3**	0.61
Total	**488**	**100.00**

Table 7 shows the range of local cited references found in 488 Indian publications on polio research during 1994-2018. Two third of the publications (321, 65.78%) had 1-10 local cited references and little more than one fifth of the publications (103, 21.11%) included zero local cited references. While 50 records had 11-20 local cited references, 11 and 3 records had 21-30 and more than 30 local cited references respectively.

Table 8: Authorship Pattern

Authorship Pattern	Total	%
Single	76	15.57
Joint Authors	73	14.96
Three Authors	75	15.37
Four	66	13.52
Five	37	7.58
Six	35	7.17
Above 6	126	25.82
Grand Total	**488**	**100.00**

Table 8 shows the authorship pattern of 488 research papers of India on polio research as indexed in WoS database during the study period. 15.57% (76) of the papers were contributed by single authors. The remaining 85% of the papers were published in collaborative mode. One fourth of the papers (126, 25.82%) were authored by more than 6 researchers. 75, 73 and 66 papers were published in three, two and four author pattern. While 37 records were published in five author style, 35 records were published in six author style. Thus, the collaborative research is dominant Indian polio research output 1994-2018.

Table 9: Prolific authors

Name of the Author	No. of Records Published	% of 469
John, TJ	41	8.74
Bahl, S	31	6.61

Sutter, R W	26	5.54
Kang, G	24	5.12
Grassly, NC	23	4.90
Deshpnadi, J M	20	4.26
John, J	18	3.84
Arya, SC	16	3.41
Jafari, H	15	3.20
Thacker, N	14	2.99
Vashishtha, VM	13	2.77
Paul, Y	13	2.77
Pallansch, MA	13	2.77
Giri, S	13	2.77
Dhole, TN	13	2.77
Aylward, RB	13	2.77
Das, S	12	2.56
Verma, H	11	2.35
Agarwal N	11	2.35
Van Der Meeren, O	10	2.13
Wenger, J	9	1.92
Praharaj, I	9	1.92
Iturriza-Gomara, M	9	1.92
Deshpandi, J	9	1.92
Kumar, R	8	1.71
Banerjee, K	8	1.71
Abraham, A M	8	1.71
Sethi, R	7	1.49
Muliyil, J	7	1.49
Han, HH	7	1.49
Dasgupta, R	7	1.49
Babji, S	7	1.49
Kuriyakose, S	6	1.28
Kohler, KA	6	1.28
Hlady, WG	6	1.28
Durrani, S	6	1.28
Total	**469**	**100.00**

Table 9 shows the most prolific authors of Indian polio research literature output during 1994-2018. 36 authors who have contributed more than 5 publications are included in the above table. John TJ has emerged as the most productive author with 41 publications followed by Bahl S with 31 records, Sutter R W with 26 records, Kang G with 24 records and Grassly NC with 23 records. There are 15 authors who have contributed 10-20 research papers while there are 16 authors with 6- 9 publications. These 36 authors have contributed 469 out of 488 Indian research papers on polio.

Table 10: Productive Journals

Name of the Journal	No. of Records	%
Indian Pediatrics	42	8.61
Vaccine	39	7.99
Indian Journal of Medical Research	27	5.53
Journal of Infectious Diseases	22	4.51
Lancet	18	3.69
Human Vaccines &Immunotherapeutic	17	3.48
Indian Journal of Pediatrics	15	3.07
Bulletin of The World Health Organization	14	2.87
National Medical Journal of India	10	2.05
Plos One	9	1.84
Expert Review of Vaccines	7	1.43
Current Science	7	1.43
Pediatric Infectious Disease Journal	6	1.23
Journal of Medical Virology	6	1.23
Journal of General Virology	6	1.23
International Journal of Infectious Diseases	6	1.23
American Journal of Tropical Medicine And Hygiene	5	1.02
Journal of Virology	5	1.02

Indian Journal Of Medical Microbiology	5	1.02
Other Journals ( )	222	45.49
Grand Total	**488**	100.00

Table 10 and Fig.3 showthe most productive journals in Indian polio research output during 1994-2018. 19 journals have published about 55% of Indian polio research output. The Journal ' Indian Pediatrics' is the most productive journal with 42 Indian research papers on polio followed by Vaccine with 39 records, Indian journal of medical research with 27 records and Journal of infectious diseases with 22 records. The journals with 18, 17, 15, 14 and 10 publications are LANCET, Human vaccines and immunotherapeutic, Indian journal of pediatrics, bulletin of WHO and National medical journal of India respectively. The other ten journals have published 5-9 Indian research papers on polio.

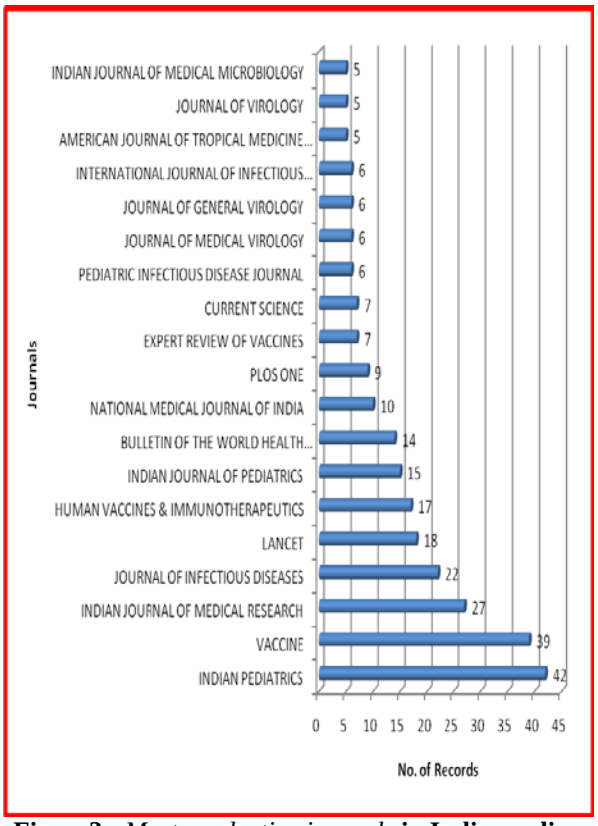

Figure3 : *Most productive journals* **in Indian polio research ouput**

0. Major Findings and Conclusion

- India has published 488 records on polio research during 1994-2018 as indexed in Web of Science database. All the 488 records are in English language and they were all published in journals.
- Year 2017 has witnesses the most number of Indian publications (44).
- Two third of Indian research papers on polio are articles.
- A majority of 111 (22.75%) records had 1-10 cited references followed by 107 (21.93%) records with 11-20 cited references and 98 records with 21-30 cited references.
- More than half of the Indian publications (255, 52.25%) received 1-10 global citations
- About half of the publications (242, 49.59%) did not get even a single local citation while just one record got more than 100 local citations.
- Two third of the publications (321, 65.78%) had 1-10 local cited references and little more than one fifth of the publications (103, 21.11%) included zero local cited references.
- One fourth of the papers (126, 25.82%) were authored by more than 6 researchers.
- John TJ has emerged as the most productive author with 41 publications followed by Bahl S with 31 records, Sutter R W with 26 records, Kang G with 24 records and Grassly NC with 23 records.
- The Journal ' Indian Pediatrics' is the most productive journal with 42 Indian research papers on polio.

Though less in numbers, Indian contribution in polio research output as indexed in Web of Science database has been existing over the period of 25 years (1994-2018). It shows a positive growth too. Comparing to polio cases and polio related health issues, the number of publications seems to be less. More researchers should be motivated to undertake research in polio and its related domains. As the articles are the most preferred document type among the researchers, they should be introduced to UGC CARE reference list of quality journals and the open access journals indexed in Web of Science and Scopus databases. Few papers did not have any reference. The polio researchers should be directed to include cited references in their papers, as the way of acknowledgment. Fifty percent of the papers did not get even a single local citation score. The researchers

should take some strenuous efforts to see that they prepare high quality articles with different perspectives to attract citations of other papers available both in the same set and outside. The researchers may form small team to undertake research work on polio related issues. The most productive journals in polio research literature may be introduced among the polio researchers. A good number of open access journals need to be introduced. More research funds may be allocated for the institutions and individuals undertaking research on polio related health disorders. Indian Citation Index needs to grow stronger to include more Indian publications to ensure more visibility and outreach.

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