

# Nipah Virus Research: A Scientometric Assessment of Global Publications Output during 1999-2018

B. M. Gupta<sup>1</sup>, K K Mueen Ahmed<sup>2</sup>, Ritu Gupta<sup>3\*</sup>

## ABSTRACT

The present study examined 1181 global publications in Nipah virus, as covered in multidisciplinary and bibliographic Scopus database during 1999-2018, with a view to understand their growth rate, global share, citation impact, international collaborative papers share, distribution of publications by broad subjects, productivity and citation profile of top organizations and authors, preferred media of communication and bibliographic characteristics of high cited papers. The global publications in Nipah virus registered an annual average growth rate of 16.23% and its citation impact averaged to 28.05 citations per paper. Among the 62 countries participating in global Nipah virus research, the top 10 more productive countries account together for more than 100% of its global research output and citation share. The individual global publication share of top 10 most productive countries varied widely 4.23% to 45.98% during 1999-2018, with USA accounting for the highest publication share (45.98%), followed by Australia (16.77%), Malaysia (11.09% share), and other 7 countries (from 4.23% to 7.96%) during 1999-2018. Four of top 10 countries scored relative citation index above the world average of 1.28: Malaysia (1.67), Australia (1.47), Bangladesh (1.41) and USA (1.37) during 1999-2018. The international collaborative papers share of top 10 most productive countries in Nipah virus research varied widely from 24.56% (India) to 88.46% (Bangladesh). Medicine, among various broad subjects, contributed the largest publications share of 59.97% to global Nipah virus research, followed by immunology and microbiology (42.51%), biochemistry, genetics and molecular biology (21.25%), agricultural and biological sciences (11.85%), and other 3 sub-fields contribution varying from 4.57% to 6.10% during 1999-2018. Among various organizations and authors contributing to global Nipah virus research, the 15 most productive global organizations and authors together contributed 65.11% and 48.69% global publication share and 99.15% and 89.29% global citation share respectively during 1999-2018. Amongst 1077 journal papers (in 410 journals) in global Nipah virus research, the top 20 most productive journals contributed 40.39% share of total journal publication output during 1999-2018. Seventy nine (79) publications were found to be high cited, as they registered citations from 101-793 during 1999-2018 and they together received 114880 citations, which averaged to 188.359 citations per paper.

**Key words:** Nipah virus, Virology, Infectious diseases, Global publications, Scientometrics, Bibliometrics.

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## INTRODUCTION

Nipah virus (NIPV) was first isolated from cerebrospinal fluid (CSF) specimens collected from encephalitic patients in Malaysia in 1999. Morphologic, serologic and genetic studies indicated that the virus was closely related to Hendra virus (HENV) isolated in 1994 in Australia and both viruses (non-segmented, negative-stranded RNA viruses) form the new Henipavirus genus within the Paramyxoviridae family.<sup>1</sup> Its name originated from Sungai Nipah, a village in the Malaysian Peninsula where pig farmers became ill with encephalitis.<sup>2</sup>

Nipah virus was first identified as a zoonotic pathogen after an outbreak involving severe respiratory illness in pigs and encephalitic disease in humans in Malaysia and Singapore in 1998 and 1999. Three years later, a genetically distinct NiV independently emerged in India as well as in Bangladesh, where human NiV

outbreak events have been reported nearly every year since. A putative NiV also caused an outbreak of disease in horses and people in the Philippines in 2014. To date, there is no reported evidence of NiV outbreaks in humans emerging in any other country than Malaysia, Singapore, Bangladesh, India and Philippines. More than 600 cases of NiV human infections have been reported globally. A total of 276 cases were reported with 106 fatalities (38%) in Malaysia, but case fatalities in later outbreaks in India and Bangladesh were associated with significantly higher case fatality rates of 43 to 100%.<sup>3</sup> From 1998 to 2015, more than 600 cases of Nipah virus human infections were reported. Subsequent outbreaks in India and Bangladesh have occurred with high case fatality.<sup>4</sup>

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Virus transmission from bats to humans occurs through inhalation, contact or consumption of NiV contaminated foods. NiV is transmitted by zoonotic (from bats to humans, or from bats to pigs and then to humans) as well as human-to-human routes. Human-to-human transmission is particularly notable in the outbreaks in India and Bangladesh, where it has been reported to account for 75% and 51% of cases, respectively. At present no vaccines or antiviral drugs are available for NiV disease and the treatment is just supportive. Current prevention strategies focus on raising disease awareness in affected areas.<sup>3</sup>

Nipah virus can cause a range of mild to severe disease in domestic animals such as pigs. Nipah virus infection in humans causes a range of clinical presentations, from asymptomatic infection (subclinical) to acute respiratory infection and fatal encephalitis. Infected people initially develop influenza-like symptoms of fever, headaches, myalgia (muscle pain), vomiting and sore throat. This can be followed by dizziness, drowsiness, altered consciousness and neurological signs that indicate acute encephalitis. Some people can also experience atypical pneumonia and severe respiratory problems, including acute respiratory distress. Encephalitis and seizures occur in severe cases, progressing to coma within 24 to 48 h. The case fatality rate is estimated at 40% to 75%; however, this rate can vary by outbreak depending on local capabilities for epidemiological surveillance and clinical management. Nipah is believed to be transmitted from what are called flying foxes or mega bats, so called because they are the largest bat species. They eat fruits and live in trees. These are a part of the old-world fruit bat family called pteropid bats. Bats often end up being reservoirs for a number of severe infectious diseases including Ebola, SARS coronavirus, Nipah and Hendra.<sup>5</sup>

The persistence and circulation of the virus within the bat population (*Pteropus* spp.) and the wide geographical range of the potential reservoirs from Madagascar to Australia, have great implications on human and animal public health, prophylaxis and health education measures.<sup>4</sup>

## Literature Review

So far only one bibliometric study on international contribution to Nipah virus research during 1999-2010 was conducted by Safahieh, Sanni and Zainab,<sup>6</sup> which examined 462 papers on Nipah virus research, with a focus on identifying active authors, institutions, countries and citations received. Data was extracted from SCI-Expanded database, (Web of Science) and analyzed using descriptive figures and tables. The active contributing countries were USA (with 41.0% share), followed by Australia (19.3%), Malaysia (16.0%), England (6.5%) and France (5.6%). The productive authors are mainly affiliated to the Centre for Disease Control and Prevention, USA and Commonwealth Scientific and Industrial Research Organization (CSIRO) in Australia and University of Malaya Medical Centre, Malaysia.

## OBJECTIVES

The present study examines the performance of global Nipah virus research during 1999-2018, based on publications output indexed in Scopus database. The study looks at the distribution of global publication output of the world and of 10 most productive countries, by document type and source type, growth rate of its annual and ten year output, the share of international collaborative publications of leading countries, broad subject-wise publication scatter across sub-fields, identification of significant keywords depicting trends in research, publication output and citation impact of top 15 global organizations and authors, identification of 20 significant journals and characteristics of its 79 high cited publications.

## MATERIALS AND METHODS

The publication data on Nipah virus research for the present study was derived from the Scopus database (<http://www.scopus.com>) covering the period 1999-2018. Keyword “Nipah virus” was searched in “TITLE-ABS-KEY” tag during the period 1999-2018 to get global publication data. This search string was applied first for searching global publication data on Nipah virus research and then further restricted to individual country by name in “country tag” one by one to ascertain publication output of top 10 most productive countries (including India) in Nipah virus research. The first search string was subsequently refined, using analytical tags in Scopus database, by “subject area tag”, “country tag”, “source title tag”, “journal title name” and “affiliation tag”, to get data/information on the distribution of publications output by subject, collaborating countries, author-wise, organization-wise and journal-wise, etc. For citation data, citations to publications were also collected from date of publication till 24 May 2018. The data for the study was collected on 24 May 2018. The data covered for 2018 was incomplete. A number of bibliometric indicators were used to measure the global performance of Nipah virus research.

## RESULTS

The global research output of the world in field of Nipah virus cumulated to 1181 publications in 20 years during 1999-2018. The annual output of the world in Nipah virus research increased from 9 in the year 1999 to 57 in 2017, registering 16.23% growth per annum. The research output in fact first increased from 9 to 106 in 2013 and the decreased to 57 in 2017. The cumulative world output in Nipah virus research in 10 years 1999-2008 increased from 458 to 723 publications during succeeding ten-year period 2009-18, registering 57.86% growth. Of the total global publications output, 58.51% (691) appeared as articles, 22.86% (270) as reviews, 4.40% (52) as book chapters, 3.73% (44) as conference papers, 3.05% (36) as editorials, 2.79% (33) as notes, 1.95% (23) as short surveys, 1.69% (20) as letters, 0.42% (5 each) as books and erratum, 0.02% (1) and 0.17% (2) as conference reviews. The citation impact of global publications on Nipah virus research in 20 years averaged to 28.05 citations per publication (CPP) during 1999-2018; its ten-yearly impact averaged to 46.83 CPP for the period 1999-2008, which sharply declined to 16.15 CPP in the succeeding ten-years 2009-2018 (Table 1).

### Top 10 Most Productive Countries in Nipah Virus.

The global research output in the field of Nipah Virus research had originated from 62 countries during 1999-2018, of which 46 published 1-10 papers each in 20 years, 7 countries 11-50 papers each, 6 countries 51-100 papers each, 2 countries 101-200 papers each and 1 county 1543 papers. The top 10 most productive countries in Nipah Virus have contributed 50 to 543 publications each during 1999-2018 (Table 2). The top 10 most productive countries in Nipah Virus research accounted for more than 100.0% (113.12%) global publication share and more than 100.0% (148.58%) citation share during 1999-2018. Their ten-yearly output accounted for more than 100.0% (104.15%) global publication share during 1999-2008 which increased to more than 100.0% (118.81%) during succeeding ten-year period 2009-18. Country-wise, the global publication share of top 10 countries varied widely 4.23% to 45.98% during 1999-2018, with USA accounting for the highest publication share (45.98%), followed by Australia (16.77%), Malaysia (11.09% share) and other 7 countries (from 4.23% to 7.96%) during 1999-2018. The global publication share registered a increasing publication share in USA (8.77%), France (5.16%), Bangladesh (3.63%), India (2.89%), Germany (1.64%), Singapore (1.57%), Canada (1.41%) and U.K. (0.10%), as against decrease in Malaysia (8.63%) and Australia (1.86) in ten years period (1999-2008 and 2009-18). Four of top 10 countries scored relative citation index

**Table 1: World Output in Nipah Virus, 1999-2018.**

Publication Period	World		
	TP	TC	CPP
1999	9	925	102.78
2000	33	2258	68.42
2001	35	2534	72.40
2002	38	1860	48.95
2003	35	1925	55.00
2004	65	3254	50.06
2005	56	2226	39.75
2006	61	2374	38.92
2007	59	1707	28.93
2008	67	2385	35.60
2009	73	2280	31.23
2010	75	2011	26.81
2011	57	1283	22.51
2012	90	2408	26.76
2013	106	1745	16.46
2014	80	974	12.18
2015	88	538	6.11
2016	78	365	4.68
2017	57	71	1.25
2018	19	4	0.21
1999-2008	458	21448	46.83
2009-18	723	11679	16.15
1999-2018	1181	33127	28.05

TP=Total Papers; TC=Total Citations; CPP=Citations Per Paper

above the world average of 1.28: Malaysia (1.67), Australia (1.47), Bangladesh (1.41) and USA (1.37) during 1999-2018.

### International Collaboration

The international collaborative output of top 10 most productive countries in Nipah Virus research as a national share in the country-wise output varied widely from 24.56% to 88.46% with highest share coming from Bangladesh (88.46%), followed by Australia (73.74%), Canada (72.22%), Singapore (70.0%), U.K. (61.54%), France (48.94%), USA (48.25%), Germany (46.97%), Malaysia (44.27%) and India (24.56%) during 1999-2018.

### Subject-Wise Distribution of Research Output

According to the Scopus classification, the global Nipah virus research output published during 1999-2018 is distributed across seven sub-fields, with medicine accounting for the highest publications share (50.97%), followed by immunology and microbiology (42.51%), biochemistry, genetics and molecular biology (21.25%), agricultural and biological sciences (11.85%), and other 3 sub-fields contribution varying from 4.57% to 6.10% during 1999-2018. Its activity index, which computes change in research activity in the discipline over time 1999-2008 to 2009-18 (world average activity index of a given subject is taken as 100), witnessed increase in immunology and microbiology (from 86.30 to 108.68), biochemistry, genetics and molecular biology (from 61.64 to 124.30), agricultural and biological sciences (from 64.47 to 122.51), pharmacology, toxicology and pharmaceuticals (from 59.86 to 125.43) and neurosciences (from 85.95 to 108.90), as against decline of research activity in medicine (from 103.23 to 97.95) and veterinary science (from 111.02 to 93.02) from 1999-2008 to 2009-18. Agricultural and biological sciences, among various subjects registered the highest citations impact per paper of 31.16 CPP, FOLLOWED BY immunology and microbiology (29.99), medicine (27.46), neurosciences (26.0) biochemistry, genetics and molecular biology (22.26), veterinary science (21.47) and pharmacology, toxicology and pharmaceuticals (13.59) during 1999-2018 (Table 3).

**Table 2: Global Publication Share of Top 10 Most Productive Countries in Nipah Virus during 1999-2018.**

S.No	Name of the Country	Number of Papers			Share of Papers			TC	CPP	HI	ICP	%ICP	RCI
		1999-2008	2009-18	1999-2018	1999-2008	2009-18	1999-2018						
1	USA	186	357	543	40.61	49.38	45.98	20872	38.44	75	262	48.25	1.37
2	Australia	82	116	198	17.90	16.04	16.77	8150	41.16	52	146	73.74	1.47
3	Malaysia	75	56	131	16.38	7.75	11.09	6119	46.71	38	58	44.27	1.67
4	France	22	72	94	4.80	9.96	7.96	2867	30.50	29	46	48.94	1.09
5	U.K.	35	56	91	7.64	7.75	7.71	3263	35.86	28	56	61.54	1.28
6	Germany	21	45	66	4.59	6.22	5.59	1714	25.97	20	31	46.97	0.93
7	India	14	43	57	3.06	5.95	4.83	893	15.67	14	14	24.56	0.56
8	Canada	17	37	54	3.71	5.12	4.57	1903	35.24	24	39	72.22	1.26
9	Bangladesh	10	42	52	2.18	5.81	4.40	2054	39.50	21	46	88.46	1.41
10	Singapore	15	35	50	3.28	4.84	4.23	1384	27.68	17	35	70.00	0.99
	Total	477	859	1336	104.15	118.81	113.12	49219	36.84	31.8	733		1.31
	World	458	723	1181				33127	28.05				
	Share of 10 Countries in World Total	104.15	118.81	113.12	40.61	49.38	45.98	20872	38.44	75	262	48.25	1.37

TP=Total Papers; TC=Total Citations; CPP=Citations Per Paper; HI=h-index; ICP=International Collaborative Papers; RCI=Relative Citation Index

**Table 3: Subject-Wise Breakup of Global Publications in Nipah Virus Research during 1999-2018.**

S. No	Subject*	Number of Papers (TP)			Activity Index		TC	CPP	%TP
		1999-2008	2009-18	1999-2018	1999-2008	2009-18			
1	Medicine	241	361	602	103.23	97.95	16533	27.46	50.97
2	Immunology and Microbiology	168	334	502	86.30	108.68	15057	29.99	42.51
3	Biochemistry, Genetics and Molecular Biology	60	191	251	61.64	124.30	5588	22.26	21.25
4	Agricultural and Biological Sciences	35	105	140	64.47	122.51	4363	31.16	11.85
5	Veterinary Science	31	41	72	111.02	93.02	1546	21.47	6.10
6	Pharmacology, Toxicology and Pharmaceutics	13	43	56	59.86	125.43	761	13.59	4.74
7	Neurosciences	18	36	54	85.95	108.90	1404	26.00	4.57
	World Output	458	723	1181					

- There is overlapping of literature covered under various subjects  
TP=Total Papers; TC=Total Citations; CPP=Citations Per Paper

### Profile of Top 15 Most Productive Global Organizations

Three hundred fifty four (354) organizations participated in global research on Nipah Virus during 1999-2018, of which 298 organizations contributed 1-10 papers each, 31 organizations 11-20 papers each, 18 organizations 21-50 papers each, 5 organizations 51-100 papers each and 2 organizations 101-118 papers each. The productivity of top 15 most productive global organizations in Nipah Virus research varied from 28 to 118 publications and together they contributed 65.11% (769) publication share and 99.15% (32844) citation share during 1999-2018. The scientometric profile of these top 15 organizations is presented in Table 4.

- **Five of these organizations** registered publications output greater than the group average of 51.27: CSIRO, Animal Health Laboratory, Geelong, Victoria, Australia (118 papers), Centre for Disease Control and Prevention, Atlanta, USA (113 papers), University of Malaya, Malaysia (73 papers), Uniformed Services University of Health Science, Bethesda, USA (65 papers) and National Institute of Health, Bethesda, USA (56 papers) during 1999-2018;
- **Seven organizations** registered citation impact above the group average of 42.71 citations per publication during 2008-17: University of Malaya, Malaysia (56.04), Centre for Disease Control and Prevention, Atlanta, USA (52.30), Queensland Department of Agriculture and Fisheries, Brisbane, Australia (47.77), CSIRO, Animal Health Laboratory, Geelong, Victoria, Australia (47.43), National Institute of Health, Bethesda, USA (46.50), Uniformed Services University of Health Science, Bethesda, USA (43.31) and Mount Sinai School of Medicine, New York, USA (43.03) during 1999-2018;
- **Six organizations** contributed international collaborative publications share above the group average of 56.91%: International Centre for Diarrheal Disease Bangladesh (97.44%), EcoHealth Alliance, New York, USA (85.71%), Queensland Department of Agriculture and Fisheries, Brisbane, Australia (80.65%), CSIRO, Animal Health Laboratory, Geelong, Victoria, Australia (78.81%), Centre for Disease Control and Prevention, Atlanta, USA (69.91%) and Uniformed Services University of Health Science, Bethesda, USA (69.23%) during 1999-2018

- **Seven organizations** registered the relative citation index above the group average (1.52) of all organizations: University of Malaya, Malaysia (2.0), Centre for Disease Control and Prevention, Atlanta, USA (1.86), Queensland Department of Agriculture and Fisheries, Brisbane, Australia (1.70), CSIRO, Animal Health Laboratory, Geelong, Victoria, Australia (1.69), National Institute of Health, Bethesda, USA (1.66), Uniformed Services University of Health Science, Bethesda, USA (1.54) and Mount Sinai School of Medicine, New York, USA (1.53) during 1999-2018

### Profile of Top 15 Most Productive Authors

Five Hundred Fifty six (556) authors participated in global research on Nipah Virus during 1999-2018, of which 494 authors contributed 1-10 papers each, 2 authors' 63-84 papers each. The research productivity in the field of Nipah Virus research of top 15 most productive authors varied from 27 to 84 publications. Together they contributed 48.69% (575) global publication share and 89.29% (29579) citation share during 1999-2018. The Scientometric profile of these 15 authors is presented in Table 5.

- **Four authors** registered publications output above the group average of 38.33: L.F. Wang (84 papers), C.C. Broader (63 papers), B. Lee (43 papers), P. Daszak (41 papers) during 1999-2018;
- **Five authors** registered impact above the group average of 51.44 citations per publication: K.B. Chua (123.56), T.G. Ksiazek (1101.42), P.E. Rollin (74.14), P.A. Rota (65.22) and G. Crameri (63.60) during 1999-2018
- **Eight authors** contributed international collaborative publications share above the group average of 70.43% of all authors: E.S. Gurley (97.22%), S.P. Luby (92.11%), G. Crameri (90.0%), L.F. Wang (85.71%), H.E. Field (81.82%), T.G.Ksiazek (80.56%), P. Daszak (78.05%), P.E. Rollin (71.43%) during 1999-2018;
- **Five authors** registered the relative citation index above the group average (1.83) of all authors: K.B. Chua (4.40), T.G. Ksiazek (3.62), P.E. Rollin (2.64), P.A. Rota (2.33) and G. Crameri (2.27) during 1999-2018.

**Table 4: Scientometric Profile of Top 15 Most Productive Global Organizations in Nipah Virus Research during 1999-2018.**

S. No	Name of the Organization	TP	TC	CPP	HI	ICP	%ICP	RCI
1	CSIRO, Animal Health Laboratory, Geelong, Victoria, Australia	118	5597	47.43	41	93	78.81	1.69
2	Centre for Disease Control and Prevention, Atlanta, USA	113	5910	52.30	40	79	69.91	1.86
3	University of Malaya, Malaysia	73	4091	56.04	31	30	41.10	2.00
4	Uniformed Services University of Health Science, Bethesda, USA	65	2815	43.31	30	45	69.23	1.54
5	National Institute of Health, Bethesda, USA	56	2604	46.50	24	26	46.43	1.66
6	University of Texas Medical Branch at Galveston, USA	54	1729	32.02	22	21	38.89	1.14
7	University of California at Los Angeles, David Geffen School of Medicine, USA	39	1636	41.95	20	9	23.08	1.50
8	International Centre for Diarrheal Disease Bangladesh	39	1597	40.95	19	38	97.44	1.46
9	INSERM, France	35	898	25.66	18	19	54.29	0.91
10	Mount Sinai School of Medicine, New York, USA	32	1377	43.03	16	12	37.50	1.53
11	Queensland Department of Agriculture and Fisheries, Brisbane, Australia	31	1481	47.77	20	25	80.65	1.70
12	University of Marburg, Germany	30	1103	36.77	15	14	46.67	1.31
13	EcoHealth Alliance, New York, USA	28	856	30.57	14	24	85.71	1.09
14	CNRS Centre Nationale de la Recherche Scientifique, France	28	646	23.07	10	11	39.29	0.82
15	Universiti Putra Malaya, Malaysia	28	504	18.00	12	7	25.00	0.64
	Total of 15 organizations	769	32844	42.71	22.13	453	58.91	1.52
	Total of World	1181	33127	28.05				
	Share of top 15 organizations in World total output	65.11	99.15					

TP=Total Papers; TC=Total Citations; CPP=Citations Per Paper; HI=h-index; ICP=International Collaborative Papers; RCI=Relative Citation Index

**Table 5: Scientometric Profile of Top 15 Most Productive Authors in Nipah Virus Research during 1999-2018.**

S.No	Name of the Author	Affiliation of the Author	TP	TC	CPP	HI	ICP	%ICP	RCI
1	L.F. Wang	CSIRO, Animal Health Laboratory, Geelong, Victoria, Australia	84	3902	46.45	34	72	85.71	1.66
2	C.C. Broader	Uniformed Services University of Health Science, Bethesda, USA	63	2653	42.11	28	43	68.25	1.50
3	B. Lee	University of California at Los Angeles, David Geffen School of Medicine, USA	43	1661	38.63	20	11	25.58	1.38
4	P. Daszak	Consortium for Conservation Medicine, New York, USA	41	1972	48.10	22	32	78.05	1.71
5	S.P. Luby	International Centre for Diarrheal Disease Bangladesh	38	1473	38.76	18	35	92.11	1.38
6	E.S. Gurley	International Centre for Diarrheal Disease Bangladesh	36	1385	38.47	18	35	97.22	1.37
7	T.G. Ksiazek	Centre for Disease Control and Prevention, Atlanta, USA	36	3651	101.42	26	29	80.56	3.62
8	H.E. Field	Animal Research Laboratory, Brisbane, Australia	33	707	21.42	21	27	81.82	0.76
9	P.A. Rota	Centre for Disease Control and Prevention, Atlanta, USA	32	2087	65.22	22	18	56.25	2.33
10	G. Crameri	CSIRO, Animal Health Laboratory, Geelong, Victoria, Australia	30	1908	63.60	23	27	90.00	2.27
11	H.C. Aquilar	University of California at Los Angeles, David Geffen School of Medicine, USA	28	1210	43.21	16	10	35.71	1.54
12	A. Maisner	University of Marburg, Germany	28	768	27.43	14	11	39.29	0.98
13	G.A. Marsh	CSIRO, Animal Health Laboratory, Geelong, Victoria, Australia	28	790	28.21	14	19	67.86	1.01
14	P.E. Rollin	Centre for Disease Control and Prevention, Atlanta, USA	28	2076	74.14	22	20	71.43	2.64
15	K.B. Chua	University of Malaysia, Malaysia	27	3336	123.56	20	16	59.26	4.40
	Total of 15 authors		575	29579	51.44	21.2	405	70.43	1.83
	Total of World		1181	33127	28.05				
	Share of top 15 authors in World total output		48.69	89.29					

TP=Total Papers; TC=Total Citations; CPP=Citations Per Paper; HI=h-index; ICP=International Collaborative Papers; RCI=Relative Citation Index

## Medium of Research Communication

Of the total world output on Nipah Virus research, 91.19% (1077) appeared in journals, 4.40% (50) in books, 3.81% (45) in book series and 0.59% (7) in conference proceedings publications during 1999-2018. 1077 journal papers appeared in 410 journals, of which 380 journals published 1-5 papers each, 13 journals 6-10 papers each, 14 journals 11-30 papers each, 2 journals 31-50 papers each and 1 journal 103 papers during 1999-2018. The top 20 most productive journals reported 9 to 33 papers each on Nipah Virus research; together they accounted for 40.39% (435 papers) of total Nipah Virus output published in journals during 1999-2018, shown increase from 35.27% to 43.81% share between 1999-2008 and 2009-18. The top ranking journal is *Journal of Virology* (with 103 papers), followed by *Emerging Infectious Diseases* (44 papers), *PLOS One* (37 papers), *Journal of General Virology* (25 papers), *PLOS Pathogens* (22 papers each), etc. during 1999-2018 (Table 6).

## Significant Keywords

Around 40 significant keywords have been identified from the literature which through light on the research trends in Nipah Virus research. These keywords are listed in Table 7 in the decreasing order of the frequency of their occurrence in the literature during 1999-2018.

## Highly Cited Papers

A total of 79 highly cited papers were identified in the nipah virus literature, each having 101 to 793 citations (56 papers each in citation range 101-200, 18 papers each in citation range 201-400, 3 papers in citation range 401-500 and 2 paper in citation range 667-793) in 20 years during 1999-2018. Together these 79 papers cumulated a total of 14880 citations, averaging 188.35 citations per paper. Of the 79 highly cited papers, 21 resulted from the participation of research organizations in their role as stand-alone (non-collaborating) institutional authors and remaining 58 from two or more research organizations working in their role as collaborating partners per paper (17 national collaborative and 41 international collaborative). Among 79 highly cited papers, the largest participation was seen from USA (52 papers), followed by the Australia (22 papers), Malaysia (17 papers), France (9 papers), U.K. (8 papers), Bangladesh (7 papers), Canada, Germany and Singapore (4 papers each), Ghana (3 papers), Cambodia, Canada, China, Denmark, Hong Kong, Madagasagar, Panama, South Africa, Sweden and Switzerland (2 papers each) and 14 other countries including India (1 paper each). These 79 highly cited papers involved the participation of 721 personal authors and 298 research organizations in total across globe. The leading organizations participating in high cited papers were: Centre for Disease Control and Prevention, Atlanta, USA (18 papers), CSIRO, Animal Health Laboratory, Geelong, Victoria, Australia (17 papers), University of Malaya (10 papers), Uniformed Services University of Health Science, Bethesda, USA (7 papers), University of California at Los Angeles, David Geffen School of Medicine, USA and International Centre for Diarrheal Disease Bangladesh (6 papers each), National Institute of Health, Bethesda, USA and Mount Sinai School of Medicine, New York, USA (5 papers each), University of Texas Medical Branch at Galveston, USA and Queensland Department of Agriculture and Fisheries, Brisbane, Australia (4 papers each), University of Marburg, Germany and EcoHealth Alliance, New York, USA (3 papers each), etc. The leading authors participating in high cited papers were: T.G. Ksiazek (13 papers), L. F. Wang (12 papers), K.B. Chua (10 papers), C.C. Broader, P.A. Rota, G. Cramer and P.E. Rollin (7 papers each), B. Lee (6 papers), S.P. Luby, E.S. Gurley and H.C. Aquilar (5 papers each), etc.

Of the 79 highly cited papers, 62 were published as article, 15 as review papers and 2 as conference papers. These 79 highly cited papers were published in 39 journals, with 13 papers in *Journal of Virology*, 11 papers

**Table 6: Top 20 Most Productive Journals in Nipah Virus Research during 1999-2018.**

S. No	Name of the Journal	Number of Papers		
		1999-2008	2009-18	1999-2018
1	Journal of Virology	33	70	103
2	Emerging Infectious Diseases	22	22	44
3	PLOS One	2	35	37
4	Journal of General Virology	8	17	25
5	PLOS Pathogens	2	20	22
6	Virology	11	10	21
7	Journal of Virological Methods	9	10	19
8	Virology Journal	7	11	18
9	Science	11	5	16
10	Virus Research	6	10	16
11	Current Opinion in Virology	0	13	13
12	Neurology Asia	2	11	13
13	Vaccine	2	11	13
14	Antiviral Research	2	10	12
15	Future Virology	2	10	12
16	Journal of Infectious Diseases	8	3	11
17	OIE Revue Scientifique Et Technique	7	4	11
18	Archives of Virology	5	5	10
19	Proceeding of NAS of USA	4	6	10
20	Microbes and Infection	9	0	9
	Total of 20 journals	152	283	435
	Total global journal output	431	646	1077
	Share of top 20 journals in global journal output	35.27	43.81	40.39

in *Emerging Infectious Diseases*, 5 papers in *Microbes and Infection*, 3 papers in *PLOS One*, *PLOS Pathogens*, *Proceeding of the NAS of USA* and *Science*, 2 papers each in *American Journal of Pathology*, *Annals of Neurology*, *Clinical Infectious Diseases*, *Journal of Comparative Pathology*, *Lancet*, *Nature* and *OIE Revue Scientifique Et Technique* and 1 paper each in 26 other journals.

## CONCLUSION AND SUMMARY

Research publications (1181 publications) on Nipah virus during the last 20 years (1999-2018) were derived from the Scopus database with a view to study its quantitative and qualitative bibliometric characteristics. The publication data showed that the annual output increased from 7 in 1999 to 106 in 2013 and the decreased to 57 in 2017, registering 16.23% annual growth. Its cumulative publication output in ten-years (1999-2008) increased from 458 to 723 publications during succeeding ten-year period 2009-18, registering 57.86% growth. Nipah virus global citation impact averaged to 28.05 citations per paper in 10 years, which decreased from 46.83 to 16.15 from 2008-12 to 2013-17.

Although global research output in the field of Nipah Virus research had originated from 62 countries, however, more than 100% of its global research output and citation share was from just top 10 most productive countries. The top 10 most productive countries global share individually varied widely 4.23% to 45.98% during 1999-2018, with USA accounting for the highest publication share (45.98%), followed by Australia (16.77%),

**Table 7: List of Significant Keywords in Literature on Global Nipah Virus Research during 1999-2018.**

S. No	Keyword	Frequency	S. No	Keyword	Frequency
1	Nipah Virus	930	21	SARS Coronavirus	84
2	Hendra Virus	360	22	Viral Encephalitis	79
3	Paramyxoviridae	346	23	Cercopithecus Aethiops	75
4	Hanipavirus Infection	302	24	Measles Virus	75
5	Virus Infection	250	25	West Nile Flavivirus	70
6	Paramyxovirus	234	26	Viruses	69
7	Virology	229	27	Virus Vaccine	63
8	Virus Transmission	204	28	HIV Virus	58
9	Bat	202	29	Rabies Virus	57
10	Zoonosis	194	30	Swine Diseases	55
11	Chiroptera	163	31	Influenza Virus	49
12	Virus Encephalitis	146	32	Coronavirus	48
13	Swine	142	33	Hantavirus	58
14	Genetics	120	34	Horse	48
15	Encephalitis	113	35	Escherichia Coli	47
16	Viral Antibodies	96	36	Japanese Encephalitis Virus	46
17	Virus Protein	94	37	Antiviral Activity	45
18	Severe Acute Respiratory Syndrome	91	38	West Nile Virus	44
19	Emerging Communicable Diseases	86	39	RNA Viruses	47
20	Ebola Virus	85	40	Dengue	40

Malaysia (11.09% share) and other 7 countries (from 4.23% to 7.96%) during 1999-2018. The global publication share of these top 10 countries showed increase in USA, France, Bangladesh, India, Germany, Singapore, Canada and U.K. (from 0.10% to 8.77%), as against decrease in Malaysia and Australia (from 1.86% to 8.63%) in ten years period (1999-2008 and 2009-18). Four of top 10 countries scored relative citation index above the world average of 1.28: Malaysia (1.67), Australia (1.47), Bangladesh (1.41) and USA (1.37) during 1999-2018. The international collaborative papers share of top 10 most productive countries in Nipah virus research varied widely from 24.56% (India) to 88.46% (Bangladesh). The other top 8 countries international collaborative publication share varied from 44.27% to 73.74% during 1999-2018.

Medicine was the most sought after subject area of Nipah virus research, accounting for (59.97%) the highest publications share, followed by immunology and microbiology (42.51%), biochemistry, genetics and molecular biology (21.25%), agricultural and biological sciences (11.85%), and other 3 sub-fields contribution varying from 4.57% to 6.10% during 1999-2018. Among broad subjects, the research activities registered increase immunology and microbiology, biochemistry, genetics and molecular biology, agricultural and biological sciences, pharmacology, toxicology and pharmaceuticals and neurosciences, as against decline of research activity in medicine and veterinary science from 1999-2008 to 2009-18. Agricultural and biological sciences, among various subjects, registered the highest citations impact per paper of 31.16 CPP, followed by immunology and microbiology (29.99), medicine (27.46), neurosciences (26.0) biochemistry, genetics and molecular biology (22.26), veterinary science (21.47) and pharmacology, toxicology and pharmaceuticals (13.59) during 1999-2018

354 organizations and 556 authors participated in global research on Nipah Virus during 1999-2018, of which the top 15 most productive research organizations and the authors collectively contributed 65.11%

and 48.69% global publication share and 99.15% and 89.29% global citation share respectively during 2008-17. The leading organizations in terms of publication productivity were: CSIRO, Animal Health Laboratory, Geelong, Victoria, Australia (118 papers), Centre for Disease Control and Prevention, Atlanta, USA (113 papers), University of Malaya, Malaysia (73 papers), Uniformed Services University of Health Science, Bethesda, USA (65 papers) and National Institute of Health, Bethesda, USA (56 papers) during 1999-2018. The leading organizations in terms of citation impact per paper were: University of Malaya, Malaysia (56.04), Centre for Disease Control and Prevention, Atlanta, USA (52.30), Queensland Department of Agriculture and Fisheries, Brisbane, Australia (47.77), CSIRO, Animal Health Laboratory, Geelong, Victoria, Australia (47.43), National Institute of Health, Bethesda, USA (46.50), Uniformed Services University of Health Science, Bethesda, USA (43.31) and Mount Sinai School of Medicine, New York, USA during 1999-2018. The leading authors in terms of publication productivity were: L.F. Wang (84 papers), C.C. Broder (63 papers), B. Lee (43 papers), P. Daszak (41 papers) during 1999-2018. The leading authors in terms of citation impact per paper were: K.B. Chua (123.56), T.G. Ksiazek (1101.42), P.E. Rollin (74.14), P.A. Rota (65.22) and G. Crameri (63.60) during 1999-2018.

The journals medium (1077 articles published in 410 journals) accounted for 91.19% global publications share in Nipah virus research with top 20 most productive journals accounting for 40.39% of total publications output in journals during 1999-2018. Journal of Virology contributed the largest number of papers (103 papers), followed Emerging Infectious Diseases (44 papers), PLOS One (37 papers), Journal of General Virology (25 papers), PLOS Pathogens (22 papers each), etc. during 1999-2018

Of the total Nipah virus global research output, 79 publications registered high citations, in the range of 101-793 citations per paper and collectively these highly cited papers received a total of 114880 citations,

averaging to 188.35 citations per paper. These 79 highly cited papers involved the participation of 721 personal authors and 298 research organizations and were published in 39 journals, with 13 papers in *Journal of Virology*, 11 papers in *Emerging Infectious Diseases*, 5 papers in *Microbes and Infection*, 3 papers in *PLOS One*, *PLOS Pathogens*, *Proceeding of the NAS of USA* and *Science*, 2 papers each in *American Journal of Pathology*, *Annals of Neurology*, *Clinical Infectious Diseases*, *Journal of Comparative Pathology*, *Lancet*, *Nature* and *OIE Revue Scientifique Et Technique* and 1 paper each in 26 other journals

WHO in collaboration and consultation with leading national and international experts and organizations and other key stakeholders is developing a Nipah Research and Development (RandD) Roadmap. The main purpose of this roadmap is to provide a framework for identifying the vision, underpinning strategic goals, and prioritizing areas and activities (from basic research to advanced development, licensure, manufacture and deployment) for accelerating the collaborative development of medical countermeasures (MCMs)—diagnostics, therapeutics, and vaccines—against Nipah virus infection. The RandD roadmap for NiV infection is a key component of the WHO RandD Blueprint initiative for accelerating research and product development of medical countermeasures to enable effective and timely emergency response to infectious disease epidemics. NiV is identified in the Blueprint's list of "priority pathogens" (defined as pathogens that are likely to cause

severe outbreaks in the near future and for which few or no MCMs exist). Other aspects of public health preparedness and response, in addition to RandD for MCMs, are critical to successful NiV infection prevention and control. Examples include enhanced surveillance systems, minimizing zoonotic NiV transmission, improved personal protective equipment (PPE), effective community engagement, adequate infection prevention and control practices, and workforce development and training in endemic and at-risk regions. Many of these issues are beyond the scope of the RandD roadmap, but need to be addressed as part of a broader public health control strategy.

## REFERENCES

1. Pierre RE. Nipah Virus Disease. In. *Emerging Infectious Diseases*. Clinical Case Studies. 2014;175-84. <https://doi.org/10.1016/B978-0-12-416975-3.00013-3>
2. Decoding the deadly Nipah virus by Preeti Zachariah. 2018. <http://www.thehindu.com/sci-tech/health/decoding-the-deadly-nipah-virus/article24011196.ece> (Accessed on 30 May 2018)
3. Denis M. NIPAH Baseline Situation Analysis. 2018. [http://www.who.int/blueprint/priority-diseases/key-action/WHO\\_NIPAH\\_baseline\\_situation\\_analysis\\_27Jan2018.pdf?ua=1](http://www.who.int/blueprint/priority-diseases/key-action/WHO_NIPAH_baseline_situation_analysis_27Jan2018.pdf?ua=1) (Accessed on 30 May 2018)
4. WHO. Nipah virus-Key Facts. 2018. <http://www.who.int/news-room/fact-sheets/detail/nipah-virus> (Accessed on 30 May 2018)
5. Centers for Disease Control and Prevention (CDS). Nipah Virus (NiV). 2014. <https://www.cdc.gov/vhf/nipah/index.html> (Accessed on 30 May 2018)
6. Safahieh H, Sanni SA, Zainab AN. International Contribution to Nipah Virus Research 1999-2010. *Malaysian Journal of Library and Information*. 2012;17(3):35-47.

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