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Research Article

Analysis Of Productivity Pattern Of Publications And Research Growth Of Icmr Institutes Of Pune, Maharashtra, India: A Scientometric Study From 2012-2021

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ABSTRACT

This paper presents a scientometric study of papers published by ICMR institutes of the Pune region of Maharashtra from 2012 to 2021. There are two institutes situated in Pune e.g. ICMR-National Institute of Virology and ICMR-National AIDS Research Institute. ICMR-NIV is engaged to work in viral diseases in humans and ICMR-NARI is working for research in HIV/AIDS. This analysis covers mainly the year-wise distribution of articles, year-wise papers published in the highest Impact Factor journals, total Impact Factor and Average Impact Factors of articles, papers published in Indian and Foreign journals, papers published in Indexed and Non-indexed journals, the highest number of papers published in journals and year wise authorship pattern etc. We also studied year-wise citations received by articles and the top ten articles received the highest number of citations during the period. We found that a total of 690 papers were published by ICMR-NIV and 489 papers were published by ICMR-NARI, Pune during the period 2012-2021. The publishing of number of the papers increased with the year by ICMR-NIV. Both institutes published the papers in the highest Impact Factor journals. NIV and NARI have sequentially a total of 3105 and 2545 Total impact factors in ten years. NIV has an average ten years impact factor of 5.24 whereas NARI has a 5.29 IF average of ten years. In this study, we observed that more than 70% of papers were published in foreign and indexed journals by both institutes. NIV and NARI scientists preferred to publish their papers in the Indian Journal of Medical Research (IJMR) in which approximately 15 and 7.7 percent of papers were published in IJMR and many more study is done in this research paper. Approximately NIV 631 papers out of 690 and NARI 405 papers out of 489 papers are indexed in Web of Science. NIV received 9648 citations and NARI received 9387 citations during the period. The article received the highest number of citations in the ten years studied and observed that the paper published by NIV author Chadha M in the Lancet in 2017 has the highest 882 citations and NARI author Godbole SV's paper published in the New England Journal of Medicine in 2016 had highest 5351citations during the period.

Keyword: Scientometrics Study, Research Growth, Impact Factors, Indexed and Non-Indexed Journals, Indian Council of Medical Research, Publications, ICMR-National Institute of Virology, Pune, ICMR-National AIDS Research Institute, Pune, India.

1. Introduction:

There are many institutes engaged in research in Public health. The Ministry of Health and Family Welfare is responsible for health policies in India. There are two departments e.g. Department of Health and Family

Welfare and the Department of Health Research, are working on health care including preventive medicine, awareness campaigns, public health, family welfare including reproductive health, pediatrics, health education etc. Indian Council of Medical Research is working under Department of Health Research and has 23 Institutes, 4 regional Medical Research Centres and 4 Centres under ICMR Institute (1). There are two ICMR institutes situated in Pune, ICMR-National Institute of Virology and ICMR-National AIDS Research Institute.

Research institutes publish their research in scientific journals, books, conference proceedings; patents etc. and these publications make scientific information publically available, and allow the scientists and academicians to evaluate the quality of the research. The study of research publications helps to know the research growth of any institute. There are two types of metrics used to measure the growth of publications e.g. bibliometric and scientometric analysis. Bibliometric analysis is the application of statistical methods to analyze the book and articles published in any subject whereas scientometric analysis studies all quantitative aspects of science and scientific research. Scientometric indicators help to measure and analyze scientific research publications of any subjects, institutes and journals etc. It is a quantitative study of science. It is an application of statistical and mathematical methods to know the growth of research.

Scientometrics can be defined as the "quantitative study of science", communication in science and science policy (2). There are three types of scientometric study which are Article-level metrics, Author-level metrics, and Journal-level metrics. Article-level metrics measure citations or downloads per article. This metric was first used by the Public Library of Science in 2009. Author-level metrics study the impact or output of the researcher/author in research. H-index, i-10-index, m-index, Author-level Eigenfactor etc. are used for Author-level metrics. Journal-level metrics are used to know the impact of academic journals in research. There are many Journal-level metrics like Scientific Journal Rankings (SJR), CiteScore, Journal Impact Factor, SNIP (Source Normalized Impact per Paper) etc. but most commonly Journal Impact Factor and Scientific Journal Rankings (SJR) are used as a most authentic source of journal evaluation. Scientometrics study includes articles published as original research, short communications, preliminary reports, review papers, Letters to the editor, book reviews etc.(3)

ICMR-National Institute of Virology, Pune was established in 1952 as Virus Research Centre under ICMR and the Rockefeller Foundation (RF), USA for the research in investigating the Arthropod Borne viruses. In 1967, the Rockefeller Foundation withdrew its support to the Virus Research Centre and then it was fully funded by the Indian Council of Medical Research, New Delhi. In 1978, the Virus Research Centre's name was changed to the National Institute of Virology. NIV has been working as a collaborating laboratory of the World Health Organization (WHO) since 1967. NIV is also working as the National Centre for Hepatitis and Influenza in India. ICMR-NIV is a WHO-designated National Influenza Centre (NIC) and has established the diagnostic test protocols for the nation. The research areas of NIV include COVID-19, cell repository, electron microscopy, rickettsioses, hepatitis, influenza and related viruses, clinical virology, biochemistry, virus registry, biostatistics etc. NIV has two campuses in Pune including three field units in Kerala, Bangalore and Mumbai (4).

The first case of HIV came in 1959 in the world and was identified in 1960. In India, the first case of HIV was detected in 1986 and started to spread widely in the country. There was no research institute engaged in research on HIV. An institute was opened in 1992 the named National AIDS Research Institute (NARI), Pune, Maharashtra under the Indian Council of Medical Research, Ministry of Health and Family Welfare, Government of India for the research in HIV/AIDS. The National AIDS Control Programme was supported by the NARI especially in the areas of surveillance, capacity building, laboratory services and drug resistance studies etc. More over NARI is an ART centre for research study for support to the National AIDS Control Organization (5). NARI has two clinics in Pune, one of them situated at the NIV campus, Pune and the other situated at Dr. Kotnis Dispensary, Gadikhana Clinic, Pune. These clinics have the facilities for pre and post-test counseling, clinical examination, pharmacy and a small laboratory to perform STD tests etc. NARI is a WHO Collaborating Centre for HIV Diagnosis and Monitoring of Anti-Retroviral Treatment. NARI conducted India's first HIV vaccine trial in two phases. Through these trials, NARI has a world-class facility to undertake vaccine trials.

2. Literature Review:

There are many similar studies has been done on scientometric study of publications of the institutes. Gomis etal (6) studied a scientometric analysis of global scientific literature on learning resources in higher education. He retrieved approximately 4489 data from Web of Science between 1970 and 2022. His study revealed that USA published highest number of significant research input and Salamin, N published highest number of research papers. The University of Illinois published highest number of papers from USA. Most of the papers were published on e-learning, Education, Academic libraries, Learning resources, and Cloud

computing etc. Keshava (7) studied the scientometric analysis of publication output of Tumkur University faculty based on SCOPUS database from 2005-2019. He used some parameters like year-wise distribution of articles, authorship pattern etc. and observed that maximum number of papers were published in 2015 and Prof. S.C. Sharma received highest citations during the period.

Kumar (8) studied research productivity of ARIES, Nainital in his paper and found that during the period 2001-2015, 574 research papers were published in which 510 papers are published in referred journals and 64 papers are published in conferences, symposiums, bulletins etc. He also studied the year-wise growth of papers, citations, H-Index, degree of collaboration, publication pattern etc. in his paper.

3. Objectives:

There are some objectives of this study is mentioned below:

- To know the year-wise growth of research publications published by ICMR-NIV and ICMR-NARI scientists from 2012 to 2021.
- To find out the highest Impact Factor journals in which papers were published by scientists of both Institutes.
- To find out the ranking of the top ten journals in which most papers were published by both institutes.
- To find out the collaborative authorship pattern of publishing research.
- To know the year-wise total impact factor, average impact factor and highest impact factor of journal articles published by ICMR-NIV and ICMR-NARI.
- To know the papers published in Indian and Foreign Journals by both institutes
- To find out the papers published in Indexed and Non-indexed Journals.
- To know the total number of citations received by NIV and NARI papers in ten years.
- To find out the highest number of citations received by the top ten articles during the period.

4. Use of Study:

The National Institute of Virology and National AIDS Research Institute both are a pioneer institute working for research in public health. This study will help to know the year-wise research productivity and growth of NIV and NARI in respect of research papers published in the journals during the period 2012 to 2021. This study will also help to know the research trend of the scientists in terms of interested area of the subject, preferred journals for publications, year-wise average impact factors of journal articles, authorship pattern, Citations per year etc.

5. Scope & Methodology:

This paper presents a scientometric study of papers published by ICMR institutes of the Pune region of Maharashtra from 2012 to 2021. This study will help to know the publishing research trend and research growth of both institutes. All the data is collected by consulting the Annual Report of both institutes published from 2011-2012 to 2020-2021 and personal visits to the Libraries. Other bibliographic databases PubMed and Web of Science are used to cross-verify the data using simple and advanced search options. Citations of the articles are taken out from the Web of Science database, retrieved on 15 April 2024 and downloaded in Excel form. Only research papers are included in this study. Book chapters, conference proceedings papers, patents; books, compendiums, edited books, abstracts published in journals and responses are not included in this study. All the collected data are organized in MS Excel and tabular form. All the graphs are prepared in MS excel and presented here. Scientometric methods are applied to assess the data according to the object and discuss the result in this paper to know the publishing of research trends and growth of both institutes.

6. Data Analysis and Interpretation of the Study:

6.1 Year-Wise Distribution of Articles:

Year wise number of papers is presented in Table 1 and Figure 1. The table shows that a total of 690 and 489 papers were published by NIV and NARI scientists during the period 2012-2021. The highest number of papers was published in 2021 with 119 papers followed by 81 papers in 2020; 71 papers in 2019 and many more by NIV Scientists. The highest number of NARI papers was published in 2021 with 92 papers followed by 53 papers in 2012 and 2015; 47 papers in 2013 etc. A graphical presentation regarding the publishing of papers by NIV and NARI is shown in Figure 1 below to see the number of published research papers.

Table 1: Year Wise No. of Articles Published by NIV & NARI Scientists

S.N.	Year	ICMR-NIV		ICMR-NARI	
		No. of Articles	Year Wise Percentages of Articles (%)	No. of Articles	Year Wise Percentages of Articles (%)
1.	2012	52	7.5	53	10.8
2.	2013	55	7.9	47	9.6
3.	2014	58	8.4	45	9.2
4.	2015	65	9.4	53	10.8
5.	2016	64	9.2	38	7.7
6.	2017	57	8.2	39	7.9
7.	2018	68	9.8	39	7.9
8.	2019	71	10.2	39	7.9
9.	2020	81	11.7	44	8.9
10.	2021	119	17.24	92	18.8
	Total	**690**		**489**	

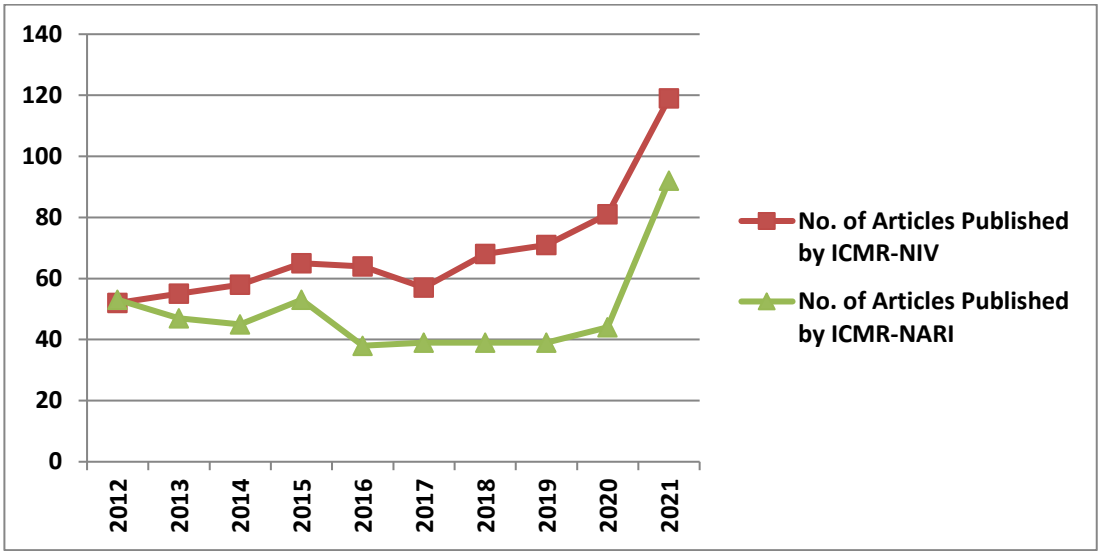

Figure 1: Year Wise No. of Articles Published by NIV & NARI Scientists

6.2 Year-Wise Papers Published in Highest Impact Factor Journals:

Table 2 shows the year-wise papers published in the highest impact factor journals and a number of papers published in those journals during the period 2012-2021. The papers published in the highest Impact Factor journals are Lancet (202.73) in 2021 by both the Institute NIV & NARI. After that articles were published in the Lancet (79.32) in 2020, the New England Journal of Medicine (59.55) in 2015, and the Lancet (53.25) in 2017 etc. The lowest impact factor journal in ten years was Emerging Infectious Diseases (5.99) in 2012. NARI papers were published in the highest Impact Factor journals New England Journal of Medicine (72.4) in 2016, again the New England Journal of Medicine (54.42) in 2013 and many more. The lowest Impact factor journal during the ten years is PloS One (11.04) in 2018. A graphical presentation of both institutes regarding year-wise highest impact factor journals is shown in Figure 2.

Table 2: Year Wise Papers Published in Highest Impact Factor Journals of NIV & NARI

Year	ICMR-NIV			ICMR-NARI		
	Highest IF	Name of the Journals	No. of Papers Published	Highest IF	Name of the Journals	No. of Papers Published
2012	5.99	Emerging Infectious Diseases	1	15.25	PLoS One	5
2013	7.32	Emerging Infectious Diseases	2	54.42	New England Journal of Medicine	1
2014	6.75	Emerging Infectious Diseases	2	22.43	Lancet Infectious Disease	1
2015	59.55	New England Journal of Medicine	1	13.58	PLoS One	4
2016	11.86	PLoS Med	1	72.40	New England Journal of Medicine	1
2017	53.25	Lancet	2	11.67	PLoS One	2
2018	14.87	Morbidity and Mortality Weekly Report	1	11.04	PLoS One	3
2019	15.87	Lancet Global Health	1	24.44	Lancet Infectious Disease	1
2020	79.32	Lancet	1	11.06	PLoS One	2
2021	202.73	Lancet	1	202.73	Lancet	1

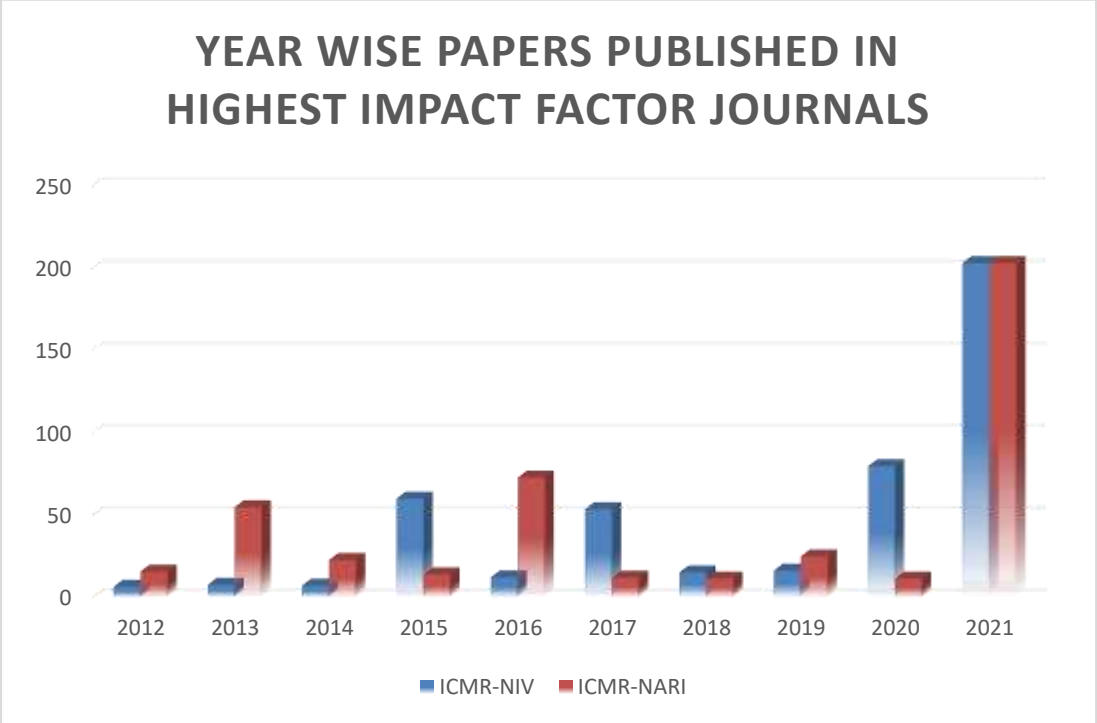

Figure 2: Year Wise Papers Published in Highest Impact Factor Journals of NIV & NARI

6.3 Year-wise total Impact Factor and Average Impact Factors of Articles:

Year-wise total papers with the highest Impact Factors, total Impact Factors and average impact factors published by NIV & NARI are shown in Table 3 and Figure 3. The table shows that the article published in 2021 is the highest Impact Factor journal during the year 2012-2021 by both institutes. It is explained above in Table 2 and Figure 2 in detail as well.

In NIV publications, the highest total impact Factor was in 2021 with a total IF of 1480.25, followed by 328.21 in 2020, 225.23 in 2015, 220.86 in 2017 and many more. As to NARI publications, the highest total impact factor was in 2021 with 1191.1; 2012 with 196.6 2013 with 176.1 etc.

Year wise highest average IF published by NIV scientists was in 2021 with 13.96 followed by 4.5 in 2017; 4.49 in 2020; 4.33 in 2015 etc. The lowest average IF was published in 2016 with 2.5 by the NIV scientists. Same as the year-wise highest average IF of NARI publications was published in 2021 with 14.8 followed by 5.6 in 2016; 5.1 in 2014; 4.6 in 2013 and 2019 etc. The lowest average IF was published in 2017 with 3.1 by the NARI scientists. To understand better, graphical presentations are shown in Figure 3 and Figure 4 in detail.

Table 3: Year Wise Total Impact Factor and Average Impact Factors of Articles

Year	ICMR-NIV				ICMR-NARI			
	Total Papers	Highest IF	Total IF	Average IF	Total Papers	Highest IF	Total IF	Average IF
2012	52	5.99	121.43	2.63	53	15.2	196.6	4.1
2013	55	7.32	121.78	2.76	47	54.4	176.1	4.6
2014	58	6.75	123.53	2.57	45	22.4	165.7	5.1
2015	65	59.55	225.23	4.33	53	13.5	132.9	3.6
2016	64	11.86	147.98	2.5	38	72.4	163.4	5.6
2017	57	53.25	220.86	4.5	39	11.6	95	3.1
2018	68	14.87	138.97	2.62	39	11	112.3	3.5
2019	71	15.87	196.77	3.17	39	24.4	147.9	4.6
2020	81	79.32	328.21	4.49	44	11	164	3.9
2021	119	202.73	1480.25	13.96	92	202.7	1191.1	14.8
	690		**3105**	**5.24**	489		**2545**	**5.29**

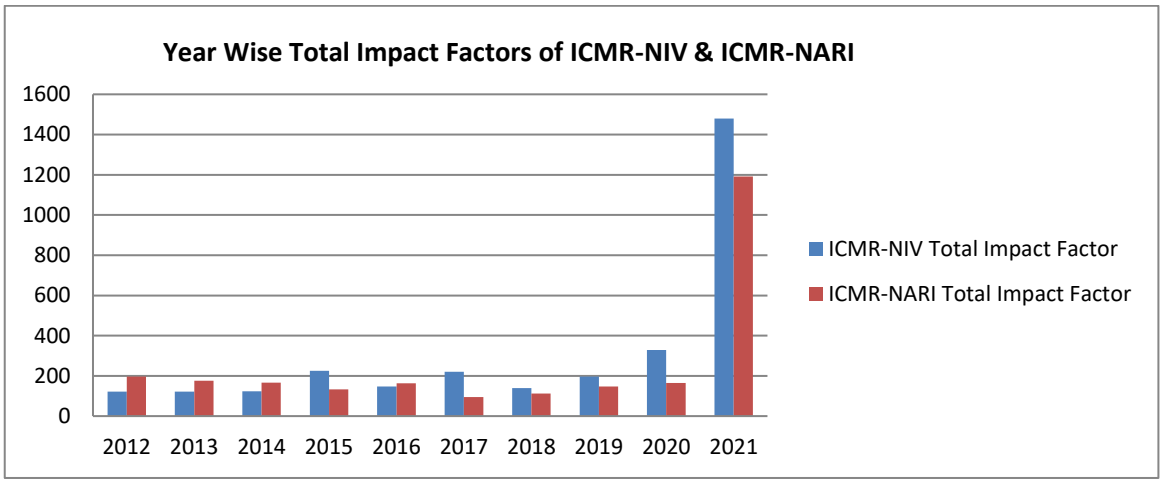

Figure 3: Year Wise Total Impact Factors of ICMR-NIV & ICMR-NARI

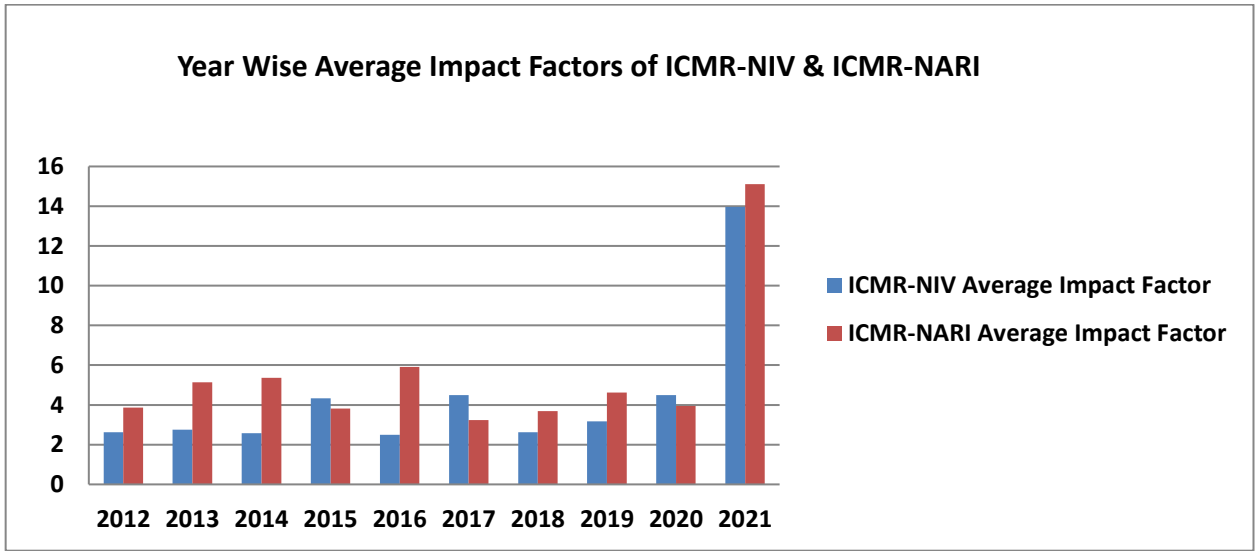

Figure 4: Year Wise Average Impact Factors of ICMR-NIV & ICMR-NARI

6.4 Publication of Papers based on Published in Indian and Foreign Journals:

Year-wise Papers published in Indian and foreign journals are included in this study. Data from Table 4 shows that a total of 492 papers (71.3%) out of 690 papers were published in foreign journals by NIV and a total of 398 papers (81.3%) out of 489 papers were published in foreign journals by NARI scientists. The highest 88.46% of papers were published in foreign journals in 2012 followed by 78.18% in 2013; 76.47 in 2018, 76.05 in 2019 etc. The lowest percentage of papers published in foreign journals was in 2020 with 54.32% by NIV.

The highest percentage of papers in foreign journals was published in 2017 (89.7%), followed by 2016 (89.4%); 2018 and 2019 (86.6%) etc. by NARI scientists. The lowest percentage of papers in foreign journals was published in 2020 (72.7%). A graphical representation is given in Figure 5 as a comparison between NIV & NARI regarding papers published in Indian and Foreign journals.

Table 4: Year Wise Papers Published in Indian and Foreign Journals

Year	ICMR-NIV					ICMR-NARI				
	Total Papers	Indian Journals	%	Foreign Journals	%	Total Papers	Indian Journals	%	Foreign Journals	%
2012	52	6	11.5	46	88.46	53	12	22.6	41	77.3
2013	55	12	21.81	43	78.18	47	10	21.2	37	78.7
2014	58	20	34.48	38	65.51	45	9	20	36	80
2015	65	26	40	39	60	53	14	26.4	39	73.5
2016	64	17	26.56	47	73.43	38	4	10.5	34	89.4
2017	57	17	29.82	40	70.17	39	4	10.2	35	89.7
2018	68	16	23.52	52	76.47	39	6	15.3	33	84.6
2019	71	17	23.94	54	76.05	39	6	15.3	33	84.6
2020	81	37	45.67	44	54.32	44	12	27.2	32	72.7
2021	119	30	25.21	89	74.78	92	14	15.2	78	84.7
Total	**690**	**198**	**28.6**	**492**	**71.3**	**489**	**91**	**18.6**	**398**	**81.3**

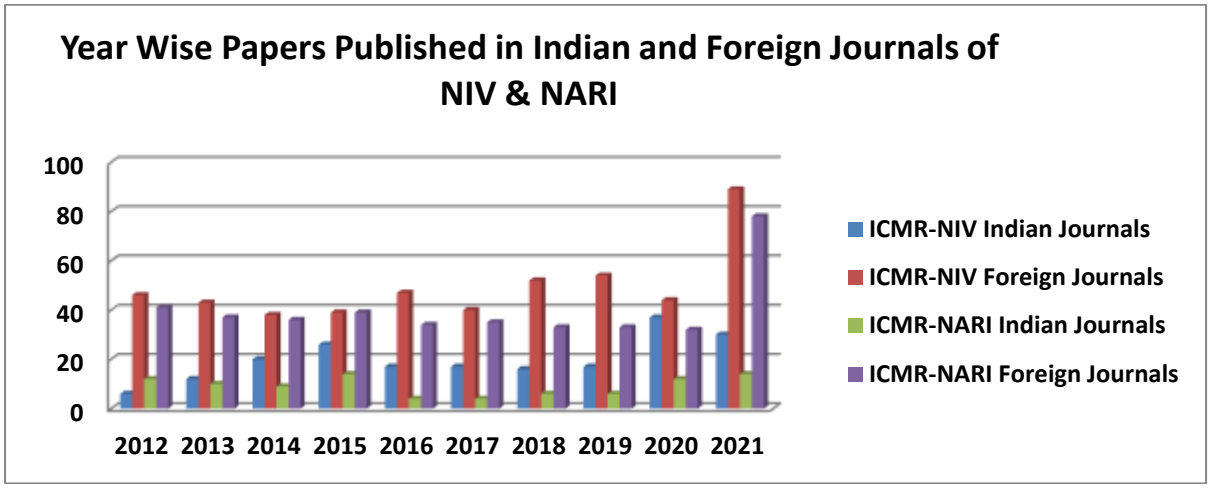

Figure 5: Year Wise Papers Published in Indian and Foreign Journals of NIV & NARI institute

6.5 Publication of Papers based on Published in Indexed and Non-indexed Journals:

Indexed and non-indexed papers published by NIV & NARI are shown in Table 5. It indicates that a total of 71.3% papers were published in indexed journals by NIV Scientists during the period 2012-2021. In other words a total of 492 papers out of 691 papers were published in ten years. Moreover, the highest percentage of papers in the foreign journal was published in 2012 (88.46%) thereafter in 2013 (78.18%); 2018 (76.47%) and many more. The lowest percentage of papers published in 2020 with 54.32% by NIV Scientists.

Table 5 shows that approx 465 papers out of 489 papers with 95% of papers published in indexed journals which highest percentage of papers published in 2012 at 98.1% followed by 2020 at 97.7%; 2019 at 97.4% etc. The lowest percentage of papers was published in 2015 with 86.7%. Only 4.9% of papers were published in non-indexed journals by NARI Scientists.

Table 5: Year Wise Papers Published in Indexed and Non-indexed Journals

Year	ICMR-NIV					ICMR-NARI				
	Total Papers	Indexed Journals	%	Non Indexed Journals	%	Total Papers	Indexed Journals	%	Non Indexed Journals	%
2012	52	46	88.46	6	11.53	53	52	98.1	1	1
2013	55	43	78.18	12	21.81	47	45	95.7	2	2
2014	58	38	65.51	20	34.48	45	42	93.3	3	3.2
2015	65	39	60	26	40	53	46	86.7	7	8
2016	64	47	73.43	17	26.56	38	37	97.3	1	1
2017	57	40	70.17	17	29.82	39	37	94.8	2	2.1
2018	68	52	76.47	16	23.52	39	37	94.8	2	2.1
2019	71	54	76.05	17	23.94	39	38	97.4	1	1
2020	81	44	54.32	37	45.67	44	43	97.7	1	1
2021	119	89	74.78	30	25.21	92	88	95.6	4	4.1
Total	**690**	**492**	**71.3%**	**198**	**28.6%**	**489**	**465**	**95%**	**24**	**4.9%**

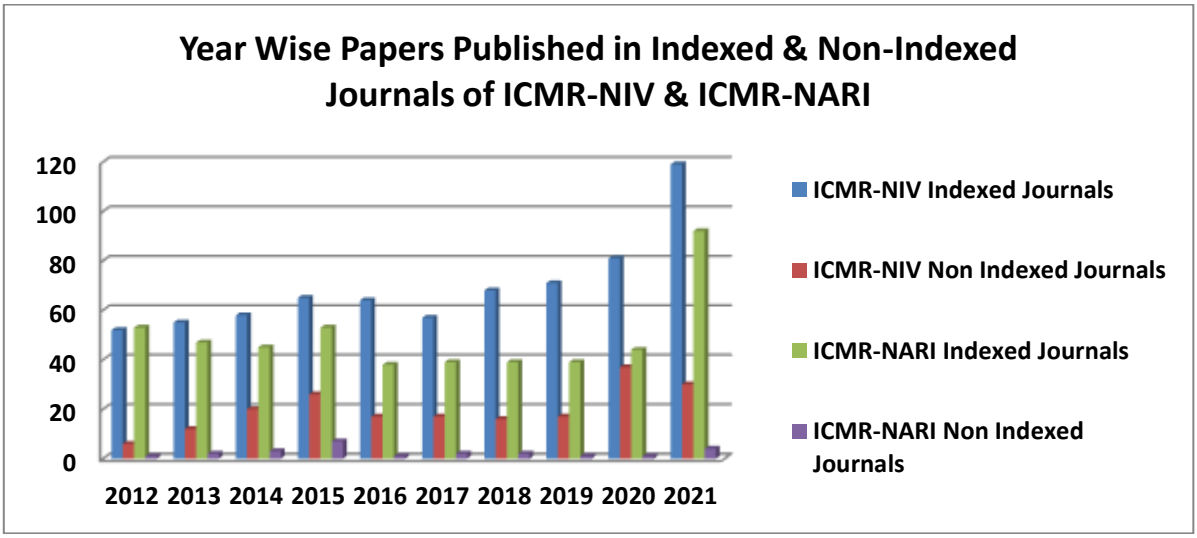

Figure 6: Year Wise Papers Published in Indexed & Non-Indexed Journals of ICMR-NIV & ICMR-NARI

6.6 Papers Published in Top Five Journals:

The highest number of papers preferred to publish in journals by NIV and NARI scientists are included in this study as well. Table 6 shows that approximately 15% and 7.7% of total papers were published in the Indian Journal of Medical Research by NIV & NARI Scientists. Journal of Medical Virology, Infection, Genetics and Evolution, Archives of Virology, Emerging Infectious Diseases, PLoS ONE, Virus Research etc. in the field of virology are preferred to publish their papers by NIV Scientists.

As Indian Journal of Medical Research was the most preferred journal in which a total of 38 papers out of 461 papers were published by NARI scientists. After that, PLoS One, AIDS Research and Human Retroviruses, Journal of Acquired Immune Deficiency Syndromes, BMC Public Health etc. were major journals in which papers were published by NARI Scientists.

Table 6: Papers Published in Top Ten Journals by NIV & NARI

S.N.	ICMR-NIV			ICMR-NARI		
	Name of the Journals	**No. of Articles**	**% of Papers**	**Name of the Journals**	**No. of Articles**	**% of Papers**
1.	Indian Journal of Medical Research	104	15	Indian Journal of Medical Research	38	7.7
2.	Journal of Medical Virology	30	4.34	PLoS One	29	5.9
3.	Infection, Genetics and Evolution	23	3.33	AIDS Research and Human Retroviruses	16	3.2
4.	Archives of Virology	18	2.6	Journal of Acquired Immune Deficiency Syndromes	14	2.8
5.	Emerging Infectious Diseases	18	2.6	BMC Public Health	10	2

6.7 Year Wise Authorship Pattern:

Authorship patter and author's collaboration for publishing of papers by NIV and NARI Scientists is shown in Table 7. The table indicates that out of 690 papers, 528 papers were published by more than three authors. In other words a total of 76.5% papers were published by more than three authors, 12.4% of papers by three authors, 9.2% of papers by two authors and 1.7% of papers by one author pattern was used by NIV Scientists. Same as a total of 405 papers out of 489 papers were published by more than three authors by NARI Scientists. A total of 82.8% of papers were published by more than three authors, 6.9% of papers by three and two authors and 3.2% of papers were published by one author. This shows that more than three authorship pattern for publishing papers are used by scientists of both institutes.

Table 7: Year Wise Authorship Pattern

Year	ICMR-NIV									ICMR-NARI								
	Total Papers	One Author	%	Two Author	%	Three Author	%	Four Author	%	Total Papers	One Author	%	Two Author	%	Three Author	%	Four Author	%
2012	52	1	1.9	5	9.6	9	17.3	37	71.1	53	2	3.7	2	3.7	6	11.3	43	81.1
2013	55	-	-	6	10.	7	12.7	42	76.3	47	4	8.5	3	6.3	2	4.2	38	80.8
2014	58	3	5.1	7	12	7	12	41	70.6	45	-	-	2	4.4	2	4.4	41	91.1
2015	65	1	1.5	7	10.7	11	16	46	70.7	53	4	7.5	2	3.7	3	5.6	44	83
2016	64	3	4.6	9	14	14	21.8	38	59.3	38	-	-	6	15.77	2	5.2	30	78.9
2017	57	1	1.7	7	12	11	19.2	38	66.6	39	2	5.1	2	5.1	2	5.1	33	84.6
2018	68	-	-	4	5	9	13.2	55	80.8	39	1	2.5	3	7.6	2	5.1	33	84.6
2019	71	-	-	5	7	4	5.6	62	87.3	39	-	-	2	5.1	1	2.5	36	92.3
2020	81	2	2.4	8	9.8	6	7.4	65	80.2	44	2	4.5	3	6.8	4	9.0	35	79.5
2021	119	1	0.8	6	5	8	6.7	104	87.3	92	1	1	9	9.7	10	10.8	72	78.2
	690	**12**	**1.7**	**64**	**9.2**	**86**	**12.4**	**528**	**76.5**	**489**	**16**	**3.2**	**34**	**6.9**	**34**	**6.9**	**405**	**82.8**

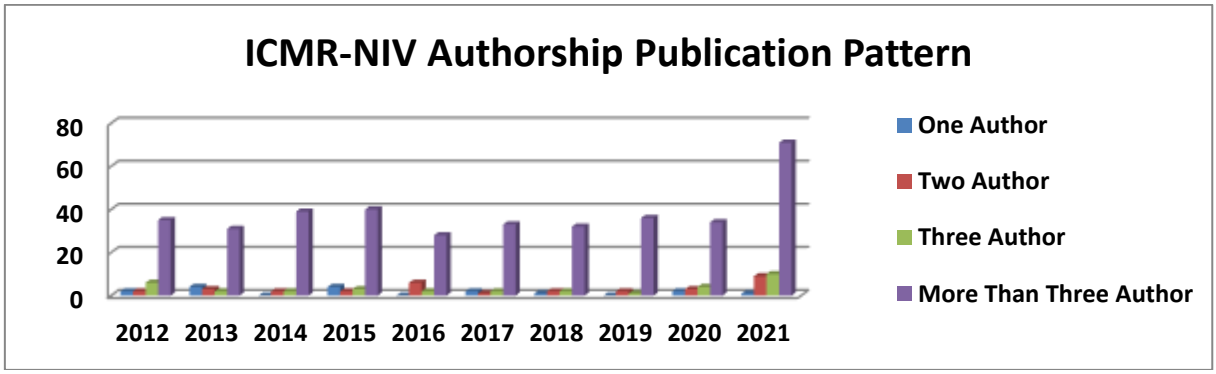

Figure 7: ICMR-NIV Year Wise Authorship Pattern

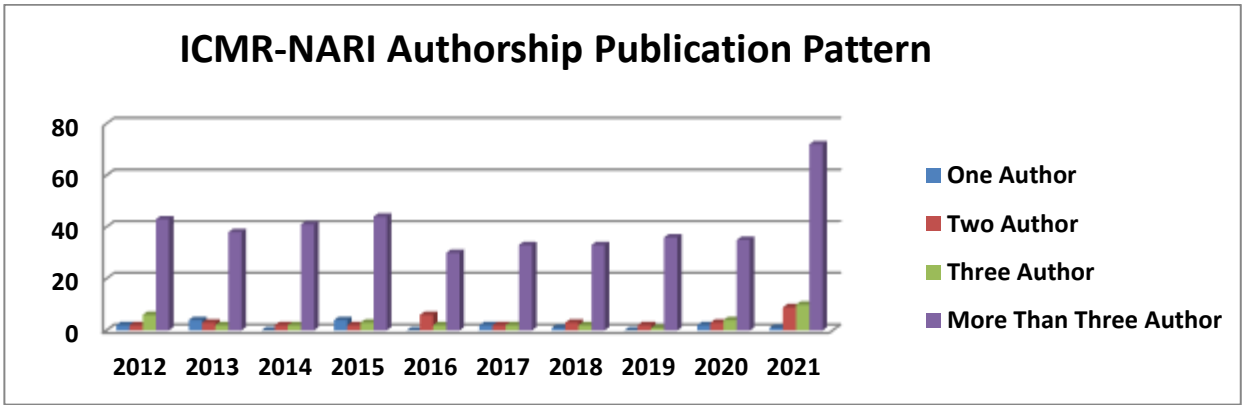

Figure 8: ICMR-NARI Year Wise Authorship Pattern

6.8 Year-wise Citations per Article:

Year-wise citations per article received during the period have been studied in this paper. The citation data was collected from the Web of Science database and retrieved on 15 April 2024. In this study, we observed that a total of 631 articles of NIV and 405 articles of NARI are indexed in WOS and received sequentially 9648 and 9387 citations during the period. NIV received the highest 2592 citations in the year 2017 and NARI received the highest 5648 citations in the year 2016. The average of articles per citation is 15.2 and 23.1 citations published by NIV and NARI scientists as shown in Table 8. H-Index of NIV and NARI is 41 and 27 during the period 2012-2021.

Table 8: Year-wise citations per articles

S.N.	Year	ICMR-NIV			ICMR-NARI		
		Total Articles	Total Citations Received	Average of Citations per Articles	Total Articles	Total Citations Received	Average of Citations per Articles
1.	2012	52	1543	29.6	50	660	13.2
2.	2013	43	1184	27.5	47	565	12
3.	2014	60	1553	25.8	36	639	17.7
4.	2015	56	1293	23	35	516	14.7
5.	2016	68	1022	15	34	5648	166.1
6.	2017	52	2592	49.8	31	309	9.9
7.	2018	58	2004	34.5	30	138	4.6
8.	2019	66	895	13.5	37	275	7.4
9.	2020	74	1225	16.5	51	329	6.4
10.	2021	102	1979	19.4	54	308	5.7
Total		**631 Articles**	**9648 Citations**	**15.2 Citations per Articles**	**405 Articles**	**9387 Citations**	**23.1 Citations per Articles**

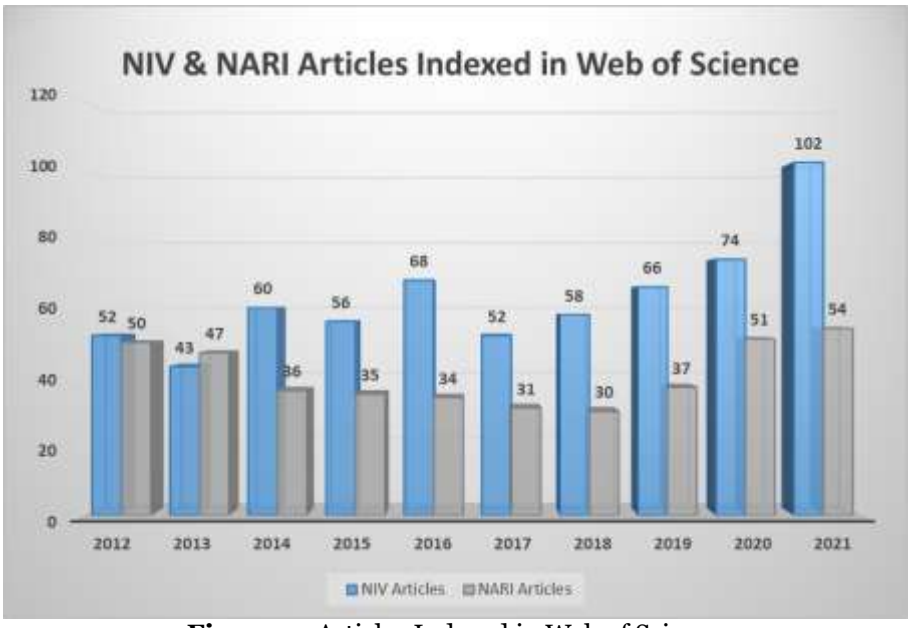

Figure 9: Articles Indexed in Web of Science

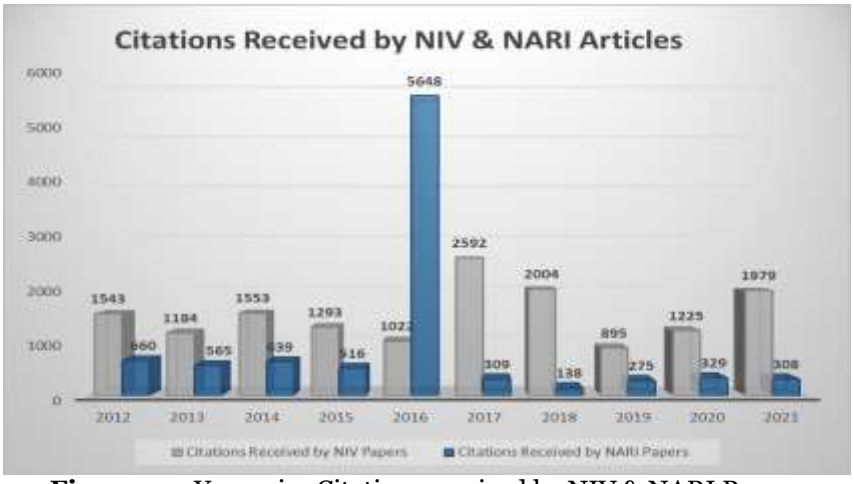

Figure 10: Year-wise Citations received by NIV & NARI Papers

6.9 Top Ten Articles Received the Highest Number of Citations:

Table 9 shows the highest number of citations received by the top ten papers published by NIV scientists. The top three articles receiving the most citations were published in the Lancet journal in 2017 by Chadha M, which received 882 citations, while the articles published in 2018 received 860 citations and the 2017 papers received 256 citations. All the top ten papers were published in high-impact factor journals like Lancet, Nature, PLOS Medicine, PLOS One, Lancet Infectious Diseases etc. Five papers published by Chadha M received the most citations among the top ten papers. The bibliographic details with Authors and citations are given in Table 9 below.

Table 9: Top Ten NIV Articles Received Highest Number of Citations during the Period 2012-2021

S.N.	Article Details	Name of the Journals	Name of the NIV Authors	Years	Highest Citations
1.	Shi T etal. Global, regional, and national disease burden estimates of acute lower respiratory infections due to respiratory syncytial virus in young children in 2015: a systematic review and modelling study. Lancet. 2017 Sep 2;390(10098):946-958.	Lancet	Chadha M	2017	882
2.	Iuliano AD etal. Estimates of global seasonal influenza-associated respiratory mortality: a modelling study. Lancet. 2018 Mar 31;391(10127):1285-1300.	Lancet	Chadha M	2018	860
3.	India State-Level Disease Burden Initiative Collaborators. Nations within a nation: variations in epidemiological transition across the states of India, 1990-2016 in the Global Burden of Disease Study. Lancet. 2017 Dec 2;390(10111):2437-2460.	Lancet	Tandale BV	2017	256
4.	Bedford T etal. Global circulation patterns of seasonal influenza viruses vary with antigenic drift. Nature. 2015 Jul 9;523(7559):217-20.	Nature	Chadha M, Potdar V	2015	248
5.	Lafond KE, etal. Global Role and Burden of Influenza in Pediatric Respiratory Hospitalizations, 1982-2012: A Systematic Analysis. PLoS Med. 2016 Mar 24;13(3):e1001977.	PLOS Medicine	Chadha M	2016	195
6.	Ella R etal. Safety and immunogenicity of an inactivated SARS-CoV-2 vaccine, BBV152: a double-blind, randomised, phase 1 trial. Lancet Infect Dis. 2021 May;21(5):637-646.	Lancet Infectious Diseases	Sapkal G, Yadav P, Abraham P	2021	125
7.	Apte-Deshpande A etal. Serratia odorifera a midgut inhabitant of Aedes aegypti mosquito enhances its susceptibility to dengue-2 virus. PLoS One. 2012;7(7):e40401.	PLoS One	Gokhale MD	2012	109
8.	Saha S etal. Influenza seasonality and vaccination timing in tropical and subtropical areas of southern and south-eastern Asia. Bull World Health Organ. 2014 May 1;92(5):318-30.	Bulletin of the World Health Organization	Chadha M, Mishra A	2014	109
9.	Dash AP, Bhatia R, Sunyoto T, Mourya DT. Emerging and re-emerging arboviral diseases in Southeast Asia. J Vector Borne Dis. 2013 Apr-Jun;50(2):77-84.	Journal of Vector Borne Diseases	Mourya DT	2013	87
10.	Rao CD etal. Antigenic diversity of enteroviruses associated with nonpolio acute flaccid paralysis, India, 2007-2009. Emerg Infect Dis. 2012 Nov;18(11):1833-40.	Emerging Infectious Diseases	Yergolkar P	2012	86

Table 10: Top Ten NARI Articles Received Highest Number of Citations during the Period 2012-2021

S.N.	Article Details	Name of the Journals	Name of the NIV Authors	Years	Highest Citations
1.	Cohen MS etal. Antiretroviral Therapy for the Prevention of HIV-1 Transmission. N Engl J Med. 2016 Sep 1;375(9):830-9.	New England Journal of Medicine	Godbole SV	2016	5351
2.	Grinsztejn B etal. Effects of early versus delayed initiation of antiretroviral treatment on clinical outcomes of HIV-1 infection: results from the phase 3 HPTN 052 randomised controlled trial. Lancet Infect Dis. 2014 Apr;14(4):281-90.	Lancet Infectious diseases	Godbole SV	2014	320
3.	Klionsky DJ etal. Guidelines for the use and interpretation of assays for monitoring autophagy (4th edition)1. Autophagy. 2021 Jan;17(1):1-382.	Autophagy	Mukherjee A	2021	176
4.	Rhee SY etal. Geographic and temporal trends in the molecular epidemiology and genetic mechanisms of	PLoS Medicine	Paranjape RS	2015	168

	transmitted HIV-1 drug resistance: an individual-patient- and sequence-level meta-analysis. PLoS Med. 2015 Apr 7;12(4):e1001810.				
5.	Chatterjee P etal. Healthcare workers & SARS-CoV-2 infection in India: A case-control investigation in the time of COVID-19. Indian J Med Res. 2020 May;151(5):459-467.	Indian Journal of Medical Research	Panda S	2020	115
6.	Campbell TB etal. Efficacy and safety of three antiretroviral regimens for initial treatment of HIV-1: a randomized clinical trial in diverse multinational settings. PLoS Med. 2012;9(8):e1001290.	PLoS Medicine	Tripathy S	2012	97
7.	Walensky RP etal. Cost-effectiveness of HIV treatment as prevention in serodiscordant couples. N Engl J Med. 2013 Oct 31;369(18):1715-25.	New England Journal of Medicine	Godbole SV	2013	92
8.	Murhekar MV etal. Prevalence of SARS-CoV-2 infection in India: Findings from the national serosurvey, May-June 2020. Indian J Med Res. 2020 Jul & Aug;152(1 & 2):48-60.	Indian Journal of Medical Research	Panda S	2020	82
9.	Kalokhe A, Del Rio C, Dunkle K, Stephenson R, Metheny N, Paranjape A, Sahay S. Domestic violence against women in India: A systematic review of a decade of quantitative studies. Glob Public Health. 2017 Apr;12(4):498-513.	Global Public Health	Sahay S	2017	63
10.	Thio CL etal. Characterization of HIV-HBV coinfection in a multinational HIV-infected cohort. AIDS. 2013 Jan 14;27(2):191-201.	AIDS	Kulkarni S	2013	62

Same as Table 10 demonstrates the top ten papers received the highest number of citations, published by NARI scientists and observed that Godbole SV papers published in the New England Journal of Medicine in 2016 received highest 5351 citations during the period and other articles are shown in Table 10 in detail above.

7. Findings & Discussion:

In this study there are some findings discussed below:

- In this study we observed that a total of 690 and 489 papers were published by NIV and NARI during the period 2012-2021. We found that the paper publishing graph is increasing with years by NIV and NARI has some fluctuation in the graph as we see in Figure 1.
- The highest numbers of papers were published in 2021 with 119 articles and the lowest numbers of papers was published in 2012 with 52 articles by NIV scientists. Same as highest number of papers was published in 2021 with 92 articles and lowest numbers of papers were published in 2016 with 38 articles by NARI scientists. We found that the number of published papers has doubled from 2012 to 2021 by both institutes.
- We also observed that both institutes published their papers in the highest impact factor journal Lancet with 202.73 IF in 2021 and lowest impact factor journal in Emerging Infectious Diseases (5.99 IF in 2012) by NIV and PLoS One (11.06 IF in 2020) by NARI.
- A total Impact Factor and average Impact Factors of articles are studied and observed that 3105 IF and 2545 IF are the total Impact factors of articles published by NIV and NARI. The average Impact Factor of ten years is 5.24 and 5.29 of papers of NIV and NARI during the year 2012-2021.
- The highest total IF of the articles was in 2021 with 1480.25 of NIV and 1191.1 of NARI. The lowest total IF of the articles was in 2012 with 121.43 of NIV and 95 IF was in 2017 of NARI.
- The highest Average IF of the articles was in 2021 with 13.96 and the lowest Average IF was 2.5 in 2016 NIV papers. Same as highest Average IF of the articles was in 2021 at 14.8 and the lowest Average IF was 3.1 in 2017 NARI papers. All data is explained in a comparative graph is shown in Figure 3 & 4.
- In this study we found that most of the papers were published in foreign journals by the scientists of NIV & NARI institute. We observed that a total of 492 papers (71.3%) out of 690 papers were published in foreign journals by NIV and that a total of 398 papers (81.3%) out of 489 papers were published in foreign journals by NARI.
- We found that the total contribution of papers in indexed journals is 492 out of 690 papers which are approx 71.3% of total papers published by NIV Scientists. Alike total contribution of papers in indexed journals published by NARI scientists is 465 out of 489 papers which are approximately 95% of total papers. Thus both the institutes published more than 70% of total papers in foreign journals.
- Indian Journal of Medical Research is the most preferred journal in which approximately 15% and 7.7% of papers were sequentially published by NIV and NARI scientists.
- The authorship pattern of papers publishing is studied in this research and observed that there are 76.5% of papers were published by More Than Three Authors by NIV scientists and 82.8% of papers were published by More Than Three Authors by NARI scientists. After that Three Authorship pattern and Two Authorship patterns were used by both institute NIV and NARI Scientists that shows the publishing trend of authorship pattern is more than three authors as Jie, Hui-Jie and Zhen (9) also found in his paper.
- Citation received by NIV and NARI articles are studied in this paper and found that approximately NIV 631 and 405 articles are indexed in WOS and received 9648 and 9387 citations during the period. It is also

observed that NIV received 15.2 citations per articles and NARI received 23.1 citations per articles as shown in Table 8 in detail.

- Top ten articles that received the highest number of citations are studied in this paper and found that Chadha M's paper published in the Lancet journal in 2017 received the highest 882 citations and Godbole SV's paper published in the New England Journal of Medicine in 2016 received 5351 citations during the ten years 2012 to 2021.

8. Conclusion:

Scientists and researchers in research institutes are engaged to discover new things for the development of the Nation. The National Institute of Virology and National AIDS Research Institute are established by ICMR in the Pune region. The papers published by both institutes are taken for the study. Scientometric methods are used to know the research productivity of both institutes. In this paper, we found that a total of 690 and 489 research papers were published by NIV and NARI Scientists and per year the number of publishing of papers is increased over the year. Both institutes published their papers in the highest IF factor journals like Lancet, New England Journal of Medicine, Lancet Global Health, Lancet Infectious Disease etc. The Total IF and Average IF is increased over the year as the total IF from 2012 to 2021 increased from 121.43 to 1480.25 of NIV and from 196.6 to 1191.1 of NARI. This shows the continues active research growth of both institutes. Both institutes published more than 70% of their papers in foreign and Indexed journals. Indian Journal of Medical Research is the most preferred journal by NIV and NARI Scientists. Scientists preferred to publish their papers in foreign-indexed journals with Impact Factors. More than 75% of papers were published by more than three authors show the collaborative author pattern used by both institutes indicate the increasing trend of research through collaboration. Approximately 631 NIV articles are indexed in WOS and received 9648 citations and the Average of Citations per Article is 15.2 for NIV papers. The same as 405 NARI articles are indexed in WOS and received 9387 citations and 23.1 citations per article during the period 2012-2021.

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