

RESEARCH OUTPUT ON NOROVIRUS: A SCIENTOMETRIC ANALYSIS DURING 2010 TO 2019

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Abstract—The study examines on norovirus research in which vast numbers of articles published in the different regions of world during 2010 -2019 based on the database of wob of science. The visualization of this study was to execute a scientometric analysis of all published articles by researchers in globally. As such, the articles can help to all the users for rereading. This study approved depends on several seientometric pointers explained through five numbers of tables and three numbers of figures, such as Main information, Annual total citations per year, Author impact citations, Author productions over time and Author productions over time documents and for figures, (a) Yearly productions (b) Country productions, most cited countries, and Most cited Sources etc. Results of this analysis, most references (61509), Keywords Plus (5110), Author Appearances (27166), Single-authored documents in author's collaborative work (160) were found on noro virus research. The findings were identified the highest numbers of articles (554) from 2017, most productive author of by Vinje J, highest document types published for articles (4240), topmost contribution counties by USA (3770), Average Article Citations also (28.74%). Topmost (12.00%) average cited source by two journals (Journal of virology and Appl Environ Microbiology). These papers found about various aspects of the appearances and outlines of contributions of the study on research.

Keywords—Caliciviridae, Gastroenteritis, Norovirus, Scientometric, Virology.

INTRODUCTION

In 19–21 million U.S. citizens a year, norovirus causes gastroenteritis. Their yearly hospitalizations and fatalities in the United States are 56 000-71,000 people and 570-800 people per year. In winter it is more prevalent, although it may also influence individuals at any time of year. Sometimes people misunderstand the name "stomach flu" as an illness with norovirus (Markus MacGill 2017; Atmar, R. L., & Estes, M. K. (2001). The medical word gastroenteritis is not related to grip. Norovirus is an infection in the respiratory system causing vomiting, diarrhoea, and fever. It is not an influenza grip. Norovirus belongs to the Virus Family of Caliciviridae. People may acquire the virus by ingesting infected food or water. Norovirus spreads via faeces and vomits from infected humans and animals. Noroviruses can hardly be removed since they may live in warm and cold conditions. It may cause vomiting, diarrhoea, stomach pains, fever, and headaches. Norovirus is an antibody. Norovirus symptoms are comparable to cold- and flu-bug symptoms. Nausea, speaking, stomach pain, diarrhoea and tiredness are symptoms of this disease (Markus MacGill 2017; De Wit, M. A. S., Koopmans, M. P. G., Kortbeek, L. M., Wannet, W. J. B., Vinje, J., Van Leusden, F., & Van Duynhoven, Y. T. H. P. (2001). Diarrhea symptoms typically last 1-3 days and occur 12 to 48 hours after first infection. The virus may continue spread to the faeces and vomit for 2 or more weeks after symptoms have been gone. The CDC recommends that you remain at home if you feel uncomfortable. People with norovirus should consume a light diet made up of easy-to-digest foods. People who cannot consume sufficient fluids with dehydration may need to get fluids intravenously (Markus MacGill 2017). It may be helpful for some to take oral rehydration fluids. Individuals with weaker immune systems, individuals who have had an organ transplantation, and persons living with HIV may be at an increased risk of acquiring norovirus (Hale, A., Mattick, K., Lewis, D., Estes, M., Jiang, X., Green, J., & Brown, D. (2000). The Department of Health and Human

Services say the following are major causes: contaminated food, cosy fish, ready to eat meals, ice cream, cookies, fruit and sandwiches. Norovirus is the most frequent cause of infections with human Norovirus (Markus MacGill 2017).

This word is becoming more common and used to define scientific studies since Vassily V. Nalimov created the term 'scientometrics' in the sixties, including growth, structure, interconnections, and productivity (Nalimov, Vasily Vasilevich; Mul'chenko, Z. M. (1969). Scientometrics is associated with bibliometrics and information and has overlapping interests. The scientometric analysis is used to objectively map the scientific field of knowledge, whereas the critical evaluation attempts, based on scientific findings, to identify research topics and problems (Sivakalai, S 2020;2021; sivasekaran, K 2021).

METHODOLOGY

This study is based on the scientific productions in norovirus as reflected in Social Science Citation Index (SSCI), Science Citation Index (SCI), and Arts and Humanities Citation Index (A&HCI). The time period considered in this study is from 2010 to 2019. A search was carried out in WOS database to get an overall picture of the size of the scientometric literature. SSCI, SCI, and A&HCI were searched by topic field "norovirus" by limiting it to the period between 2010 and 2019. Bibliometrix a R-Tool of R-Studio Version 3.6.1 (Sivankalai, S; Sivasekaran, K 2020;2021) as complete science planning assessment, and biblioshiny, the gleaming limit up to a web interface for bibliometrix, were utilized to presentation and succeed the metadata from Web of Science (Sivankalai, S 2016). Finally, the evaluation was based on parameters including Description on norovirus, Document types, Document contents, Authors collaboration, yearly and Country Publication, Annual total citations per year, Author impact citations, Author productions over time, most cited countries, and cited Sources.

RESULT AND DISCUSSION

The table 1 provides five types of contents such as Description, Document types, Document contents, Authors and Authors collaboration about main information for noroviruses data. Seven numbers of descriptions were available.

Description: From the table it was cleared that the highest no. of 61509 records was reported by References. The next, place was Documents which reported with 4240 of records followed by Average citations per year per document with 2.438 no. of records, Sources (Journals, Books, etc) with 778 no. of records. Table 1 accordingly, Average citations per documents was reported with 19.92% of records which followed by Average years from publication with 6.6% of records, respectively. In addition to this, the analysis was cleared that all the descriptions of articles contributed during time span of 2010:2019.

Document types: Document types shows that most of research on noro virus, the resulted in the form of articles have a total of 3520 which followed by Review: 288, Meeting abstract: 177, Editorial material: 75, Letter: 70, respectively.

Table: 1 Main Information for Norovirus data

Description	Results
Timespan	2010:2019
Sources (Journals, Books, etc)	778
Documents	4240
Average years from publication	6.6
Average citations per documents	19.92
Average citations per year per document	2.438
References	61509
Document types	
Article	3520
Article; book chapter	1
Article; proceedings paper	19
Article; retracted publication	1
Biographical item	1
Correction	19

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Editorial material	75
Letter	70
Meeting abstract	177
News item	25
Proceedings paper	31
Reprint	2
Retraction	1
Review	288
Review; book chapter	9
Review; retracted publication	1
Document contents	
Keywords Plus (ID)	5110
Author's Keywords (DE)	5068
Authors	
Authors	13619
Author Appearances	27166
Authors of single-authored documents	131
Authors of multi-authored documents	13488
Author's collaboration	
Single-authored documents	160
Documents per Author	0.311
Authors per Document	3.21
Co-Authors per Documents	6.41
Collaboration Index	3.31

Below 50, the document types were listed in the table 1 such as Proceedings paper has a total of 31, News item: 25, Article; proceedings paper and Correction were 19 each, Review; book chapter: 9, Reprint: 2 and then Article; book chapter, Article; retracted publication, Biographical-item, Retraction and Review; retracted publication: 1 each out of total document types published in the above period of this study.

Document contents: The document contents were outlined with two types of contents such as Keywords Plus (ID) and Author's Keywords (DE) (Records: 5110 and 5068) in the table 1.

Authors: The observation shows from the table 1 that authors with extremely output in research on norovirus was Author Appearances with 27166 records. Subsequent positions were occupied by Authors with 13619 and Authors of multi-authored documents 13488 records, respectively. The remaining position was Authors of single-authored documents with less number of 131 records out of this field of study.

Author's collaboration: The list of author's collaborations was presented in the table 1 which was characterised that Single-authored documents were the most ideal with 160 records which followed by Co-Authors per Documents with 6.41 %, Collaboration Index with 3.31% and Authors per Document with 3.21% of records, respectively. In the contrary, Remaining of Documents per Author was smallest with 0.311% records of output available during the period.

Figure 1 (a) shows that the annual production of articles about Noro virus in the world. In the world level research output in field of Noro viruses had published a total number of articles of 4240 from the year 2010 to 2019, and the growth of published articles is constantly increasing from the year 2010 to 2015. The published articles had slowly up and down from the year 2016 to 2018. The highest number of articles had published (554) in the year 2017, and very lowest number of articles had published (10) in the year 2019 of total of articles published during 2010 -19. The country information of figure 1 (b) presents that twenty numbers of region in the world published frequency of articles on the study of nor virus. As expected, USA was in the top list of regions with highest frequency (3770). In this connection, next most productive

places attained by the regions with their frequency like China (1065), Japan (1007), UK (826), South Korea (688), Germany (551), France (541) and so on. The difference of frequency between the regions of Thailand (143) and Switzerland (140) was only three than the all the regions in the table 7. The last two places attained by the region of Denmark and Portugal with frequency (108 and 101) respectively.

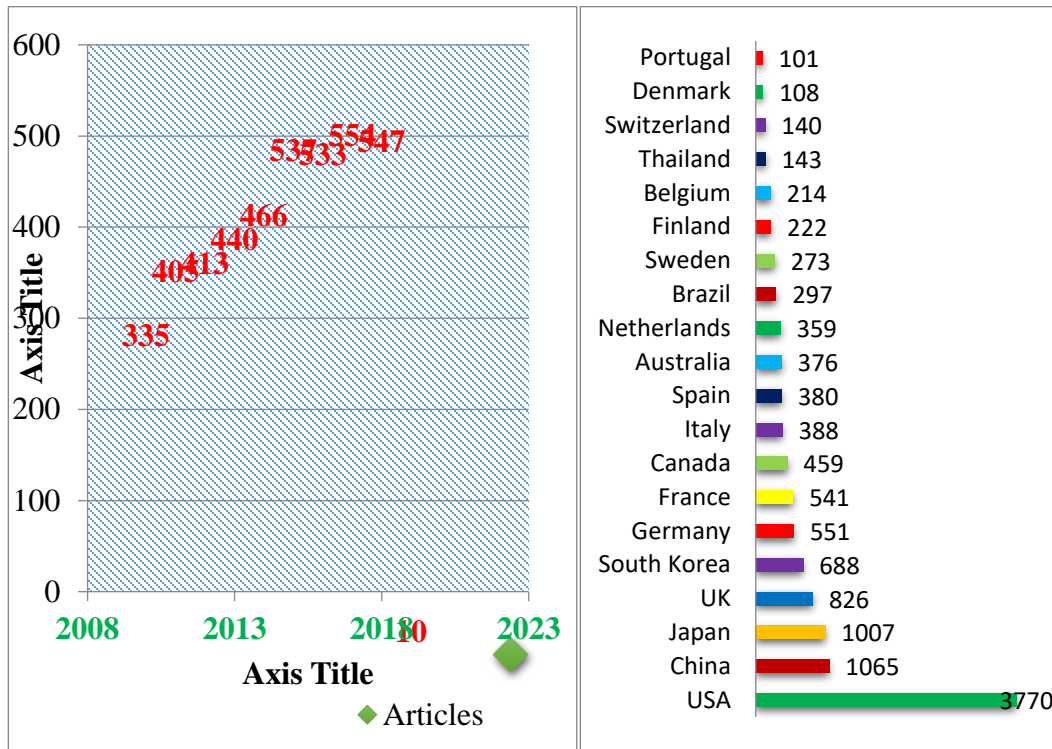


Figure 1. (a) Yearly productions

(b) Country productions

Table: 2 Annual total citations per year

Year	N.of articles	Mean TC per Articles	Mean TC per Year	Citable Years
2010	335	36.06	3.28	11
2011	405	32.42	3.24	10
2012	413	29.40	3.27	9
2013	440	25.68	3.21	8
2014	466	22.12	3.16	7
2015	537	21.40	3.57	6
2016	533	11.59	2.32	5
2017	554	8.86	2.22	4
2018	547	5.29	1.76	3
2019	10	0.5	0.25	2

The norovirus research output for analysing annual total citations per year during the period 2010-19 presents in table 2. The most productive number of articles (554) published in the year 2017 and at same time it's got mean total citation per articles (8.86%) and mean total citation per year (2.22%) in the citable year (4). Similarly, most valuable mean total citation per articles (36.06%) showed in the year 2010 and its published articles (335) mean total citation per year (3.28%) and also indicated the highest citable years (11). In the year 2015, the major contribution of mean total citation per year (3.57%) and its published articles (537), mean total citation per articles (21.40%) in the citable years (6). According to

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table 3 indicated the least number of annual total citations (Mean total citation per articles: 0.5% and mean total citation per year: 0.25%) in the year 2019 and also published articles (10) in the citable years (2).

Table: 3 Author impact citations

Author	h -index	g-index	m -index	TC	NP	PY start
Vinje J	38	74	3.167	5612	98	2010
Jiang X	28	45	2.333	2413	81	2010
Hall AJ	30	63	2.5	4082	66	2010
Atmar RL	26	49	2.167	2461	60	2010
Estes MK	22	44	1.833	2014	54	2010
Tan M	22	38	1.833	1527	50	2010
Ushijima H	17	24	1.417	747	48	2010
Parashar UD	25	47	2.083	3015	47	2010
Miagostovich MP	17	26	1.417	807	46	2010
Vesikari T	20	31	1.667	1071	46	2010
Chang KO	17	23	1.417	626	43	2010
Lopman BA	21	41	1.75	2375	41	2010
Green KY	20	37	1.667	1388	40	2010
Wobus CE	18	38	1.5	1452	40	2010
Khamrin P	15	23	1.25	619	39	2010
Blazevic V	16	27	1.333	822	38	2010
Koopmans M	25	38	2.083	3037	38	2010
Uyttendaele M	20	31	1.667	994	38	2010
Goodfellow I	18	29	1.5	885	37	2010
Jaykus LA	17	27	1.417	761	37	2010

TC – Total Citation NP – Number of Publication PY – Publication Year

Table 3 of author impact citation of noro virus reveals that the author's value of h index, g index, m index, Total citation, number of publication and publication year start. The most productive author of Vinje J registered the highest place (h-index: 38, g- index: 74, m -index: 3.167, TC: 5612, NP: 98) in among all these authors presented in the table and same publication started year 2010. In this connection, the author of Hall AJ registered second most productive place (h -index: 30, g- index: 63, m -index: 2.5, TC: 4082 NP: 66). Four authors of Ushijima H, Miagostovich MP, Chang KO and Jaykus LA obtained the same value of h- index and m -index (17 and 1.417) each. Three authors of Vesikari T, Green KY and Uyttendaele M obtained the same value of h- index and m -index (20 and 1.667) each. Two authors of Parashar UD and Koopmans M obtained the same value of h- index and m -index (25 and 2.083) each, as well as the author of Estes MK and Tan M obtained the same value of h- index and m -index (22 and 1.833) each and the authors of Wobus CE and Goodfellow I obtained the same value of h- index and m -index (18 and 1.5) each. Three authors of Tan M, Wobus CE and Koopmans M obtained the same value of Koopmans M g- index (380 each). From the table, the observation was found that third highest TC received by the author of TC (3037). Three authors of Blazevic V, Koopmans M and Uyttendaele M and have the same number of NP (38) each. Two authors of Miagostovich MP and Vesikari T have the same number of NP (46) each, as well as Green KY and Wobus CE T have the same number of NP (40) each, out of total author impact citation of noro virus during 2010.

Table: 4 Author productions over time

Author	year	Frequency	TC	TC per Year
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Atmar RL	2010	7	588	49
Atmar RL	2011	4	489	44.455
Atmar RL	2012	5	191	19.1
Atmar RL	2013	4	115	12.778
Atmar RL	2014	10	436	54.5
Atmar RL	2015	10	353	50.429
Atmar RL	2016	9	141	23.5
Atmar RL	2017	6	61	12.2
Atmar RL	2018	5	87	21.75
Blazevic V	2010	1	57	4.75
Blazevic V	2011	4	223	20.273
Blazevic V	2012	3	116	11.6
Blazevic V	2013	3	82	9.111
Blazevic V	2014	4	106	13.25
Blazevic V	2015	7	111	15.857
Blazevic V	2016	6	75	12.5
Blazevic V	2017	4	35	7
Blazevic V	2018	6	17	4.25
Chang KO	2010	1	18	1.5
Chang KO	2011	4	95	8.636

Table 4 provides that author productive over time for research articles of nor virus. From this table, the author of Atmar RL contributed the highest frequency in the years 2014 and 2015(10) each, followed by Blazevic V (Year: 2015 and frequency: 7) and Chang KO (Year: 2011 and frequency: 4). The same number of frequency (4) contributed by the author of Atmar RL in the years 2011 and 2013 as well as Blazevic V (frequency:3, years: 2012 and 2013, frequency:4, years:2011 and 2017 and frequency:6, years:2016 and 2018). The topmost TC contributed by the author of Atmar RL (588) in the year 2010 and at the same time highest TC per year (50.429%) in the year 2015 followed by the author of Blazevic V (TC: 223 and TC per year: 20.273%) in the year 2011 and author of Chang KO (TC: 95 and TC per year: 8.636%) in the year 2011.

The Author productions over time documents in table 5 show that the author provided the articles in the several sources for research in norovirus during the period 2011 -15. The observation was that the highest position took part the title namely an automated genotyping tool for enteroviruses and noroviruses (Total citations: 419) and at the same time TC per Year: 38.091% from the source of journal of clinical virology in the year 2011. The next position took part by the title advances in laboratory methods for detection and typing of norovirus (Total citations: 396 and TC per Year: 56.571%) from the source of journal of clinical microbiology in the year 2015. Two various types of titles namely advances in laboratory methods for detection and typing of norovirus and genotypic and epidemiologic trends of norovirus outbreaks in the United States, 2009 to 2013 (Total citations: 186 and TC per Year: 23.25%) were in the same source of journal of clinical microbiology in the years 2015 and 2014, followed by norovirus disease in the united states (Total citations: 298 and TC per Year: 33.111%) and novel surveillance network for norovirus gastroenteritis outbreaks, united states(Total citations: 177 and TC per Year: 16.091) were in the same source of emerging infectious diseases in the years 2013 and 2011 respectively. Finally, the table showed that the tiles were listed based on their total citations.

Table: 5 Author productions over time documents

Author	Year	Tittles	Source of articles	Total citations	TC per Year
Vinje J	2011	An automated genotyping tool for enter viruses and noroviruses	Journal of clinical virology	419	38.091
Vinje J	2015	Advances in laboratory methods for detection and typing of norovirus	Journal of clinical microbiology	396	56.571
Vinje J	2014	Enteric bacteria promote human and mouse norovirus infection of b cells	Science	390	48.75
Vinje J	2013	Proposal for a unified norovirus nomenclature and genotyping	Archives of virology	350	38.889
Vinje J	2013	Norovirus and medically attended gastroenteritis in U.S. Children	New England journal of medicine	321	35.667
Vinje J	2013	Norovirus disease in the United States	Emerging infectious diseases	298	33.111
Vinje J	2014	Genotypic and epidemiologic trends of Norovirus outbreaks in the United States, 2009 to 2013	Journal of clinical microbiology	186	23.25
Vinje J	2011	Novel surveillance network for norovirus gastroenteritis outbreaks, united states	Emerging infectious diseases	177	16.091
Vinje J	2012	Environmental transmission of norovirus gastroenteritis	Current opinion in virology	150	15
Vinje J	2013	Indications for worldwide Increased norovirus activity associated with emergence of a new variant of genotype ii.4, late 2012	Eurosurveillance	139	15.444

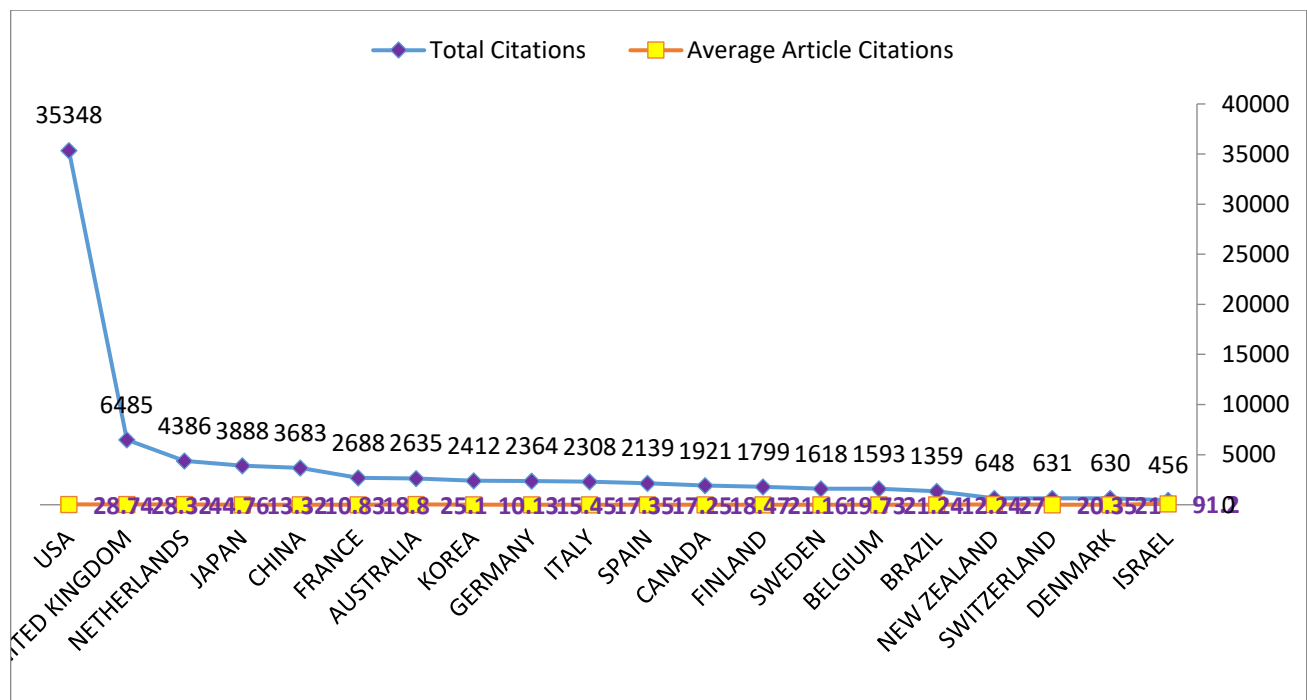


Figure 2. Most cited countries

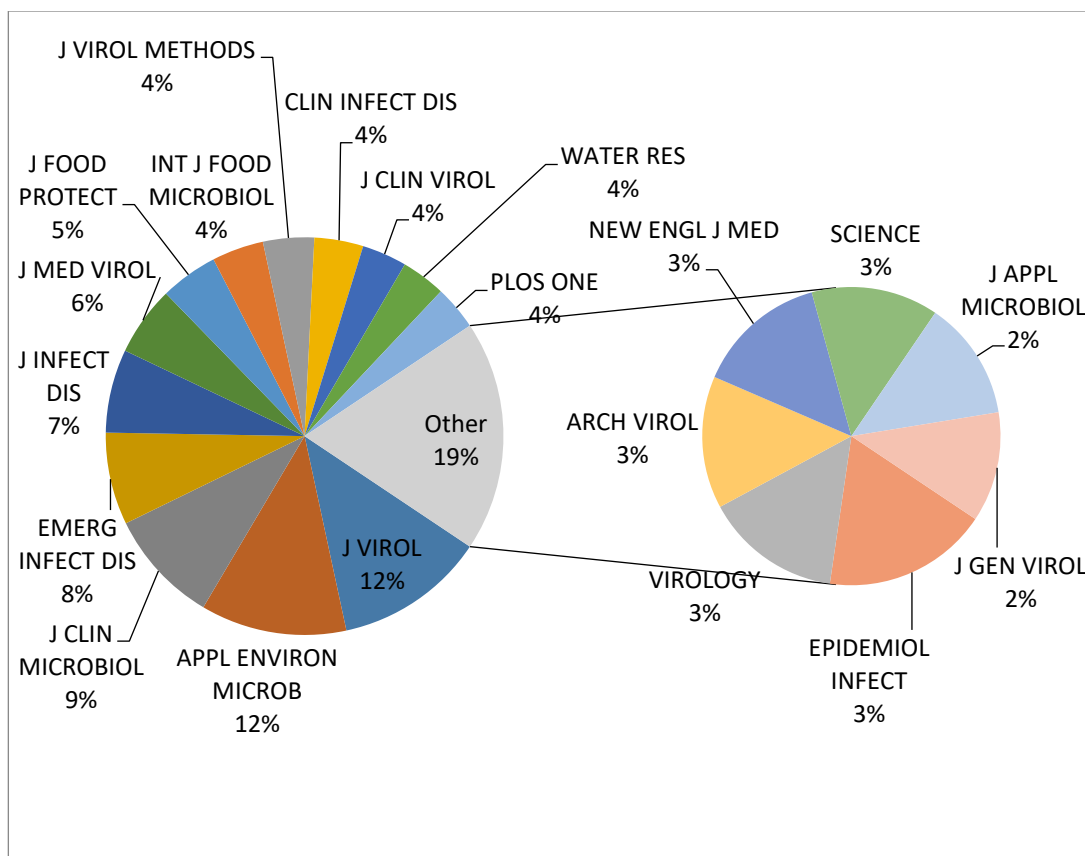


Figure 3. Most cited Sources

The discussion about most cited countries in figure 2 for the analysis of nor virus indicates that most productive twenty countries involved in the field of articles. Accordingly, this figure, the greatest output in this analysis was USA with total citations of 35348 (Average Article Citations: 28.74%) and at the same time Israel was highest with average article citations of 91.20% and lowest place of total citation (456). This is indicated that most of USA researcher's concern becoming added for publishing the articles on nor virus. Subsequent places occupied by United Kingdom (Total citation: 6485 and average article citations: 28.32%), Netherlands (Total citation: 4386 and average article citations: 44.76%), Japan (Total citation: 3888 and average article citations: 13.32%) and China (Total citation: 3683 and average article citations: 10.83%) and so on. Similarly, two countries China and Korea had the lowest average article citations (10.83% and 10.13%).

Figure 3 contains that different most cited sources used for studying on noro virus. The highest two numbers of sources (Journal virology and Appl Environ Microb) were obtained average cited source (12.00%) each, followed by J Clin Microbial (9.00%), Emerg Infect Dis (8.00%), J Infect Dis (7.00%), J Med Virol (6.00%), J Food Protect (5.00%). The same time six sources (Int J Food Microbiol, J Virol Methods, Clin Infect Dis, J Clin virology, Water RES and PLOS ONE) was obtained average cited source (4.00%) each, followed five sources (New Engl J Med. Virology, Arch virol, Science and (Epidemiol Infect) was obtained average cited (3.00%). Finally, two sources (J Appl Microbiol and J Gen Virol) were obtained average cited (2.00%).

CONCLUSION:

This study concluded that the analysis of scientometric on norovirus research as described in web of science. This articles also most first scientometric analysis in the field of norovirus, from the point of view, the worth of these articles increased globally. The most contributing years 2017 was identified by the above discussion. The most contribution was performed by the author of Vinje J who published articles in several sources during 2011-15. These findings can help to most the researchers who involved publishing more articles in various countries is higher than the previous years. This information should inspire to the new researchers in the worldwide for the coming years who involving research related to noro virus in future. Furthermore, the conclusion of studying scientometric literature will be raised among the researchers.

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