World Literature on Hepatitis C Virus Research: A Scientometric Study

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Abstract

The study analyses the Hepatitis C virus research output from around the world during 1999-2013 on different parameters including the growth, global publications, international conference papers, contribution of major collaborative partner countries, contribution of various subject fields and by type of Hepatitis C, most productive institutions and authors and patterns of research communication in most productive journals. Scopus Citation Database has been used to retrieve the data for 15 years (1999-2013) by searching different relevant keywords in its combined title, abstract and keywords fields; totally 60434 records were retrieved from the database. The study reveals that the year-wise research output in the last two years were only in increasing trend. Among the top twelve listed sources "articles" occupies the first position with 41442 records

Keywords
Hepatitis C virus Research, Hepatitis Publications, Scientometrics analysis

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INTRODUCTION

'Scientometrics' can be defined as the measuring of scientific and technological activity. Bibliometric is a branch of scientometric that focuses principally on the quantitative study of scientific publication for statistical purpose. Scientrometric is used as guidance for the future of research, on the basis of existing research in a specific field. Scientometric is the study of the quantitative aspects of science as a discipline or economic activity. It is part of the sociology of science and has application in science policy making. It involves quantitative studies of scientific activities, including publications, and hence a vast area of bibliometrics has been covered to some extent.

Scientometrics has been studied from several angles. Some of the observations about it are as follows: *"Measuring is knowing" - Heike Kamerlingh Onnes . "If scientometrics is a mirror of science in action, then scientometricians' particular responsibility is to both polish the mirror and warn against optical illusions" - Michel Zitt "We think of statistics as facts that we discover, not numbers we create" - Joel Best*[1-2] In Scientometric models-rank-frequency distribution-exponential function and negative power function, concentration measurement are used. Quantitative characteristics of social science papers and citation were analyzed through distribution of region, and institution.[3-6] Individual journal have been the focus of many bibliometric and scientometric studies.[7-11]

Hepatitis C virus (HCV) was identified in the year 1989. It has been shown to be the major cause of parenterally transmitted non-A, non-B (PT-NANB) hepatitis. HCV usually is spread by shared needles among drug abusers, blood transfusion, hemodialysis, and needle sticks. Approximately 90% of transfusion-associated hepatitis is caused by HCV. Transmission of the virus by sexual contact has also been reported, but is considered rare. An estimated 50% to 70% of patients with acute HCV infection develop chronic infection. Patients with chronic HCV infection can continue to infect others. Patients with chronic HCV infection are at risk for developing cirrhosis, liver failure, and liver cancer.

WHO estimates that 3 per cent of the world population is infected with HCV and around 170 million individuals are chronic carriers with the risk of developing liver cirrhosis and liver cancer. In many countries, particular population subgroups, such as voluntary blood donors have a very high

prevalence of HCV infection specially in the developing world. In the USA, an estimated 4 million people have contracted the disease, 4 times more than HIV infection. Approximately 3-4 million new acute infections and about 54000 deaths occur each year. It has also become a leading reason for liver transplantation.

The cost of treating Hepatitis C is significant both to the individual and to society. In the United States, the average lifetime cost of the disease was estimated at 33,407 USD in 2003 with the cost of a liver transplant as of 2011 costing approximately 200,000 USD. In Canada, the cost of a course of antiviral treatment was as high as 30,000 CAD in 2003, while in the United States the costs were between 9,200 and 17,600 in 1998 USD. In many areas of the world, people are unable to afford treatment with antivirals as they either lack insurance coverage or the insurance agencies won't pay for antiviral. In this connection **World Hepatitis Day**, observed on July 28 every year, aims to raise global awareness of hepatitis - a group of infectious diseases known as Hepatitis A, B, C, D,and E encourage prevention, diagnosis and treatment. Hepatitis affects hundreds of millions of people worldwide, causing acute and chronic disease and killing close to 1.4 million people every year.

Objectives of the study

1. To examine the year-wise growth and the development of Hepatitis C Virus literature
2. To identify the source-wise research publications in the field.
3. To know the output with respect to country (and its elevation).
4. To identify the core journal in the field of Hepatitis C Virus Research.
5. To analyze the growth in different branches of Hepatitis C Virus subjects pertaining to Hepatitis C Virus literature.To evaluate the authorship pattern on Hepatitis C virus research
6. To find out the language-wise distribution
7. To find out the most published authors and highly cited publications.

Data Source and Methodology

This study used Scopus International Database [http://www.scopus.com/ search/][12] to extract relevant data on Hepatitis C virus research of world and other 15 most productive countries for the last 15 years (1999-2013). An advanced search strategy involving "Hepatitis C virus" as the keywords were used to search and download data using Title, Abstract and Keywords field, resulting in downloading of 60434 records related to Hepatitis C virus research. For identifying Hepatitis C virus research by sub-fields, database classification as provided in Scopus database has been used

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DATA ANALYSIS AND INTERPRETATION

Table 1: Global Trend in Hepatitis C Virus Research

S. No	Year	Total No of Articles	Percentage	Cumulative No. of Articles	Cumulative Percentage
1	1999	2651	4.38	2651	4.38
2	2000	3047	5.04	5698	9.42
3	2001	2825	4.67	8523	14.10
4	2002	3201	5.29	11724	19.39
5	2003	3590	5.94	15314	25.34
6	2004	3859	6.38	19173	31.72
7	2005	4154	6.87	23327	38.59
8	2006	4188	6.92	27515	45.52
9	2007	4201	6.95	31716	52.48
10	2008	4232	7.00	35948	59.48
11	2009	4479	7.41	40427	66.89
12	2010	4517	7.47	44944	74.36
13	2011	5011	8.29	49955	82.66
14	2012	5218	8.63	55173	91.29
15	2013	5261	8.70	60434	100
Total		60434	100.00	432522	100.00

Table 1 gives the year-wise distribution of articles in Hepatitis C virus research. The number varies from year to year and increases in the number of articles from the year 1999 to 2013. Out of the total 60434 articles, the maximum number of articles is in the year 2013, contributing 5261 articles, which is 8.70% the total publication. The minimum number of articles is in the year 1999 with 2651 articles, which is 4.38% of the total publication.

Table shows the Hepatitis C virus research growth shows that there is a gradual increase in the growth rate of Hepatitis C virus research. This analysis proves the hypothesis that there is a gradual increase in the growth rate of Hepatitis C virus research. Hence the hypothesis is accepted. The publication rate in 2000 was below five percent, and during the later 2002 it ranged between five and above eight percent. In 2011 the publication growth rate touched nearly nine percent. Between 1999 and 2013 it increased two times.

Relative Growth Rate and Doubling Time of Hepatitis C Virus Research

The analysis of growth rate in Hepatitis C Virus research publications is one of the prime aspects of discussion. This analysis aims at identifying the trends and growth of prospects in the present research. However proliferation of Hepatitis C virus research has made it extremely difficult for scientists to keep in touch with the recent advances in their field. Hence the provision of information to information seeker is the prime duty of library professionals, who have to meet the information needs of scientists of various discipline.

In this connection, a study on the growth rate of publications provides some useful results. The rate of growth of literature on Hepatitis C virus research is determined by calculating relative growth rate and doubling time of the publication.

Table 2: Showing Growth rate (R) and Doubling Time (Dt) of Hepatitis C virus research

Year	No. of Pub	Cumulative	W^1	W^2	R(a)	Mean	Doubling	Mean DT
1999	2651	2651	7.88			0.66	0.91	1.35
2000	3047	5698	7.88	8.64	0.76		1.69	
2001	2825	8523	8.64	9.05	0.41		2.23	
2002	3201	11724	9.05	9.36	0.31		0.58	
2003	3590	15314	9.36	8.18	1.18	0.61	0.41	3.09
2004	3859	19173	8.18	9.86	1.66		3.64	
2005	4154	23327	9.86	10.05	0.19		6.70	
2006	4188	27515	10.05	10.22	0.98		4.95	
2007	4201	31716	10.22	10.36	0.14		5.77	
2008	4232	35948	10.36	10.48	0.12	0.12	5.77	5.36
2009	4479	40427	10.48	10.60	0.12		6.30	
2010	4517	44944	10.60	10.71	0.11		6.93	
2011	5011	49955	10.71	10.81	0.10		6.93	
2012	5218	55173	10.81	10.91	0.10		6.93	
2013	5261	60434	10.91	11.00	0.10		7.70	6.95
Total	60434	Mean value of Rt (P) and Dt (P)			6.28		4.49	

The growth rate of Hepatitis C virus research was analyzed by relative growth rate (RGR) and doubling time (DT) RGR is a measure to study the increase in number of articles and the Dt is directly related to RGR. It is the time required for article to become double of the existing amount. RGR decreased from the rate 0.41 in 1999 to 0.76 in 2013. The Mean relative growth for 5 year periods is 1999-03 (0.66), 2003-08 (0.61), 2009-13 (0.12).

The mean Dt for the same periods are as follows: 1999-03, 1.35; 2004-08, 3.09; and 2009-13, 5.36; Next comes the Relative Growth Rate. A cursory glance at the above graph is enough to drive home the fact that the growth rate of publication decreased as years went by. It was 0.76 in the year 1999 and decreased to 0.10 in 2013. The doubling time for publication of all sources of Hepatitis C virus

research publications has increased from 0.91 in 1999 to 7.70 in 2013. The aggregate level stands as 4.49 (years) when computed.

It is seen that there is a general progressive increase in the number of publication of literature on Hepatitis C virus research. However its relative growth rate has shown a declining trend which means the rate of increase is low in terms of proportion and this has been highlighted by doubling time for publications, which is more than the relative growth of total scientific publication. It shows a declining trend, and doubling time for publication reflects an increasing trend.

Table 3: Source - wise Distribution of Hepatitis C virus research at World Level

S. No	Document Types	No .of articles	Percentage of articles	Cumulative. No. of articles	Cumulative percentage
1	Articles	41442	68.57	41442	68.57
2	Review	9735	16.10	51177	84.68
3	Letters	2844	4.70	54021	89.38
4	Conference Paper	2192	3.62	56213	93.01
5	Editorial	1552	2.56	57765	95.58
6	Note	1201	1.98	58966	95.57
7	Short Survey	891	1.47	59857	99.04
8	Book Chapter	244	0.40	60101	99.44
9	Erratum	185	0.30	60286	99.75
10	Article in Press	134	0.22	60420	99.97
11	Book	10	0.01	60430	99.99
12	Conference Review	4	0.00	60434	100
Total		60434	100.00	681112	100.00

Table 3 indicates that document-wise output in Hepatitis C virus research, Articles are in the first position with 41442, followed by Review which occupies the second place with 9735 records. Letters occupy the third place with 2844 records, Conference Papers 2192, Editorial 1552, Note 1201, Short Survey 891, Book Chapter 244, Erratum 185, Article in Press published 134, Book 10 and Conference Review has 4 records.

Table 4: Most Productive Countries

S. No	Country Name	Records	Percentage	H-index
1	United States	15837	26.20	1.518
2	Japan	5063	8.37	694
3	Italy	4853	8.03	654
4	France	4489	7.42	742
5	Germany	3746	6.19	815
6	United Kingdom	3582	5.92	934
7	Spain	3240	5.36	531
8	China	3087	5.10	436
9	Canada	1855	3.06	725
10	Australia	1588	2.62	583
11	Taiwan	1418	2.34	300
12	Brazil	1195	1.97	342
13	India	1154	1.90	341
14	Switzerland	1015	1.67	629
15	Egypt	929	1.53	148

Table 4 shows that the most productive country in research publication in Hepatitis C virus, the United States of America has the first place with 15837 records, and followed by Japan with 5063 records, Italy with 4853 records, France with 4489, Germany with 3746, United Kingdom with 3582, Spain with 3240, China with 3087, Canada with 1855, Australia with 1588, Taiwan with 1418, Brazil with 1195, India with 1154, Switzerland with 1015 and Egypt with 929 records.

Table 5: Top 15 Journals

S. No	Journal Name	Publications			
		Records	Percentage	Impact Factor (2013)	Country
1	Journal of Hepatology	1602	2.6	10.401	Pakistan
2	Journal of Virology	1131	1.8	**4.648**	United States
3	Clinics in Liver Disease	1108	1.8	2.703	USA
4	Journal of Viral Hepatitis	1102	1.8	3.307	European
5	Journal of Medical Virology	936	1.5	2.217	United States
6	World Journal of Gastroenterology	768	1.2	2.433	China
7	Digestive and Liver Disease	651	1.0	2.889	United States
8	Journal of Gastroenterology and Hepatology Australia	567	0.9	3.325	Australia
9	Gastroenterology	559	0.9	13.926	Japan
10	Hepatology Research	536	0.8	2.218	Hong Kong
11	International Journal of Molecular Medicine	531	0.8	**4.768**	Switzerland
12	Liver Transplantation	527	0.8	3.793	Singapore
13	Journal of Infectious Diseases	478	0.7	5.848	America
14	Journal of General Virology	473	0.7	3.529	United Kingdom
15	Clinical Infectious Diseases	468	0.7	9.374	Spain

The research articles in Hepatitis C virus research have been published in 2109 journals. The scientists have published the highest number of article in Hepatitis C virus in the Journal of Hepatology, which is about 1602 (2.6 percent), followed by Journal of Virology 1131 (1.8 percent), Clinics in Liver Disease 1108 (1.8 percent), Journal of Viral Hepatitis 1102 (1.8 percent), Journal of Medical Virology 936 (1.5 percent), World Journal of Gastroenterology 768 (1.2 percent), Digestive and Liver Disease 651 (1.0 percent), Journal of Gastroenterology and Hepatology Australia 567 (0.9 percent), Gastroenterology 559 (0.9 percent), Hepatology Research 536 (0.8 percent), International Journal of Molecular Medicine 531 (0.8 percent), Liver Transplantation 527 (0.8 percent), Journal of Infectious Diseases 478 (0.7percent), Journal of General Virology 473 (0.7 percent) and Clinical Infectious Diseases 468 (0.7 percent). Put together, other journals do not come up even to 0.5 percent of the total publications.

Table 6: Subject- wise Distribution of Publications on Hepatitis C Virus Research (Selected)

S. No	Subject Areas	Records	Percentage
1	Medicine	45686	75.59
2	Immunology and Microbiology	14213	23.51
3	Biochemistry, Genetics and Molecular Biology	9788	16.19
4	Pharmacology, Toxicology and Pharmaceutics	4662	7.71
5	Agricultural and Biological Sciences	1347	2.22
6	Chemistry	1276	2.11
7	Nursing	634	1.04
8	Social Sciences	539	0.89

9	Neuroscience	465	0.76
10	Multidisciplinary	427	0.70
11	Veterinary	384	0.63
12	Health Professions	347	0.57
13	Environmental Science	310	0.51
14	Chemical Engineering	296	0.48
15	Psychology	271	0.44
16	Engineering	256	0.42
17	Mathematics	164	0.27
18	Computer Science	153	0.25
19	Dentistry	148	0.24
20	Materials Science	119	0.19
21	Others subjects	270	0.41

Table 6 shows that Subject-wise, 'Medicine' occupies the prime position with 45686 publications (75.59 % of the total). 'Immunology and Microbiology' has a share of 14213 articles (23.51 %). 'Biochemistry, Genetics and Molecular Biology' has 9788 publications to its credits (16.19 %), 'Pharmacology, Toxicology and Pharmaceutics' has 4662 (7.71) and 'Agricultural and Biological Sciences' has 1347 (2.22 %). All other subjects account for 5.0 %.

So far, 134 areas have been identified as subjects which come under the head Hepatitis C virus Research. Out of the 134 the most important fields are Medicine, Immunology and Microbiology, Biochemistry, Genetics and Molecular Biology, Pharmacology, Toxicology and Pharmaceutics, Agricultural and Biological Sciences, Chemistry, Nursing, Social Sciences, Neuroscience, Multidisciplinary, Veterinary science besides Health Professions and Environmental Science.

Out of these 134 subjects, the most important subject Medicine gets much attention. Next comes Immunology and Microbiology followed by Biochemistry, Genetics and Molecular Biology, Pharmacology, Toxicology and Pharmaceutics, Agricultural and Biological Sciences, Chemistry, Nursing, Social Sciences and others.

Table 7: Language distribution of the Hepatitis C virus research (1999 – 2013)

S .No	Languages	No of Publications	Percentage	Cumulative No of Publications	Cumulative Percentage
1	English	52364	86.64	52364	86.64
2	Chinese	1571	2.59	53935	89.24
3	French	1381	2.28	55316	91.53
4	Spanish	1252	2.07	56568	93.60
5	German	900	1.48	57468	95.09
6	Japanese	756	1.25	58224	96.34
7	Russian	450	0.74	58674	97.08
8	Polish	321	0.53	58995	97.61
9	Italian	281	0.46	59276	98.08
10	Portuguese	232	0.38	59508	98.46
11	Turkish	158	0.26	59666	98.72
12	Czech	128	0.21	59794	98.94
13	Hungarian	122	0.20	59916	99.14
14	Croatian	115	0.19	60031	99.33
15	Korean	99	0.16	60130	99.49
16	Dutch	66	0.10	60196	99.60
17	Danish	29	0.04	60225	99.65
18	Serbian	25	0.04	60250	99.69
19	Romanian	24	0.03	60274	99.73

20	Greek	21	0.03	60295	99.76
21	Norwegian	21	0.03	60316	99.80
22	Bulgaria	20	0.03	60336	99.83
	Others language	81	0.09	60434	100.00
Total		60434	100.00	60434	100

Research literature on Hepatitis C virus has been published in various journals in various languages. Among them English ranks the first occupying nearly 86.64% of the total output. The second ranked language is Chinese and French and Spanish languages follow this. This is a clear indication that any author despite his country of orgin or language publishes his research findings mainly in English rather than their own mother language.

Table 8: Showing Authorship pattern

S. No	Authorship pattern	No of Articles	Percentage	Cumulative No of articles	Total no of Authors
1	1 author	4532	7.49	4532	4532
2	2 authors	11065	18.30	15597	22130
3	3 authors	10090	16.69	25687	30270
4	4 authors	7602	12.57	33289	30408
5	5 authors	8835	14.61	42124	44175
6	6 authors	4230	6.99	46354	25380
7	7 authors	3226	5.33	49580	22582
8	8 authors	3022	5.00	52602	24176
9	9 authors	2417	3.99	55019	21753
10	10 authors	604	0.99	55623	6040
11	11 authors	1208	1.99	56831	13288
12	12 authors	181	0.29	57012	2172
13	More than 12 authors	400	0.66	57412	5200

It is observed from the above table that a substantial number of research articles are single-authored which accounts for one fourth of the total output. Two-author articles account for 18.30 percent of the total output and three- author articles account for 16.69 percent, marginally more than two–author publications. As the number of authors of single publications increases, the production quantum of multi-author publications decreases, so much so that ten authors collectively wrote just two articles, and nine collectively produced only four publications.

The total number of articles published is 60434 and they were contributed by 252106 authors. Out of these 7.49% of the articles are single authored. It shows that single author's share is very substantial. Further, the tables shows that the average number of authors per paper is 3.1.

FINDINGS AND CONCLUSION

- The volume of literature published on a Hepatitis C virus which is available on Scopus comprises 60434 articles, and Hepatitis C virus research shows upward trend. A total number of 60434 articles were published globally in the field of Hepatitis C virus during the period1999-2013. It is observed that the highest quantity of literatre on Hepatitis C virus was produced during the block period 2011-2013. During this period that articles and reviews significantly increased. An exponential growth in the number of publication on Hepatitis C virus has been observed during the period. It is found out that 25.63 percent of hepatitis C virus research has been published during 2011-2013, and that the largest number of these articles were published in 2013.It is observed that the average relative growth rate for the study period is 4.49 per annum and that the relative growth rate has decreased from 0.41 in 1999 to 0.76 in 2013.

- Among the countries, the USA with 15837 (26.20%) publications occupies the first place followed by Japan with 5063 (8.37%), Italy with 4853 (8.03%), France with 4489 (7.42%), Germany with 3746 (6.19%). India occupies the 13th position in the world in terms of publication. The USA got the first position in the rank by the highest number of citation, h-index followed by Japan and so on. It is observed that the USA invariably stands at the top, followed by Japan in producing Hepatitis C virus research. Other countries which follow them are Canada and Australia in that order.

- The largest volume of Hepatitis C virus research was published in Journal of Hepatology.

- The mentioned authors were contributed "Zeuzem" published the highest number of publications (333) with percentage of 0.5.

- The highest number of papers published is in medical sciences (45686) which constitute 75.59 percent of the total output, followed by Immunology and Microbiology (14213) and Biochemistry, Genetics, and Molecular Biology (9788) and followed by other subjects.

- The number of articles written in English far exceeds those written in all other languages, increase in Hepatitis C virus research particularly since 2001 onwards when green revolution took its roots. A number of serials in specialized disciplines of science and technology were added to the ones already exiting in these areas. This increase in research is being undertaken by a host of national and internatinal institutes. The application of scientometric study on Hepatitis C virus and characteristics is found to be very useful in understanding the communication and information science use pattern in the field of this study.

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