Exploring The Authorship Pattern And Degree Of Collaboration In Hepatology Research In India: A Scientometric Study

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Abstract

The present study examines the authorship patterns and degree of collaboration in the field of Hepatology, based on the publications indexed in the Web of Science core collection during the period from 1992 to 2021. The study covers year wise growth of publications, authorship pattern, degree of collaboration, collaborative index, co-authorship index, relative growth rate, doubling time, and most prolific institutions & journals. For the study, a total number of 10476 publications were collected and MS-*Excel spreadsheet and VOSviewer were used to represent the results of the study graphically. The results reveals that the collaborative index for universal level value is 5.97. Sarin, S.K is the most prolific author having 964 publications, 19806 citations, with 20.54 average citations per paper. The multiple-authored publications received more citations than that of single-authored publications.*

Keywords
Hepatology; Growth rate; Doubling time;
Collaborative Index; Degree of Collaboration;

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1. INTRODUCTION

Hepatology is one of the important subjects of medical science. It is a study of the prevention, diagnosis, and treatment of diseases that affect the liver.The liver is the major organ of the human body and liver diseases are one of the major health issues around the world,affecting the health and lives of many individuals and families. Treatment of liver disease and alcohol related, metabolic diseases requires costly medication and surgical procedures, including transplantation and specialized multidisciplinary centers, and orphan drugs. (Strazzabosco, Allen, &Teisberg 2017). The study shows the contribution of authorship patterns in the field of hepatology research in India. The collaborative index, Coauthorship index, & degree of collaboration are used to evaluate the measurement of single and multi-author collaborative research patterns. The authorship pattern is an important aspect of the scientometric study. It helps to gather the current status and the future scenario of hepatology research output, and its analysis will definitely help the information scientists as well as the scientific community (Kumar Singh & Aditya Tripathi 2018).

Scientometricsis an analytical tool that has a great potential to gain valuable insights into the evolution of the research in this field of new scientific disciplines. The authorship pattern is an important scientometric measurement tool reflecting current communication patterns, productivity, and degree of collaboration among the contributing researchers in the research field. In the broadest sense, scientometrics encompasses all quantitative aspects and the dissemination of scientific and technological knowledge. Scientometrics ultimately addresses the quantitative evaluation of contributions of scientists, institutions, journals, and countries to the advancement of knowledge. Scientometric indicators provide insights into the performance of scientific productivity in different fields of science and differentiate between scientific fields in the typical number of publications produced by a researcher. Scientometric indicators can help to evaluate scientific impact, which is calculated based on citations, and multiple scientific fields.

2. OBJECTIVES OF THE STUDY

The objectives of the present study are to find out the trend of research collaboration in the field of hepatology. In specific objectives are as follows:

1. To study the growth rate and doubling time of hepatology during the period of 1992 to 2021;
2. To find out the distribution of hepatology research from different forms;
3. To determine the authorship pattern in the hepatology literature;
4. To examine the single versus multi-authored papers and study the degree of Collaboration;
5. To study the block year versus Co-Authorship Index (CAI);
6. To determine the collaborative index in the field of hepatology research;
7. To examine the most prolific authors in the field of hepatology research;
8. To find out the single multi-authored papers and study the degree of collaboration;
9. To determine the highly productive journals;
10. To study the highly productive institutions/organizations and
11. To find out the highly cited papers in hepatology research.

3. METHODOLOGY

The present study isfindto scientometric analysis of the authorship pattern and degree of collaboration in hepatology for 30 years during the period of 1992 to 2021. The datawas collected from the Web of Science (www.isiknowledge.com) databasemaintained by Clarivate Analytics.The data on endocrinology was extracted by using the search string SU=Hepatology AND CU=India on Hepatology for the same period. For interpreting the data, MS-Excel, SPSS, and VOS Viewer software were used. The data obtained resulted as of June 2022, a total number of 10476 publications and 115178 citations were retrieved during the period of the study.

4. DATA ANALYSIS AND INTERPRETATION

4.1 Relative Growth Rate and Doubling Time of hepatology research

The growth of publications were analysed by using two indicators Relative Growth Rate and Doubling time (Mahapatra, 1985).

Relative Growth Rate (GR) is the increase in the number of publications per unit of time. calculating the mean R

RGR = W2- W1/T2 – T1

Where:

R = mean relative growth rate over the specific period of intervals;
W1 = Log W1 (natural log of initial number of publication);
W2 = Log W2 (natural log of final number of publication);
T2 T1 = the unit difference between the initial and final time

Doubling Time (Dt.) The doubling time is the given period required for a quantity to double in size or value. This can be calculated by using the following formula

Doubling time Dt = 0.693/R

Here, Dt (P) = average doubling time of publications

Table 1 shows the Relative Growth Rate (RGR) and Doubling Time (Dt.) in hepatology research during the period of 1992 to 2021. Data on the table revealed that the relative growth of literature is decreasing every year, whereas doubling time is increasing every year. RGR is highest in the year 1993 with 0.67 and lowest in the year 2021 with 0.08. During 30 years period (1992-2021), the doubling time is highest in the year 2021 with 10.57 and lowest in the year 1993 with 1.03 in the same period. The mean growth rate and doubling time for India's output is 0.17 and 5.41.

Table 1: Growth of Hepatology research Publications

Year	No. of Publications	Cumulative	W 1	W 2	RGR	Dt. (P)
1992	74	74		4.30		
1993	71	145	4.30	4.98	0.67	1.03
1994	66	211	4.98	5.35	0.38	1.85
1995	75	286	5.35	5.66	0.30	2.28
1996	111	397	5.66	5.98	0.33	2.11
1997	91	488	5.98	6.19	0.21	3.36
1998	130	618	6.19	6.43	0.24	2.93
1999	107	725	6.43	6.59	0.16	4.34
2000	94	819	6.59	6.71	0.12	5.68
2001	85	904	6.71	6.81	0.10	7.02
2002	106	1010	6.81	6.92	0.11	6.25
2003	97	1107	6.92	7.01	0.09	7.56
2004	111	1218	7.01	7.10	0.10	7.25
2005	138	1356	7.10	7.21	0.11	6.46
2006	345	1701	7.21	7.44	0.23	3.06
2007	268	1969	7.44	7.59	0.15	4.74
2008	569	2538	7.59	7.84	0.25	2.73
2009	300	2838	7.84	7.95	0.11	6.20

2010	338	3176	7.95	8.06	0.11	6.16
2011	469	3645	8.06	8.20	0.14	5.03
2012	578	4223	8.20	8.35	0.15	4.71
2013	468	4691	8.35	8.45	0.11	6.59
2014	497	5188	8.45	8.55	0.10	6.88
2015	516	5704	8.55	8.65	0.09	7.31
2016	589	6293	8.65	8.75	0.10	7.05
2017	611	6904	8.75	8.84	0.09	7.48
2018	677	7581	8.84	8.93	0.09	7.41
2019	1499	9080	8.93	9.11	0.18	3.84
2020	615	9695	9.11	9.18	0.07	10.57
2021	781	10476	9.18	9.26	0.08	8.94
Total	**10476**		**Mean Value**		**0.17**	**5.41**

4.2 Distribution of Authorship Pattern

Table 2 analyses the authorship pattern of 10476 publications during the period of 1992 to 2021. The data is divided into eleven blocks as single., two, three, four, five, six, seven, eight, nine, ten, and more than ten authored publications. The result shows that four authored papers ranked first with 1405 publications followed by five authored papers which ranked second with 1396 publications of the total contributions. The three authored papers ranked third with 1357 of the total publications. The six authored papers ranked fourth with 1221 of the total publication. The two authored papers ranked fifth with 1037 of the total publication during the period of 1992 to 2021.

Table 2: Distribution of Authorship Patterns in Hepatology literature

Year	Single	Two	Three	Four	Five	Six	Seven	Eight	Nine	Ten	Above Ten	Grand Total
1992	3	16	8	8	14	18	5	0	0	1	1	74
1993	4	19	7	9	10	9	9	4	0	0	0	71
1994	3	8	6	15	13	10	6	3	1	1	0	66
1995	3	9	23	7	12	11	7	2	1	0	0	75
1996	4	16	25	24	16	13	8	1	3	0	1	111
1997	7	13	13	21	13	8	10	2	1	1	2	91
1998	5	26	26	25	16	23	5	2	2	0	0	130
1999	5	15	27	15	16	12	11	4	1	0	1	107
2000	8	7	16	18	20	14	6	3	1	0	1	94
2001	4	6	12	14	24	10	9	6	0	0	0	85
2002	6	19	18	19	14	14	6	4	5	1	0	106
2003	4	17	19	21	12	9	3	3	5	1	3	97
2004	8	9	14	21	20	17	9	5	2	1	5	111
2005	7	13	19	13	26	24	14	8	1	4	9	138
2006	16	33	46	49	71	51	33	27	8	4	7	345
2007	9	23	36	55	47	42	19	18	6	5	8	268
2008	22	57	64	82	100	87	54	52	27	13	11	569
2009	20	28	32	48	37	40	28	24	15	12	16	300
2010	15	32	45	42	44	49	39	19	11	14	28	338
2011	38	50	54	61	58	60	41	47	19	14	27	469
2012	49	52	74	72	69	61	55	50	35	21	40	578
2013	39	50	76	66	49	41	40	34	19	14	40	468
2014	26	40	71	84	73	63	47	20	20	12	41	497
2015	14	41	65	68	75	65	46	38	25	22	57	516
2016	24	46	68	75	60	76	62	32	30	33	83	589
2017	30	66	81	63	80	56	42	40	26	22	105	611
2018	50	59	68	79	64	58	47	45	39	30	138	677
2019	77	145	174	179	197	167	142	82	82	57	197	1499
2020	41	48	79	56	69	50	41	39	30	26	136	615
2021	39	74	91	96	77	63	59	52	46	32	152	781
Grant Total	**580**	**1037**	**1357**	**1405**	**1396**	**1221**	**903**	**666**	**461**	**341**	**1109**	**10476**

4.3 Distribution of hepatology research in different sources

Table 3 analyses thedifferent types of sources. The study reveals the total number of 10476 publications during the period from 1992 to 2021. It shows that a total number of 4819 (46%) publications are in the form of research meeting abstracts, followed by Journal articles3289 (31.40%) publications, Letters 950 (9.07%) publications, Editorial materials 715 (6.83) publications. The study shows that the highest number of publications published as Meeting abstracts and least number of publications published in the form of Biographical-Items, News Items, Retracted Publications, and Retractions.

Table 3: Form of documents in hepatology research in India

Sl. No.	Document Types	TP	%	Cumulative	Cumulative %
1	Meeting Abstracts	4819	46.00	4819	46.00
2	Articles	3289	31.40	8108	77.40
3	Letters	950	9.07	9058	86.46
4	Editorial Materials	715	6.83	9773	93.29
5	Review Articles	523	4.99	10296	98.28
6	Proceedings Papers	89	0.85	10385	99.13
7	Early Access	40	0.38	10425	99.51
8	Notes	24	0.23	10449	99.74
9	Corrections	19	0.18	10468	99.92
10	Biographical-Items	2	0.02	10470	99.94
11	News Items	2	0.02	10472	99.96
12	Retracted Publications	2	0.02	10474	99.98
13	Retractions	2	0.02	10476	100
	Total	**10476**	100		

4.4 Degree of Collaboration

Single Vs Multiple authors: The major finding of the study reveals that the Hepatologydomain is highly collaborative as the analysis of data indicates that multiple authorship of the paper is used to measure the extent of research collaboration. (Subramanyam, 1983) propounded that the DC, is a measure to calculate the proportion of single and multi-author papers and to interpret it as a degree.

According to Subramanyam, the Formula is

$$DC = Nm/ (Ns + Nm)$$

Where:

DC= Degree of Collaboration
Nm = The number of multi authored papers,
Ns = The number of single-author paper

Table 4 analyses the distribution of the degree of collaboration which indicates an increasing and decreasing trend i.e. 0.959 in 1992 to 0.950 in 2021. The average degree of collaboration is 0.945. The degree of collaboration is high in the year 2015 and the degree of collaboration is low in the year 2000, when single authorship productivity is 6.72% and multiple authorship productivity is 7.50%.

Table 4: Single versus Multi-Authored and Degree of Collaboration (Annual Distribution of Degree of Collaboration in Authorship)

Period	Single Author (Ns)		Multiple Authors (Nm)		Total	Degree of Collaboration
	TO	%	TO	%		
1992	3	0.52	71	0.72	74	0.959
1993	4	0.69	67	0.68	71	0.944
1994	3	0.52	63	0.64	66	0.955
1995	3	0.52	72	0.73	75	0.960
1996	4	0.69	107	1.08	111	0.964
1997	7	1.21	84	0.85	91	0.923
1998	5	0.86	125	1.26	130	0.962
1999	5	0.86	102	1.03	107	0.953
2000	8	1.38	86	0.87	94	0.915
2001	4	0.69	81	0.82	85	0.953
2002	6	1.03	100	1.01	106	0.943
2003	4	0.69	93	0.94	97	0.959
2004	8	1.38	103	1.04	111	0.928
2005	7	1.21	131	1.32	138	0.949
2006	16	2.76	329	3.32	345	0.954
2007	9	1.55	259	2.62	268	0.966
2008	22	3.79	547	5.53	569	0.961
2009	20	3.45	280	2.83	300	0.933
2010	15	2.59	323	3.26	338	0.956
2011	38	6.55	431	4.36	469	0.919
2012	49	8.45	529	5.35	578	0.915
2013	39	6.72	429	4.34	468	0.917
2014	26	4.48	471	4.76	497	0.948
2015	14	2.41	502	5.07	516	0.973
2016	24	4.14	565	5.71	589	0.959
2017	30	5.17	581	5.87	611	0.951
2018	50	8.62	627	6.34	677	0.926
2019	77	13.28	1422	14.37	1499	0.949
2020	41	7.07	574	5.80	615	0.933

2021	39	6.72	742	7.50	781	0.950
	580	**100**	**9896**	**100**	**10476**	**0.945**

4.5 Co- Authorship Index

Co-Authorship Index is used to study the change in Co-Authorship pattern during the study period (Garg &Padhi (1999).And elaborated by Schubert and Braun (1986) suggested formula to computer CAI.

CAI = {(*Nij/Nio)/(Noj/Noo*)}x100

Where

Nij= Number of publications having j author for a particular block
Nio = = Total output for the particular block
Noj = Number of papers having j authors for all blocks
Noo = Total number of papers for all authors and all blocks

CAI = 100 The number of publications corresponds to the average within a co-authorship pattern.
CAI >100 The number of publications are higher than the average
CAI <100 The number of publications are lower than the average

Table 5 presents the Co-authorship Index (CAI) for publication having a single author, two authors, three authors, four authors, five authors, six authors, seven authors, eight authors, nine authors, ten authors, and more than ten authors. CAI for 30 years (1992 to 2021) are grouped into six different blocks. The details of block year versus co-authorship are presented in the Table 5.

The co-authorship effort which is identified from the CAI of Indian hepatology literature during the period of 1992 to 2021. In the first block (1992–1996) highest CAI value is 173.04 from two authors publications, and the least CAI value is 4.76 from the above ten authors publications. Followed by the second block (1997–2001) four authors publications has highest CAI value i.e. 143.13, and the least CAI value is 7.45 from the above ten authors publications. In the third block (2002– 2006) five authors publications has highest CAI value i.e. 134.64, and the least CAI value is 28.45 from the above ten authors publications.

In the fourth block (2007–2011) six authors publications has highest CAI value i.e. 122.70, and the least CAI value is 43.73 from the above ten authors publications. In the fifth block (2012– 2016) ten authors publications has highest CAI value i.e. 118.34, and the least CAI value is 93.11 from the above ten authors publications. In the sixth block (2017–2021) above ten authors publications has highest CAI value i.e. 164.40 and the least CAI value is 7.45 from six authors publications.

Table 5: Block Year versus Co-Authorship Index (CAI)

	Block Periods						
No. of authors	**1992-1996**	**1997-2001**	**2002-2006**	**2007-2011**	**2012-2016**	**2017-2021**	**Grand Total**
Single	77.34	103.31	92.92	96.63	103.68	102.34	580
Two	173.04	133.50	115.35	98.74	87.36	94.67	1037
Three	134.18	143.13	112.36	91.73	103.21	90.99	1357
Four	118.32	136.77	115.07	110.46	102.78	84.31	1405
Five	122.87	131.73	134.64	110.40	92.39	87.37	1396
Six	131.83	113.38	123.80	122.70	99.15	80.81	1221
Seven	102.28	93.82	94.62	108.02	109.53	91.80	903
Eight	39.62	52.74	92.76	129.46	103.36	97.02	666
Nine	28.62	22.41	59.88	91.18	110.70	121.15	461
Ten	15.48	6.06	42.40	91.66	118.34	122.65	341
Above Ten	4.76	7.45	28.45	43.73	93.11	164.40	1109
Total	**100**	**100**	**100**	**100**	**100**	**100**	**10476**

4.6 Collaborative Index

The collaborative index has been calculated by using the formula given by Lawani (1980). The Collaboration Index (CI) is the simplest index presently used to explore the literature, which is to be interpreted as the mean number of authors per paper.

The Collaborative index has been calculated by using the formula given by Lawani (1980) as:

$$CI = \frac{\sum j = 1^{j f i}}{N}$$

Where,

j = the number authors in an paper i.e. 1, 2, 3 ……
fj = the number of j authored papers published in discipline during a certain period of time
N = the total number of papers published in discipline during a certain period of time
A = the total number of authors per papers

Table 6 examined the Collaborative Index (CI) values, it can be obtained by the total number of authors divided by the total number of published papers. Collaborative Index during the period of 1992 to 2021 was calculated. The highest Collaborative Index value is 7.17 in the year 2020, followed by 7.04 in 2018. The least Collaborative Index value is 4.02 in the year 1998. The average collaborative Index value is 5.31 and the collaborative Index for universal value is 5.97. The result shows that the value of the collaborative Index gradually increased from the year of 1992 to 2021.

Table 6: Collaborative Index

Year	No. of Publications	No. of Authors	Collaborative Index
1992	74	329	4.45
1993	71	298	4.20
1994	66	307	4.65
1995	75	318	4.24
1996	111	471	4.24
1997	91	404	4.44
1998	130	522	4.02
1999	107	461	4.31
2000	94	416	4.43
2001	85	399	4.69
2002	106	457	4.31
2003	97	438	4.52
2004	111	560	5.05
2005	138	762	5.52
2006	345	1741	5.05
2007	268	1371	5.12
2008	569	3010	5.29
2009	300	1672	5.57
2010	338	1980	5.86
2011	469	2573	5.49
2012	578	3284	5.68
2013	468	2585	5.52
2014	497	2802	5.64
2015	516	3254	6.31
2016	589	3911	6.64
2017	611	4036	6.61
2018	677	4766	7.04
2019	1499	9505	6.34
2020	615	4412	7.17
2021	781	5450	6.98
Total	**10476**	**62494**	**5.97**

4.7 Most Prolific Authors in the field of Hepatology Research

Table 7 identifies themost prolific authors in the field of hepatology. The author Sarin, Shiv Kumar of Institute of Liver Biliary Sciences (ILBS), New Delhi, is the most productive author with 964 publications and 19806 citations, (ACPP 20.54 and h-index 68), followedby Kumar, Ashish of Sir Ganga Ram Hospital, New Delhi has published 417 publications with 5841 citations, Gupta, R of Govind Ballabh Pant Hospital, New Delhi has published 307 publications with 3044 citations (ACPP 9.92 and h-index 29), and Kochhar, R of Postgraduate Institute of Medical Education and Research (PGIMER), Chandigarh has published 293 publications with 1978 citations (ACPP 6.75 and h-index 24) (Figure 1).

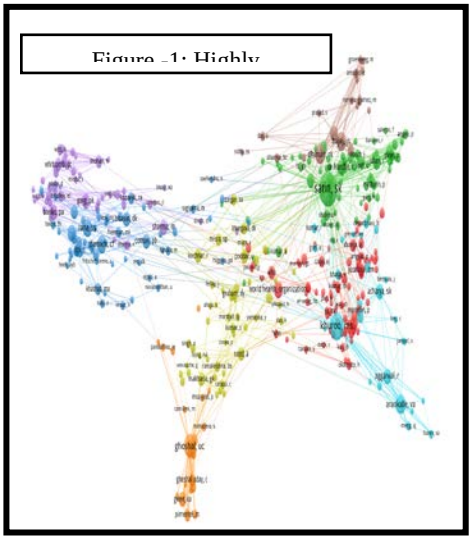


Table 7: Highly productive Authors in the Hepatology research in India

Sl. No	Author	Affiliation / Institution	No. of. Publications	No. of. Citations	ACPP	H-Index
1	Sarin, Shiv Kumar	Institute of Liver Biliary Sciences (ILBS), New Delhi	964	19806	20.54	68
2	Kumar, Ashish	Sir Ganga Ram Hospital, New Delhi	417	5841	14.01	37
3	Reddy, D. Nageshwar	Asian Institute of Gastroenterology, Hyderabad	347	4740	13.66	33
4	Gupta, R	Govind Ballabh Pant Hospital, New Delhi	307	3044	9.92	29
5	Kochhar, R	Postgraduate Institute of Medical Education and Research (PGIMER), Chandigarh	293	1978	6.75	24
6	Singh, Kartar	Sanjay Gandhi Postgraduate Institute of Medical Sciences, Lucknow, Uttar Pradesh	265	2772	10.46	30
7	Rana, Surinder Singh	Postgraduate Institute of Medical Education and Research (PGIMER), Chandigarh	249	1480	5.94	21
8	Sharma, Manik	All India Institute Medical Science, (AIIMS)New Delhi,	239	3085	12.91	18
9	Bhasin, Deepak Kumar	Postgraduate Institute of Medical Education and Research (PGIMER), Chandigarh	228	1806	7.92	24
10	Sharma, BarjeshChander	Govind Ballabh Pant Hospital, New Delhi	222	8624	38.85	43
11	Dhiman, Radha K	Postgraduate Institute of Medical Education and Research (PGIMER), Chandigarh	220	4311	19.6	35
12	Sharma, Vijay	Mahatma Gandhi University of Medical Sciences & Technology	209	769	3.68	15
13	Ghoshal, Uday C	Sanjay Gandhi Postgraduate Institute of Medical Sciences, Lucknow, Uttar Pradesh	203	4053	19.97	36
14	Maiwall, Rakhi	Institute of Liver Biliary Sciences (ILBS), New Delhi	197	1777	9.02	21
15	Sharma, Praveen	Govind Ballabh Pant Hospital, New Delhi	197	3702	18.79	32
16	Sharma, Shvetank	Institute of Liver and Biliary Sciences, New Delhi	196	1013	5.17	17
17	Singh, Virendra	Postgraduate Institute of Medical Education and Research (PGIMER), Chandigarh	193	1706	8.86	22
18	Duseja, Aja	Postgraduate Institute of Medical Education and Research (PGIMER), Chandigarh	191	3170	16.6	29
19	Rastogi, Archana	Institute of Liver Biliary Sciences (ILBS), New Delhi	190	2134	11.23	19
20	Kumar S	Sanjay Gandhi Postgraduate Institute of Medical Sciences, Lucknow, Uttar Pradesh	183	1351	7.38	22

4.8 Most productive journals in the field of Indian Hepatology literature

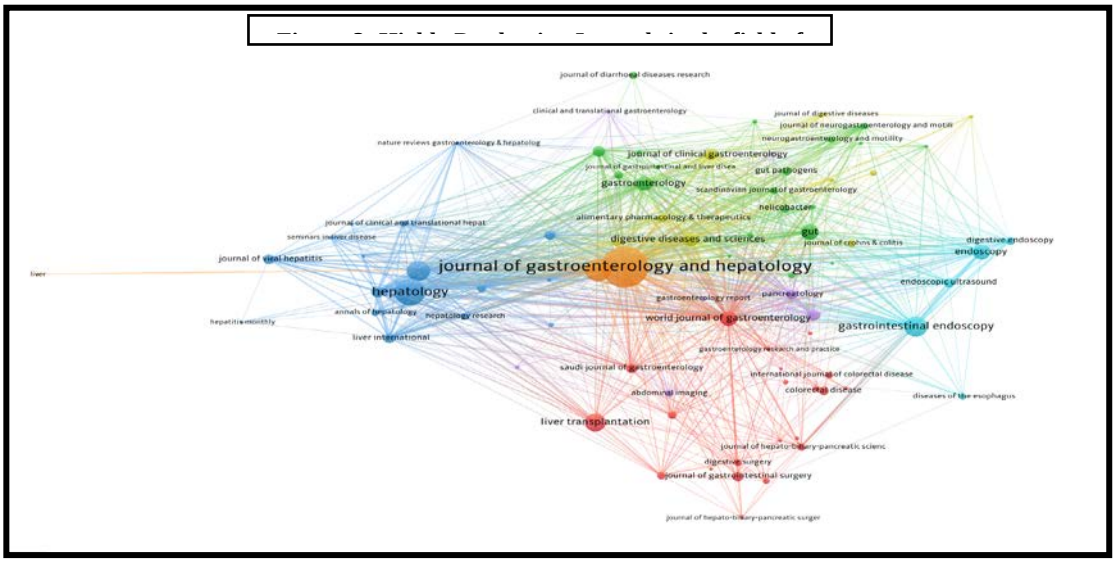
Table 8 reveals thatthe list of top 20 productive journals preferred bythe scientists of India in the field of hepatology research.Journal of Gastroenterology and Hepatology from the USA has ranked first in terms of publications i.e.2592 publications and followed by Hepatology from the USAwhich has ranked second and has contributed 995 publications, American Journal of Gastroenterology from Philadelphia has ranked third with 704 publications, Gastrointestinal Endoscopy from the USAhas ranked fourth in terms of publications i.e.535, and Journal of Hepatology fromthe Netherlands has fifth with 503 publications.

With regard to average citations per paper (ACP), Hepatology International ranks first (48.11 ACP), followed by World Journal of Gastroenterology (30.28 ACP), Clinical Gastroenterology and Hepatology (27.61 ACP), Liver International (22.08), and Journal of Viral Hepatitis (20.76 ACP)(Figure 2).

Table 8:Highly Productive Journals in the field of Hepatology

Sl. No.	Journal Name	Publisher	TP	TC	ACP	Impact Factor
1	Journal of Gastroenterology and Hepatology	Wiley, USA	2592	15301	5.9	2.251
2	Hepatology	Wiley, USA	995	6532	6.56	14.08

3	American Journal of Gastroenterology	Lippincott Williams &Wilkins, Philadelphia	704	5765	8.1	10.38
4	Gastrointestinal Endoscopy	American Society for Gastrointestinal Endoscopy	535	5033	9.41	5.639
5	Journal of Hepatology	Elsevier¸Netherlands	503	6207	12.34	25.083
6	Liver Transplantation	Wiley, USA	388	958	2.47	4.57
7	Gut Journal	BMJ (British Medical Journal), United Kingdom	314	4700	14.97	19.82
8	Endoscope	European Society of Gastrointestinal Endoscopy, Germany	295	3696	12.53	5.196
9	World Journal of Gastroenterology	Baishideng Publishing Group, USA	271	8206	30.28	3.365
10	Gastroenterology	Elsevier, Netherlands	253	4481	17.71	22.68
11	Digestive Diseases and Sciences	Springer Science+Business Media, Germany	224	3803	16.98	2.937
12	Pancreas	Openventio Publishers, USA	150	1499	9.99	2.92
13	Hepatology International	Springer New York, USA	149	7168	48.11	6.047
14	Journal of Clinical Gastroenterology	Lippincott Williams & Wilkins, Philadelphia	149	2462	16.52	9.99
15	Journal of Pediatric Gastroenterology and Nutrition	Lippincott Williams & Wilkins, Philadelphia	140	2505	17.89	2.799
16	Journal of Viral Hepatitis	Wiley, USA	123	2554	20.76	3.561
17	Liver International	Wiley, USA	121	2672	22.08	5.175
18	Pancreatology	Elsevier, Netherlands	113	1633	14.45	3.629
19	Saudi Journal of Gastroenterology	Wolters Kluwer Medknow Publications, Mumbai	112	979	8.74	1.990
20	Clinical Gastroenterology and Hepatology	American Gastroenterological Association, USA	103	2844	27.61	11.38



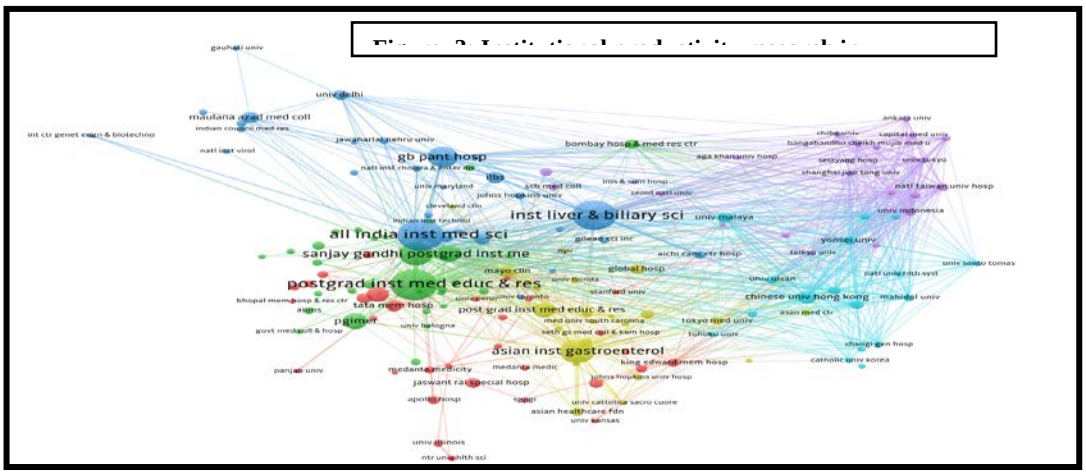
4.9 Organization/ Institutional productivity research in Hepatology in India

Table 9 shows the most productive organizations, the total number of citations, and average citations per papers in hepatology research. These organisations have together contributed 7338 publications with 70.05% of the total research output. Post Graduate Institute of Medical Education Research (PGIMER), Chandigarh has contributed the highest number of publications, i.e.1412 publications with 13.48% of total research output, followed by the Institute of Liver Biliary Sciences (ILBS), New Delhi has contributed 990 publications with 9.45%, All India Institute of Medical Sciences (AIIMS), New Delhi has contributed 906 publications with 8.65%, Sanjay Gandhi Postgraduate Institute of Medical Sciences, Lucknow, Uttar Pradesh has produced 701 publications with 6.69%, and Asian Institute of Gastroenterology, Hyderabad has contributed 551 publications with 5.26%.

In terms of Post Graduate Institute of Medical Education Research (PGIMER), Chandigarh has received the highest citations i.e. 16513 with 11.69 average citations per paper (ACP), followed by Govind Ballabh Pant Institute of Postgraduate Medical Education Research, New Delhi has received 15341 citations with 28.57 average citations per paper, and
Institute of Liver Biliary Sciences (ILBS), New Delhi has received 14001 citations with 14.4 average citations per paper(Figure 3).

Table 9: Institution/ Organizations Productivity

Sl. No.	Institution / Organization	No. of. Publications	No. of. Citations	ACPP	H-Index
1	Post Graduate Institute of Medical Education Research (PGIMER), Chandigarh	1412	16513	11.69	56
2	Institute of Liver Biliary Sciences (ILBS), New Delhi	990	14001	14.4	53
3	All India Institute of Medical Sciences (AIIMS), New Delhi	906	1412	18.11	68
4	Sanjay Gandhi Postgraduate Institute of Medical Sciences, Lucknow, Uttar Pradesh	701	13848	19.75	56
5	Asian Institute of Gastroenterology, Hyderabad	551	7397	13.42	44
6	Govind Ballabh Pant Institute of Postgraduate Medical Education Research, New Delhi	537	15341	28.57	60
7	Christian Medical College Hospital (CMCH), Vellore, Tamil Nadu	296	4366	14.75	37
8	Sir Ganga Ram Hospital, New Delhi,	207	1601	7.73	20
9	Maulana Azad Medical College, New Delhi	205	4981	24.3	38
10	Indian Council of Medical Research (ICMR), New Delhi	188	1801	9.58	23
11	Tata Memorial Hospital (TMC), Mumbai, Maharashtra	186	1557	8.37	23
12	King Edward Memorial Hospital and Seth GordhandasSunderdas Medical College, Mumbai, Maharashtra	170	2963	17.43	26
13	Dayanand Medical College & Hospital (DMC&H), Ludhiana, Punjab	169	3000	17.75	26
14	Global Hospitals India, Hyderabad Telangana	145	3444	23.75	22
15	St. John's Medical College, Bengaluru, Karnataka	128	1928	15.06	19
16	Institute of Post Graduate Medical Education Research (IPGMER), Kolkata	116	2397	20.66	27
17	University of Delhi, Delhi	111	2782	25.06	25
18	SMS Medical College Hospital, Jaipur	110	1014	9.22	15
19	Bombay Hospital Medical Research Centre, Mumbai, Maharashtra	108	3468	32.11	26
20	Council of Scientific Industrial Research (CSIR), New Delhi	102	1466	14.37	23



4.10 Highly Cited Papers/ Publications from India in Hepatology

Table 10 indicates the top10 cited papers from India in hepatology research published during the period of 1992 to 2021. A total of 7416 citations were received with 741.6 average citations per paper. The top ten papers with the highest citations were published in 5 journals including 5 papers in Hepatology International, 2 papers in Lancet Gastroenterology & Hepatology, 1 papereach in World Journal of Gastroenterology, Hepatology,Journal of Hepatology. All the papers multi authored (Three or more than 3 authors).

The paper titled Asian-Pacific clinical practice guidelines on the management of hepatitis B: a 2015 update received the highest citations i.e. 1070 published in *Hepatology International* in the year 2016, followed by Global prevalence and genotype distribution of hepatitis C virus infection in 2015: a modelling study received second highest citations i.e. 1039 published in the journal*Lancet Gastroenterology & Hepatology*in the year 2017,Asian Pacific Association for the Study of the Liver consensus recommendations on hepatocellular carcinoma received 788 which was citations published in the journal *Hepatology International* duringthe year 2010.

Table 10: List of top 20 highly cited papers, 1992-2021

Sl. No.	Title	Year	Authors	Source	Citations	Page No.	Vol. No.
1	Asian-Pacific clinical practice guidelines on the management of hepatitis B: a 2015 update	2016	Sarin, SK; Kumar, M; Kao, JH	Hepatology International	1070	1-98	10(1)
2	Global prevalence and genotype distribution of hepatitis C virus infection in 2015: a modelling study	2017	Blach, S; Zeuzem, S; Razavi, H	Lancet Gastroenterology & Hepatology	1039	161-176	2(3)
3	Asian Pacific Association for the Study of the Liver consensus recommendations on hepatocellular carcinoma	2010	Omata, M; Lesmana, LA; Sarin, SK	Hepatology International	788	439-474	4(2)
4	Asian-Pacific consensus statement on the management of chronic hepatitis B: a 2012 update	2012	Liaw, YF; Kao, JH; Omata, M	Hepatology International	735	531-561	6 (3)
5	Asia-Pacific clinical practice guidelines on the management of hepatocellular carcinoma: a 2017 update	2017	Omata, M; Cheng, AL; Sarin, SK	Hepatology International	710	317-370	11 (4)
6	Role of the normal gut microbiota	2015	Jandhyala, SM; Talukdar, R; Reddy, DN	World Journal of Gastroenterology	706	8787-8803	21(29)
7	Prevalence, Classification and Natural-History of Gastric Varices - A Long-Term Follow-Up-Study In 568 Portal-Hypertension Patients	1992	Sarin, Sk; Lahoti, D; Makwana, U	Hepatology	692	1343-1349	16(6)
8	Acute-on-chronic liver failure: consensus recommendations of the Asian Pacific Association for the study of the liver (APASL)	2009	Sarin, SK; Kumar, A; ; Yuen, MF	| Hepatology International	651	269-282	3(1)
9	Burden of liver diseases in the world	2019	Asrani, SK; Devarbhavi, H; Kamath, PS	Journal of Hepatology	579	151-171	70(1)
10	Global prevalence, treatment, and prevention of hepatitis B virus infection in 2016: a modelling study	2018	Razavi-Shearer, D; Gamkrelidze, I; Razavi, H	Lancet Gastroenterology & Hepatology	446	383-403	3(6)

5. CONCLUSION

The present study shows the level of the research in the field of hepatology in India during the period 1991 to 2021. Publication productivity is used as the criteria for the research output of individual scholars, academic programs, and institutions. Studies consistently show that there occurs enormous variation in authors' levels of productivity. The analysis of the publication productivity of hepatology research shows that there is an increasing trend of publication growth. A total number of 10476 papers were published by scientists during the period. The results reveals the highest degree of collaboration is 0.973, and thehighest collaborative index value is 7.17, the Journal of Gastroenterology and Hepatology from the USA has contributed highest number of publications i.e. 2592, and amongthe research institutes the Post Graduate Institute of Medical Education Research (PGIMER), Chandigarh has produced the highest number of publications, i.e.1412.

Scientometric analysis is a statistical and mathematical tool that has an eminent perspective to increase valuable insights into the evolution of the research in this field as in the case of new emerging technologies and processes such as hepatology research. The productivity of scientists in the field of hepatology shows substantial growth both quantitatively and qualitatively with the development of research in India. The co-authorship pattern indicates that the collaboration between the nations has increased profusely in the last two decades. This will further strengthen the alliance between the developed and developing countries. Therefore, there is a necessity to enhance the focus in the field of hepatology research, so that it will be helpful for the government and policymakers to formulate an effective set of determinant structures for the distinguished growth of the research in this field.

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