Research Trends in Herpes Zoster During 1989–2023 : A Scientometric Study

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Abstract

Purpose – The study attempts to bring out the research status of Herpes Zoster during 1989-2023 across the globe since it is one of the killing diseases.

Design – Bibliographic databases contain the published records for conducting bibliometric studies. Data were extracted from Web of Science, using a keyword "Herbs Zoster". The search period was limited to

Methodology - Data were identifies as 12782 records. VOS viewer and Biblioshiny software were used to validate the records and comparisons. The search period was limited from 1989 to 2023.

Findings – USA leads the other countries in terms of research in Herpes Zoster followed by U.K. There are similar keywords used such as Virus, Varicella, Vaccine, Neuralgia and Simplex. Time series analysis reveals that scientific publications are expected to be 519.9% in 2033. As far as degree of collaboration is concerned, multi authors' contribution is noteworthy i.e.408 (2018 – 2023)



Originality – The present study brings out the impact of the spread of killing disease like Herpes Zoster. This work will be useful for medical practitioners and researchers who are involved in communicable diseases. Decisions makers will gain the effect of research being taken up in Herpes Zoster.

Keywords – Herpes Zoster, research, metrics, communicable disease, Scientometrics, Web of Science

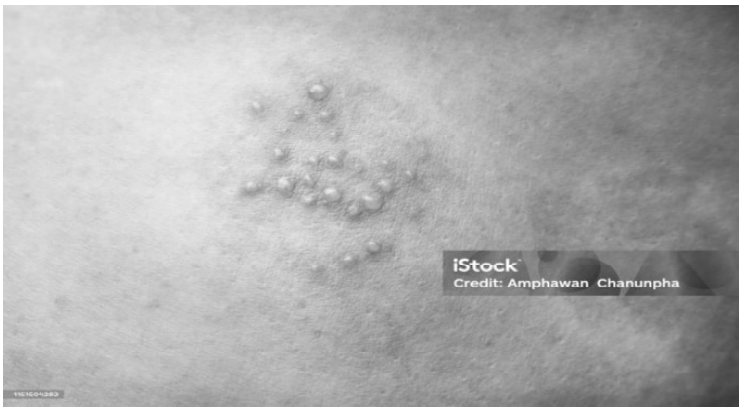
Introduction

Scientometrics is one of the suitable methods to identify the research trends in any subject. Academics of Information science used to apply Scientometrics tools to validate the quantum of data for a subject. Now it has widely been applied by academics of different subject domains. The present study brings out the research trends in Herpes Zoster at global level.

Herpes Zoster (HZ) is one of the diseases which may lead to the claim the life of human beings. It will cause stroke and acute myocardial infarction. Herpes Zoster infections are being recognized through pain, unilateral vesicular skin eruptions. It has a life time risk of 10 to 30 %. It is otherwise known as a Shingles which is caused by reactivation of Varicella-Zoster Virus (VZV) that may further lead to chicken box. People with Herpes Zoster (HZ) will commonly face a rash either in one or two adjacent dermatomes. It mostly appears on the trunk. The rash is usually painful, itchy or tingly. Headache, photophobia and malaise are the regular symptoms for being experienced.

Postherpetic Neuralgia (PHN) is the common complication of Herpes Zoster. PHN is a kind of pain which exists in the area where the rash is located and to continue more than 90 days. PHN may last even for months or years. 10 % to 18% of people with Herpes Zoster will have PHN. There are vaccines like Recombinant Zoster (RZV, Shingrix) which can prevent shingles and its related complications. It is also a communicable disease through skin - to - skin contact. It is treatable but not curable.

Image of the affected part in human body



Source:

https://www.istockphoto.com/photo/woman-leg-skin-background-with-rash-from-herpes-zoster-or-shingles-disease-gm1151504282-312099549?utm_source=pixabay&utm_medium=affiliate&utm_campaign=SRP_image_ sponsored&utm_content = https%3A%2F%2Fpixabay. com%2 Fimages%2Fsearch% 2Fherpes% 2520zoster%2F&utm_term=herpes+zoster

Review of related work

Pratiwi, Hening et al (2024) attempted to navigate an Asthma network using social network methods. Asthma being a communicable disease affects humans gradually. The study used tweet by forming a Whatsapp group by which 48122 records were received for analysis. News reporters emerged as most influential group followed by government health care organizations. Education became an important factor which influenced to know the effective spread of Asthma.Twitter data were effectively used to know the notions on Asthma using NodeXLPro software. It was typically imported into Gephi application. It was further emphasized the need for dissemination and promotion of Asthma related awareness and education.

Zhu, Wenjunetal (2023) conducted a Scientometrics study for bipolar disorder using Web of science database. Records during 2002-2021 were taken for analysis and discussion. There were 55, 358 publications found during the study period. Cite space, VOS viewer and His cite were performed to measure the research trends in bipolar disorder Cite space was applied to explore bibliographical analysis such as country wise , Institution wise keyword, category and similar. This kind of study will highlight the gaps or unaddressed issues within the subject domain which may further require greater attention and consideration for future research work.

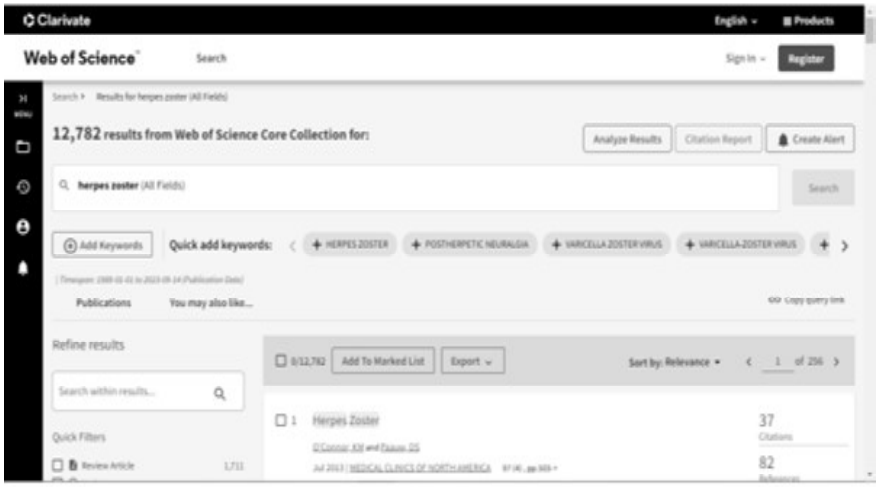
Objectives of the study

1. To identify the Herpes Zoster research output during 1989–2023,
2. To find out the growth of literature on Herpes Zoster research
3. To know the India's share compared with the world output,
4. To determine the core journals in the field,
5. To trace the authorship pattern in the field,
6. To rank the most productive institutions and
7. To examine the applicability of the Bradford law of scattering, Lotkas Law and Zips Law

Materials and Methods

Data were retrieved from Web of Science database for this study.WoS contains millions of metadata records, and the present study used the keyword "Herpes Zoster"andsearched for a period of 35 years from January 1989 to September 2023. The search results showed that 12782 bibliographic records werefoundand taken into consideration for the study. Prior to 1989 there were no records reported in theWoS database with the key word 'Herpes Zoster'.The retrieved data has different categories such as articles, review, editorial material, meeting abstract, proceeding paper, biographical items. The data has been transferred to excel spreadsheet for further analysis. Hiscite software and Biblioshiny (R Package) software have effectively been used.

Screen shot showing the authenticity of data extraction.



The Biblioshiny software was developed by Massimo Aria and CorradoCuccurullo (2017), University of Naples Fedcrico II, Italy.

Table 1: Year wise distribution of Herpes Zoster

S. No	Year	Records	Cumulative Records	Percentage
1	1989-1993	842	842	6.58
2	1994-1998	1268	2110	9.92
3	1999-2003	1187	3297	9.28
4	2004-2008	1489	4786	11.6
5	2009-2013	2127	6913	16.6
6	2014-2018	2680	9593	20.9
7	2019-2023	3189	12782	24.9

Year wise distribution has been classified for better understanding. The highest number of research output i.e.3189(24.9%) was found during 2019-2023 and the lowest number of research output i.e. 842(6.58%) identified during 1989-1993. It is found that there is a slight decrease in the growth of literature during2019-2023 compared with theperiod1989-1993.

Table 2: Comparison between of Global and Indian Output (with-Index)

Period	Global Output	Percentage	Indian Output	Percentage	h - Index
2023-2014	5930	46.35%	169	2.85%	114
2013-2004	3547	28.10%	72	1.99%	145
2003-1994	2458	19.07%	24	0.97%	131
1993-1989	847	6.48%	5	0.59%	85

It has been identified the research productivity in Herpes Zoster between India and the rest of the world from 1989 to 2023. The outcomes confirm that there is a maximum of three digits in the number of scientific papers. The largest number of research articles (5930, 46.35%) was found from the globe between 2023 and 2014, while more than two digits were identified from India with 114 h-index, the majority of Indian literature was found (169, 2.85%) between 2023 and 2014. Additionally, the fewest paperswere found from the globe between 1993- 1989 (847, 6.48%) and found in India between 1993-1989 (5, 0.59%) with 85 h- indexand discovered virtually before 1989–1993. In terms of global productivity, the growth rate has progressively increased during 1989–1993.

Table 3 : Ranking of Core journals on Herpes Zoster (Top 10 Journals)

S. No	Journal	Records	% of 1722	Cumulative no. of Records	Cumulative %
1	JOURNAL OF VIROLOGY	387	22.47%	387	22.47%
2	VACCINE	233	13.53%	620	36.00%
3	JOURNAL OF INFECTIOUS DISEASES	202	11.73%	822	47.73%
4	CLINICAL INFECTIOUS DISEASES	172	9.98%	994	57.72%
5	JOURNAL OF MEDICAL VIROLOGY	159	9.23%	1153	66.95%

6	JOURNAL OF THE AMERICAN ACADEMY OF DERMATOLOGY	141	8.18%	1294	75.14%
7	JOURNAL OF DERMATOLOGY	110	6.38%	1404	81.53%
8	PLOS ONE	109	6.32%	1513	87.86%
9	INTERNATIONAL JOURNAL OF DERMATOLOGY	108	6.32%	1621	94.13%
10	HUMAN VACCINES & IMMUNOTHERAPEUTICS	101	5.86%	1722	99.87

Core journals were identified and categorized based on rank-wise productivity. The Journal of Virology is the most productive and highly ranked one, with 387 records (22.47%), followed by Vaccine with 233 records (13.53%). The Journal of Infectious Disease, with 202 records (11.73%), got ranked third.

Table 4: Relative Growth Rate (RGR) and Doubling Time (DT)

S. No.	Period	Quantum of	Cumulative Output Output	W1	W2	R(a)=W2-W1	Mean	Dt (a)	Mean
1	Before	Nil 1989	-	-	-	-		-	
2	Jan1989-	842 1993	842	6.73	6.73	-		-	
3	1994-	1268 1998	2110	7.14	7.65	0.51		1.35	
4	1999-	1187 2003	3297	7.07	8.10	1.03		0.67	
5	2004-	1489 2008	4786	7.30	8.47	1.17	1.09	0.59	0.70
6	2009-	2129 2013	6915	7.66	8.84	1.18		0.58	
7	2014-	2675 2018	9590	7.89	9.16	1.27		0.54	
8	2019-	3192 2023Sep	12782	8.06	9.45	1.39		0.49	



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Relative Growth Rate (RGR) and Doubling Time (DT) were explored on global Herpes zoster research output. 3192 research articles were found during 2019–2023, and the numbermay rise to 824 during 1989–1993. The relative growth rate of Herpes Zoster is seen with the range from 0.51 during (1994–1998) to 1.39 (2019–2023).

Table 5: International Collaborative research on Herpes Zoster (Top 10)

S. No	Country	Records	Percentage	TLCS	TGCS
1	USA	4523	35.38%	48131	168849
2	UK	1156	9.04%	12571	52866
3	Japan	992	7.76%	6281	22151
4	Germany	970	7.35%	6200	34743
5	Peoples R China	747	5.84%	1940	8372
6	France	633	4.95%	3124	22313
7	Belgium	576	4.50%	4918	23234
8	Canada	557	4.35%	6030	23697
9	Italy	548	4.28%	2671	20165
10	Unknown	479	3.74%	1904	6331

It has been identified that the worldwide collaborative research on Herpes Zoster at the global level. The highest number of research output was found from the United States (4523, 35.38%). Output from Republic of China (747, 5.48%), Japan (992, 7.76%), the United Kingdom (1156, 9.04%), and Germany (970, 7.35%) were also identified and presented for easy reference.



Figure 1

Table 6: Highly Productive Keywords on Herpes Zoster (Top 10)

S. No	Word	Records	TLCS	TGCS
1	ZOSTER	6271	60676	112970
2	HERPES	5202	45487	93541
3	VIRUS	2503	23139	76054
4	VARICELLA	2362	26015	59256
5	PATIENTS	1715	10392	41509
6	INFECTION	1070	6121	25186
7	VACCINE	858	11823	22379
8	NEURALGIA	836	10191	21869
9	TREATMENT	799	4705	19224
10	SIMPLEX	755	5160	23821

Keyword which represents ***Herpes Zoster***was identified and illustrated. Throughout the study period, Herpes Zoster was used by the subject experts and the phrase "Zoster" appeared 6271 times, followed by "Herpes" with 5202 times. With 687 usages, the word "Virus" gained the third position.

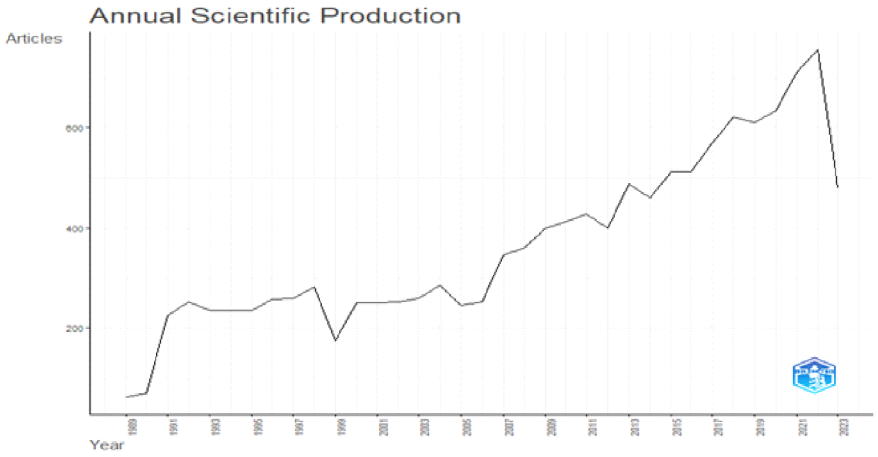


Figure 2: Annual Scientific Production

Figure 2 denotes the growth of documents on Herpes Zoster. There is an increasing trend in the number of documents on annual scientific production. Further, it is seen that research and publication of documents in the preceding years has gained momentous growth in Herpes Zoster.

Table 7: Time Series Analysis

Year	No. of Publication (Y)	X	X^2	XY
1989	62	-17	289	-1054
1990	68	-16	256	-1088
1991	225	-15	225	-3375
1992	252	-14	196	-3528
1993	235	-13	169	-3055
1994	235	-12	144	-2820
1995	235	-11	121	-2585
1996	257	-10	100	-2570
1997	259	-9	81	-2331
1998	282	-8	64	-2256
1999	175	-7	49	-1225

2000	251	-6	36	-1506
2001	250	-5	25	-1250
2002	252	-4	16	-1008
2003	259	-3	9	-777
2004	285	-2	4	-570
2005	244	-1	1	-244
2006	253	0	0	0
2007	346	1	1	346
2008	360	2	4	720
2009	400	3	9	1200
2010	410	4	16	1640
2011	428	5	25	2140
2012	400	6	36	2400
2013	489	7	49	3423
2014	459	8	64	3672
2015	511	9	81	4599
2016	530	10	100	5120
2017	569	11	121	6259
2018	622	12	144	7464
2019	611	13	169	7943
2020	633	14	196	8862
2021	712	15	225	10680
2022	756	16	256	12096
2023	477	17	289	8109
	12782		3570	55431

Straight Line equation:

$Yc = a+bX$

Since $\Sigma X=0$

$a = \Sigma Y/N=12774/35=364.9$

$b = \Sigma XY/\Sigma X^2=55431/3570=15.5$

Estimated Literature is when X = 2023 – 2033 = 10

= 364.9 + (15.5 x 10) = 519.9

Estimated Literature is when X = 2038 – 2023 = 15

= 364.9 + (15.5 x 15) = 597.4

Number of anticipatedScientific publications are to be 519.9 in 2033, while 597.4 articles are estimated in 2038. The predicted value of the literary outputduring 2033 - 2038 is split by the formula time series analysis. The findings indicate the potential future and research directions are possible for Herpes Zoster publications worldwide. It demonstrates a gradually declining trend in the publications of research as well. Therefore,further initiative will enhancethe publications and research output on Herpes Zoster to some extent.

Table 8: Authorship Pattern on Herpes Zoster

Period	1	2	3	4	5	5+	Total
1989-1993	348	364	339	318	296	395	1860
1994-1998	218	225	200	178	155	292	1268
1999-2003	348	388	414	398	324	312	2184
2004-2008	162	220	237	219	196	430	1465
2009-2013	189	302	291	295	260	791	2129
2014-2018	167	159	146	154	139	497	1262
2018-2023	255	328	377	417	408	829	2614
Total	1689	1986	2204	1979	1778	3146	12782

(Note: 1* Single Author, 2* Two Author, 3* Three Author, 4* Four Author, 5* Five Author, 5+ Five above Author).

The authorship pattern of publications through joint research projects are shown in Table 8. The number of contributors per publication is broken down by period. Notably, the greatest number of single-authored contributions has occurred between 1989 - 1993. In similar, the highest number of contributions from two authors was noted during thesame period. The results showed that there isdiversity in the distribution of author groups and their publications over a period. In particular, the chart highlights the high productivity of collaborative authorship by indicating consistent growththrough multi-authors.

Table 9: Degree of Collaboration (DC)

Period	Number of Single Author (NS)	Number of Multi Author (NM)	Total (NM+NS)	DC= NM/NM/+NS
1989-1993	348	395	743	0.53
1994-1998	218	292	510	0.57
1999-2003	348	312	660	0.47
2004-2008	162	430	592	0.72
2009-2013	189	791	980	0.80
2014-2018	167	497	664	0.74
2018-2023	255	408	663	0.61
Total	1689	3125	4812	0.64

To evaluate the authorship pattern in terms of single versus multi-authored literature output, the degree of collaboration (DC) is used. (DC) is defined as the ratio of the number of collaborative research papers to the total number of research papers in a discipline during certain period of time. This formula suggested by Subramanian (1983) is used and expressed as: C= Nm/Nm+Ns

Where, C- denotes the degree of collaboration in a discipline; Nm- indicates the number of multi- authored research papers in the discipline published



during the year; Ns- represents the number of single authored papers in the discipline published during the same year. While, it is observed based on the formula and it is found that the degree of collaboration for Herpes Zoster is 0.53 between 1989-1993, 0.57 between 1994-1998, 0.47 between 1999-2003, 0.72 between 2004-2008, 0.80 between 2009-2013, 0.74 between 2014-2018, 0.61 between 2018-2023 accordingly.

Table 10: Lotkas Law of Author Productivity

No of Papers	No of Authors	Log of X	Log of Y	XY	X^2	$1/X^n$
1	1689	0	3.22	0	0	1
2	1986	0.03	3.29	0.09	0	0.93
3	2204	0.47	3.34	1.56	0.22	0.90
4	1979	0.60	3.29	1.97	0.36	0.88
5	1778	0.69	3.24	2.23	0.47	0.86
6	3146	0.77	3.49	2.68	0.59	0.85
Total	12782	2.56	19.87	8.53	1.64	5.42

Lotka's law is applied to find out the author productivity (Lotka, 1926). Majority of published articles are the output of a small number of scholars who have made a significant contribution. Alogarithmic relationship between the quantity of publications and the number of researchers is brought out using the law. In Lotka's (1926) words, "the number of authors making n contributions is about 1/n2 of those making one, and the proportion of all contributors that make a single contribution is about 60 percent." (Potter, 1988). The law can be expressed generally as XY=C, where X is the total number of publications, Y is the proportion of authors with X publications, and C and n are field-specific constants. Moreover, 1/n2 of the total articles are contributed by authors who publish n publications. Tsay (2003) states that, the formula is often known as the Inverse Square Law.

Calculation of the exponent "n"

To apply Lotka's law, the first step is to determine the value of the exponent "n". This value is calculated using the linear square method which involves utilizing the formula below. The data provided in table 10 is used to calculate the parameter "n" by substituting the values in the equation. It allows us to derive the value of "n"

$$n = \frac{N\sum XY - \sum X \sum Y}{N\sum X^2 - (\sum X)^2}$$

$$n = \frac{6 \text{ X } 8.53 - 2.56 \text{ X } 19.87}{6 \text{ X } 1.64 - (2.56)^2}$$

$$n = \frac{51.18 - 50.86}{9.84 - 6.55}$$

$$n = \frac{0.32}{3.29}$$

$$n = 0.09$$

Where,

N= number of pairs of data

X= Logarithm of X i.e number of publications

Y= Logarithm of Y i.e number of authors

The constant c is calculated using formula

$$C = \frac{1}{\sum 1/x^n}$$

$$C = \frac{1}{5.42}$$

$$C = 0.18$$



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Zipf's law of Word occurrence

$$r*f = c$$

Where,

r = Rank

f = Frequency of Word

c = Constant

Taking log on both the sides,

Log (f) + log (r) = Log C

Where, c is constant

Zipf's law (1932) is applied in decreasing order of frequency word occurrence. When Zipf's law is applied, it is discovered that when the frequency of words is added to the log their rank, the results are nearly identical for each word. The frequency of the words appearing in the tittle, "Zoster", is shown in the below graph:

Word: Zoster

Frequency: 31758

Rank: 1

Log Frequency + Log of Rank

Log 31758 + Log 1

= 10.36 + 0.00

= 10.36

Table 11 : Zipf's law of Word occurrence

S.	Keyword No	Frequency	Rank (F)	Log f (r)	Log r	r*f=c	Log c
1	Zoster	31758	1	4.50	0	31758	4.50
2	Herpes	5343	2	3.72	0.30	10686	4.02
3	Virus	1864	3	3.27	0.47	5592	3.74
4	Varicella	908	4	2.95	0.60	3632	3.56
5	Patients	482	5	2.68	0.69	2410	3.38
6	Infection	312	6	2.49	0.77	1872	3.27
7	Vaccine	200	7	2.30	0.84	1400	3.14
8	Neuralgia	128	8	2.10	0.90	1024	3.01
9	Treatment	109	9	2.03	0.95	981	2.99
10	Simplex	81	10	1.90	1.00	810	2.90

Rank, Frequency and Log have been calculated and presented in table 11. Hence it is observed that Zipf's law does not apply on word occurrence.

Table 12.1: Bradford's Law of Scattering (1934)

No. of journals	Cumulative number of journals	No. of articles	Cumulative No. of articles
1	1	387	387
1	2	233	620
1	3	202	822
1	4	172	994
1	5	159	1153
1	6	141	1294
1	7	111	1405
1	8	109	1514
1	9	108	1622



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1	10	101	1723
1	11	95	1818
1	12	93	1911
1	13	92	2003
1	14	91	2094
1	15	89	2183
1	16	85	2268
1	17	82	2350
1	18	81	2431
1	19	80	2511
1	20	77	2588
1	21	74	2662
1	22	74	2736
1	23	72	2808
1	24	72	2880
1	25	72	2952
1	26	71	3023
1	27	69	3092
1	28	68	3160
1	29	63	3223
1	30	387	387
Other	31	1932	2319
Journals			

e^y is the Euler's number (value 1.781)

y^m is the number of articles in the journal and,

P is the number of Zones

Thus, y_m: 387, $e_{y:}$ 1.781, P: 3

Hence, K = $(1.781 \times 387)^{1/3}$

= $(689.247)^{1/3}$

Consider the logs of both sides

Log K= $(689.247)^{1/3} = (2.83837)^{1/3} = 0.94612$

K= 8.83

Number of core Journals (Bradford's first zone), i.e.., r_o can be calculated using the following formula:

r_o= T (k-1)/(kp-1)

T= Total number of journals: 1961

K= Bradford's constant: 8.83

P= Number of Bradford's zones: 3

r_o= 1961 (8.83-1) / (8.83^3-1)

= 1961 (7.83) / (688.465-1)

= 15354.63 / 687.465

= 22.33

r_o = ro x 1 = 22.33 = 23

r1 = ro x k = 22.33 x 8.83 = 197.17 = 197

r2 = ro x k^2 = 22.33 x 8.83^2 = 22.33 x 77.968 = 1741



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Table 12.2: Scattering of Journals and Articles over Bradford's Zone

Zone	No. of journals	Journals %	No. of articles	Articles %	Multiplier
1	23	1.17	4256	33.3	-
2	197	10.2	4320	33.8	8.56
3	1741	88.7	4206	32.9	8.83
Total	1961	100 %	12782	100 %	1.12

1: n: n2

23: 197: 1741

Table 12.1 and 12. 2 indicate that the first zone that consists of 23 (1.17%%) journals, which published 4256 (33.3%) research papers under the nuclear zone as they represent a small group of journals. The next group contains 197 (10.2%) journals with 4320 (33.8%) articles, and the third zone includes 1741 (88.7%) journal contributing 4206 (32.9%) articles. According to Bradford's law (1934), the number of variants and combinations lead to the formation of data.

Coupling Network Map

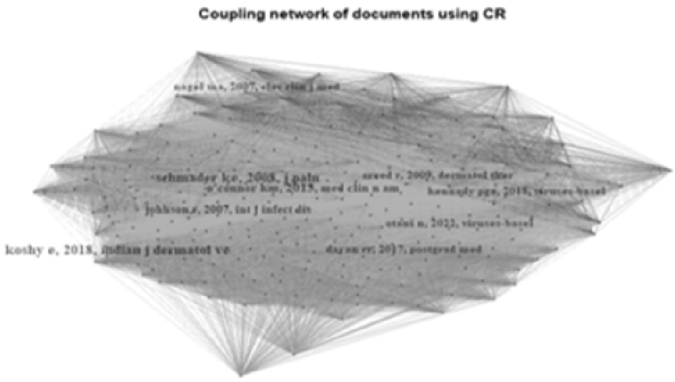


Figure: 3

Figure3 denotes the Network map of coupling analysis based on network of documents using Cognitive ratio. A bibliographic coupling network was established and the relationship between articles is determined based on the degree as well.

Discussion

Research studies on communicable disease have widely been taken up to social awareness and impact on public health as well. The present study visualized the impact of Herpes Zoster. The effect of the Herpes Zoster differs from one continent to another. There are medicines available and it will not be cured completely due to its nature. We have retrieved 12782 of records from science citation indexed journals using Web of Science online Bibliographic database. India being a most populous country next to China strives hard to provide good health information services and system to its citizens. There are many cases of Herpes Zoster being reported in Africans due to temperature, poor cleanliness, awareness and health education. Mapping of knowledge trends in a subject lead to provide evidence initiated through a quantitative research becomes inevitable one. Thus it provides concrete and significant decision support so as to combat many communicable diseases. Further the world has experienced lock down for months together to stop the spread and save the life of human beings. WHO also published diseases on a priority basis such as pandemic (Malik, Ahmad Azam et al,2021).

Findings and Conclusion

The research output i.e.3189(24.9%) was found during 2019-2023 and the lowest number of research output i.e. 842(6.58%) identified during 1989-1993. The largest number of research articles (5930, 46.35%) was found from the globe between 2023 and 2014, while more than two digits

were identified from India with 114 h-index, majority of Indian literature was found (169, 2.85%) between 2023 and 2014. 3192 research articles were found during 2019–2023, and the number may rise to 824 during 1989–1993. The relative growth rate of Herpes Zoster is seen with the range from 0.51 during (1994–1998) to 1.39 (2019–2023).

Web of science database provides a large amount of records (data) for measuring the research performance of any of the subject. The present study has retrieved 12782 of records from Web of Science (SC) using the keyword Herpes Zoster with the limit i.e. 01.01.1989 to 12.09.2023 years. World Health Organization (WHO) and regional level centres take initiatives to disseminate the information and health awareness among the public across the globe. WHO took major part in curtailingCovid – 19 which claimed huge human lives. Herpes Zoster is also a killing disease to some extent. It can be controlled at the initial stage of spread in a human body.

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