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EVALUATION OF RESEARCH PAPERS ON OTORHINOLARYNGOLOGY DURING THE PERIOD 1989-2018: A SCIENTOMETRIC STUDY

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ABSTRACT

The purpose of this study was to measure the number of contributions and highlight the contributions made by the researchers in the field of Otorhinolaryngology and published on the Web of Science database during 1989-2018 using scientometric analysis. Data were interpreted by using software such as Histcite, Vosviewer, and tabulated using MS Excel. The results indicated that 2039 papers were published during 1989 - 2018 and the highest number of publications 199 (9.8%) was produced in 2017. The average number of publications per year was 67.96. The major channel of communication used by the researchers was journals for thirty years. The trends in multi-authored papers have tremendously increased (85.58%) compared to (14.42%) single-authored papers. The relative growth rate (0.37) and degree of collaboration (0.86) is noted significantly and the highest no of papers (16.87%) was contributed by the collaboration of four authors. It also noted that the value of the highest degree of collaboration was (0.96) in 2017. The publication behavior of researchers shows that they were highly selective in publishing the research results in specialized journals. The International Journal of Pediatric Otorhinolaryngology, Laryngo-Rhino-Otologie stands first and second places respectively. The anonymous author (58, 2.8%) contributed more numbers of papers in the domain of Otorhinolaryngology with Germany (422, 20.7%) being the country producing more research papers followed by Turkey, the UK, and the USA. More than 200 papers had been published in Otorhinolaryngology, Surgery, and Medicine General Internal.

Keywords: Otorhinolaryngology, Otorhinology, Laryngology, Scientometrics.

1. INTRODUCTION

Scientometrics is the quantitative study of science, technology, and science policy. It has been evolved over time from the study of indices for improving information retrieval from peer-reviewed scientific publications (commonly described as the "bibliometric" analysis of science) to cover other types of documents and information sources relating to science and technology. Scientometric indicators contribute to standardize, collect, report and analyze a wide range of science, technology, and innovation activities.

Otorhinolaryngology is a specialty within medicine that deals with conditions of the ear, nose, and throat (ENT) and associated connection of the head and neck. Patients seek treatment from an otorhinolaryngologist for diseases of the ear, nose, throat, base of the skull, and for the surgical management of cancers and benign tumors of the head and neck. Otorhinolaryngology (ORL) comprises 20% of the adult general practice consultations. Like all medical and surgical specialties, Otorhinolaryngology faces important questions about the quality and quantity of health care being

delivered. As Otorhinolaryngology deals with most of the parts of the head and neck, it is connected with other areas of research in medicine. Otolaryngology, Neurology, Pediatric Otolaryngology, Rhinology, Laryngology, Head and Neck, Facial plastic and reconstructive surgery are the seven subspecialties of Otorhinolaryngology.

One method of measuring professional or academic interest in the medical field is a scientometric analysis of publications. It is believed that publications represent the awareness and usage level of the given field. In medicine, citation count denotes the academic influence of a subject area. The study thus determines to uncover the distribution of ORL articles by analyzing the characteristics of these articles such as year, author, language, publication type, country, subject, journal, keyword etc which in turn will be helpful in determining the qualities that make an ORL article important to the field of science as well as medicine.

2. REVIEW OF LITERATURE

Balasubramani, R., & Murugan, C. (2011) used a scientometric method to quantitatively analyze the research articles in remote sensing during 1975-FEB 2010. Various factors such as number of papers published, cited references, country-wise publications, productive authors, number of institutions involved in the research, most preferred journal, most preferred language by the scientist, etc were studied in a detailed manner. During their study period, 1,188 articles were published and cited references were 30,654. Their results indicated that the average number of publications published per year was 38.07.

Cimmino et al., (2005) evaluated the distribution and scope of papers published in the world in ORL journals and compared the impact of this research among different countries. Papers published in the 29 ORL journals screened by the Institute for Scientific Information (ISI, Philadelphia, PA, and the USA) during 1995-2000 were considered. The journal impacts factor (IF), the source country population, and gross domestic product (GDP) were recorded. All keywords, both assigned by the authors and attributed by ISI, were identified and their frequency was also calculated using a special-purpose program. The total number of papers in the ORL literature during the period 1995-2000 increased from 2036 to 3705. The leading keywords were “cancer” for disease and “surgery” for treatment. The data shows high scientific production of relatively small countries. It was suggested that the dispersion of keywords should be avoided and journal editors should enhance their standardization.

Gupta et al., (2015) examined 4117 global publications in nasal polyps research covered in Scopus during the period 2004-2013. They observed an average annual growth rate of 6.92% and citation impact per paper of 3.30. The world nasal polyps research output came from 83 countries and the top 10 most productive countries include the USA, the UK, Germany, Turkey, Japan, South Korea, China, Italy, Belgium, and India accounted for 91.24% share of the global publication and citation output during 2004-13. The USA contributed the largest citation share to the global citations in nasal polyps, followed by the UK, Belgium, Germany, Italy, Japan, China, South Korea, Turkey, and India during 2004-13. The top 10 most productive countries share the international collaborative papers in nasal polyps varied from 6.25% to 53.70% during 2004-13, with highest share from Belgium, followed by the UK, China, Germany, Italy, the USA, Japan, South Korea, India, and Turkey during 2004-13.

Gurberg et al., (2014) assessed the Canadian contribution to the Otolaryngology literature during the period 2008-2012. All articles published from January 2008 - December 2012 in 5 Otolaryngology journals were reviewed. Nationality, number of authors, and study type were extracted. The output, number of authors, and study type of Canadian papers were compared to International papers using Mantel-Haenszel Common Odds Ratio Estimate, Pearson's Chi-Squared or Fisher's exact tests. 4519 papers were analyzed. THERE was a statistically significant decrease in Canadian authored papers from 12.8% in 2008, 9 to 10.2% in 2011-12 (Fishers exact, $p = .01$). Multi-authorship increased in Canadian papers (χ^2 , $p = .01$). The types of studies published by Canadian Otolaryngologists did not find any change over the study period. Canadian authored papers in a sample of Otolaryngology journals decreased from 2008 to 2012. The increase in multi-authorship, instead of increasing collaboration, suggested reduced per capita publication productivity.

Narzary, R., & Murugan, C. (2018) analyzed colorectal cancer research output based on the data available on the Web of Science (WoS) database during the period 2005-2016. A total of 1219 records were taken for the analysis of Indian publications on colorectal cancer. The analysis revealed that there is an increasing trend in colorectal cancer research publications and the majority of the publications are in the form of articles across the world. India's highest collaborating country was the USA with 15.6% of the total collaborative work undertaken. The country-wise distribution and year wise contributions showed that 50% of world CRC research came from three countries viz. the USA, China, and Japan.

Sanabria, A. (2019) had done a bibliometric analysis on the International Head and Neck Scientific Group (IHNSG) activity organized in 2009 which deals with the head and neck oncology. Data was downloaded from the Web of Science database. This study conducted a descriptive analysis of the articles; an analysis of citations and a network analysis by co-authorship and by co-occurrence. From January 2009 to June 2018, 213 articles were published during the period. The mean number of articles by year was 20.7 ± 6.4 . The mean number of authors per article was 10.3 ± 5.8 . The year with the highest number of articles was 2013 with 28 articles. The total number of authors was 281. Authors from 35 countries contributed to the publications. 150(70%) articles were reviews and 44(21%) editorials. The articles have been published in 29 journals with a mean IF value of 4.5 ± 6.4 . 663 journals have cited publications of the group. The experience of a group focused on critically appraising, reviewing, and summarizing the literature had been positive with significant impact. The scientific production of the IHNSG had resulted in significant impact and its results help in the dissemination of information to authors around the world. Similar initiatives in other fields should be encouraged.

Saunders, T. F. C., Rymer, B. C., & McNamara, K. J. (2017) studied the ENT surgical literature over a period of 5 years using bibliometric methods to find out the global contributions by country. The study identified that the largest contributor at a global level was the USA with 4462 articles, followed by the UK with 1215 articles, and then by Spain, Taiwan, and the Netherlands. The highest number of publications per million populations (18.9) was contributed by the UK. Greece had the most cost-effective publication output and Japan had the least. The greatest increase in publication-quality was observed in the countries of India, Greece, and Japan.

3. OBJECTIVES

1. To find the language-wise distribution of articles.
2. To study the pattern of growth of publications during the period.
3. To find out the document type of the publications.
4. To analyze the authorship pattern, degree of collaboration, relative growth rate and doubling time.
5. To know the country-wise distribution of the publications.
6. To examine the label and cluster analysis of the otorhinolaryngology research.

4. METHODOLOGY

The data had been collected from the web of science database using the following search string retrieved on 27-Feb-2019. Topic: Otorhinolaryngology. Timespan: 1989-2018. The total number of articles retrieved was 2039. The retrieved articles were analyzed using Histcite software. Further analysis was done using MS Excel and VosViewer software.

5. DATA ANALYSIS

5.1 Year-wise distribution of publications

Table 1 shows the distribution of articles published on Otorhinolaryngology research during 1989-2018 (30 years) inclusive of 1989 and 2018. It can be observed that from 1989 to 2006, there was a frequent change of increase and decrease in the publications. After 2006, it can be noted that there is a

gradual increase in the ORL publications from 2.4% to 9.7%. The maximum number of articles was published in 2017 with 199 (9.8%) records, the next highest publication could be observed in the year 2018 with 198 (9.7%) records. The least number of articles was observed in the year 1990 with 3 (0.1%) records.

Table-1: Year-wise distribution of Publications

Publication year	TP*	%	TLCS*	TGCS*
1989	9	0.4	0	9
1990	3	0.1	1	42
1991	13	0.6	2	196
1992	13	0.6	9	177
1993	18	0.9	3	203
1994	28	1.4	10	425
1995	23	1.1	10	372
1996	43	2.1	13	299
1997	39	1.9	17	485
1998	37	1.8	16	434
1999	40	2.0	14	484
2000	49	2.4	13	410
2001	39	1.9	15	949
2002	47	2.3	19	955
2003	83	4.1	27	1772
2004	52	2.6	17	1015
2005	83	4.1	24	950
2006	48	2.4	13	818
2007	61	3.0	23	694
2008	70	3.4	15	1079
2009	76	3.7	19	745
2010	75	3.7	23	729
2011	74	3.6	21	701
2012	95	4.7	23	598
2013	96	4.7	17	564
2014	106	5.2	22	589
2015	146	7.2	22	488
2016	176	8.6	12	333
2017	199	9.8	8	182
2018	198	9.7	1	65
Total	2039	100	429	16762

*TP: “Total Publication”; TLCS: “Total Local Citation Score”; TGCS: “Total Global Citation Score”

5.2 Relative Growth Rate and Doubling Time of ORL Literature

Table 2 depicts that Relative Growth Rate and Doubling Time of total publications. Though the publication had grown from 1989 (9 records) to 2018 (198 records), the relative growth rate was 0.29 in 1989 which decreased up to 0.10 in 2018. A mean relative growth rate of 0.37 could be deduced for the

study period. The mean doubling time during the period 1989-2003 was 3.13 and for 2004-2018 it was increased to 7.44. The overall mean doubling time was 10.57.

Table-2: Relative Growth Rate and Doubling Time

Year	Total Publications	Cumulative No. of Publications	W1*	W2*	R(a) (W2-W1)	Mean R(a) 1-2*	Doubling Time Dt(a)	Mean Dt(a) 1-2
1989	9	9	-	2.20	-	0.28	-	3.13
1990	3	12	2.20	2.48	0.29		2.41	
1991	13	25	2.48	3.22	0.73		0.94	
1992	13	38	3.22	3.64	0.42		1.66	
1993	18	56	3.64	4.03	0.39		1.79	
1994	28	84	4.03	4.43	0.41		1.71	
1995	23	107	4.43	4.67	0.24		2.86	
1996	43	150	4.67	5.01	0.34		2.05	
1997	39	189	5.01	5.24	0.23		3.00	
1998	37	226	5.24	5.42	0.18		3.88	
1999	40	266	5.42	5.58	0.16		4.25	
2000	49	315	5.58	5.75	0.17		4.10	
2001	39	354	5.75	5.87	0.12		5.94	
2002	47	401	5.87	5.99	0.12		5.56	
2003	83	484	5.99	6.18	0.19		3.68	
2004	52	536	6.18	6.28	0.10	6.79	7.44	
2005	83	619	6.28	6.43	0.14	4.81		
2006	48	667	6.43	6.50	0.07	9.28		
2007	61	728	6.50	6.59	0.09	7.92		
2008	70	798	6.59	6.68	0.09	7.55		
2009	76	874	6.68	6.77	0.09	7.62		
2010	75	949	6.77	6.86	0.08	8.42		
2011	74	1023	6.86	6.93	0.08	9.23		
2012	95	1118	6.93	7.02	0.09	7.80		
2013	96	1214	7.02	7.10	0.08	8.41		
2014	106	1320	7.10	7.19	0.08	8.28		
2015	146	1466	7.19	7.29	0.10	6.61		
2016	176	1642	7.29	7.40	0.11	6.11		
2017	199	1841	7.40	7.52	0.11	6.06		
2018	198	2039	7.52	7.62	0.10	6.78		
Total	2039					0.37		10.57

*R (1-2) = Mean Relative Growth Rate over the Specified Period interval;

*W1= log w1 (Natural log of the initial number of publications)

*W2 = log w2 (Natural log of the initial number of publications)

*T2-T1= the unit Difference between the initial time and final time.

*R (a) = Relative Growth Rate per unit publication per unit of time (Year)

Relative Growth Rate and Doubling Time

Formula

$$R(1-2) = \frac{W2 - W1}{T2 - T1}$$

$$Dt(a) = \frac{0.693}{R(a)}$$

WHERE,

R (1-2) = Mean relative growth rate for the specified period.

W1= log w1 (Natural log of the initial number of publications)

W2 = log w2 (Natural log of the initial number of publications)

T2-T1= the unit difference between the initial and the final time.

R (a) = relative growth rate per unit publication per unit of time.

5.3 Exponential Growth Rate

The exponential growth rate of publications in Otorhinolaryngology research during 1989-2018 could be seen in table 3. The maximum growth rate (4.33%) was found in the year 1991 (13 records), followed by 1.77% in the year 2003 (83 records). The least exponential growth rate (0.33%) was observed in the year 1990 (3 records). The average exponential growth rate was 35.61% during the period. It shows high variations in growth rate from 1989 to 2006 and after 2007 a stable growth rate could be observed.

Table-3: Exponential Growth Rate

S.No	Year	No. of Publications	Exponential Growth rate
1	1989	9	-
2	1990	3	0.33
3	1991	13	4.33
4	1992	13	1.00
5	1993	18	1.38
6	1994	28	1.56
7	1995	23	0.82
8	1996	43	1.87
9	1997	39	0.91
10	1998	37	0.95
11	1999	40	1.08
12	2000	49	1.23
13	2001	39	0.80
14	2002	47	1.21
15	2003	83	1.77
16	2004	52	0.63
17	2005	83	1.60
18	2006	48	0.58
19	2007	61	1.27

20	2008	70	1.15
21	2009	76	1.09
22	2010	75	0.99
23	2011	74	0.99
24	2012	95	1.28
25	2013	96	1.01
26	2014	106	1.10
27	2015	146	1.38
28	2016	176	1.21
29	2017	199	1.13
30	2018	198	0.99
	Total	2039	35.61

5.4 Prolific Authors wise Distribution

The top 20 prolific authors were recognized in Otorhinolaryngology research. They had published 9 or more papers during 1989-2018. The identified 20 authors had brought about 271 (13%) papers. An anonymous person became the most productive author who contributed 58 (2.8%) articles, followed by Feldmann H with 15 (0.7%) articles, Guntinas-Lichius O, Mallard O, and Werner JA with 14 (0.7%) articles.

Table-4: Prolific authors wise distribution (Top 20)

S.No	Author	Records	%	TLCS	TGCS
1	[Anonymous]	58	2.8	0	0
2	Feldmann H	15	0.7	14	94
3	Guntinas-Lichius O	14	0.7	6	91
4	Mallard O	14	0.7	1	27
5	Werner JA	14	0.7	14	221
6	Laccourreye O	13	0.6	5	52
7	Hormann K	12	0.6	3	118
8	Aaltonen LM	11	0.5	9	66
9	Laskawi R	11	0.5	3	78
10	Pitkaranta A	11	0.5	7	136
11	Verillaud B	11	0.5	0	30
12	Back L	10	0.5	2	99
13	Bootz F	10	0.5	8	137
14	Huttenbrink KB	10	0.5	8	165
15	Iro H	10	0.5	2	142
16	Michel J	10	0.5	0	14
17	Stuck BA	10	0.5	4	147
18	Bequignon E	9	0.4	0	12
19	Bonfils P	9	0.4	4	38
20	Escabasse VP	9	0.4	0	12

5.5 Authorship Pattern of Publications

5.5.1 Single Author versus Multi-Authors

Table 5.1 shows the contributions of a single author and multiple authors of Otorhinolaryngology research during the period 1989-2018. Single authors had contributed 294 (14.42%) publications and multiple authors had contributed 1745 (85.58%) publications out of 2039 publications. Hence, it was inferred that the majority of the articles were published by multiple authors.

Table-5.1: Single vs. Multi Authors

S.No	Authorship Pattern	Publications	%
1	Single Author	294	14.42
2	Multiple Authors	1745	85.58
	Total	2039	100

5.5.2 Authorship Pattern

Table 5.2 shows the authorship pattern in otorhinolaryngology research during 1989-2018. The utmost number of papers (344) had been brought out by the collaborative work of four authors followed by three authors (297), single author (294), five authors (290), two authors (248), six authors (215), seven authors (138), eight authors (76), more than ten authors (70), nine authors (40) and the least with the collaborative work of ten authors (27) records.

Table-5.2: Authorship Pattern of Publications

S.No	Authors	No. of Publications	%
1	Single Author	294	14.42
2	Two Authors	248	12.16
3	Three Authors	297	14.57
4	Four Authors	344	16.87
5	Five Authors	290	14.22
6	Six Authors	215	10.54
7	Seven Authors	138	6.77
8	Eight Authors	76	3.73
9	Nine Authors	40	1.96
10	Ten Authors	27	1.32
11	Above Ten Authors	70	3.43
	Total	2039	100

5.5.3 Year-wise Authorship Pattern

Table 5.3 shows the authorship pattern of publications by year based on collaborative research.

Table-5.3: Year-wise Authorship Pattern

Year	1	2	3	4	5	6	7	8	9	10	10+	Total
1989	4	2		2	1							9
1990	1							1				2
1991	6	3	4	1								14
1992	4	1	4	2	1	1						13
1993	9	2	4	3								18
1994	11	2	3	7	1	2	2					28
1995	14	2	1	2	3		1					23
1996	17	9	7	4	3		1	1		1		43
1997	18	6	6	7	1	1						39
1998	11	7	2	5	2	5	2	2			1	37
1999	18	2	6	8	4	1		1				40
2000	14	7	6	10	6	4	1	1				49
2001	5	7	8	8	7	1	1			1	1	39
2002	12	6	4	13	4	1	4	3				47
2003	23	8	18	9	12	5	3	2	1		2	83
2004	8	7	5	7	16	3	2	2	1	1		52
2005	20	15	14	14	12	4	2	1			1	83
2006	5	4	6	13	9	5	3			1	2	48
2007	7	10	8	15	7	2	2	5	2		3	61
2008	6	14	9	13	9	9	3	3	2	1	1	70
2009	10	10	5	16	11	11	4	2	1	3	3	76
2010	4	9	15	8	12	10	9	4	1		3	75
2011	5	9	8	11	11	15	7	5	3			74
2012	8	13	12	16	17	14	8	2	3	1	1	95
2013	8	10	15	19	13	13	5	5	4	1	3	96
2014	6	7	19	17	17	19	5	5	5	1	5	106
2015	15	15	23	16	22	21	14	8	2	4	6	146
2016	9	15	28	31	33	17	16	9	3	6	9	176
2017	7	18	26	36	27	30	25	7	8	2	13	199
2018	9	28	31	31	29	21	18	7	4	4	16	198
Total	294	248	297	344	290	215	138	76	40	27	70	2039

5.6 Degree of Collaboration

Table 6 amounts to calculate the degree of collaboration in Otorhinolaryngology research by using the formula given by (K. Subramanyam, 1982) which was,

$$C = \frac{NM}{NM + NS}$$

Where,

C - the degree of collaboration

NM - no. of multi-authored papers

NS - no. of single-authored papers

The degree of collaboration varied from 0.56 to 0.96 for the duration of the study. The average mean value was 0.86 suggesting the increase of collaborative research in Otorhinolaryngology.

Table-6: Degree of Collaboration

S.No	Year	Single Author (NS)	Multiple Authors (NM)	Total (NS+NM)	Degree of Collaboration C=NM/NM+NS
1	1989	4	5	9	0.56
2	1990	1	1	2	0.50
3	1991	6	8	14	0.57
4	1992	4	9	13	0.69
5	1993	9	9	18	0.50
6	1994	11	17	28	0.61
7	1995	14	9	23	0.39
8	1996	17	26	43	0.60
9	1997	18	21	39	0.54
10	1998	11	26	37	0.70
11	1999	18	22	40	0.55
12	2000	14	35	49	0.71
13	2001	5	34	39	0.87
14	2002	12	35	47	0.74
15	2003	23	60	83	0.72
16	2004	8	44	52	0.85
17	2005	20	63	83	0.76
18	2006	5	43	48	0.90
19	2007	7	54	61	0.89
20	2008	6	64	70	0.91
21	2009	10	66	76	0.87
22	2010	4	71	75	0.95
23	2011	5	69	74	0.93
24	2012	8	87	95	0.92

25	2013	8	88	96	0.92
26	2014	6	100	106	0.94
27	2015	15	131	146	0.90
28	2016	9	167	176	0.95
29	2017	7	192	199	0.96
30	2018	9	189	198	0.95
	Total	294	1745	2039	0.86

5.7 Language-wise distribution of Publications

Table 7 depicts the language-wise distribution in otorhinolaryngology research. It was clearly evident that English was the most preferred language for research publication in most of countries. Majority of the papers were in the English language 1663 (81.6%), followed by German 280 (13.7%), Spanish 13 (1.5%), French 21 (1%), Turkish 16 (0.8%) and so on.

Table-7: Language wise distribution of Publications

Language	TP*	%	TLCS*	TGCS*
English	1663	81.6	333	15487
German	280	13.7	93	1114
Spanish	31	1.5	0	52
French	21	1	0	61
Turkish	16	0.8	2	10
Czech	6	0.3	0	5
Portuguese	6	0.3	0	27
Russian	4	0.2	0	1
Slovene	3	0.1	0	0
Hungarian	2	0.1	1	5
Italian	2	0.1	0	0
Korean	2	0.1	0	0
Serbian	2	0.1	0	0
Malay	1	0.1	0	0
Total	2039	100	429	16762

*TP: "Total Publication"; TLCS: "Total Local Citation Score"; TGCS: "Total Global Citation Score"

5.8 Document wise distribution of publications:

Table 8 reveals the type of document used for publication during the period 1989-2018. It could be seen that most of the publications were in Articles with 1603 (78.6%), followed by Review 171 (8.4%), Article; Proceeding Paper 111 (5.4%), Editorial Material 86 (4.2%), Letter 34 (1.7%), Meeting Abstract 11 (0.5%) and so on.

Table-8: Document wise distribution of Publications

S.No	Document Type	TP*	%	TLCS*	TGCS*
1	Article	1603	78.6	344	12946
2	Review	171	8.4	39	1930
3	Article; Proceedings Paper	111	5.4	33	1759
4	Editorial Material	86	4.2	6	55
5	Letter	34	1.7	6	43
6	Meeting Abstract	11	0.5	0	0
7	Biographical-Item	6	0.3	0	5
8	Note	6	0.3	0	5
9	Correction	3	0.1	0	12
10	Article; Book Chapter	2	0.1	1	7
11	Item About an Individual	2	0.1	0	0
12	News Item	2	0.1	0	0
13	Book Review	1	0.1	0	0
14	Review; Book Chapter	1	0.1	0	0
	Total	2039	100	429	16762

*TP: “Total Publication”; TLCS: “Total Local Citation Score”; TGCS: “Total Global Citation Score”

5.9 Country-wise distribution of publications:

Table 9 gives the distribution of otorhinolaryngology publications by the country during 1989-2018. Germany had ranked top among the countries in terms of publications with 422 (20.7%) records, followed by Turkey and the UK with 163 (8%) and the USA with 152 (7.5%) publications. India had contributed 111 (5.4%) and ranks 5th in the top 20 countries.

Table-9: Country-wise distribution of Publications (Top 20)

Country	Records	%	TLCS	TGCS
Germany	422	20.7	150	3718
Turkey	163	8	22	969
UK	163	8	61	1862
USA	152	7.5	23	1704
Unknown	129	6.3	17	365
India	111	5.4	7	654
Italy	88	4.3	17	1272
France	78	3.8	13	577
Brazil	67	3.3	20	633
Netherlands	67	3.3	14	956
Japan	62	3	4	375
Finland	55	2.7	32	610
Spain	46	2.3	2	205
Peoples R China	43	2.1	2	264
Austria	40	2	15	683

South Korea	38	1.9	3	287
Malaysia	32	1.6	0	120
Sweden	32	1.6	6	488
Switzerland	30	1.5	11	712
Denmark	27	1.3	11	326

5.10 Institution wise distribution

Table 10 shows the contribution of the top 20 countries during 1989-2018. It showed that Unknown Institution had contributed 94 (4.6%) publications, followed by Helsinki University with 44 (2.2%), Munich University with 26 (71.3%) publications, Cologne University with 23 (1.1%), and so on. It could be noted that Cologne University had the highest Global Citation Score” of 465 and Unk nown Institution with the least global citation Score” of 14. Helsinki University had the highest Local Citation Score of 26.

Table-10: Institution wise distribution (Top 20)

S.No	Institution	Records	%	TLCS	TGCS
1	Unknown	94	4.6	6	14
2	Univ Helsinki	44	2.2	26	458
3	Univ Munich	26	1.3	11	390
4	Univ Cologne	23	1.1	14	465
5	Univ Munster	22	1.1	15	111
6	Helsinki Univ Hosp	20	1	3	43
7	Montefiore Med Ctr	15	0.7	4	48
8	Univ Amsterdam	15	0.7	0	119
9	Hacettepe Univ	14	0.7	5	127
10	Tech Univ Munich	14	0.7	0	99
11	Univ Erlangen Nurnberg	14	0.7	2	179
12	Univ Sao Paulo	14	0.7	2	87
13	Univ Ulm	13	0.6	5	77
14	Univ Fed Sao Paulo	12	0.6	8	210
15	Univ Sains Malaysia	12	0.6	0	15
16	Univ Gottingen	11	0.5	1	88
17	Univ Hosp	11	0.5	1	69
18	Univ Paris 05	11	0.5	2	39
19	Univ Tubingen	11	0.5	7	205
20	Univ Vienna	11	0.5	1	105

5.11 Subject category-wise distribution

Table 11 shows the top 20 subjects wise distribution of ORL Literature during 1989-2018. The highest publication could be seen from the subject Otorhinolaryngology with 1223 (59.98%) records, followed by Surgery with 254 (12.45%), Medicine-General Internal with 205 (10.05%), Pediatrics with 182 (8.92%), and so on.

Table-11: Subject category-wise distribution (Top 20)

S.No	Subject	Records	%
1	OTORHINOLARYNGOLOGY	1223	59.98
2	SURGERY	254	12.45
3	MEDICINE GENERAL INTERNAL	205	10.05
4	PEDIATRICS	182	8.92
5	MEDICINE RESEARCH EXPERIMENTAL	87	4.26
6	CLINICAL NEUROLOGY	83	4.07
7	DENTISTRY ORAL SURGERY MEDICINE	41	2.01
8	ONCOLOGY	34	1.66
9	PHARMACOLOGY PHARMACY	33	1.61
10	PUBLIC ENVIRONMENTAL OCCUPATIONAL HEALTH	30	1.47
11	ANESTHESIOLOGY	28	1.37
12	RADIOLOGY NUCLEAR MEDICINE MEDICAL IMAGING	25	1.22
13	NEUROSCIENCES	24	1.17
14	RESPIRATORY SYSTEM	24	1.17
15	HEALTH CARE SCIENCES SERVICES	17	0.83
16	IMMUNOLOGY	17	0.83
17	INFECTIOUS DISEASES	16	0.78
18	ALLERGY	15	0.73
19	PATHOLOGY	13	0.63
20	PSYCHIATRY	13	0.63

5.12 Journal wise distribution

Table 12 shows the top 20 Journal wise distribution of ORL Literature during 1989 -2018. The International Journal of Pediatric Otorhinolaryngology was the most preferred journal with 147 (7.2%), followed by Laryngo-Rhino-Otologie journal with 124 (6.1%), Journal of Laryngology and Otology with 123 (6%), and so on. Indian Journal of Otolaryngology and Head & Neck Surgery was ranked 8th in the Top 20 Journal of ORL research.

Table-12: Journal wise distribution (Top 20)

S.No	Journal	Records	%	TLCS	TGCS
1	INTERNATIONAL JOURNAL OF PEDIATRIC OTORHINOLARYNGOLOGY	147	7.2	28	1217
2	LARYNGO-RHINO-OTOLOGIE	124	6.1	38	529
3	JOURNAL OF LARYNGOLOGY AND OTOLOGY	123	6	42	714
4	HNO	120	5.9	56	554
5	EUROPEAN ARCHIVES OF OTO-RHINO-LARYNGOLOGY	109	5.3	32	960
6	CLINICAL OTOLARYNGOLOGY	89	4.4	18	531
7	ACTA OTO-LARYNGOLOGICA	45	2.2	11	220
8	INDIAN JOURNAL OF OTOLARYNGOLOGY AND HEAD & NECK SURGERY	45	2.2	4	86
9	OTOLARYNGOLOGY-HEAD AND NECK	45	2.2	7	596

	SURGERY				
10	LARYNGOSCOPE	44	2.2	37	1335
11	ARCHIVES OF OTOLARYNGOLOGY-HEAD & NECK SURGERY	37	1.8	12	1026
12	EUROPEAN ANNALS OF OTORHINOLARYNGOLOGY-HEAD AND NECK DISEASES	35	1.7	5	129
13	OTOLOGY & NEUROTOLOGY	29	1.4	3	292
14	BRAZILIAN JOURNAL OF OTORHINOLARYNGOLOGY	27	1.3	8	137
15	JOURNAL OF EVOLUTION OF MEDICAL AND DENTAL SCIENCES-JEMDS	21	1	0	0
16	AMERICAN JOURNAL OF OTOLARYNGOLOGY	19	0.9	8	319
17	B-ENT	18	0.9	4	46
18	JOURNAL OF CRANIOFACIAL SURGERY	16	0.8	1	61
19	ACTA OTORHINOLARYNGOLOGICA ITALICA	15	0.7	1	100
20	ACTA OTORRINOLARINGOLOGICA ESPANOLA	14	0.7	0	12

5.13 Keyword wise distribution of Publications

Figure 1 indicates the major keywords used in ORL research articles. 4304 keywords were used as mesh headings and top 20 keywords were taken for calculating Zipf's law. Zipf's law had given the relationship between the rank of a word and frequency of its appearance in a sentence or passage.

$$r * f = c$$

'r' - the rank of a word and 'f' - frequency of occurrence

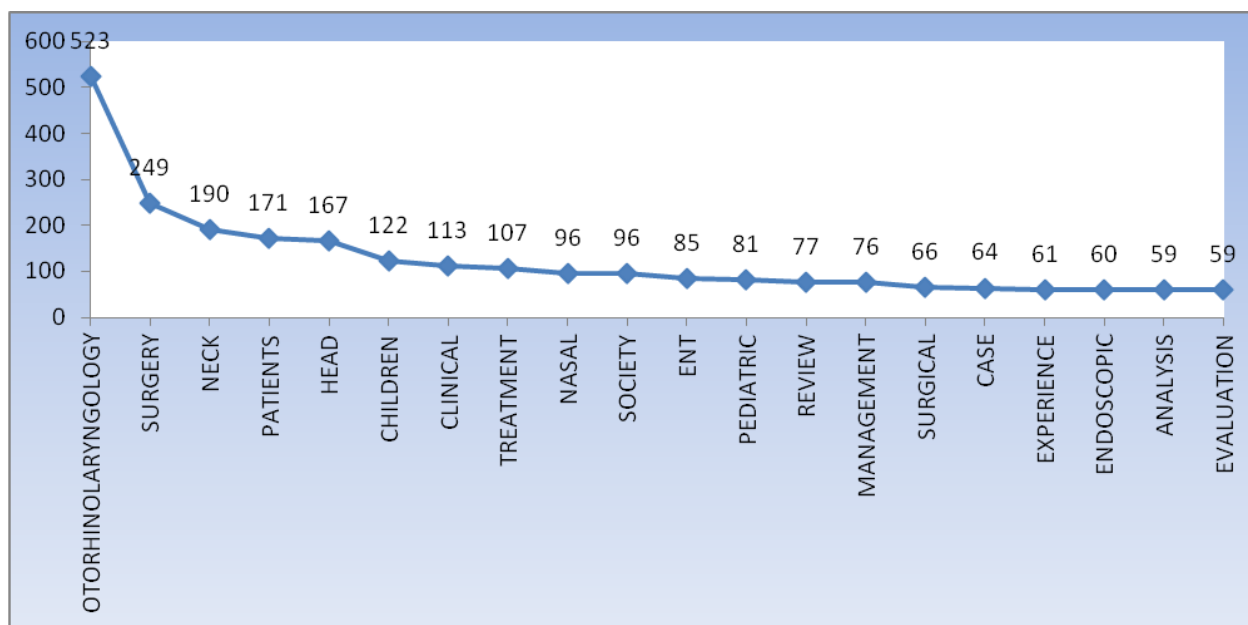


Figure-1: Application of Zipf's Law

5.14 Highly cited papers in ORL research

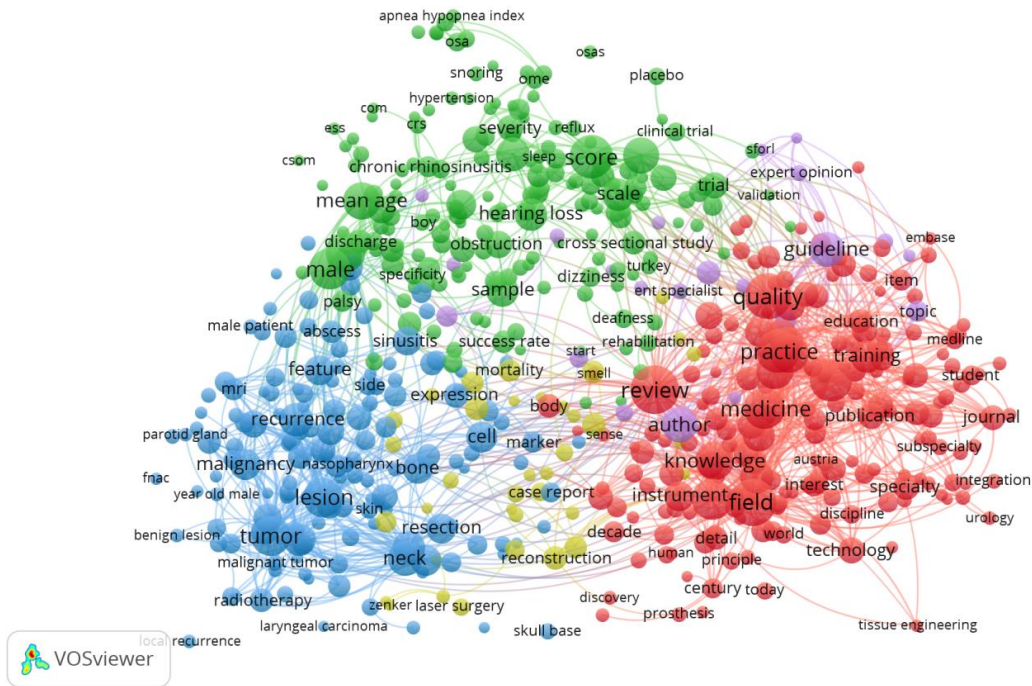
Table 13 reveals that Fokkens WJ, 2012, RHINOLOGY, V50, P1 is the top most cited paper and it had been cited 21 times followed by KOUFMAN JA, 1991, LARYNGOSCOPE, V101, P1 with 14 records, Friedman M, 1999, LARYNGOSCOPE, V109, P1901, DOI 10.1097/00005537-199912000-00002 with 10 records, and so on.

Table-13: Highly cited papers in ORL publications

S.No	Author/Year/Journal	Records	%
1	Fokkens WJ, 2012, RHINOLOGY, V50, P1	21	1
2	KOUFMAN JA, 1991, LARYNGOSCOPE, V101, P1	14	0.7
3	Friedman M, 1999, LARYNGOSCOPE, V109, P1901, DOI 10.1097/00005537-199912000-00002	10	0.5
4	HOUSE JW, 1985, OTOLARYNG HEAD NECK, V93, P146, DOI 10.1177/019459988509300202	10	0.5
5	Hummel T, 1997, CHEM SENSES, V22, P39, DOI 10.1093/chemse/22.1.39	10	0.5
6	Ang KK, 2010, NEW ENGL J MED, V363, P24, DOI 10.1056/NEJMoa0912217	9	0.4
7	Haynes AB, 2009, NEW ENGL J MED, V360, P491, DOI 10.1056/NEJMsa0810119	9	0.4
8	KENNEDY DW, 1985, ARCH OTOLARYNGOL, V111, P576	9	0.4
9	WILSON WR, 1980, ARCH OTOLARYNGOL, V106, P772	9	0.4
10	BYL FM, 1984, LARYNGOSCOPE, V94, P647	8	0.4
11	CROFT CB, 1991, CLIN OTOLARYNGOL, V16, P504, DOI 10.1111/j.1365-2273.1991.tb01050.x	8	0.4
12	Hummel T, 2007, EUR ARCH OTO-RHINO-L, V264, P237, DOI 10.1007/s00405-006-0173-0	8	0.4
13	Robinson K, 1996, ANN OTO RHINOL LARYN, V105, P415, DOI 10.1177/000348949610500601	8	0.4
14	Shah RK, 2004, LARYNGOSCOPE, V114, P1322, DOI 10.1097/00005537-200408000-00003	8	0.4
15	Stammberger H., 1991, FUNCTIONAL ENDOSCOPI	8	0.4
16	YOUNG T, 1993, NEW ENGL J MED, V328, P1230, DOI 10.1056/NEJM199304293281704	8	0.4
17	BENT JP, 1994, OTOLARYNG HEAD NECK, V111, P580, DOI 10.1016/S0194-5998(94)70525-9	7	0.3
18	BRODSKY L, 1989, PEDIATR CLIN N AM, V36, P1551	7	0.3
19	Belafsky PC, 2001, LARYNGOSCOPE, V111, P1313, DOI 10.1097/00005537-200108000-00001	7	0.3
20	Brown P, 2004, LANCET, V364, P697	7	0.3

5.15 Label and Cluster Analysis of ORL Research

For analyzing the bibliometric network, VOS viewer is used. Maps were created by using net and vec file from bibexcel. Figure 2 and Figure 3 depicts the Cluster view and Label view of Otorhinolaryngology respectively.



Fig

re-2: Cluster view of Otorhinolaryngology

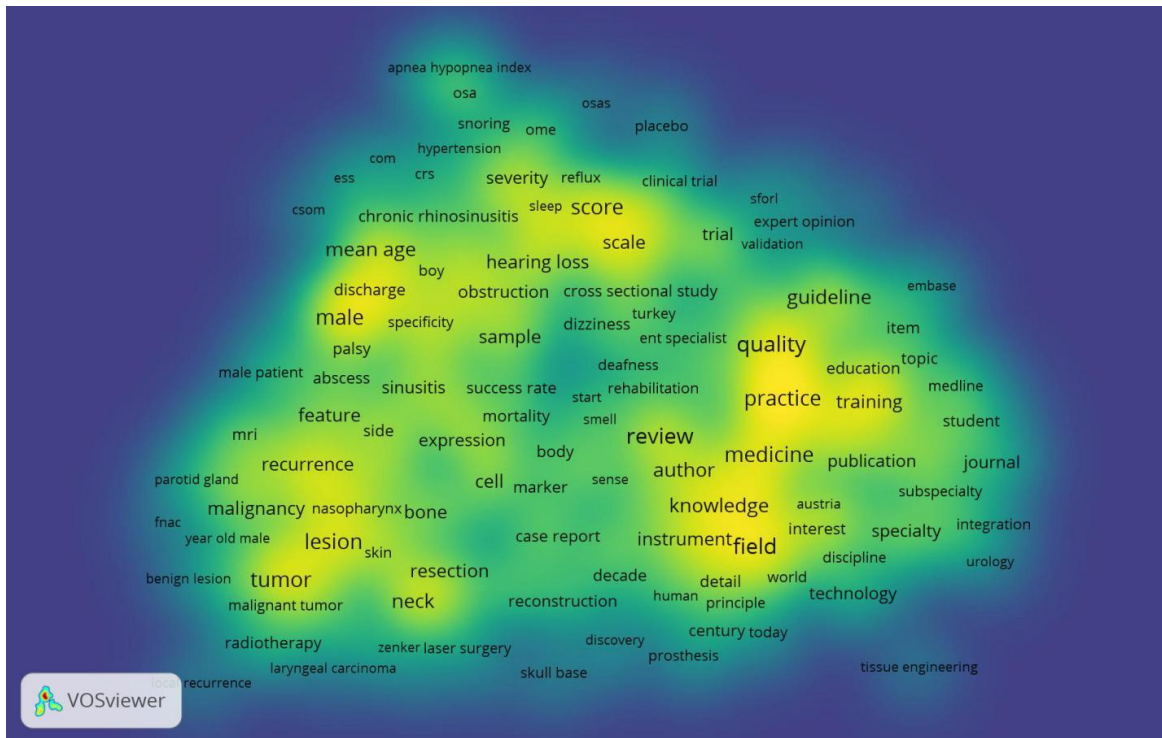


Figure-3: Label view of Otorhinolaryngology

6. FINDINGS AND CONCLUSION

The distribution of ORL literature by language showed that the most common scholarly communication was in the English language with 1663 (81.6%) articles.

The distribution of articles by year displayed that a total of 2039 publications were published in Otorhinolaryngology during 1989-2018 (30 years). The maximum number of articles 199 (9.8%) were published in the year 2017. There could be observed an increasing and decreasing trend in the relative growth rate and doubling time data. The mean relative growth rate for the period 1989-2018 was 0.37. The mean doubling time was 10.57 and the average exponential growth rate was 35.61% for the period of 1989-2018.

The distribution of publications by document type was found mostly in the form of journal articles with 1603 (78.6%) publications during the study period.

From the prolific author's list, it could be seen that Anonymous author was the most productive author with 58 (2.8%) records. The authorship pattern indicated that the maximum number of papers was published by the collaborative work of four authors 344 and the least number of papers published by a group of ten authors with 27 records. The Degree of Collaboration varied from 0.56 to 0.95 during the period of the study. High collaborative research could be seen from the mean value of 0.86.

The top 20 distribution of articles by the country during 1989-2018 ranked Germany at the top among all the countries with 422 (20.7%) publications. The top 20 Institution wise distribution of productivity during 1989-2018 showed that Unknown Institution had contributed 94 (4.6%) publications.

The top 20 Journal wise distribution in ORL literature during 1989-2018 showed that "International Journal of Pediatric Otorhinolaryngology" had contributed 147 (7.2%) publications making it the most preferred Journal. The most highly cited paper in ORL literature was "Fokkens WJ, 2012, RHINOLOGY, V50, P1" with 21 citations. The most common keyword used by the researcher was "Otorhinolaryngology" with 523 (25.6%) of the total records.

The publications in the Otorhinolaryngology research had grown from 9 in the year 1989 to 198 in the year 2018. During 2014 to 2018 there was a tremendous and gradual increase in the publishing of ORL papers where multiple authors i.e., 1745 (85.58%) had contributed more than the single authors i.e., 294 (14.42%). The publications from varied disciplines such as Surgery, Pharmacology, Dentistry, Radiology, Neurosciences indicated the growing trend of ORL literature in various disciplines.

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