Research Output on Brain Tumour: A Global Literature Perspective

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Abstract

Growth of Scientific research were measured using bibliometric study on a discipline or a domain. The global research on braintumour has been measured using the bibliometric study. A total of 1,47,696 publications can be seen in Scopus, a multi discipline data based on "Brain Tumour" during the forty years period of 1974-2013. The techniques such yearwise distribution, authorship pattern, source title, RGR and Doubling time, citation pattern were employed. The study shows the linear growth in brain tumour research. Their exist collaborative research among the scientists throughout the globe.
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Keywords

Bibliometric, brain tumour, Relative Growth Rate, Doubling time, authorship pattern, citation analysis

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INTRODUCTION

The brain is a soft, spongy mass of *tissue*. It is protected by the bones of the skull, Three thin layers of tissue (*meninges*), Watery fluid (*cerebrospinal fluid*) that flows through spaces between the meninges and through spaces (*ventricles*) within the brain. The brain directs the things onechoose to do (like walking and talking) and the things our body does without thinking (like breathing). The brain is also in charge of our senses (sight, hearing, touch, taste, and smell), memory, emotions, and personality. A network of nerves carries messages back and forth between the brain and the rest of the body. Some nerves go directly from the brain to the eyes, ears, and other parts of the head. Other nerves run through the spinal cord to connect the brain with the other parts of the body. Within the brain and spinal cord, *glial cells* surround *nerve cells* and hold them in place.

When most normal *cells* grow old or get damaged, they die, and new cells take their place. Sometimes, this process goes wrong. New cells form when the body doesn't need them, and old or damaged cells don't die as they should. The buildup of extra cells often forms a mass of tissue called a growth or tumor. Primary brain tumors can be *benign* or *malignant*:

Benign brain tumors do not contain *cancer* cells. Usually, benign tumors can be removed, and they seldom grow back. Benign brain tumors usually have an obvious border or edge. Cells from benign tumors rarely invade tissues around them. They don't spread to other parts of the body. However, benign tumors can press on sensitive areas of the brain and cause serious health problems. Unlike benign tumors in most other parts of the body, benign brain tumors are sometimes life threatening. Benign brain tumors may become malignant. Malignant brain tumors (also called brain cancer) contain cancer cells. - Malignant brain tumors are generally more serious and often are a threat to life. They are likely to grow rapidly and crowd or invade the nearby healthy brain tissue. Cancer cells may break away from malignant brain tumors and spread to other parts of the brain or to the spinal cord. They rarely spread to other parts of the body. In the US, about 2000 children and adolescents younger than 20 years of age are diagnosed with malignant brain tumors each year. Higher incidence rates were reported in 1985–94 than in 1975–83. There is some debate as to the reasons; one theory is that the trend is the result of improved diagnosis and reporting, In children under 2, about 70% of brain

tumors are medulloblastoma, ependymoma, and low-grade glioma. Less commonly, and seen usually in infants, are teratoma and atypical teratoidrhabdoidtumor.Germ cell tumors, including teratoma, make up just 3% of pediatric primary brain tumors, but the worldwide incidence varies significantly.[1]

BIBLIOMETRIC STUDY

Bibliometric analysis is employed by the researchers to study the growth of literature in given field. Pritchard (1969) defined the term Bibliometric as the application of statistical and mathematical methods to books and other communication. The bibliometrics has emerged as a thrust area of research, incorporating different branches of human knowledge. There are famous Laws of Bibliometric i.e. Lotka's law (1926) of scientific productivity, Bradford's law (1934) of scattering and Zips law (1949) on frequency of words. But the Bibliometric studies started in late sixties.

OBJECTIVES

Main objectives of the study are

1. To examine the worldwide research production in Brain Tumour during the period 1974-2013.
2. To identify the document type of the publications in Brain Tumour.
3. To identify the organisations conducting the research in Brain Tumour.
4. To compare and measure the growth rate of literature published by authors globally.
5. To identify and analyse the research contribution in the subject field of Brain Tumour.
6. To identify the top source titles those carry the research productions in Brain Tumour.

HYPOTHESES

The following hypotheses are formulated for this study based on the objectives.

- There are more literatures worldwide published on Brain Tumour.
- Growth of publications in Brain Tumour is comparatively higher in developed countries.
- The research productivity in Brain Tumour is dominated by English language.
- Journals are major source of publications for Brain Tumour.
- There exists no steady growth in publication production in Brain Tumour research.

METHODOLOGY

For this study, the literature on Brain Tumour downloaded from online multidiscipline database 'Scopus' which is an international indexing and abstracting database. The term 'Brain Tumour' was used for retrieving literatures. A total of 147696 records were identified in the field of brain tumour worldwide during the period 1974-2013. The collected data has been classified by using Excel and the same has been loaded into SPSS (statistical package for social sciences) for the purpose of analysis. Statistical tools such as frequency distribution and percentage analysis and Bibliometric techniques were used for the study. Analysis on year wise distribution, subject coverage and organisations which contributed papers were covered.

RESULTS AND DISCUSSIONS

Country wise Distribution of Research in Brain Tumour.

Table 1 shows the country wise research articles published in Brain Tumour.

Table 1: Country wise Distribution

S.No	COUNTRY	Pub	%
1	United States	47354	32.07
2	Japan	14508	9.83
3	Germany	12032	8.15
4	United Kingdom	7615	5.16
5	France	7157	4.85
6	Italy	7133	4.83
7	China	5916	4.01
8	Canada	5125	3.47
9	Spain	3366	2.28
10	India	2880	1.95
11	Netherlands	2744	1.86
12	Switzerland	2643	1.79
13	South Korea	2371	1.61
14	Australia	2170	1.47
15	Sweden	2085	1.41
16	Turkey	1874	1.27
17	Taiwan	1635	1.11
18	Belgium	1526	1.03
19	Austria	1478	1.00
20	Poland	1454	0.98
21	Brazil	1370	0.93
22	Israel	1253	0.85
23	others	12007	8.13
Total		**147696**	**100.00**

It is seen from the Table 1 that Collaborative Research have been carried out in the area of Brain tumour beyond the territory. United States of America holds the key position with 47354 (32.07%) of total publications followed by Japan and Germany with a total publications of 14508 (9.83%) and 12032 (8.15%) respectively.

Year wise Distribution of Research Productivity by Global Authors

Table 2 shows the year wise research productivity on Brain Tumour by global authors. The Highest number of research productivity is in the year 2013 with a total number of publications is 9608 (6.51%) followed by 2012 with 9336 (6.32%) and 8751 (5.93%).

Table 2: Year wise Contribution

YEAR	No.of pub	%	cum TP	cum %
1974	1519	1.03	1519	1.03
1975	1495	1.01	3014	2.04
1976	1415	0.96	4429	3.00
1977	1388	0.94	5817	3.94
1978	1427	0.97	7244	4.91
1979	1348	0.91	8592	5.82
1980	1363	0.92	9955	6.74
1981	1479	1.00	11434	7.75
1982	1398	0.95	12832	8.69
1983	1529	1.04	14361	9.73
1984	1608	1.09	15969	10.82
1985	1675	1.13	17644	11.95
1986	1670	1.13	19314	13.08
1987	1801	1.22	21115	14.30
1988	1840	1.25	22955	15.55
1989	2054	1.39	25009	16.94
1990	2224	1.51	27233	18.45
1991	2192	1.48	29425	19.93
1992	2534	1.72	31959	21.65
1993	2622	1.78	34581	23.42
1994	3142	2.13	37723	25.55
1995	3342	2.26	41065	27.82
1996	3325	2.25	44390	30.07
1997	3763	2.55	48153	32.62
1998	3711	2.51	51864	35.13
1999	4084	2.77	55948	37.90
2000	4094	2.77	60042	40.67
2001	4396	2.98	64438	43.65
2002	4453	3.02	68891	46.66
2003	4995	3.38	73886	50.05
2004	5358	3.63	79244	53.67
2005	5856	3.97	85100	57.64
2006	6178	4.18	91278	61.83
2007	6284	4.26	97562	66.08
2008	6875	4.66	104437	70.74
2009	7503	5.08	111940	75.82
2010	8019	5.43	119959	81.22
2011	8765	5.93	128724	87.15
2012	9350	6.33	138074	93.48
2013	9622	6.51	**147696**	**100.00**
Total	**147696**	**100.00**		

It can be seen from the table 2 and fig 1 that their exist uniform growth in publications since 2009. Between 2009 and 2013, the percentages of growth of the publications are between 5.08% and 6.51%. It shows that there is a steady growth in the publications during these periods.

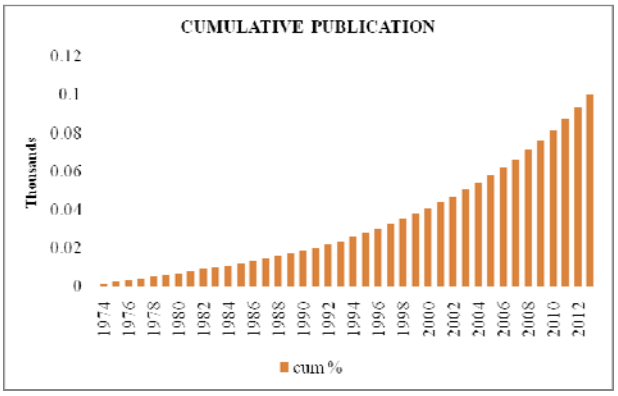


Fig. 1 Year wise growth of publications.

It can be seen from the figure that the growth is parabolic in nature.

Block year wise Distribution of publications

In order to identify the exact period of growth, the analysis is made based on block year wise distribution. The study period has been grouped into four block years of ten years period.

Table 3:Block year wise Distribution

S.No	Year	No. of papers	Perce-ntage	Cumulative Percent
1	1974-1983	14361	9.73	9.73
2	1984-1993	20220	13.70	23.42
3	1994-2003	39305	26.62	50.04
4	2004-2013	73810	49.97	100.0
Total		**147696**	**100.0**	

It is seen from table 3 that in the block year 2004-2013 has more publications compared to other three block years. In the block year 2004-2013, there were 73755 (49.97%) publications. It shows that in the recent years, the growth of literature in brain tumour is getting increased. It clearly indicates that the brain tumour has a greater impact during the period 2004-2013 when compared to the previous block year 1994-2003.

Bibliographic Form

The publications in Brain Tumour were contributed in different bibliographic forms such as articles, reviews, conference papers, letters, book chapters, notes, etc and the same is shown in fig 2.

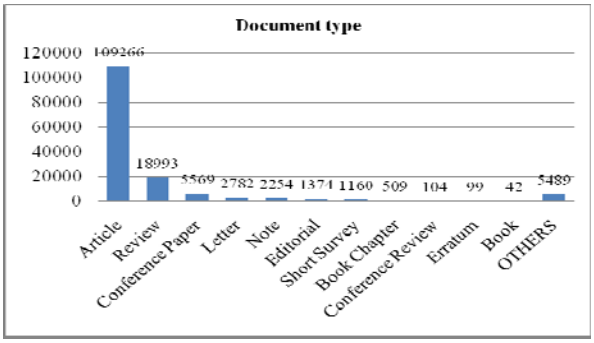


Fig. 2 Bibliographic Form

Fig 2 shows that maximum number of publications were journal articles with a publications of 109266 (74.01%)followed by reviews 334 (12.86%) and Conference proceedings 5569 (3.77%). The other type of document publications have 5489 (3.72%).

Table 4:Languagewise Distribution

S.No	Language	Pub	%
1	English	125293	84.86
2	Japanese	5425	3.67
3	French	3564	2.41
4	German	3508	2.38
5	Chinese	2278	1.54
6	Spanish	1859	1.26
7	Russian	1840	1.25
8	Polish	1025	0.69
9	Italian	983	0.67
10	Portuguese	376	0.25
11	Czech	343	0.23
12	Turkish	256	0.17
13	Others	946	0.64
Total		**147696**	**100.00**

The majority of the research outputs were published in English ie. 125293 (84.86%) followed by Japanese with 5425 (3.67%). (Table 4)

Source Titles and Brain Tumour Research Productivity

Sources of publishing in brain tumourwere listed in the table 5.

Table 5: Source Title

S. No	Source Title	Pub
1	Journal of Neuro Oncology	3261
2	Journal of Neurosurgery	2875
3	Neurosurgery	2862
4	ActaNeurochirurgica	1607
5	Cancer Research	1521
6	International Journal of Radiation Oncology Biology Physics	1397
7	Cancer	1390
8	Surgical Neurology	1277
9	Neurological Surgery	1212
10	Neurologia Medico Chirurgica	1186
11	Child S Nervous System	1070
12	American Journal of Neuroradiology	966
13	Plos One	929
14	Journal of Biological Chemistry	911
15	ActaNeuropathologica	845
16	Neuro Oncology	819
17	Journal of Clinical Oncology	771
18	Journal of Neurochemistry	769
19	Neurology	739
20	Journal of Clinical Neuroscience	694
21	Brain Research	684
22	Neuroradiology	682
23	Clinical Cancer Research	641
24	International Journal of Cancer	620
25	Proceedings of the National Academy of Sciences of the United States of America	607
26	British Journal of Neurosurgery	595
27	Brain and Nerve	590
28	Neurochirurgie	561
29	Radiology	538
30	Anticancer Research	537
31	Biochemical and Biophysical Research Communications	515
32	Journal of Neurology Neurosurgery and Psychiatry	512
33	Pediatric Neurosurgery	503
34	British Journal of Cancer	501
35	Others	112509
Total		147696

3261(2.21%) publications were published in " Journal of Neuro Oncology" followed by "Journal of Neurosurgey"2875 (1.95%) and "Neurosurgery" 2862 (1.94%).

Relative Growth Rate (RGR) and Doubling Time (Dt)

The relative growth rate and doubling time has been calculated and the same is shown in table 6 and fig 3 and 4.

Table 6: Relative Growth Rate (RGR) andDoubling Time (Dt)

Year	No.of pub	%	cum TP	cum %	w1	w2	RGR	Dt
1974	1519	1.03	1519	1.03		7.32581	7.33	0.09
1975	1495	1.01	3014	2.04	7.32581	8.01102	0.69	1.01
1976	1415	0.96	4429	3.00	8.01102	8.39593	0.38	1.80
1977	1388	0.94	5817	3.94	8.39593	8.66854	0.27	2.54
1978	1427	0.97	7244	4.90	8.66854	8.88793	0.22	3.16
1979	1348	0.91	8592	5.82	8.88793	9.05859	0.17	4.06
1980	1363	0.92	9955	6.74	9.05859	9.20583	0.15	4.71
1981	1479	1.00	11434	7.74	9.20583	9.34435	0.14	5.00
1982	1398	0.95	12832	8.69	9.34435	9.4597	0.12	6.01
1983	1529	1.04	14361	9.72	9.4597	9.57227	0.11	6.16
1984	1608	1.09	15969	10.81	9.57227	9.6784	0.11	6.53
1985	1675	1.13	17644	11.95	9.6784	9.77815	0.10	6.95
1986	1670	1.13	19314	13.08	9.77815	9.86859	0.09	7.66
1987	1801	1.22	21115	14.30	9.86859	9.95774	0.09	7.77
1988	1840	1.25	22955	15.54	9.95774	10.0413	0.08	8.29
1989	2054	1.39	25009	16.93	10.0413	10.127	0.09	8.09
1990	2224	1.51	27233	18.44	10.127	10.2122	0.09	8.13
1991	2192	1.48	29425	19.92	10.2122	10.2896	0.08	8.95
1992	2534	1.72	31959	21.64	10.2896	10.3722	0.08	8.39
1993	2622	1.78	34581	23.41	10.3722	10.4511	0.08	8.79
1994	3142	2.13	37723	25.54	10.4511	10.538	0.09	7.97
1995	3342	2.26	41065	27.80	10.538	10.6229	0.08	8.16
1996	3325	2.25	44390	30.05	10.6229	10.7008	0.08	8.90
1997	3763	2.55	48153	32.60	10.7008	10.7821	0.08	8.52
1998	3711	2.51	51864	35.12	10.7821	10.8564	0.07	9.33
1999	4084	2.77	55948	37.88	10.8564	10.9322	0.08	9.14
2000	4094	2.77	60042	40.65	10.9322	11.0028	0.07	9.81
2001	4396	2.98	64438	43.63	11.0028	11.0735	0.07	9.81
2002	4453	3.01	68891	46.64	11.0735	11.1403	0.07	10.37
2003	4995	3.38	73886	50.03	11.1403	11.2103	0.07	9.90
2004	5358	3.63	79244	53.65	11.2103	11.2803	0.07	9.90
2005	5856	3.96	85100	57.62	11.2803	11.3516	0.07	9.72
2006	6178	4.18	91278	61.80	11.3516	11.4217	0.07	9.89
2007	6284	4.25	97562	66.06	11.4217	11.4882	0.07	10.41
2008	6875	4.65	104437	70.71	11.4882	11.5563	0.07	10.18
2009	7503	5.08	111940	75.79	11.5563	11.6257	0.07	9.99
2010	8019	5.43	119959	81.22	11.6257	11.6949	0.07	10.02
2011	8765	5.93	128724	87.15	11.6949	11.7654	0.07	9.83

2012	9350	6.33	138074	93.48	11.7654	11.8355	0.07	9.88
2013	9622	6.51	147696	100.00	11.8355	11.9029	0.07	10.29
	147696	**100.00**						

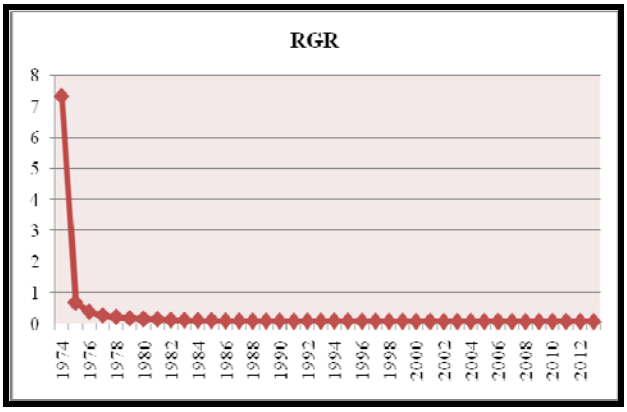


Fig. 3Relative Growth Rate (RGR)

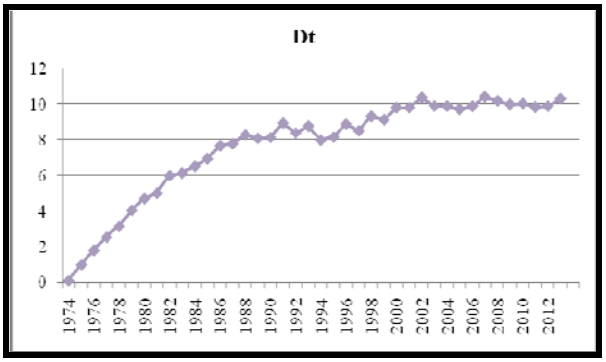


Fig. 4Doubling Time (Dt)

The relative growth rate is around 7% per year which indicates that the growth is 7% on an average per year. It shows that there will be a huge no. of publications in the said subject area globally.

Author Productivity

The top ten Indian authors were identified and the same is shown in Table 7 along with their number of contributions. .

Table 7: Global Authors

S.No	Author Name	Publications	%
1	Berger, M.S.	358	0.24
2	Bigner, D.D.	328	0.22
3	Friedman, H.S.	267	0.18
4	Black, P.M.	250	0.17
5	Kondziolka, D.	237	0.16
6	Scheithauer, B.W.	235	0.16
7	Weller, M.	234	0.16
8	Burger, P.C.	226	0.15
9	Sawaya, R.	218	0.15
10	Packer, R.J.	210	0.14
11	Rutka, J.T.	210	0.14
12	Ushio, Y.	201	0.14

Out of 12 authors, Berger, M S has 358 (0.24%)publicationsfollowed by Bigner, D D328 (0.22%),Friedman, H S267 (0.18%) and Black, P M with 250 (0.17%) publications.

6.8 Organisations and Brain Tumour Research

The organisations contributing research publications in Brain Tumour were identified and the same is shown in Table 8.

Table 8
Organisation

S. No	Affiliation	Pub	%
1	University of Texas M. D. Anderson Cancer Center	1939	1.31
2	University of California, San Francisco	1860	1.26
3	Massachusetts General Hospital	1453	0.98
4	Memorial Sloan-Kettering Cancer Center	1273	0.86
5	Duke University School of Medicine	1164	0.79
6	VA Medical Center	1118	0.76
7	Brigham and Women's Hospital	1044	0.71
8	National Cancer Institute	1001	0.68
9	Mayo Clinic	966	0.65
10	Inserm	964	0.65
11	Harvard Medical School	880	0.60
12	University of Toronto	788	0.53
13	Cleveland Clinic Foundation	728	0.49
14	David Geffen School of Medicine at UCLA	721	0.49
15	St. Jude Children Research Hospital	721	0.49
16	Universitat Heidelberg	711	0.48
17	Hospital for Sick Children University of Toronto	704	0.48
18	The Johns Hopkins School of Medicine	675	0.46
19	German Cancer Research Center	669	0.45
20	HopitalPitieSalpetriere	641	0.43
21	Washington University in St. Louis, School of Medicine	616	0.42
22	UniversitadegliStudi di Roma La Sapienza	616	0.42
23	Universitat Tubingen	611	0.41
24	UCL	600	0.41
25	University of Pennsylvania	599	0.41
26	University of Washington Seattle	591	0.40
27	Charite - Universitatsmedizin Berlin	589	0.40

28	Children's Hospital Boston	567	0.38
29	Baylor College of Medicine	565	0.38
30	Johns Hopkins University	562	0.38
31	Ohio State University	527	0.36
32	University of California, Los Angeles	508	0.34
33	others	120725	81.74
Total		**147696**	**100**

Table 8 shows that University of Texas M. D. Anderson Cancer Centerholds first place in contributing research productions in Brain Tumour with 1939 (1.31%%) of the total publications of 147641University of California, San Francisco with 1860(1.26%) and Massachusetts General Hospital with 1453(0.98%).

Author Pattern

The authorship pattern in respect of Indian authors is presented in Table 10. Single author publications was less compared to multiple authors.

Table 10: Author Pattern

S. No.	No. of Authors	No. of publications	Percentage	Cumulative Percentage
1	Single	16764	11.4	11.4
2	Two	19057	12.9	24.3
3	Three	21674	14.7	38.9
4	Four	20662	14.0	52.9
5	Five	17821	12.1	65.0
6	More than 5 authors	51718	35.0	100.0
	Total	**147696**	**100.0**	

It is seen from the table that out of 2880 publications, 725 (25.2%) publications were by more than five authors followed by four, three and two authors. Around 2740 (95.1%) publications were by multiple authors. It shows that the authors prefer to publish with co-authors rather publishing the article as single author.

CONCLUSION

There are 147696 publications available in Scopus database worldwide in Brain Tumour wherein India bags 2880 (1.95%) publications and placed in the 10th position. The most popular subjects of research are Medicine, Biochemistry, Genetics and Molecular Biology, and Neuroscience. In order to bring about more balance in future between different subfields of Brain Tumour, more attention and funding needs to be focused. The lack of fund to the research is a major drawback to the researchers.

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