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Review article

Global level research output in brain death: a Scientometric analysis

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ABSTRACT

The present study has analysed nearly the growth of research publications published during the study period from 2012 to 2021 with a sample of 5614 articles published in the field of brain death. The highest number of articles i.e. 652(11.61%) was published in the year 2020. Followed by the second-highest number of articles in 603(10.74%) were contributed in the year 2018. The RGR of an article has gradually decreased from 0.73 in the year 2013 to 0.10 in the year 2021 for the given study period. The doubling time of the publication of articles gradually increases from 0.94 in the year 2013 to 6.66 in the year 2021. The most prolific authors in the field of brain death, it is observed that Lewis, A. has contributed the highest number of articles i.e. 58(15. 43%) research publications in the United States. The large majority of the research output is available in the form of Article 3550(63.23%) research publication, and , the country of United States contributed the highest number of articles which amounts to more than 1767(40.43%) of the total publication. The Institutions of with Harvard Medical School alone published 101(14.55%) articles, and the journals of found that Transplantation Proceedings is on the top of the list with the publication of 346(29.88%) publications securing the first rank. The time series analysis statistical application will be expected in the brain death research publications in the year 2025 is around equal to 1661 and in the year 2030 is around equal to 2211. So that time serious analysis confirmed that the publications on the brain death research are increasing trend. The highly cited paper Mallon D.H.; et.al (2023) Defining delayed graft function after renal transplantation: Simplest is best, Transplantation, 96 (10): 885-889. The citation of 219 and document type of article.

Keywords: Scientometric, Brain Death, RGR, Time series analysis, highly cited paper, RCI.

INTRODUCTION

Brain death (also known as brain stem death) is when a person on an artificial life support machine no longer has any brain functions. This means they will not regain consciousness or be able to breathe without support. A person who is brain dead is legally confirmed as dead. They have no chance of recovery because their body is unable to survive without artificial life support. Brain death is legal death: If someone is brain dead, the damage is irreversible and, according to UK law, the person has died. It can be confusing to be told someone has brain death, because their life support machine will keep their heart beating and their chest will still rise and fall with every breath from the ventilator. But they will not ever regain consciousness or start breathing on their own again. They have already died. The brain stem: The brain stem is the lower part of the brain that's connected to the spinal cord (part of the central nervous system in the spinal column). The brain stem is responsible for regulating most of the body's automatic functions that are essential for life.

These include: breathing, heartbeat, blood pressure, swallowing. The brain stem also relays information to and

from the brain to the rest of the body, so it plays an important role in the brain's core functions, such as consciousness, awareness and movement. After brain death, it is not possible for someone to remain conscious. Causes of brain death: Brain death can happen when the blood or oxygen supply to the brain is stopped. This can be caused by: cardiac arrest – when the heart stops beating and the brain is starved of oxygen, a heart attack – when the blood supply to the heart is suddenly blocked, a stroke – when the blood supply to the brain is blocked or interrupted, a blood clot – a blockage in a blood vessel that disturbs or blocks the flow of blood around your body. Brain death can also be caused by: a severe head injury, a brain haemorrhage, infections, such as encephalitis, a brain tumor [1].

Scientometrics Study

Scientometrics is one of the truly interdisciplinary research fields to extend almost all scientific fields. In addition, many extensive bibliometric studies of important science fields appeared during the last two decades. At present, the connotation of bibliometric turns out to be the science of measurement relating to documents. The word measurement means the application of mathematical and statistical techniques to find out the growth of documents, scattering, or literature in various types of documents, publication of documents by an author, impact of document, and so on. Cole and Eales (1917) [2]. In their publication on the history of comparative anatomy, applied statistical methods for analysing the literature called statistical analysis. The most important contribution was made by Hulme (1923) [3]. When he published the book statistical bibliography, this term continued to be used for statistical measures till the end of the 1960s. Ranganathan (1948) [4]. Coined the term librametry to denote the measurement of various library activities and services using mathematical and statistical techniques.

Alan Prichard (1969) [5]. Coined the term bibliometric to denote the Application of mathematical and statistical methods to books and other media, the process of written communication, and of the nature and course of a discipline. Van Raan (1997) [6].According to scientometric research is devoted to Quantitative studies of science and technology. According to Beck (1978) [7].Scientometrics is defined as the quantitative evaluation and inter-comparison of scientific activity, productivity, and progress". Bookstein (1995) [8]. Defined "scientometrics as the science of measuring science. Scientometrics is also considered as a bibliometric measurement for evaluation of scientific development, social relevance and impact of the application of science and technology". Ingwerson and Christensen (1997) [9]. Defined the term "informatics designates a recent extension of the traditional bibliometric analysis, also to cover non-scholarly communities in which information is produced, communicated and used".

Review of Literature

Rajendran P, Manickaraj J, Elango B. (2013) [10]. Examines the research output in wireless communication contributed by the Indian scientists during 2001 – 2012 as reflected in the SCOPUS database. A total of 1128 records are retrieved and exported to the MS - Excel. The distribution of various forms of communication of Indian scientists has been presented 808 (71.63%) are appeared as conference paper. RGR is decreased from 0.56 in the year 2002 to 0.26 in the year 2012 and the corresponding Dt is gradually increased from 1.24 to 2.67. The degree of collaboration falls between 0.83 and 1 with an average of 0.95 during the study period. The journals of Communications in Computer and Information Science Germany with 51 (4.52%) research publications, the institutions of Anna University with 32 the rank of 1. The highly cited paper Dighe P.A., Mallik R.K., Jamuar S.S. (2003) Analysis of transmit-receive diversity in Rayleigh fading. IEEE Transactions on Communications, 51 (4): 694 – 703. Cited by 254, the document of Article the country of the India.

Jeyshankar & Vellaichamy (2016) [11]. Examined the Scientometric Analysis of Autism Research Output during 2007-2011, In the present study, we attempt to analyse 13079 global literature on Autism, indexed in the Scopus database during 2007- 11. Totally 70 countries contributed to the literature, the majority of the papers coming from the USA (49.24%), followed by the United Kingdom (15.61%), Germany (4.93%), etc. The study analyzed that Indian scientists together have published 134 papers on Autism research during 2007-11. India ranks 17th among the other countries in Autism research with a global publications share of 1.01% during 2007-11. In-depth, this study analyzed that majority of the publications are published in the form of articles (64.76%) and the majority (79%) of the scientists preferred to publish their research papers in joint authorship. The study also analyzed that majority of the autism research

appeared in the Journal of Autism and Developmental Disorders (7.19%).

Sujatha and Padmini (2015) [12]. Studied the journal of IEEE Transactions on Antennas and Propagation. It has published 3442 papers during 2010-2014 with maximum number of 789 articles in 2014 and an average of 688 papers per year. They have noted that, 3442 articles were contributed by 86 countries with a maximum number of 57 countries in the year 2013 and most of the contributions (921) are from USA followed by China (572); India stands in the 21st position with 52 articles. The journal published 2374 articles in core areas, viz. communication (926), antennas (733), wireless (342), electromagnetics (217), wave propagation and scattering (156). These are the fields which received highest attention in research justifying the journal title Antennas and Propagation.

Vellaichamy & Jeyshankar (2014) [13]. Examines Anemia Research in India: A bibliometric analysis of publications output during 1993–2013, this study is made an attempt to make the quantitative study of research output on anemia disease. Data of the present study is obtained from Scopus (http:// www.scopus.com) online multidisciplinary database for the period 1993–2013. The study reveals that 5085 papers were published during the period under study. The highest number of papers (739) is published in the year 2013 but it received 178 citations only. The minimum number (47) of papers is published in the year 1996, but they have received 3245 citations. The study reveals that the lowest number (0.56%) of citations was received in the year 2013. The study also focuses on authorship pattern, degree of collaboration, most productive authors, subject pattern, major collaborative partners in India, most productive journals, active institutions, and highly cited papers. Keywords: Bibliometrics; Anemia; Publication output; citation analysis, India.

Gupta et.al (2018) [14]. Examined acute Pancreatitis Research in India: A Scientometric Assessment of Publications during 2007-16. The present study examined 581 Indian acute pancreatitis research publications, as indexed in the Scopus database during 2007-16, The Indian publications registered an annual average growth rate of 14.09%, the global share of 4.28%, international collaborative publications share of 11.88% and its citation impact averaged 9.21 citations per paper. The top 15 organizations and authors together contributed 48.02% and 59.38% respectively as their share of India publication output and 44.26% and 58.13% respectively as their share of India citation output during 2007-16. Among 574 journal papers in Indian acute pancreatitis research, the top 14 journals registered 35.71% share during 2007-16, which showed an increase from 26.70% to 40.21% from 2007-11 and 2012-16. Indian Journal of Gastroenterology and Journal of the Pancreas, contributed the largest number of papers (27 papers each), there were only the top 7 highly cited publications.

Reenu Arti Thakur et.al (2020) [15]. Examined a Scientometric Study on 'Brain Tumor' Research Publication during the Period 2010-2019, the various Scientometrics parameters in Brain Tumor research in India during the period 2010-2019. The yearly growth lies between 3.97% in 2010 and 21.48% in 2019 and out of a total of 2444 publications the maximum number of articles is 525 (21.48%) on Brain Tumours is published in year 2019. Jalai, R. is the most productive author in brain tumor research with 44 publications. Most of the publication is published in the form of article 1507 (61.67%). Most of the articles on brain tumors are published in Neurology India 122 (8.63%). Brain Tumor is the most productive keyword and used in 1349 (4.98%) of brain tumor publications. 1894 (77.5%) of publications on brain tumors were published in the form of Journals. All India Institute of Medical Sciences, New Delhi has contributed the most 153 (6.26%) in the brain tumor research publications

Jiazhen Zheng et.al (2021) [16]. Analysed the Knowledge framework and emerging trends in intracranial aneurysm magnetic resonance angiography: a scientometric analysis from 2004 to 2020, a total of 1,272 articles on IAMRA published between 2004 and 2020 were included. Of 257 journals, the American Journal of Neuroradiology (IF 2018: 3.256) published the most IAMRA articles (109 publications, 8.57%), A total of 1387 institutions published articles, with the Mayo Clinic publishing the most (33 articles, 2.59%), Of 399 authors, Rinkel ranked first with 19 articles, followed by Li MH (18 articles), Uchino A (15 articles), and Saito N (13 articles). Cluster RCA showed that the first cluster was "#0 growth", followed by "#1 Guglielmi detachable coils". Timeline views showed that the time span of "#0 growth" was the closest to today. The modularity value was 0.6971, and the mean silhouette value was 0.5477.

Ravichandran and Vivekanandhan (2021) [17]. Analysed the wireless sensor network research output in India during 2010-2019 from the SCOPUS database with 11775. This study identified that a maximum number of 2058(17.48%) publications are contributed in the year 2019 and the compound annual growth rate was 5.44. This study identified that the relative growth rate was decreasing trend and doubling time was increasing trend. The average degree of collaboration was 0.96 and CAI was decreasing trend for more than three authors from 1st block year (106.71) to 2nd block year (97.39).

Analysed Limbic encephalitis: A scientometric analysis of global publications during 2004–13, The paper examines 901 global publications in limbic encephalitis as indexed in the Scopus database during 2004–13, witnessing an annual average growth rate of 17.27% and an average citation impact per paper of 5.76. The limbic encephalitis publication output came from 48 countries, of which the top 10 (United States, Japan, U.K., Germany, France, Spain, Italy, etc.) accounted for 92.45% of global publication share during 2004–13. Limbic encephalitis output came from 210 organizations, of which the top 10 contributed 19.98% share during 2003–12. The largest publication share (91.56%) in limbic encephalitis came from medicine, three countries, namely Spain, Austria and U.K. out of 10 have achieved a higher share of the relative index than the average relative citation index of 1.91 of top 10 countries during 2004–13 [18].

Objectives of the Study

To examine the year-wise distribution of Brain Death research literature output during 2012-2021.

To examine the document type-wise distribution of Brain Death research literature output

To examine the form of document types in Brain Death research output

To examine the in Scopus database core collection in Brain Death research output

To examine the time series analysis in Brain Death research output

To examine the Highly cited papers in Brain Death research output

To examine the Institutional and Country of Brain Death research output

To enlist the most prolific authors and most productive journals in Brain Death research output

Methodology

The researcher has collected the required research data from the online version of the Scopus database on the Brain Death From 2012 to 2021 and it is used as the main source of data for the present study. The researcher has used the Brain Death for searching the records on a given field, an overall of 5614 records was retrieved as a result of a search made in the database. : (TITLE-ABS-KEY ("brain death") AND PUBYEAR > 2011 AND PUBYEAR < 2022) the data was collected on 03.09.2022 for the Scopus database in the Micro Soft Excel sheet.

Data Analysis and Interpretation

Year-Wise Growth of Brain Death Research Publication

Table 1: Year-Wise Growth of Brain Death Research Publication

year	Publications	%	Citation	%	Cited	%	CPP	RCI
2012	511	9.10	56553	12.53	856	3.54	110.67	1.38
2013	554	9.87	54548	12.09	1377	5.69	98.46	1.22
2014	577	10.28	61648	13.66	1927	7.96	106.84	1.33
2015	540	9.62	58745	13.02	2167	8.95	108.79	1.35
2016	540	9.62	53379	11.83	2472	10.21	98.85	1.23
2017	514	9.16	47488	10.52	2983	12.32	92.39	1.15
2018	603	10.74	47679	10.57	3143	12.99	79.07	0.98
2019	568	10.12	35913	7.96	3305	13.66	63.23	0.79
2020	652	11.61	21614	4.79	3255	13.45	33.15	0.41
2021	555	9.89	13680	3.03	2718	11.23	24.65	0.31
Total	**5614**	**100.00**	**451247**	**100.00**	**24203**	**100.00**		

Table 1 reveals the growth of research publications published during the study period from 2012 to 2021 with a sample of 5614 articles published in the field of brain death. The highest number of articles i.e. 652(11.61%) was published in the year 2020. Followed by the second-highest number of articles in 603(10.74%) were contributed in the year 2018. These two years are considered as most productive years. The productivity of the publications in these two years increased to 22.35%. However, the minimum number of articles 511(9.10%) were published in the year 2012.

The highest number of citations is 61648(13.66%) research publications, and cited is 3305(13.66%), the CPP is 110.67, and the RCI is 1.38. Followed by 58745(13.02%) research publications, the cited 2167(8.95) research publications, the CPP is 108.75, and the RCI is 1.35. The lowest number of citations is 13680(3.03%) research publications, the cited

2718(11.23%) research publications, the CPP is 24.65, and the RCI is 0.31.

RGR and Doubling time in the field Brain Death Research Publication

Table 2: RGR and doubling time in the field of Brain Death Research Publication

Years	Publications	Cum	W1	W2	RGR=(W2-W1)	Dt=(0.693/RGR
2012	511	511		6.24		
2013	554	1065	6.24	6.97	0.73	0.94
2014	577	1642	6.97	7.40	0.43	1.60
2015	540	2182	7.40	7.69	0.28	2.44
2016	540	2722	7.69	7.91	0.22	3.13
2017	514	3236	7.91	8.08	0.17	4.01
2018	603	3839	8.08	8.25	0.17	4.06
2019	568	4407	8.25	8.39	0.14	5.02
2020	652	5059	8.39	8.53	0.14	5.02
2021	555	5614	8.53	8.63	0.10	6.66
Total	**5614**		**69.46**	**78.10**	**2.40**	**32.88**

Table 2 clearly shows the mean relative growth rate and doubling time of the publications in the area of the spice for the study period. It is noticed that the RGR of an article has gradually decreased from 0.73 in the year 2013 to 0.10 in the year 2021 for the given study period. The doubling time of the publication of articles gradually increases from 0.94 in the year 2013 to 6.66 in the year 2021. It can be summarized from the above discussion that the RGR of the article gradually decreased. And on the other hand, the doubling time of the articles gradually increased.

Table -3 shows the contribution of the most prolific authors in the field of brain death, it is observed that Lewis, A. has contributed the highest number of articles i.e. 58(15.43%) research publications in the United States, followed by Wijdicks, E.F.M. 40(10.64%) research publications United Kingdom, and Greer, D.M. 37(9.84%) research publications in Germany. The lowest author in Leuvenink, H.G.D. 30(7.98%) research publications in Australia.

The highest number of citations is 2528(16.92%) research publications, and H-index is 23, the CPP is 43.59, and the RCI is 1.10. Followed by 2176(14.56%) research publications, the H-index is 21, the CPP is 70.19, and the RCI is 1.77. The lowest number of citations is 969(6.49%) research publications, the H-index is 13, the CPP is 26.92, and the RCI is 0.68.

Most Prolific Authors in the Field of Brain Death Research Publication

Table 3: Most Prolific Authors in the Field of Brain Death Research Publication

Author	Country	No, of Publications	%	Citation	%	CPP	h-index	RCI
Lewis, A.	United States	58	15.43	2528	16.92	43.59	23	1.10
Wijdicks, E.F.M.	United Kingdom	40	10.64	2086	13.96	52.15	18	1.31
Greer, D.M.	Germany	37	9.84	1142	7.64	30.86	17	0.78
Rady, M.Y.	Spain	37	9.84	1279	8.56	34.57	17	0.87
Bernat, J.L.	Canada	36	9.57	1155	7.73	32.08	19	0.81
Ramírez, P.	China	36	9.57	969	6.49	26.92	13	0.68
Shemie, S.D.	France	36	9.57	1214	8.13	33.72	18	0.85
Parrilla, P.	Italy	35	9.31	1263	8.45	36.09	18	0.91
Gardiner, D.	Netherlands	31	8.24	2176	14.56	70.19	21	1.77
Leuvenink, H.G.D.	Australia	30	7.98	1129	7.56	37.63	12	0.95
Total		**376**	**100.00**	**14941**	**100.00**			

Most Prolific Subjects in the Field of Brain Death Research Publication

Table 4: Most Prolific Subjects in the Field of Brain Death Research Publication

Subject	No. of Publications	%
Agricultural and Biological Sciences	47	6.50
Arts and Humanities	252	34.85
Biochemistry, Genetics and Molecular Biology	274	37.90
Business, Management and Accounting	5	0.69
Chemical Engineering	42	5.81
Chemistry	20	2.77
Computer Science	63	8.71
Decision Sciences	9	1.24
Dentistry	8	1.11
Economics, Econometrics and Finance	3	0.41
Total	**723**	**100.00**

Table -4 shows the contribution of the most prolific subjects in the field of brain death, it is observed that Biochemistry, Genetics and Molecular Biology contributed the highest number of with 274(37.90%) research publications, followed by Arts and Humanities with 252(34.85%) research publications, and Computer Science with 68.71%) research publications. The lowest subject was Economics, Econometrics and Finance with 3(0.41%) research publications.

Table 5 depicts the geographical wise distribution of publications, out of 4370 articles, the United States contributed the highest number of articles which amounts to more than 1767(40.43%) of the total publication then followed by United Kingdom 470(10.76%) and, the Germany 357(8.17%), these three countries together contributed more than 59.38% of the world publications in the field of brain death. Further, it is observed that the Spain 299(6.84%), Canada 280 (6.41%), China 265(6.06%), France 258(5.90%), Italy 250(5.86%), Netherlands 220(5.03%), Australia 198 4.53%).

The highest number of citations is 222337(50.68%) research publications, and H-index is 178, the CPP is 125.83, and the RCI is 1.25. Followed by 51931(11.84%) research publications, the H-index is 95, the CPP is 145.56, and the RCI is 1.45. The lowest number of citations is 9502(2.17%) research publications, the H-index is 42, the CPP is 43.19, and the RCI is 0.43.

Country-wise Distribution of Brain Death Research Publication

Table 5: Country-wise Distribution of Brain Death Research Publication

Country	No. of Publications	%	Citation	%	CPP	h-index	RCI
United States	1767	40.43	222337	50.68	125.83	178	1.25
United Kingdom	470	10.76	17725	4.04	37.71	51	0.38
Germany	357	8.17	51931	11.84	145.46	95	1.45
Spain	299	6.84	31364	7.15	104.90	79	1.04
Canada	280	6.41	20467	4.67	73.10	63	0.73
China	265	6.06	22644	5.16	85.45	67	0.85
France	258	5.90	20981	4.78	81.32	67	0.81
Italy	256	5.86	25943	5.91	101.34	66	1.01
Netherlands	220	5.03	9502	2.17	43.19	42	0.43
Australia	198	4.53	15798	3.60	79.79	53	0.79
Total	**4370**	**100.00**	**438692**	**100.00**			

Top ten Research Institutions in the field of Brain Death Research Publication

Table 6: top ten Research Institutions in the field of Brain Death Research Publication

Institutions	Publications	%	Citation	%	CPP	h-index	
Harvard Medical School	101	14.55	8869	17.02	87.81	48	
University of Toronto	74	10.66	5432	10.42	73.41	37	
Mayo Clinic	69	9.94	4772	9.16	69.16	31	
Universitair Medisch Centrum Groningen	69	9.94	5713	10.96	82.80	38	
Inserm	67	9.65	4161	7.98	62.10	30	
AP-HP Assistance Publique - Hopitaux de Paris	66	9.51	4187	8.03	63.44	35	
Erasmus MC	64	9.22	4976	9.55	77.75	34	1.04
Massachusetts General Hospital	63	9.08	4517	8.67	71.70	36	0.95
NHS Blood and Transplant	61	8.79	4315	8.28	70.74	32	0.94
Universidade de São Paulo	60	8.65	5181	9.94	86.35	33	
Total	**694**	**100.00**	**52123**	**100.00**			

Table -6 gives the account of research publications by the top ten research institutions at the global level in the area of Brain Death all together they published 694 publications sharing nearly more than the world publications during the study period. Which, Harvard Medical School alone published 101(14.55%) articles and then followed by the University of Toronto contributed nearly 74(10.66%) articles, Mayo Clinic and Universitair Medisch Centrum Groningen 69(9.94%), Inserm 67(9.657%) research publication. The lowest institutions in Universidade de São Paulo 608.65%) research publications.

The highest is 8869(17.02%) research publications, the H-index is 48, the CPP is 87.81, and the RCI is 1.17. Followed by 5713(10.96%) research publications, the H-index is 38, the CPP is 82.80, and the RCI is 1.10, 5432(10.42%) research publications, the H-index is 37, the CPP is 73.41, and the RCI is 0.98. The lowest number of citations is 4161(7.98%) research publications, the H-index is 30, the CPP is 62.10, and the RCI is 0.83.

Table -7 shows the top ten most productive journals in the area of the brain death. It found that Transplantation Proceedings is on the top of the list with the publication of 346(29.88%) publications securing the first rank. Accordingly, American Journal of Transplantation the second rank with a publication of 165(14.25%) research publications. secured the third rank of Transplantation with 135(11.66%) research publications. These three journals appear to be the most productive journals in the field of the brain death. The remaining productivity journals are also listed in the above table. The lowest Neurology 56(4.84%) research publications.

The highest citation is 12870(27.13%) research publications, the CPP is 37.20, and the H index is 46, the RCI is 0.91. Followed by 11074(23.34%) research publications, the H index is 55, the CPP is 140.18, and the RCI is 3.42. The lowest number of citations is 746(1.57%) research publications, the CPP is 9.10, the H- index is 10 and the RCI is 0.22.

Most Productive Journals in the field of Brain Death Research Publication

Table 7: Most Productive Journals in the field Brain Death Research Publication

Journals	Publications	%	Citation	%	CPP	h-index	RCI
Transplantation Proceedings	346	29.88	12870	27.13	37.20	46	0.91
American Journal Of Transplantation	165	14.25	4152	8.75	25.16	29	0.61
Transplantation	135	11.66	2831	5.97	20.97	24	0.51
Liver Transplantation	87	7.51	894	1.88	10.28	13	0.25
Experimental And Clinical Transplantation	82	7.08	746	1.57	9.10	10	0.22
Clinical Transplantation	79	6.82	11074	23.34	140.18	55	3.42
Transplant International	76	6.56	7533	15.88	99.12	47	2.42
Critical Care Medicine	66	5.70	1614	3.40	24.45	22	0.60
Neurocritical Care	66	5.70	1902	4.01	28.82	20	0.70
Neurology	56	4.84	3831	8.07	68.41	32	1.67
Total	**1158**	**100.00**	**47447**	**100.00**			

Type of Document wise distribution in Brain Death Research Publication

Table 8: Type of Document wise distribution in Brain Death Research Publication

Document Type	Publications	%	Citation	%	CPP	h-index	RCI
Article	3550	63.23	167585	37.12	47.21	147	0.59
Review	701	12.49	255153	56.51	363.98	174	4.53
Letter	399	7.11	3172	0.70	7.95	19	0.10
Editorial	263	4.68	3	0.00	0.01	1	0.00
Note	261	4.65	15246	3.38	58.41	58	0.73
Conference Paper	191	3.40	1597	0.35	8.36	19	0.10
Book Chapter	189	3.37	6537	1.45	34.59	30	0.43
Short Survey	34	0.61	869	0.19	25.56	13	0.32
Book	14	0.25	992	0.22	70.86	15	0.88
Erratum	7	0.12	37	0.01	5.29	3	0.07
Conference Review	4	0.07	268	0.06	67.00	9	0.83
Undefined	1	0.02	64	0.01	64.00	3	0.80
Total	**5614**	**100.00**	**451523**	**100.00**			

It is evident from table 8 showing the bibliographical form-wise distribution of documents, that the large majority of the research output is available in the form of Article 3550(63.23%), and a considerable amount of publications are also published in the form of research Review 701(12.49%). And Letter 399(7.11%) research publications. A Significant amount of publications were brought in the form of Editorial and Note respectively 263(4.68%), and 261(4.65%). However, very few publications are also published in the form of Conference Paper 191(3.40%), Book chapter 189 (3.37%), Short Survey 34(0.61%), Book 34 (0.61%), and Erratum 7(0.12%) Conference Review 4 (0.07%), Undefined 1 (0.02%). It can be concluded from the above discussion that the majority of the publications are published in the form of Article and Review of (75.72%) research publications.

Table -9 shows the contribution of the most prolific keyword in the field of brain death, it is observed that brain death has contributed the highest number of Brain Death with 4779 (17.07 %) research publications, followed by Human with 4658(16.64%) research publications, and Humans with 3858(13.78%) research publications. The lowest keyword was Organ Donor with 1489(5.32%) research publications.

The keywords of the Brain Death Research Publication

Table 9: Keywords of the Brain Death Research Publication

Keyword	Frequency	%
Brain Death	4779	17.07
Human	4658	16.64
Humans	3858	13.78
Article	2718	9.71
Male	2449	8.75
Female	2287	8.17
Adult	2173	7.76
Priority Journal	2081	7.43
Transplantation	1507	5.38
Organ Donor	1489	5.32
Total	**27999**	**100.00**

The Funding agency of the Brain Death Research Publication

Table 10: Funding agency of the Brain Death Research Publication

Name of the Funding Agency	Publications	%
National Institutes of Health	137	2.90
National Natural Science Foundation of China	67	1.42
National Heart, Lung, and Blood Institute	64	1.35
National Institute of Diabetes and Digestive and Kidney Diseases	44	0.93
Japan Society for the Promotion of Science	42	0.89
National Center for Advancing Translational Sciences	39	0.82
U.S. Department of Health and Human Services	38	0.80
National Institute of Neurological Disorders and Stroke	33	0.70
Health Resources and Services Administration	30	0.63
Ministry of Education, Culture, Sports, Science and Technology	23	0.49
Total	**517**	**10.93**

Table -10 shows the contribution of the most prolific funding agency in the field of brain

death, it is observed that brain death has contributed the highest number of National Institutes of Health with 137 (2.90%) research publications, followed by National Natural Science Foundation of China with 67 (1.42%) research publications, and National National Heart, Lung, and Blood Institute with 64(1.35%) research publications. The lowest keyword was Ministry of Education, Culture, Sports, Science and Technology with 23 (0.49%) research publications [16].

Time Series Analysis

Time series analysis reveals the estimated growth values are identified based on previous data. A straight–line equation is adapted to measure the future values based on previous data. Time series analysis used by Jeyshankar and Ramesh babu (2013)[19] Ravichandran.S, Vivekanandhan.S, & G.Vinita Angeline (2022)[20].

Time Series Analysis Brain Death Research Publication

Table 11 shows that the time series analysis formula has been predicted for the Brain Death research publications for the years 2025 and 2030

The straight Line Equation is

$Y = a + bx$

Here,

$\sum Y = 5614, \sum X^2 = 110, \sum XY = 12136$

$a = \sum Y/N = 5614/10 = 561.4 = 561$

$b = \sum XY/ \sum X^2 = 12136/110 = 110.3 = 110$

Estimated publications in the year 2025 are when X=2025-2015=10

$Y = a + bx$

$= 561 + (110*10) = 561+1100 = 1661$

The Estimated literature in 2030 is when X=2030-2015=15

$Y = a + bx$

$= 561 + (110*15) = 561 + 1650 = 2211$

The estimated growth based on a time series analysis statistical application will be expected in the Brain Death research publications in the year 2025 is around equal to 1661 and in the year 2030 is around equal to 2211. So that time serious analysis confirmed that the publications on the brain death research are increasing trend.

Highly cited papers in Brain Death Research Publication

Table 11: Time Series Analysis Brain Death Research Publication

Year	Count (Y)	X	X^2	XY
2012	511	-5	25	-22465
2013	554	-4	16	-18212
2014	577	-3	9	-13665
2015	540	-2	4	-9078
2016	540	-1	1	-4481
2017	514	1	1	4716
2018	603	2	4	10468
2019	568	3	9	16779
2020	652	4	16	22204
2021	555	5	25	25870
Total	**5614**		**110**	**12136**

Table 12: highly cited papers in Brain Death Research Publication

Titles	Cited by	Document Type
Mallon D.H.; et.al (2023) Defining delayed graft function after renal transplantation: Simplest is best, Transplantation, 96 (10): 885-889.	219	Article
Muller X.; Marcon F.; et.al (2018) Defining Benchmarks in Liver Transplantation: A Multicenter Outcome Analysis Determining Best Achievable, Annals of Surgery Results, 267(3): 419-425.	172	Article
Monbaliu D.; et.al (2012) Liver transplantation using Donation after Cardiac Death donors, Journal of Hepatology, 56(2): 474-485.	170	Note
Messer S.; et.al (2020) A 5-year single-center early experience of heart transplantation from donation after circulatory-determined death donors, Journal of Heart and Lung Transplantation, 39(12): 1463-1475.	161	Article
Moseby-Knappe M.; et.al (2019) Serum Neurofilament Light Chain for Prognosis of Outcome after Cardiac Arrest, JAMA Neurology, 76(1): 64-71.	154	Article
Hamdy S. (2012) Our bodies belong to god: Organ transplants, Islam, and the struggle for human dignity in Egypt, 342	148	Book
Arrich J.; et.al (2012) Hypothermia for neuroprotection in adults after cardiopulmonary resuscitation. Cochrane database of systematic reviews (Online), 9, CD004128.	148	Review
O'Neill S.; ei.al (2014) A meta-analysis and meta-regression of outcomes including biliary complications in donation after cardiac death liver, Transplant International transplantation, 27(11): 1159-1174.	127	Article
Schlegel A.; et.al (2020) Hypothermic oxygenated perfusion protects from mitochondrial injury before liver transplantation, BioMedicine, 60, Art.No103014	121	Article
Diamond J.M.; et.al (2017) Report of the International Society for Heart and Lung Transplantation Working Group on Primary Lung Graft Dysfunction, Journal of Heart and Lung Transplantation, 36(10): 1104-1113.	113	Editorial

Table – 12 the highly cited paper Mallon D.H.; et.al (2023) Defining delayed graft function after renal transplantation: Simplest is best, Transplantation, 96 (10): 885-889. The citation of 219 and document type of article. Followed by the Muller X.; Marcon F.; et.al (2018) Defining Benchmarks in Liver Transplantation: A Multicenter Outcome Analysis Determining Best Achievable, Annals of Surgery Results, 267(3): 419-425. The citation 172 and document of article, Monbaliu D.; et.al (2012) Liver transplantation using Donation after Cardiac Death donors, Journal of Hepatology, 56(2): 474-485. The citation of 170 and document type of Note. In the highly cited paper of 06 article. Note 01, Book 01, Review 01 and Editorial 01.

Major Findings of the Study

The present study has analysed nearly the growth of research publications published during the study period from 2012 to 2021 with a sample of 5614 articles published in the field of brain death. The highest number of articles i.e. 652(11.61%) was published in the year 2020. Followed by the second-highest number of articles in 603(10.74%) were contributed in the year 2018.

The RGR of an article has gradually decreased from 0.73 in the year 2013 to 0.10 in the year 2021 for the given study period. The doubling time of the publication of articles gradually increases from 0.94 in the year 2013 to 6.66 in the year 2021.

During the most prolific authors in the field of brain death, it is observed that Lewis, A. has contributed the highest number of articles i.e. 58(15.43%) research publications in the United States and the most prolific subjects in the field of brain death, it is observed that Biochemistry, Genetics and Molecular Biology contributed the highest number of with 274(37.90%) research publications.

During the large majority of the research output is available in the form of Article 3550(63.23%) research publication, and , the country of United States contributed the highest number of articles which amounts to more than 1767(40.43%) of the total publication.

The Institutions of with Harvard Medical School alone published 101(14.55%) articles, and the journals of found that Transplantation Proceedings is on the top of the list with the publication of 346(29.88%) publications securing the first rank.

During the highest number of keywords of the contributed the highest number of Brain Death with 4779 (17.07 %) research publications. The highest number of funding agency of the contributed of National Institutes of Health with 137 (2.90%) research publications.

The time series analysis statistical application will be expected in the brain death research publications in the year 2025 is around equal to 1661 and in the year 2030 is around equal to 2211. So that time serious analysis confirmed that the publications on the spice research are increasing trend.

The highly cited paper Mallon D.H.; et.al (2023) Defining delayed graft function after renal transplantation: Simplest is best, Transplantation, 96 (10): 885-889. The citation of 219 and document type of article.

CONCLUSION

This clinical interaction demonstrates some of the medical and ethical challenges in the diagnosis of brain death. Brain death is synonymous with death and not a prognostication of future outcome. In this paper studied the country of United States contributed the highest number of articles which amounts to more than 1767(40.43%) of the total publication. The Institutions of with Harvard Medical

School alone published 101(14.55%) articles, and the journals of found that Transplantation Proceedings is on the top of the list with the publication of 346(29.88%) publications securing the first rank. While a patient's prognosis plays an important role in decisions about withdrawal of care, prognosis does not play a role in the medico-legal realm of declaring brain death. In the setting of a poor prognosis, a capable surrogate can support a plan to terminate care for futility even when the brain death diagnosis is thwarted. Clinicians should not allow a dismal prognosis to introduce bias into declaring brain death but should strictly adhere to the clear medico legal criteria.

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