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Knowledge Mapping of Alzheimer's Disease Research: A Scientometric Analysis

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Abstract:
The paper explores the growth pattern of Alzheimer's disease literature, published during 2014-2018. The data has been retrieved from Web of Science database by using the key word 'Alzheimer's Disease'. The downloaded articles were classified chronologically and transferred to spread sheet for the analysis as per the objectives of the study. The study results revealed that, a total of 38936 publications were found out of which maximum publications (8355) were found in the year 2018 and the minimum 7192 publications were found in the year 2014. Mean relative growth rate of Alzheimer's disease literature has shown exponential trend. Data set is well fitted with, Polynomial model (r^2=.965), Linear (r^2=.964) and Exponential (r^2=.964). Among top 10 sub-field, maximum 18426 research publications were on 'Neuroscience' sub-field and minimum 1119 research publications were on 'Psychology' sub-field. It is found that University of California System affiliated with highest number of publications i.e. 1823 (4.68%) of the total publications and University of California San Francisco affiliated with 624 publications positioned 10th place. secured 10th position with 624 publications. Among top 10 journals, International Journal of Alzheimer's Disease (UK) published highest number of publications with 2930 (7.53%) publications and Journal of Neurochemistry (Wiley, IF 4.87) published the lowest number of publications.

Keywords: Growth pattern, Alzheimer's disease, Research output, Web of Science, Relative Growth Rate

Introduction

Alzheimer's disease (AD) is the most common type of dementia. "Dementia" is an umbrella term describing a variety of diseases and conditions that develop when nerve cells in the brain die or no longer function normally. The death or malfunction of these nerve cells, called neurons, causes changes in one's memory, behavior, and ability to think clearly. In AD, these brain changes eventually impair an individual's ability to carry out such basic bodily functions as walking and swallowing. AD is ultimately fatal.It was first identified more than 100 years ago, but research into its symptoms, causes, risk factors, and treatment has gained momentum only in the past 30 years. Although research has revealed a great deal about AD, the

precise physiological changes that trigger the development of AD largely remain unknown. The only exceptions are certain rare, inherited forms of the disease caused by known genetic mutations (Thies,2012).

According to Sudarsana and Baba (2019) “Measuring the impact of science on society and comparing the output as well as its impact at national and international levels are the key aims of scientometrics, however, Scientometric is an application of quantitate techniques to scientific communication, which include the measurement of impact articles, journals and institutes. It supports understanding of scientific citations and mapping the research domains”.

Review of literature

The literature review plays a very important role in the research process. It provides an account of the studies carried out by the professionals and the views and opinions of them in the field of scientometrics in India as well as in abroad. An attempt has been made to collect major recent related studies on the theme and the same has been reviewed and presented. The sources consulted to collect the literature is ScienceDirect, ResearchGate and Emerald insight an online database of full test articles. The relevant article have been downloaded and reviewed to determine the research gaps.

Liu et al. (2020) based on 1767 articles from the Web of Science Core Collection and PubMed database, this study carried out the analysis from the keywords, cited references, countries, authors, and some other aspects by using Citespace.This paper aims to explore the knowledge structure, analyze the current research hot spots, and discuss the research trend through screening and summarizing the present literature. This is the first study to specifically visualize the relationship between pesticide exposure and Parkinson's Diseas (PD), and forecast research tendency in the future, projections of prevalence. **Danesh & GhaviDel (2020)** the study aimed to review the scientific publications of the Coronavirus, which are in the four types of Articles (4474), Meeting abstracts (313), Proceedings paper (290), and Reviews (235) correspondingly. Result show the uppermost percentage of the publication of Coronavirus was in 2005 (6.8%), 2004 (6.78%), and 2006 (5.92%), respectively. Different Source Types of Coronavirus Scientific Publications Frequency Distribution. Some of the most essential literatures related to scientific representation of medical sciences. Among the most proliferated organizations in Coronavirus scientific publications, The University of Hong Kong, Chinese Academy of Sciences, and Utrecht University have ranked first to third, respectively. Representing the scientific structure from different angles will guide Coronavirus specialists and researchers and policymakers in the Ministry of Health and Medical Science Associations. The Journal of Virology, is the most proliferated one in the Coronavirus publications. **Golpinar & Demir (2020)** the objective of the present research was to perform a comprehensive and holistic analysis of the publications concerning the cerebellum published during the period from 1980 to 2019 through bibliometric approaches and to determine the evolving research trends on the cerebellum topic over the 40 years. .A positive and significant correlation was found between the number of cerebellum articles produced by the countries and the development indexes of the countries. The top three productive journals were found to be the Journal of Neuroscience, Brain Research, and Cerebellum. An evaluation of the analysis results with a view to identifying the trend topics about the cerebellum articles from past to present showed that the most frequently used

keywords around 1990 were magnetic resonance imaging (MRI), stroke, granule cell, hippocampus, plasticity medulloblastoma, neurogenesis, cerebellar atrophy, and electron microscopy. **Dong et al. (2019)** China has become the country with the second largest total number of published AD articles; however, Chinese articles contain much more basic research and less clinical research compared to global publications. Neurobiology of Aging was the most active journal on AD research with 5,206 articles (2.874%), The journal publishing the most AD research from China were PLoS ONE with 450 articles (3.199%), The National Natural Science Foundation of China funded the largest number of studies on Alzheimer's disease in China. Globally, the National Institutes of Health, the National Institute on Aging, and the Department of Health and Human Services jointly sponsored 11,809 articles, ranking first in the world for funding published AD research. The Chinese Academy of Sciences was the top Chinese contributor to AD research with 1,330 publications, 47,469 total citations, and an h-index of 79, By 2017. The number of AD publications from China had increased significantly, and Chinese research institutes with a focus on AD research had been established. In China, the National Natural Science Foundation of China (NSFC) funded the most research and producing 6,128 articles (43.557%). **Bansal et al. (2018)** have analyzed research productivity on chikungunya in India during 2006-15. The most deadly and incurable disease Chikungunya virus is spread to people by the bite of an infected mosquito. Outbreaks have occurred in countries in Africa, Asia, Europe, and the Indian and Pacific Oceans. In late 2013, chikungunya virus was found for the first time in the Americas on islands in the Caribbean. The virus is one of the challenge to the medical field. There is no medicine to cure this disease. The scientists in the field of medicine are doing experiments to investigate medicine. In this context the researchers were retrieved the required data from Scopus database by using the keyword chikungunya. A total of 9919 publications were retrieved and analysed as per the objectives of the study. The study found that 77.35% contributions are from Medicine of the total publications and rest is other subjects. The annual average growth rate was 17.56% and citation impact per paper of 10.79. The study also depicted 10 most productive countries, 15 organizations and authors. Another scientometric study was conducted by **Nagalingam (2017)** has conducted a scientometric study on parkinson's disease Research Productivity in Asia during 2010– 2017. The study reveals the growth of publications on the topic. There were a total of 14064 publications on the area during the period of study. The study reported that research articles was the communicative media used by the scientists. Moreover, the scientists were collaborated to work together to investigate medicine to cure disease. There was a collaborative research pattern. Further three authored papers were on first place, Parkinsonism and Related Disorders gets the first position followed by PLoS One in the research publications. Hattori, N (China) was the most productive author. Research on Rabies goes back to the beginning of nineteenth century. It was GG Zinke who reported that rabies was caused by an infectious agent. During 1880s, Louis Pasteur became interested in rabies and investigated medicine. There are lot of research is going on in world on the cure of rabies India is no exception to it. Library professionals those who working in the medical libraries have to keep abreast over the communication channels which disseminate the research output. In this regard a study was conducted on rabies research productivity in India. **Sachithanantham et al. (2015)** the scientists choose Journal of the Association of Physicians of India (JAPI) to communicate the research output. National Institute of Mental Health and Neurosciences (NIMHANS), Bangalore is active in research with highest number of records. Collaborative research gained momentum. All India Institute of Medical Sciences (AIIMS) and National Institute of Mental Health and Neuroscience (NIMHANS) have the highest publications

on neuroscience a branch of medicine connected with all types neural diseases. **Amudha & Sevukan (2014)** the research performance is measured by Scientometric indices such as h-Index, G-index, i10-index so and so on so forth. Council of Scientific Industrial Research (CSIR) is pioneer in research have h-index of 31. The Indian scientists in the field of neuroscience prefer 'Journal of Neurology India' to publish research productivity. Plenty of research have been conducted all over the world on neural science. India is no exception to it. For example, in Scopus Citation Database, India has got 16th place among other countries in terms of research publications on Alzheimer's disease. (**Gupta & Adarsh 2013)**

Objectives

1. To know the year- wise distributions of publications,
2. To compute and ascertain the Relative Growth Rate and Doubling Time of Publications,
3. To apply some statistical models to explore their goodness-of-fit,
4. To determine sub field -wise distribution of publications,
5. To analyses the institution-wise distribution of publications,
6. To identify the most preferred Journals.

Scope and methodology

The study is based on the research productivity as indexed in Web of Science for the year 2014 to 2018 only. The data has been retrieved from the database by using the key word 'Alzheimer's disease'. A total 38936 results were found which were processed and analyzed to achieve the objectives of the study.

Analysis and interpretation of data

Year-wise Distributions of Publications

The below table depicts the year-wise distribution of publications of Alzheimer's disease during the period (2014-2018). A total of 38936 publications were found out of which maximum 8355 were found in the year 2018, followed by 8235 publications in 2017 and the minimum 7192 publications were found in the year 2014.

Table 1: Year-wise Distribution of Publications

Year	No. of Publications	Cumulative No. of Publications
2014	7192	7192
2015	7348	14540
2016	7806	22346
2017	8235	30581
2018	8355	38936
Total	**38936**	

Relative Growth Rate and Doubling Time

The Relative Growth Rate explains increase in the number of publications in Alzheimer's disease research output during the period 2014 to 2018. The growth of publications was analyzed by using two parameters: Relative Growth Rate (RGR) & Doubling time (Dt) (Mahapatra, 1985).

$$\text{Relative Growth Rate(RGR)} = \frac{LN(P_2) - LN(P_1)}{T2 - T1}$$

Where,

RGR = Growth Rate over the specific period of the interval
P_1 = Loge (natural log of the initial number of contributions)
P_2 = Loge (natural log of the final number of contributions)
T1 = The unit of initial time
T2 = The unit of final time

$$\text{Doubling time(Dt)} = \frac{0.693}{RGR}$$

The mathematical representation of the mean relative growth rate of publications over a specific period is shown in the below Table 2. The maximum 1.54 relative growth rate was recorded in the year of 2018; however, the maximum 1.02 doubling time was recorded in year of 2015. Average RGR 0.92 and average D_t 0.53 recorded in the study period 2014-2018. Therefore, the relative growth rate is increasing trend and doubling time of publications was linear trend.

Table 2: Relative Growth Rate and Doubling Time of Publications

Year	No. of articles	Cumulative No. of articles	Loge(1)[p]	Loge(2)[p]	RGR(P)	Mean RGR (P)	Dt(P)	Mean Dt(P)
2014	7192	7192	8.88	8.88	0		0	
2015	7348	14540	8.90	9.58	0.68		1.02	
2016	7806	22346	8.96	10.01	1.05	0.92	0.66	0.53
2017	8235	30581	9.02	10.33	1.31		0.53	
2018	8355	38936	9.03	10.57	1.54		0.45	
Total	**38936**							

Growth Models

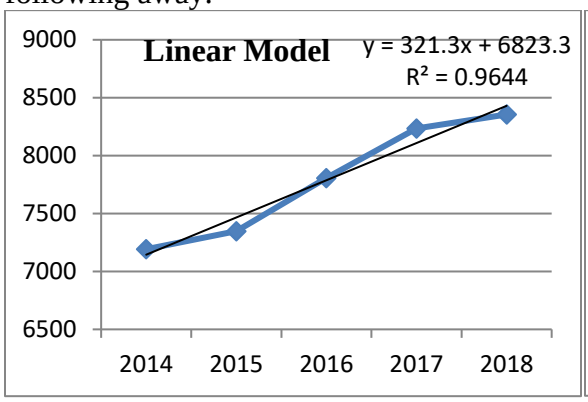
The linear and exponential growth trend is fitted to number of articles for the year 2014-2018. The figures1, 2 and 3 shows that the R^2 value for exponential trend (1) is more than that of linear trend (0.964), this point out that linear trend is more appropriately fitted as compare to exponential trend.

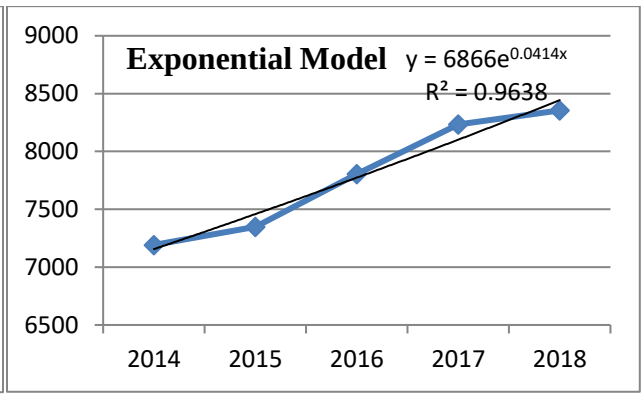
Table 3: Growth Models

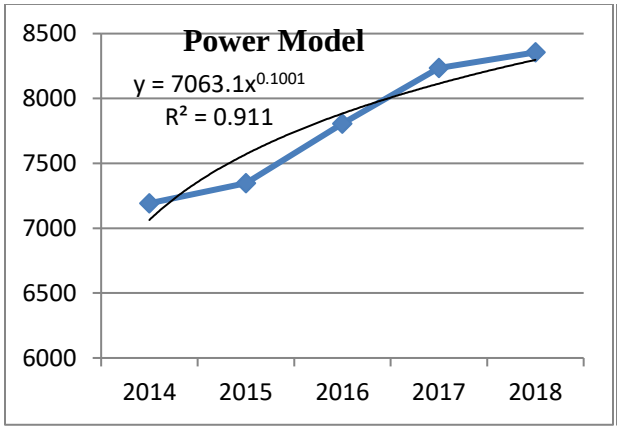
Model	r2
Polynomial model	.965
Linear	0.964

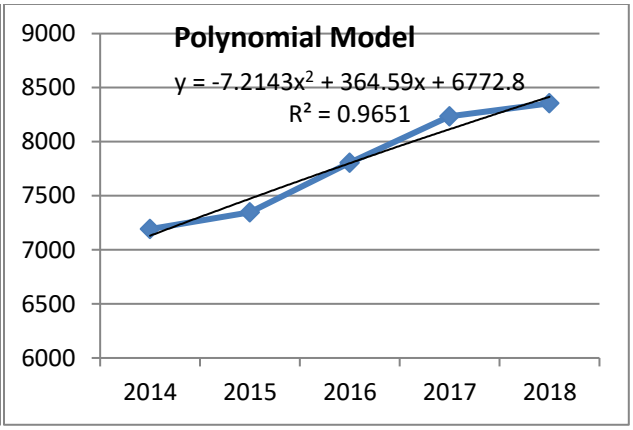
Exponential	0.963
Logistic	0.904
Power	0.911

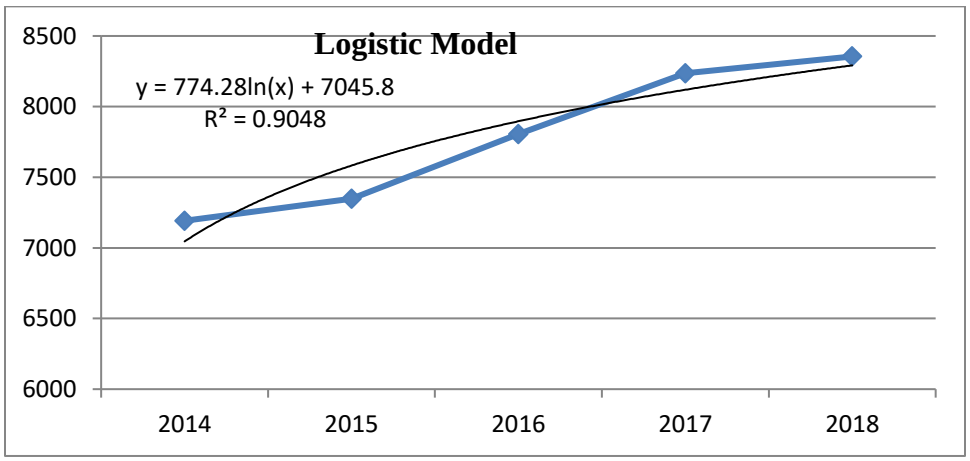
Given data set is well fitted with, Polynomial model (r^2=.965), Linear (r^2=.964) and Exponential (r^2=.964) as their r^2 is nearest to 1 hence it is well followed in Polynomial model, Linear and Exponential Model. The given models also presented in the form of graphical presentation in the following away.











Sub field -wise Distribution of Publications

Table 4 depicts the sub field-wise distribution of publication. Out of top 10 sub-field, the maximum 18426 research publication on 'Neuroscience', followed by 'Biochemistry, and 'Pharmacology' with 568 and 484 publications and minimum 1119 research papers were on 'Psychology'.

Table 4: Sub field-wise Distribution of Publications

Sub-field	Publications	Share in Total (%)
Neuroscience	18426	47.32
Biochemistry	5210	13.38
Pharmacology	4784	12.29
Geriatrics	3984	10.23
Chemistry	2911	7.48
Psychiatry	2527	6.49
Science and Technology	2443	6.27
Cell Biology	2203	5.66
Research Experimental Medicine	1476	3.79
Psychology	1119	2.87

Distribution of Publications by Organizations

The below table shows the Distribution of Publications by Organizations. It is found that University of California System affiliated with highest number of publications i.e. 1823 (4.68%) publications. Further it is witnessed that University of Londonstands second with 1377 (3.54%) publications, followed by Harvard Universitywith 1065 publications. University of California San Francisco positioned 10th place with 624 publications.

Table 5: Organization-wise Distribution of Publications

Organization	Publications	Share in Total (%)
University of California System	1823	4.68
University of London	1377	3.54
Harvard University	1065	2.74
Institute National de la Sante et de la RechercheMedicaleInserm	1034	2.66
University College London	940	2.41
Helmholtz Association	820	2.11
Centre National de la RechercheScientifique	802	2.06
Va Boston Healthcare System	744	1.91
Karolinska Institute	668	1.72
University of California San Francisco	624	1.60

Most preferred journals

The literature on Alzheimer's disease research is spread over 2867 journals. Table 5 shows the top 10 journals produced Alzheimer's disease research. The journal named 'Journal of

Alzheimer's disease' produces the highest number of publications with 2930 (7.53%) publications. The journal 'Neurobiology of Aging' stands the 2nd position with the publication of984 (2.53) and 'Journal of Neurochemistry' produces the lowest publications among top ten journals.

Table 6: Most preferred top ten journals

Journal	Publications	Share in Total (%)
Journal of Alzheimers Disease	2930	7.53
Neurobiology of Aging	984	2.53
Plos One	902	2.32
Alzheimers Dementia	691	1.78
Scientific Reports	673	1.73
Frontiers in Aging Neuroscience	615	1.58
Current Alzheimer Research	511	1.31
Molecular Neurobiology	424	1.09
Alzheimers Research Therapy	361	0.93
Journal of Neurochemistry	329	0.85

Findings and Conclusion

The study analyzed the Collaborative trends on an Alzheimer's disease research based on Web of Science from 2014-2018. The findings of the study arefootprint of the Alzheimer's disease in terms of research performance. Computed data shows that Growth of publication is in increasing trend. The relative growth rate is increasing trend and doubling time of publications was decline. It may be due to lack infrastructure viz,. full-fledged laboratory; financial support and also lack of research bent of mind of the scientists. The reason may be number of journals in the field indexed in the database may be few. Polynomial, Linear and Exponential Model trends are more appropriately fitted. With regard to sub field-wise distribution 'Neuroscience' stands first. It is found that 'University of California System' published largest number of publications i.e. 1823 (4.68%) of the total publications. 'Journal of Alzheimer's Disease' is the most preferred journal. And so; the present study is a mirror which reflects the research image of Alzheimer's disease literature.

Scientific research is the dynamic force for technological, social and economic growth of a nation and evaluation of research output has always been an important issue. In recent years scientometrics has become an important method for measuring and evaluating research performance. It uses mathematical and statistical methods to quantify research outputs and achievements of authors, institution etc. An analysis of research productivity is also a recent trend. It can be done through various techniques.

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