Research Paper Literature

Growth of Poliomyelitis Research Literature During 1999 to 2014: A Scientometric study

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ABSTRACT

Purpose: The purpose of this paper is to find out the growth of poliomyelitis literature. While very few number of Scientometric studies in the poliomyelitis literature. This is to understand information motives and needs, as well as obstacles in the Scientometrics study of Poliomyelitis literature.
Methodology: Statistical tools such as frequency distribution and percentage analysis and Bibliometric techniques such as Relative Growth Rate (RGR), Doubling time (Dt), were used for the study.
Findings: An average RGR of articles Rt(P) increased gradually from 0.68 to2.32. Correspondingly, the values of Doubling time of the publication of articles Dt[P] increased gradually from 2000 (1.35 years) to 2014 (2.12 years).It indicates that the mean relative growth of poliomyelitis literature has an increasing trend may be due to interdisciplinary and multidisciplinary nature of research and the communication pattern of medical researcher.

KEYWORDS Scientometrics; Relative Growth Rate; poliomyelitis; exponential trend.

Introduction

Poliomyelitis frequently called **polio** or **infantile paralysis** is an infectious disease caused by the exploded virus called ***poliovirus***. Around 90 to 95% of infections indicated there is no symptoms. **(http://www.cdc.gov/vaccines/pubs/pinkbook/downloads/polio.pdf)** Whereas remaining 5 to 10% of people have minor symptoms like fever, headache, vomiting, diarrhoea, neck stiffness and pains in the arms and legs. **(http://www.who.int/mediacentre/factsheets/fs114/en/).** In 0.5% of cases there has been suffered by muscle weakness resulting in struggling to move. It is usually occur over a few hours to few days.

In 1789, Poliomyelitis disease was first recognized as a distinct condition by Michael Underwood and described a weakness of the lower extremity in children that was identifiable as poliomyelitis in England. In 1908, Karl Landsteiner researched and identified the virus that causes for Poliomyelitis.

In 1952, Polio has been dramatically increased in the United States and reported more than 21,000 paralytic cases. Finally In 1979, wild-virus polio acquired entire United States.

Worldwide polio eradication may be achieved within the next decade as well as WHO has improving their medicine service to the world wide. **(cdc.gov)**

Scientometrics is investigates quantitative aspects of science **(MariDavis, 2001).** Scientometrics is the older field of bibliometrics and the new areas of Cybermetrics and Webometrics **(Jesubright, 2014)** techniques used to analyze various quantitative or qualitative aspects of a publication. It is a scientific field that studies the evolution of science through some quantitative measures of scientific information, as the number of scientific articles published in a given period of time, their citation impact, etc. **(Rajendran, 2011).**

Objectives

1. To find out the rate of growth of poliomyelitis literature by calculating relative growth rates and doubling time for publications.
2. To fit both modified exponential curve and logistic curve for the original publications data studying actual growth pattern.

Methodology

The study focused on the Scientometrics analysis of research publications in Poliomyelitis. The data collected from the Science direct database and the research term used was 'Poliomyelitis'. A total number of articles of 9250 records were identified in the field of Poliomyelitis worldwide during the period 1999-2014.

Microsoft Excel software was used to classify the collected data and the classified data were analysed Statistical tools such as frequency distribution and percentage analysis and Bibliometric techniques such as Relative Growth Rate (RGR), Doubling time (Dt), were used for the study.

Statistical Method

To investigate the nature of growth of articles, exponential, linear and logistic were tested. The exponential growth is define as

$F(t) = a\, e^{bt}$

Where

a = the initial size of literature i.e. at time t=o and b, the continuous growth rate is related to the percentage by which the size increases each year.

The logistic has a lower limit and an upper limit or a celling beyond which the size cannot grow and can be represented mathematically as

$U_t = \frac{K}{1+\mu}$

Where,

U = expected size of literature

K andμ = constants and t= time.

Similarly, the linear growth is represented as

$U_e = a + bt$

Relative Growth Rate (RGR) and Doubling Time (Dt) had been applied. RGR means the increase in the number of articles per unit of time. The mean RGR of articles over the specific period of interval is represented as

$$R_t(P) = \frac{1}{t}\left[\log_e p(t) - \log_e p(0)\right]$$

R_t = Relative Growth Rate of articles over the specific period of time.

$\log_e p(0)$ = Logarithm of initial number of articles

$\log_e p(t)$ = Logarithm of final number of articles

Similarly, RGR of subject's articles has increased in number of articles per unit of time. The mean RGR of subject articles R_t(SA) over the period the specific period of time is determined as

$$R_t(SA) = \frac{1}{t}\left[\log_e p(t) - \log_e p(0)\right]$$

R_t (SA) = Relative Growth Rate of articles over the specific period of time.

$\log_e p(0)$ = Logarithm of initial number of articles

$\log_e p(t)$ = Logarithm of final number of articles

D_t (Doubling Time) has been calculated using the following formula:

Doubling Time $D_t = 0.693/R$

D_t (Doubling Time) is directly related to RGR and is defined as the time required for the articles to become double of the existing amount. If the number of articles in subject doubles during a given period, then the difference between logarithms of number at the beginning and at the end of this period must be the logarithm of the number 2. We used Napier logarithm and the taken value of $\log_e 2$ is 0.693. Hence, as per this (0.693) and an average growth rate we calculated by what time interval does the Napier logarithm of numbers increase by 0.693. So the Doubling time is calculated as

$$D_t(SA) = \frac{\log_e 2}{R_t(SA)} = \frac{0.693}{R_t(SA)}$$

Here, D_t (SA) = average doubling time of subject articles

Table 1: Relative Growth–rate (RGR) and doubling time (Dt) of articles in Poliomyelitis Literature 1999-2014

Year	No. of Articles	Cumulative No.of Articles	**$\log_e 1^p$**	**$\log_e 2^p$**	R_t(P)	Mean R_t(P)	D_t(P)	Mean D_t(P)
1999	309	309	5.73	5.73	0.00		0.00	
2000	320	629	5.77	6.44	0.68		1.35	
2001	312	941	5.74	6.85	1.10		2.21	
2002	280	1221	5.63	7.11	1.47		2.95	
2003	469	1690	6.15	7.43	1.28		2.56	
2004	464	2154	6.14	7.68	1.54		3.07	
2005	523	2677	6.26	7.89	1.63		3.27	
2006	551	3228	6.31	8.08	1.77	1.18	3.54	2.37
2007	623	3851	6.43	8.26	1.82		3.64	
2008	809	4660	6.70	8.45	1.75		3.50	
2009	694	5354	6.54	8.59	2.04		4.09	
2010	649	6003	6.48	8.70	2.22		4.45	
2011	692	6695	6.54	8.81	2.27		4.54	
2012	766	7461	6.64	8.92	2.28		4.55	
2013	884	8345	6.78	9.03	2.24		4.49	
2014	905	9250	6.81	9.13	2.32	2.12	4.65	4.24
Total	9250							
R^2(Linear trend for no. of articles) = **0.907**								
R^2(Exponential trend for no. of articles) = **0.887**								
R^2(Exponential trend for cumulative no. of articles) **= 0.931**								

Relative Growth Rate

As the table 1 clearly indicates, the value of an average RGR of articles R_t(P) increased gradually from 0.68 to2.32. Correspondingly, the values of Doubling time of the publication of articles D_t[P] increased gradually from 2000 (1.35 years) to 2014 (2.12 years). The mean relative growth R_t(P) for the first 8 years (from 1999 to 2005) indicates a growth rate of 1.88, where as for the last 8 years from (2006 to 2014) it was increased to 2.12. The linear and exponential growth trend is fitted to number of articles for the year 1999 to 2014. The table 1 and Fig. 1, 2 and 3 reveals that the R^2 value for the exponential trend (0.886) is less than that of linear trend (0.907), this indicates that the exponential trend is more suitably fitted as compare to linear trend. Further the exponential

trend is fitted to cumulative number of articles from 1999 to 2014. The R^2 value for this trend is 0.931, this shows 93.1 % variation observed from the cumulative number of articles.

Furthermore, mean Doubling time $D_t[P]$ for the first eight years was 2.37 and it increased to 4.24 in the last eight years, i.e. from 2006 to 2014. It shows that the mean relative growth of poliomyelitis literature has an increasing trend. It may be due to interdisciplinary and multidisciplinary nature of research and the communication pattern of medical researcher.

Figure: 1- Linear trend in No. of Articles



Figure:2- Exponential growth of no. of Articles



Figure:3- Exponential growth of Cumulative no. of Articles



Conclusion

Many research papers have tried to estimate the growth of knowledge in various ways. It appears that, for the "growth of knowledge" subfield, the time is an absolute yardstick to measure the rate of its growth and critical assessments of the amount of new knowledge contributed by these publications so that valid measures of knowledge growth may be obtained. The year wise analysis of the growth of articles output as shows that growth was peer in the year 1999 to 2014 and then there is a gradually increase in the output during the year 1999 to 2006 and 2007 to 2014. The high productivity during these years may be due to their significance in Poliomyelitis literature having got prominence in Research. Another reason may be availability of good infrastructure facilities in the Research centres.

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