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BIBLIOMETRIC STUDY OF LITERATURE ON LEPTOSPIROSIS FOR THE PERIOD 2006-2013

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Abstract

This paper attempts to assess the literary output in the field of Leptospirosis productivity for the period 2006-2013. Statistical analysis has been carried out using SPSS and other relevant measures. It shows that the year wise distributions of Leptospirosis records are increasing year after year except the years 2008, 2009 and 2011. It shows that 88.76% articles are of English language and followed by Spanish and French languages. It is observed that USA has contributed the highest number of records in the study period. Next major contribution belongs to England, Netherlands and India. India has the 4th position among the countries. It shows that 42.77% (5033) of all the cited records were “journal articles”, 35.93% (4228) “Research Support, Non-U.S. Government”, 8.92% (1050) “Review”, 5.89% (693) “letter”, 3.03% (357) “Research Support etc. Relative Growth Rate (RGR) is decreasing from 2007 (0.75) to 2013 (0.17) in the span of 8 years and Doubling Time (DT) increases from 0.92 in the year 2007 to 4.00 in the year 2013 in the study period. The Activity Index (AI) for India was peak in 2006 (234.04) more than three times the Activity Index for the year 2010 (65.05).

Key words: Bibliometrics; Leptospirosis; Relative Growth Rate; Doubling Time; Activity Index;

1. INTRODUCTION

Bibliometrics is the study dealing with the quantification of written communication, which helps, in the measurement of the published knowledge. Bibliometric analysis throws light on the pattern of growth of literature, inter-relationship among different branches of

knowledge, productivity, authorship pattern, and degree of collaboration, pattern of collection building, and their use. Gradually bibliometric studies are attaining the status of interdisciplinary in nature¹. Bibliometric techniques are being used for a variety of purposes like determination of various scientific indicators, evaluation of scientific output, selection of journals for libraries and even forecasting the potential on particular field. The popularity in the adaptation of bibliometric techniques in various disciplines stimulated stupendous growth of literature on bibliometrics and its related areas.²

In this paper an attempt has been made to identify the contributions in the field of Leptospirosis (2006-2013) in MEDLINE data which are covered in the Pub med.

2. LEPTOSPIROSIS:

Leptospirosis is an infectious diseases caused by a particular type of bacteria called a spirochete transmitted by rats as well as by skunks, opossums, raccoons, foxes and other vermin. Leptospirosis occurs worldwide but is most commonly acquired in the tropics. About 100 cases of leptospirosis are reported each year in the U.S. The disease is becoming a greater risk as more people travel to undeveloped areas of the world.³

3. LITERATURE REVIEW

Bibliometrics are applicable in many aspects of information storage and retrieval. Information science is an interdisciplinary field that encompasses the study of the production, organization, storage, retrieval, dissemination and use of information.

One of the most obvious features of science in recent years has been its rate of growth. Scientific growth has involved not only increase in manpower but also finance⁴. Wooster⁵ has estimated the number of journals that existed in the world at any one time, whereas some estimate of the number of papers published annually at various time was done by Vickery⁶ and Martyn⁷. Gottschalk and Desmond⁸ have estimated the number of scientific

and technical journals that existed in the world. Growth studies in scientific areas studied by Baker⁹ in chemistry, Conard¹⁰ in biology, May¹¹ and Lamb¹² in mathematics, Sengupta in microbiology¹³, physiology¹⁴, biochemistry¹⁵ and Ramesh Babu and Ramakrishnan in Hepatitis¹⁶.

An attempt was made by Macias-Chapula to identify the patterns of the growth in AIDS literature, as well as the types of documents published, authorship pattern, institutional affiliations of authors, and subject content¹⁷. Hartinah et...al¹⁸ studied on nutrition problems in Indonesia published during the period 1979-2000, and discussed the authorship pattern, institutional affiliation, and the half-life of the literature on nutrition. Divya Srivastava¹⁹ discussed the concept of collaboration and the methodology followed in studying research collaboration in the field of Biomedical Sciences in India. Bibliometric analysis of Medical Informatics Literature has been made by Sundari Bai et...al²⁰ with regard to Authorship pattern, Collaboration Index, Degree of Collaboration, Collaborative Coefficient and Country Wise Production.

4. OBJECTIVES

This paper attempts to:

1. Quantify the literary output in the field of Leptospirosis productivity for the period 2006-2013.
2. To study the difference between Indian contributions and other countries.
3. To compare the world's output *vs* Indian literary in the field of Leptospirosis research productivity for the period 2006-2013.

5. METHODOLOGY

The records published during the year 2006 to 2013 in the field of Leptospirosis in the MEDLINE data which are covered in the Pub med (www.pubmed.com) which is a free resource that is developed and maintained by the National Centre for Biotechnology

Information (NCBI), at the U.S. National Library of Medicine (NLM), located at the National Institutes of Health (NIH) was searched and bibliographic details like author, title, publication type, language, year; address of the contributors, country of publications, source etc. were collected. The retrieved records were converted into FoxPro and loaded in SPSS for the purpose of analysis. The keyword 'Leptospirosis' has been used for extracting the number of records available in the above said database.

In addition to the frequency distribution and percentage analysis, the following bibliometric techniques have been employed in the process of analysis and interpretation of data.

- Relative Growth Rate (RGR)
- Doubling Time (DT)
- Activity Index (AI)

5.1 Relative Growth Rate (RGR)

One of the most obvious features of science in recent years has been its rate of growth. Scientific growth has involved not only increase in manpower but also finance.

$${}_{1-2} \bar{R} = \frac{\text{Log}_e {}_2W - \text{log}_e {}_1W}{{}_2T - {}_1T}$$

whereas

${}_{1-2} \bar{R}$ = mean relative growth rate over the specific period of interval

$\text{log}_e {}_1W$ = log of initial number of articles/pages

$\text{log}_e {}_2W$ = log of final number of articles/pages after a specific period of interval

${}_2T - {}_1T$ = the unit difference between the initial time and the final time

The year can be taken here as the unit of time. The RGR for both articles and pages can be calculated separately.

Therefore

$1 - 2^{\bar{R}}$ (aa –1 year –1) can represent the mean relative growth rate per unit of articles per unit of year over a specific period of interval.

and

$1 - 2^{\bar{R}}$ (pp –1 year –1) can represent the mean relative growth rate per unit of pages per unit of year over a specific period of interval.

5.2 Doubling Time (DT)

There exists a direct equivalence between the relative growth rate and the doubling time. If the number of articles/pages of a subject doubles during a given period then the difference between the logarithms of numbers at the beginning and end of this period must be logarithms of number 2. If natural logarithm is used this difference has a value of 0.693. Thus the corresponding doubling time for each specific period of interval and for both articles and pages can be calculated by the formula:

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

Therefore,

$$\text{Doubling time for articles Dt (a)} = \frac{0.693}{1 - 2^{\bar{R}} \text{ (aa-1 year-1)}}$$

and

$$\text{Doubling time for pages Dt (p)} = \frac{0.693}{1 - 2^{\bar{R}} \text{ (pp-1 year-1)}}$$

5.3 Activity Index (AI)

Activity Index characterizes the relative research effort of a country to a given field.

It is defined as

$$AI = \{ (\text{given field's share in the country's publication output}) / (\text{given field's share in the world's publication output}) \} \times 100$$

AI = 100 indicates that the country's research effort in the given field corresponds precisely to the world's average. AI > 100 reflects higher activity than the world's average, and AI < 100 indicates lower than average effort dedicated to the field under study.

In this study, Activity Index for India has been calculated for different years to see how India's research activity changed during different years using the above formula. First suggested by Frame²¹ and used among others by Schubert and Braun²², Price²³, Karki and Garg²⁴, Nagpaul²⁵, Bharu Dutt et al²⁶ and Garg and Padhi²⁷. Activity Index characterizes the relative research effort of a country to a given field.

Mathematically $AI = \{(I_i / I_o) / (w_i / w_o)\} \times 100$

where I_i = India's output in the year i

I_o = Total Indian output

w_i = world output in the year i

w_o = Total world out put

The method used for calculating Activity Index has been explained below for Research output by different nations in different blocks.

$$AI = \left\{ (N_{ij} / N_{io}) / (N_{oj} / N_{oo}) \right\} \times 100$$

N_{ij} : Number of papers in theme i and block j;
 N_{io} : Number of papers in theme i for all blocks ;
 N_{oj} : Number of papers in all theme for block j;
 N_{oo} : Number of papers for all theme and all blocks;

6. LIMITATIONS

This study is confined to a period from 2006 to 2013 MEDLINE data which covered in Pub med only.

7. ANALYSIS AND INTERPRETATION OF DATA

7.1 INTRODUCTION

In this paper, the data collected from the source database (MEDLINE data which are covered in the Pub med) on Leptospirosis productivity for the period 2006-2013 has been analyzed and interpreted by using various bibliometric techniques.

7.2. Distributions by Year

Table 1 shows the distributions by year of Leptospirosis records. Records are increasing year after year except the years 2008, 2009 and 2011.

Table 1 – Distributions by Year

Year	Frequency	Percent
2006	1183	10.05
2007	1344	11.42
2008	1246	10.58
2009	1246	10.58
2010	1596	13.56
2011	1589	13.50
2012	1708	14.51
2013	1855	15.76
Total	11767	100.00

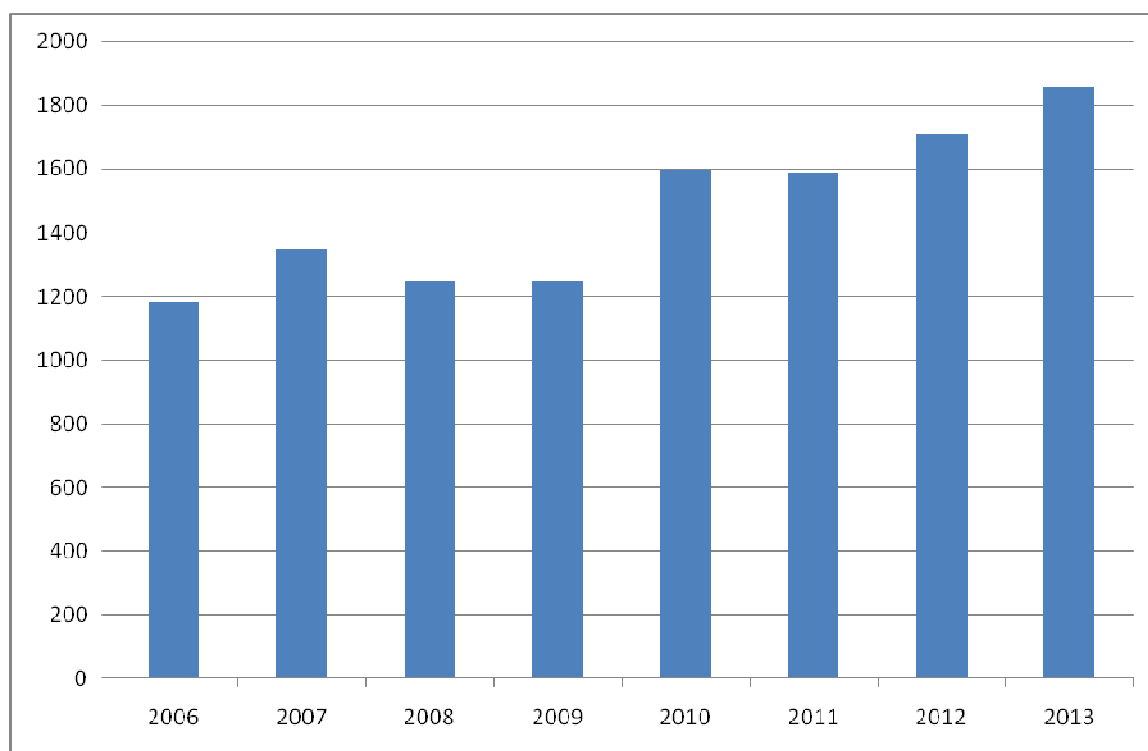


Figure 1 Year-wise distribution of Leptospirosis literature

7.3. Distribution of Publication types in the literature of Leptospirosis

Table 2
Distribution of Publication types in the literature of Leptospirosis

S. No.	Pub. Type	No. of records	%	Rank
1	Journal Article	5033	42.77	1
2	Research Support, Non-U.S. Gov't	4228	35.93	2
3	Review	1050	8.92	3
4	Letter	693	5.89	4
5	Research Support, U.S. Gov't, Non-P.H.S.	357	3.03	5
6	Research Support, N.I.H., Extramural	126	1.07	6
7	Research Support, U.S. Gov't, P.H.S.	77	0.65	7
8	Editorial	49	0.42	8
9	News	35	0.30	9
10	Validation Studies	35	0.30	9
11	Multicenter Study	21	0.18	10
12	Randomized Controlled Trial	21	0.18	10
13	Historical Article	7	0.06	11

14	Introductory Journal Article	7	0.06	11
15	Meta-Analysis	7	0.06	11
16	Published Erratum	7	0.06	11
17	Practice Guideline	7	0.06	11
18	Retracted Publication	7	0.06	11
	Total	11767	100.00	

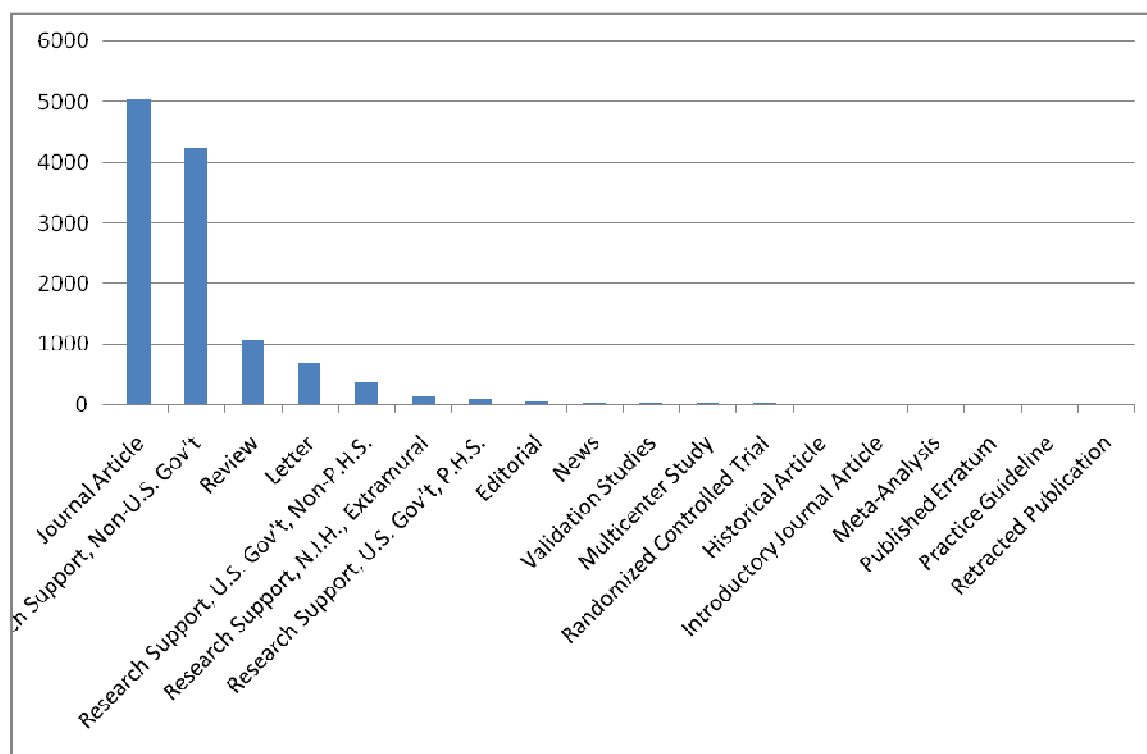


Figure 2 Distribution of Publication types in the literature of Leptospirosis

Table-2 shows that 42.77% (5033) of all the cited records were “journal articles”, 35.93% (4228) “Research Support, Non-U.S. Gov't”, 8.92% (1050) “Review”, 5.89% (693) “letter”, 3.03% (357) “Research Support, U.S. Gov't, Non-P.H.S”, 1.07% (126) “Research Support, N.I.H., Extramural” and 0.65% (77) “Research Support, U.S. Gov't, P.H.S”. The remaining 1.74% was from “Editorial”, “News”, “Validation Studies”, “Multicenter Study”, “Randomized Controlled Trial”, “Historical Article”, “Introductory Journal Article”, “Meta-Analysis”, “Published Erratum”, “Practice Guideline” and “Retracted Publication” in the MEDLINE data which are covered in the Pubmed.

7.4 Distribution of records by Language

Table 3 Distribution of records by Language

S. No	Language	Frequency	Percent
1.	ENGLISH	10447	88.78
2.	SPANISH	308	2.62
3.	FRENCH	245	2.08
4.	RUSSIAN	168	1.43
5.	CHINESE	147	1.25
6.	GERMAN	91	0.77
7.	PORTUGUESE	77	0.65
8.	JAPANESE	63	0.54
9.	DUTCH	35	0.30
10.	ROMANIAN	35	0.30
11.	CZECH	28	0.24
12.	TURKIC	28	0.24
13.	POLISH	21	0.18
14.	NORWEGIAN	14	0.12
15.	SLOVAK	14	0.12
16.	DANISH	7	0.06
17.	HEBREW	7	0.06
18.	ITALIAN	7	0.06
19.	KOREAN	7	0.06
20.	OTHERS	18	0.15
	Total	11767	100.00

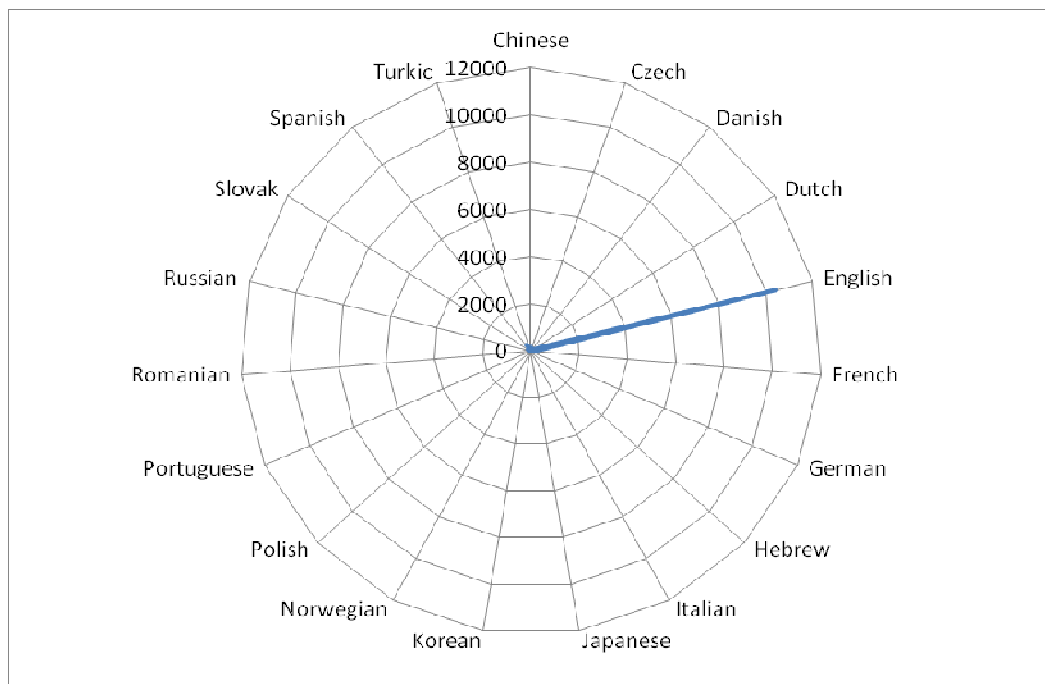


Figure 3 Distribution of records by Language

Table 3 indicates distribution by language of records. From the table and Figure shows that 88.78% articles are of English language and followed by Spanish and French languages.

7.8 Distribution of records by Country

Table 4 Distribution of records by Country

S. No	Country	Frequency	Percent
1	United States	3563	30.28
2	England	2331	19.81
3	Netherlands	833	7.08
4	India	714	6.07
5	Germany	392	3.33
6	Brazil	385	3.27
7	France	357	3.03
8	China	238	2.02
9	Japan	224	1.90
10	Thailand	210	1.78
11	Canada	203	1.73
12	Australia	196	1.67
13	Russia (Federation)	161	1.37
14	Italy	119	1.01
15	Switzerland	119	1.01
16	New Zealand	105	0.89
17	Poland	105	0.89
18	Cuba	84	0.71
19	Malaysia	77	0.65
20	Argentina	70	0.59
21	Colombia	63	0.54
22	Spain	63	0.54
23	Sweden	63	0.54
24	Egypt	56	0.48
25	Ireland	56	0.48
26	Singapore	56	0.48
27	Chile	49	0.42
28	Czech Republic	49	0.42
29	Iran	49	0.42
30	Korea (South)	42	0.36
31	Romania	42	0.36
32	South Africa	42	0.36
33	Mexico	35	0.30
34	Turkey	28	0.24
35	Saudi Arabia	21	0.18

36	Austria	14	0.12
37	Bosnia and Hercegovina	14	0.12
38	Denmark	14	0.12
39	Hungary	14	0.12
40	Israel	14	0.12
41	Nepal	14	0.12
42	Norway	14	0.12
43	Oman	14	0.12
44	Pakistan	14	0.12
45	Peru	14	0.12
46	Portugal	14	0.12
47	Puerto Rico	14	0.12
48	Scotland	14	0.12
49	Belgium	7	0.06
50	Croatia	7	0.06
51	Georgia (Republic)	7	0.06
52	Indonesia	7	0.06
53	Jamaica	7	0.06
54	Philippines	7	0.06
55	Serbia	7	0.06
56	Slovakia	7	0.06
57	Sri Lanka	7	0.06
58	Uganda	7	0.06
59	Ukraine	7	0.06
60	Venezuela	7	0.06
	Not mentioned	301	2.56
	Total	11767	100.00

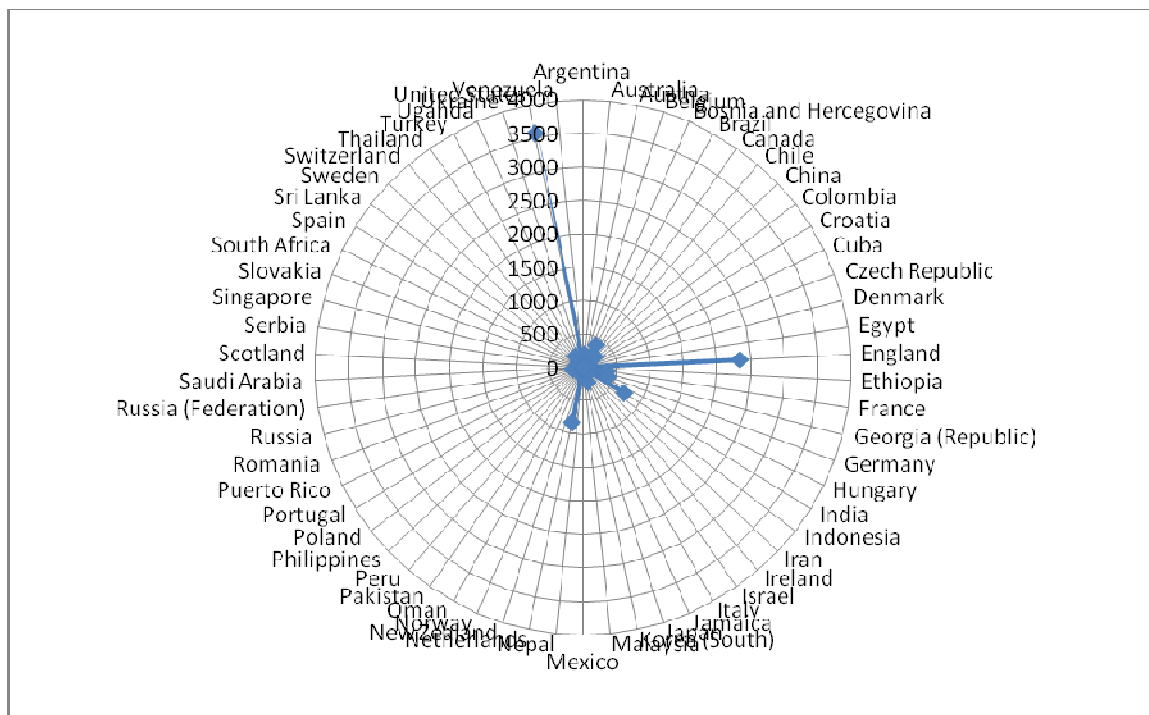


Figure 4 Distribution of records by Country

Table 4 shows the distributions by country of Leptospirosis records. It is observed that USA has contributed the highest number of records in the study. Next major contribution belongs to England, Netherlands and India. India has the 4th position among the countries.

7.9 RELATIVE GROWTH RATE (RGR) AND DOUBLING TIME (Dt)

The analysis of data on the literary output in Leptospirosis has been done with parameters such as Relative Growth Rate (RGR) and Doubling Time (DT).

Table 5 RGR and DT for Leptospirosis

S.No.	Year	Quantum of Output	Cumulative Total of Output	W_1	W_2	$1 - 2^{\overline{R}(aa^{-1} \text{ year}^{-1})}$ RGR	Dt(a)
1	2006	1183	1183		7.08		
2	2007	1344	2527	7.08	7.83	0.75	0.92
3	2008	1246	3773	7.83	8.24	0.41	1.71
4	2009	1246	5019	8.24	8.52	0.28	2.47
5	2010	1596	6615	8.52	8.80	0.28	2.50
6	2011	1589	8204	8.8	9.01	0.21	3.26
7	2012	1708	9912	9.01	9.20	0.19	3.62
8	2013	1855	11767	9.2	9.37	0.17	4.00

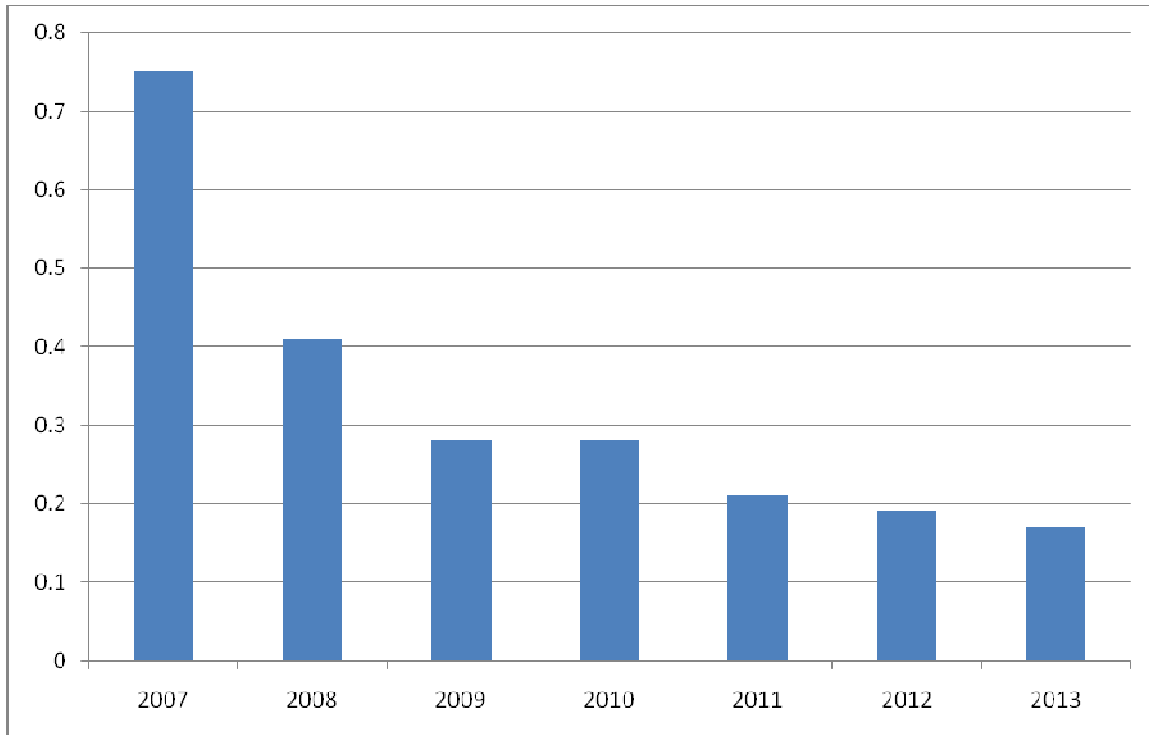


Figure 5 Relative Growth Rate for Leptospirosis

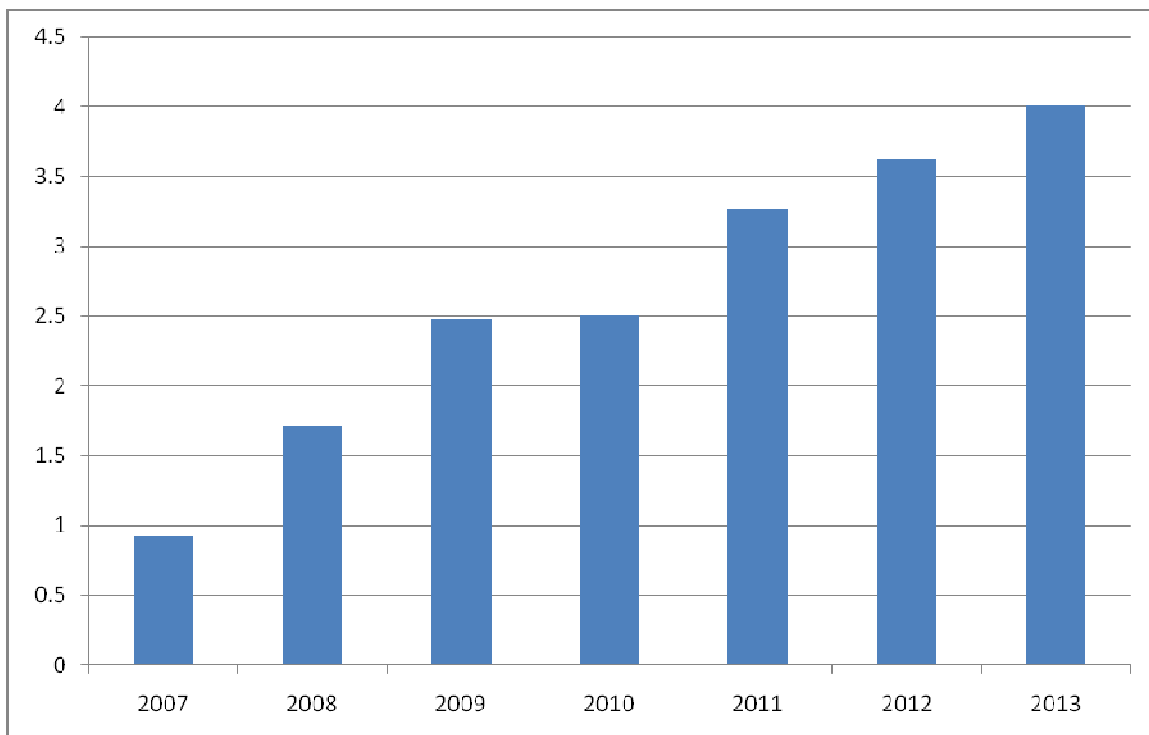


Figure 6 Doubling time for Leptospirosis

RGR and Dt for Leptospirosis Output by year wise

It is seen from Table 5 that RGR has been decreasing from 2007 (0.75) to 2013 (0.17) in the span of 8 years. Thus the RGR is decreasing by year wise. (Figure 5)

The Doubling Time (DT) has shown increase year by year. The data in table 5 reveals the value in Doubling time in eight years. The DT increases from 0.92 in the year 2007 to 4.00 in the year 2013. (Figure 6).

7.10 ACTIVITY INDEX

Table 6 - World's Output vs. India's Output

S.No.	Year	Worlds' Output	India's Output	Activity Index
1	2006	1183	168	234.04
2	2007	1344	77	94.42
3	2008	1246	112	148.14
4	2009	1246	77	101.85
5	2010	1596	63	65.05
6	2011	1589	70	72.60
7	2012	1708	70	67.54
8	2013	1855	77	68.41
	Total	11767	714 (6.35) *	100.00**

* Percentage of world output

** Average of Activity Index

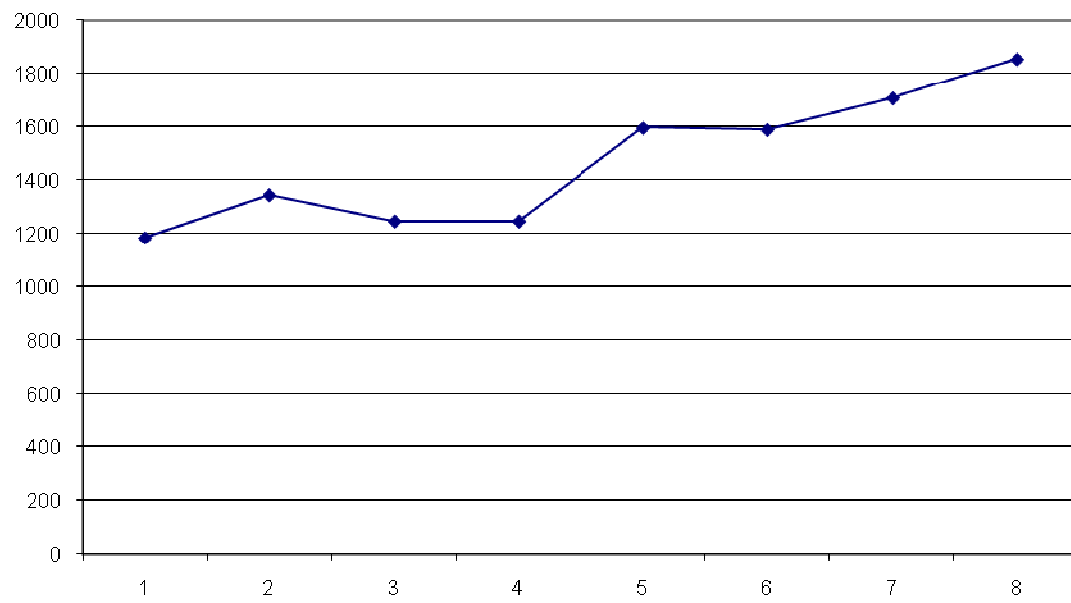


Figure 7 World Output of Leptospirosis research during 2006 – 2013

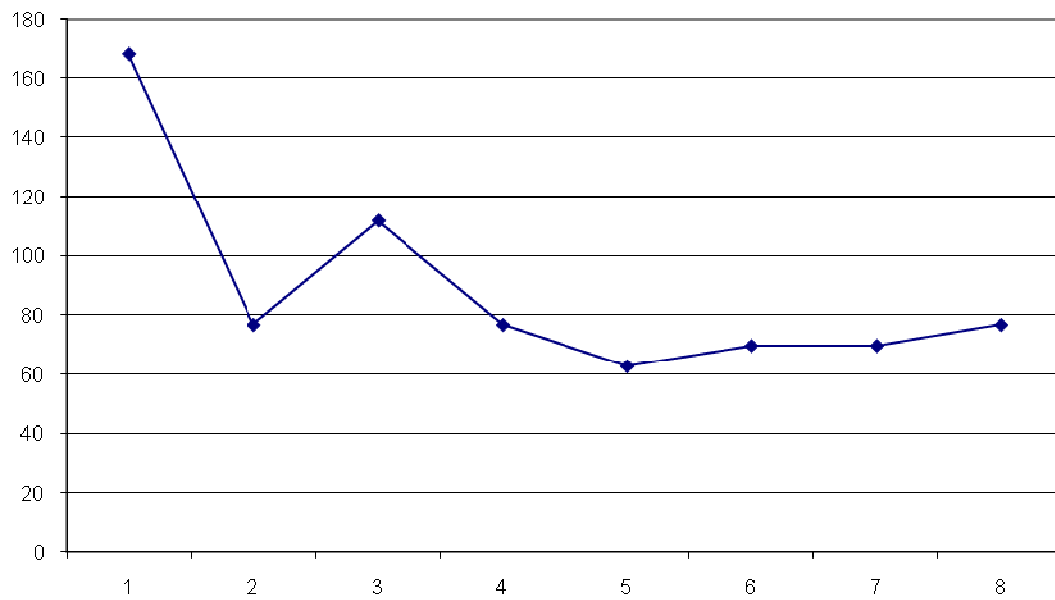


Figure 8 Indian Output of Leptospirosis research during 2006 – 2013

In Table 6, Activity Index for India has been calculated to analyze how India's research performance changes over different years. The data reveals that, Indian efforts in Leptospirosis research is greater in the year 2006 out of 8 years of study, since the Activity Index is higher than 100, in this particular year, which reflects higher activity of Leptospirosis research than the World's average. In the years, where the Activity Index is less than 100, reflects lower activity of Leptospirosis research than the world average. The Activity Index (AI) for India was peak in 2006 (234.04) more than three times the Activity Index for the year 2010 (65.05).

As seen in the graph (Figure 7) which indicates that the world output on Leptospirosis grew almost uniform rate by year after year except 2008, 2009 and 2011. It was peak in 2013. In the case of Indian output (Figure 8) the growth reaches in inconsistent manner and reaches its peak in 2006.

8. CONCLUSION

A total of 11767 contributions on Leptospirosis literature analysis during the period 2006-2013 have been identified. USA has contributed the highest number of records in the study period. Next major contribution belongs to England, Netherland and India. India has the 4th position among the countries. 88.76% articles are of English language and followed by Spanish and French languages. 42.77% (5033) of all the cited records were "journal articles", 35.93% (4228) "Research Support, Non-U.S. Gov't", 8.92% (1050) "Review", 5.89% (693) "letter", 3.03% (357) "Research Support etc. Relative Growth Rate (RGR) is decreasing from 2007 (0.75) to 2013 (0.17) in the span of 8 years and Doubling Time (DT) increases from 0.92 in the year 2007 to 4.00 in the year 2013 in the study period. The Activity Index (AI) for India was peak in 2006 (234.04) more than three times the Activity Index for the year 2010 (65.05).

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