Research output on 'Meningitis': a Bibliometric Study

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Introduction

Bibliometrics is relatively a new discipline. It is a quantitative study of various aspects of literature on a topic. The word "Bibliometrics" first appeared in print in 1969 by Alan Pritchard.[1] As Bibliometrics evolved, a series of laws have developed. Some of the more well known laws are Bradfrod's Lotka's and Zipf' s law. These fundamental laws are as follows.

Bradford's Law- To identify the journals of a particular discipline Bradford's law[2] is perhaps the best known law of bibliometrics study. This law describes studying the extent to which literature in a particular discipline is scattered over a range of journals. It also states that if scientific journals are arranged in order of decreasing productivity on a given subject, they may be divided into a nucleus of journals more particularly devoted to the subject and several groups or zones containing the same number of articles as the nucleus when the number of periodicals in the nucleus and the succeeding zones will be as   1 : n : n2 — —.

Lotka's Inverse Square Law- In 1926, Alfred J. Lotka Statician in an Insurance company proposed his Inverse square Law correlating contributors of scientific papers of their number of contribution. He claims that "a large no. of the literature is produced by a small number of authors and it is distributed so as the number of author producing n paper is approximately proportional to 1/n2."[3] Author a (1/n2)

Where is the number of contributions on articles.

For this, he analyzed the decennial index of chemical abstract from 1907-1916. He collected 6891 names of the authors contributing 1, 2, 3, etc. entries in literature.

On the basis of this data, Lotka deduced a general equation, for the relation between the frequency 'Y' of persons making 'X' contributions as follows:

Xn y = constant

If n = 2 then, the result as follows

In the case examined it is found that the number of persons making 2 contributions is about one fourth of those making one 'n' contribution is about 1/ n2 of those making one and the proportion of all contributions is about 60%.

Zipf's Law of Word Occurrence

This law was given by Zipf in 1933. Zipf developed and extended an empirical law, governing a relation between the rank of a word and the frequency of its appearance in a long text.

If 'r' is the rank of a word and 'f' is its frequency, then mathematically Zipf's law can be stated as follows:

R a (1/f) $\rightarrow$ rf = C, is a constant.

This law states that "in a long textural matter if words are in their decreasing order of frequency, then the rank of any given word of the text will be inversely proportional to the frequency of the occurrence of the work."[4]

Objectives

This study aims at identifying and describing some of the characteristics of the literature published in the field of "meningitis" over the period of 3 years (i.e. 2004, 2005 and 2006) with a view to identity the place, time, subject, area and country of origin form where the

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documents, have been published. Meningitis is an infection of the fluid of a person's spinal cord and the fluid that surrounds the brain. People sometimes refer to it as spinal meningitis. Meningitis is usually caused by a virul or bacterial infection.

Main objectives of the study are:

* To know the core periodicals containing the most of the literature on meningitis;

* To know about the country producing most of the literature on meningitis;

* To know the most productive year of the literature published on the subject;

* To find out most used from of source material i.e. periodical articles, research reports, conference proceedings, bulletins etc;

* To know the dominating language in which most of the articles on the subject have been produced;

* To know the eminent personalities in the filed of meningitis.

Methodology

For the present study, 3035 references have been collected on 5"x3" size catalogue cards from the three volumes of index medicus. These volumes of index medicus were from 2004 to 2006. Each card contained information about author, title, name of periodical, year, place of publication, language and form of document. All 3035 references (cards) were arranged and rearranged in order to complete the following studies.

Data Analysis and Interpretation

Ranking of Periodicals- Data have been collected from 406 periodicals and 3035 references were noted down on the cards as mentioned above. Subsequently, ranking of periodicals was done. However, Table 1 lists only fifteen top periodicals in which the frequency of occurrence of items is over 50. While, Table 2 shows that most of the literature on the meningitis appeared in 4 periodicals as total no of 1009 items appeared in these periodicals. Therefore, these journals may be regarded as core journals in the field 'meningitis'.

The journals having their frequency of occurrence in the range of 198-397 is 4, those in range of 23-134 is 15, in range of 11-22 is 21 and those in range of 6-10 is 35. However, the number of items covered under the range of 23-134 is more than the items covered under the range of 11-22 (Table 3.1). It is therefore, obvious that though most of the literature constituting 33.30% references appeared in core journals, the number of periodicals has been increasing for finding out much less number of items i.e. as many as 58 periodicals covered only 213 items (7.02%) 363 periodicals covered 432 items 14.20%. This is in accordance with Bradford's Law of scattering.

This ranking list may be useful for the libraries in taking policy decisions regarding the subscription list of periodicals on the subject "meningitis". It will be equally important for the documentalists in preparing an exhaustive documentation list. The study may be useful for the scientists, as they would know the core journals carrying the highest percentage of items.

TABLE-1

RANKING OF PERIODICALS

Rank	Name of periodicals	Place	Frequency	%age
1	Neurology Science	U.S.A	397	13.08
2	Kaohsiuing journal of medicine	Taiwan	280	9.22
3	Internal medicine	USA	198	6.52
4	Neurology	USA	134	4.41
5	Journal of neurology	USA	109	3.59
6	Journal of pediatrics	USA	101	3.32
7	Clinical infectious disease	USA	99	3.26
8	Lancet infectious Disease	USA	92	3.03
9	Pediatrics	Ireland	76	2.50
10	Neurology neurosurgery and psychiatry	U.K	59	1.94
11	American neurology- USA	U.S.A	41	1.35
12	European journal of neurology	USA	33	1.08
13	Journal of neuroscience	Ireland	28	0.92
14	Neuroscience eithevature	Ireland	28	0.92
14	European neurology	Switzerland	28	0.92

TABLE-2
RANGE OF FREQUENCY

S.No	Freq. Range	No of periodicals	No. of items	%age	Cumu%age
1	198-397	4	1009	33.30	33.30
2	23-134	15	795	26.19	59.50
3	11-22	21	323	10.62	70.14
4	06-10	35	263	8.67	78.81
5	03-5	58	213	7.02	85.80
6	01-02	363	432	14.20	**100**

Country wise distribution- Table 3 contains a list of 10 countries producing research material on meningitis. These countries have been ranked on the basis of frequency of occurrence of items. It was observed that 61.15% of the total articles were published from USA only. This is followed by UK, Germany and Ireland which produce 12.85%, 6.75% and 5.46% research items respectively.

TABLE 3: COUNTRY WISE DISTRIBUTION

Rank	Name of country	Freq. of occurrence	% age
1	USA	1856	61.15
1	UK	390	12.85
3	Germany	205	6.75
4	Ireland	166	5.46
5	France	99	3.26
6	Spain	75	2.47
7	Switzerland	49	1.65
8	Russia	32	1.05
8	Canada	32	1.05
9	Poland	24	0.79
10	Japan	23	0.75

Language wise Distribution- Table 4 displays the publication of items in different languages. Out of a total of 3035 items, 2576 (84.87%) were published in English language. The second and third rank occupied by Russian and French with 150 (4.94%) 132 (4.34%) items respectively. This has been followed by Spanish and German.

TABLE-4
LANGUAGE WISE DISTRIBUTION

Rank	Name of language	Freq.	Freq.%age	Cum.freq
1	English	2576	84.87	84.87
2	Russian	150	4.94	89.81
3	France	132	4.34	94.15
4	Spanish	57	1.87	96.2
5	German	50	1.64	97.66

Form wise distribution- Analysis of collected data showed that literature on the subject meningitis was published in nine different Forms as shown in table 5. It is evident from the table that 2465 items constituting 81.21% of the total data collected were appeared. The next four positions were occupied by Reviews, Research report, survey report and case study.

TABLE-5
FORM WISE DISTRIBUTION

Rank	Name of forms	Freq	Freq %	Cum freq
1	Article	2465	81.21	81.21
2	Reviews	293	9.66	90.87
3	Research Report	115	3.79	94.66
4	Survey report	89	2.93	97.59
5	Case study	30	0.93	98.58

Ranking of Authors- Table 6 lists the name of authors with ten or more than ten papers. It is worth pointing out that 652 (21.48%) items were contributed by single authors and 2383 (78.51) items were having joint authors. This shows the present trend of research is having more associations of authors.

TABLE-6
RANKING OF AUTHORS

Rank	Name of Authors	Paper
1	Appenzeller,s	16
2	Saha, SK	13
3	Mirand, A	12
3	Powell, DA	12
4	Stephens, EB	11
4	Zou, Y	11
4	Oppermann, H	11
5	Lear's	10
5	Dimlegici, EC	10

Application of Bibliometrics Laws

Bradford's Law- Ranking of Periodicals 496 periodicals were divided into three zones according to their frequency of occurrence. In the first zone 4 periodicals carried 1009 items in second zone 30 journals carried 1008 items and the third zone consisted of 462 journals carrying 1018 items. The first zone is the nucleus zone as it contains 4 periodicals, followed by 30 journals in the second zone and 462 periodicals in the third zone. Number of permutations and combinations were tried to set data according to Bradford's law and it was found as follows:

1:n:n2

4:30:462

30   34 = 2x17 (Approx)

$462 \cong 578 = 2 \times 17 \times 17$ (Approx)

Therefore, now the series is

2:2x17:2x17x17

On substituting, 17=n ,we get

2:2n:2n2

i.e.1:n:n2

(Where 1 is the number of periodicals in the nucleus and n is the multiplier)

Hence Bradford law is proved scientifically.

Lotka's Inverse Square Law

The Lotka's Law states that the number of scientists who contribute 'n' paper will be 1/n2 of those who contributed only one paper during the present analysis it was observed that 1432 authors have contributed 3035 items out of 1832 contributors. Only 294 authors have contributed more than one paper and rest 1538 authors have contributed only one paper each giving single contribution. However, according to Lotka's law single contributing should account for 60% of the total.

Lotka's law was applied to know the number of scientists contributing 2 papers 3 papers and 4 papers respectively, as given below.

Scientists Contributing Two Papers

As we know that the number of authors contributing only one paper is 1268, the

number of scientists contributing 2 papers may be calculated by the formula.

No. of scientist contributing n papers=

$$\frac{No.ofScientistscontributing / paper}{n^2}$$

On substituting n=2 in the above formula

No. of scientists contributing two papers= 1538/2² =1538/4=384

The number of scientists publishing 2 papers should be 384. However, an analysis of data from table 4.7 indicates that 139 authors have contributed 2 paper which is far less than the figure, obtained by applying Lotka's law.

Scientists Contributing Three Papers

On substituting, n=3 in the formula we get

No. of scientists contributing three papers=1538/3² =170.88=171

During the analysis it was found that only 31 authors have contributed 3 papers each. Which is again far less than the calculated figure i.e. 171.

Scientists Contributing Four Papers

On substituting n=4 in the formula we get

No. of scientists contributing 4 papers=1538/4² =1538/16=96

The analysis of the actual data shows that only 15 authors have contributed 4 papers each, which is far less than the calculated figure i.e. 96.

It may there be concluded that the trends of research now a days have changed as compared to the period when Lokta's law was formulated. At present inter-disciplinary method of research are common and most of the articles are now written in joint authorship on the basis of the analysis of the present data, it is difficult to testify the validity of Lotka's law.

Zipf's Law of Word Occurrences

This law states that in a long textural matter if words are arranged in their decreasing order of frequency, then the rank of any given word of the text will be inversely proportional to the frequency of occurrence of the word i.e.

R á 1/f (where 'r' is rank and 'f' is frequency)

rf=c (where, c is constant)

Taking log on both the sides

Log (f) +log (r)=log c

Or log (f)+log(r)=c (where c is constant)

To apply this law the words (terms) were collected from the title of the articles and ranked according to their frequency of occurrence in decreasing order. Subsequently, it is found that log of frequency of occurrence of words when added to log of their rank; the results are almost same for each word.

The log of frequency of three most potent words appeared in the titles meningitis are gives below:

5.3.1 Word   :   Meningitis

Frequency   :   420

Rank   :   1

Log of Frequency+log of rank

Log 420+log=2.6020+0=2.6020 word

5.3.2 Words   :   Infection

Frequency   :   390

Rank   :   2

Log of frequency+log of rank

Log=390+log 2=2.5910+0.3010=2.8903

5.3.3 Word   :   Viral

Frequency   :   295

Rank   :   3

Log of frequency+log of rank

Log 295+log 3

=2.4698+0.4771

=2.9469

Thus, it is proved that Zipf's law is valid even today.

Findings and Conclusion

This study is conducted on the data collected from three volumes of Index

Medicus (i.e.2004, 2005, 2006)

The following are the major findings of the study.

1. From the study, it was found that the journal titled Neurology science published from U.S.A is most productive, reporting 397 items.

2. Subject wise distribution shows that 1275 (42.00%) literature belong to the subject MS-Psychiatry and Neurology, MS-Orthopedics and Traumatology with 437 (14.39%), Medical Sciences with 284 (9.35%) items and so on.

3. The language wise distribution shows that 84.87 of literature in the field 'meningitis' published in English language whereas 15.13 literature is published in other languages.

4. The literature on the subject 'meningitis' was found to be published from 29 countries. USA is the leading country with 1856 (61.15) items of the total. This is followed by UK and Germany with 310 (12.85%) and 205 (6.75%) items respectively.

5. The study regarding the form wise distribution of items concluded that the most of the literature on the subject was published in the form of articles in the journals.

6. Author wise distribution shows that 652 (21.48%) items were contributed by single authors and 2383 (78.51%) items were written by more than one author.

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