Research Output of Scientist of Tuberculosis Research Centre (TRC), Chennai, Tamil Nadu: A Scientometric Study

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Abstract

The prime objective of this study is to analyse the quantitative growth of research output by the scientists of Tuberculosis Research Centre (TRC), Chennai, Tamil Nadu. This article covers the TRC list of publications belong to the period of 1985-2009 for the study. It indicates the patterns of communications of TRC scientists and studies the extent of concentration and scattering of their research output of core journals. Growth of literature by year-wise, authorship pattern, ranking of authors, and ranking of journals has been analysed.

Keywords: *Research Output, Scientometric Study, Tuberculosis Research Centre*

1. INTRODUCTION

Scientometrics is known as a science of sciences. It has gained significance for the simple reason that it is not merely a theoretical discipline, but has extensive applications. It helped to identify the pattern of publications, authorship, citations and behaviour of a particular subject, journal, groups and organizations in a given periods. It helps to monitor the growth of literature and patterns of research enabling monitoring a particular research institute. Scientific productivity is influenced by a large number of factors, including individual characteristics such as age, gender, psychological traits and educational background, as well as structural features like funding, institutional context and the organization of the actual research. Tuberculosis is an important area of study and research. Research productivity in research and development organization is gaining importance for the past more than three decades in India. The scientists of the TRC have three functions to perform that are research, treatment, and teaching. Research is one of the canonically functions. The research output of the TRC scientists is in the form of research papers in peer-reviewed scholarly national and international journals is being considered as one of the research output scientists.

The Tuberculosis Research Centre (TRC), a permanent institute under the Indian Council of Medical Research (ICMR), is an internationally recognized institution for Tuberculosis (TB) research. The Centre (formerly known as the Tuberculosis Chemotherapy Centre) was set up in Madras in 1956 as a five years project, under the joint auspices of the Indian Council of Medical Research (ICMR), the Government of Tamil Nadu, the World Health Organization (WHO) and the British Medical Research Council (BMRC). Recently, an International Centre for Excellence in Research (ICER) in collaboration with National Institute of Health was established at the Centre. The objective of the Centre was to develop studies designed to provide information on the mass domiciliary application of chemotherapy in the treatment of pulmonary TB. The Centre is also recognized for post-graduate training leading to the Ph.D. degrees in bacteriology, biochemistry, immunology and statistics by the Madras University and by the Inter-University Board of India and Sri Lanka. It is also a training centre for WHO fellows, as well as medical undergraduates and post-graduates of the University of Madras and of the neighbouring states [1].

2. REVIEW OF LITERATURE

A number of quantitative analyses have been carried out for the last two decades based on Bibliometrics techniques to evaluate the research productivity of individuals, organizations, countries, journals etc. Quantitative studies are also available to verify the fitness of classic law of Bibliometrics, factors of productivity and impact of research conducted in various countries. Quantitative research analysis provides data on all activity in an areas, summaries of these data, and a comprehensive perspective on activity and achievements, weighted quantitative measures, such as papers per researcher or citations per paper, remove characteristics, such as the place of production, or past reputation, that reputation of human perceptions of quality of scientists. This research study is very much helpful to assess the development of electrochemical research as well as in their application to library and information resource management.

Sevukan, Nagarajan and Sharma were analysed 348 research output of faculties of plant sciences in central universities in India. They reviewed plant sciences literature which has been approached by year, document type, authorship pattern and collaboration pattern at different levels like international, national and local. This study revealed literature outputs which steadily increased, faculties who mostly preferred to publish their articles in plant science journals and plant sciences research output of central universities faculty members were fairly collaborative [2].

Rekha Rani Varghese and Rajan were analysed 632 publications of scientist of Rajiv Gandhi Centre for Biotechnology (RGCB) during the period 1995-2006. They covered publications of scientist of RGCB which include journal articles, conference papers, patents, book chapters and Ph.D guided. They found during the year 2005 - 2006 with 112 articles published most productive year in the case of journal articles, further they found substantial growth both quantitatively and qualitatively with the development of the institution [3]. Sharma collected 2603 research articles published by the scientists of Central Potato Research Institute (CPRI) during 1991 to 2007, and collected the data from annual reports of CPRI and Journal of the Indian Potato Association. He found that most of the scientist preferred to publish research papers in joint authorship (82.67%) having 0.82 degree of collaboration and also shows no uniform pattern of literature growth [4].

Oyedokun analysed scientist' activities in the agricultural research institutes in Nigeria and reported that activities of scientists in agricultural research institutes span through technological development delivery [5]. Price and Beaver found that the most productive members were also most collaborative in the literature of oxidative phosphorylation and terminal election transport [6]. Kademani *et al*. have studied the publication productivity of the chemistry division at Bhabha Atomic Research Centre, India. The study covered 1733 papers published during 1970-1999 in various domains. The study dealt with year-wise publication productivity, collaboration trend, author productivity and Lotka's law, most productive authors, and use of communication channels [7]. Lal prepared a rank list of journals from the view points of soil scientists working in India [8]. Similar studies conducted by Sharma and Singh to study the characteristics of soil science literature used by Indian scientists to find out the major contributing authors, ranking of Indian soil science journals, seepage and obsolesce of literature [9].

As scientists publish their research findings in variety of sources, the study of publication trends viz, authorship pattern, literature growth, degree of collaboration, contribution of source-wise and authors-wise etc., it helps to motivate authors to increase their research publication. Keeping this perspective in mind the present study has been carried out.

3. OBJECTIVES OF THE STUDY

The following objectives were formulated for the present study:

1. To sketch the year-wise distribution of literature productivity and to find out the average; number of productivity during the periods from 1985-2009 by TRC scientists;
2. To examine the authorship pattern of the contribution;
3. To analyze the use of various types of documents by the scientists;
4. To identify the most prolific scientists of the TRC;
5. To identify the choice of journals of the researchers for publication of scientist research findings.

4. METHODOLOGY

Research findings are reported in various documentary publications viz. national and international research journals, research bulletins, annual scientific report, conferences, symposia proceedings etc. This information about the publications is given under the website namely www.trc-chennai.org/html/ publications. html. They have provided year-wise database of research publications of TRC Scientists' which are maintained and updated from 1959 onwards [10].

To examine the literature growth and authorship pattern in tuberculosis research and development, bibliographical details of publications (674) in electronic form were scanned and the data elements were transferred, tabulated, organized and analysed using MS-Excel 2007 spread sheet application software. The tables and graph were generated in accordance of objectives of study viz. literature growth, different authorship pattern and single v/s multiple authorship.

4.1 Participate Index

The literature growth of percentage (R) in tuberculosis research was calculated with the help of following simple bibliometric formula. To evaluate the performance level of research of an institution, an index called 'Participate Index has been calculated [PaI] the ratio of number of papers generated in a country or institution and the total number of documents collected in this repertoire [11]. This can be expressed as:

$$PaI = \frac{\text{No of papers generated in an institution}}{\text{Total number of documents collected in this repertoire}} \times 100$$

4.2 Collaborative Co-Efficient

To measure the extent and strength of collaboration among the scientists of electrochemical in CECRI, a measure called collaborative co-efficient suggested by Subramanyam's formula has been adopted to examine the degree of collaboration in this study [12].

$$C = N_m/N_m + N_S$$

whereas

C = degree of collaboration in a subject

N_m = number of multiple authored papers

N_s = number of single authored papers

4.3 Co-Authorship Index (CAI)

In order to examine how the pattern of Co-Authorship Index (CAI) has changed during the study period, the formula of Co-authorship Index suggested by Garg and Padhi has been adopted [13].

$$CAI = \{(N_{ij}/N_{io})/(N_{oj}/N_{oo})\} \times 100$$

N_{ij} : number of papers having j authors in block I;

N_{io} : Total output of block I;

N_{oj} : number of papers having j authors for all blocks;

N_{oo} : Total number of papers for all authors and all blocks;

J = 1, 2, 3……..n

CAI = 100

CAI=100 implies that co-authorship in a particular block for a particular type of authorship corresponds to the world average, CAI>100 reflects higher than average co-authorship effort and CAI<100 lower than average co-authorship effort in a particular block for a particular type of authorship. For calculating CAI the entire data was divided into three blocks as single authored, two authored and more than two authored publications.

4.4 Bradford Law

To identify the core journal of a particular discipline, Bradford's Law has been tested. This law describes studying the extent to which literature in a particular discipline is scattered over a range of journals [14]. 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…..

5. DATA ANALYSIS

A total of 764 contributions have been published in 25 years (1985 - 2009), which consists of full articles in Indian journals & foreign journals, books and conference proceedings.

Table 1 Growth of Tuberculosis Literature from 1985-2009

Sl. No.	Year	Productivity	%
1	1985 - 1989	138	18.06
2	1990 - 1994	143	18.72
3	1995 - 1999	140	18.32
4	2000 - 2004	130	17.02
5	2005 - 2009	213	27.88
Total		764	100

Table 1 shows the growth tuberculosis literature from 1985 - 2009 in Tuberculosis Research Centre (TRC) at Chennai, Tamil Nadu. Table 1 portray that out of 764 productivity, 27.88 % of them were published during the period 2005 - 2009, 18.72% of them were published in the period 1990 - 1994 respectively. Table shows that maximum number of articles (27.88%) published in the period 2005 - 2009 and minimum number of contributions 2000 - 2004 (17.02%). It is inferred from the level of the percentage of distribution of contributions from 1985 - 2009 that the level of the percentage of distribution has decreased and increased.

Table 2 Distribution of Source

Sl. No.	Types of Source	No. of Publication	%
1	Indian Journals	369	48.30
2	International Journal	329	43.06
3	Books	46	6.02
4	Proceedings	20	2.62
Total		764	100

The productivity of scientists of TRC spread over variety of publication in media like Indian journal, foreign journal, conference proceedings and books. The form-wise distribution of productivity of the scientists of TRC during the period under study is represented in Table 2. It is evident from the Table 2 that the most productivity of scientists of TRC published in journals. Out of 764 publication, 369 (48.30%) were published in Indian journals, 329 (43.06%) were published in foreign journals. The analysis reveals that most of the TRC scientists were interested to publish in foreign journals.

Table 3 Distribution of Authorship Pattern

Sl. No.	Year	Single	Two	Three	Four	Five	Six	More than Six	Total
1	1985-1989	21 (1.11)	22 (1.52)	19 (1.03)	24 (1.21)	23 (1.12)	12 (0.75)	17 (0.57)	138
2	1990-1994	28 (1.42)	11 (0.73)	22 (1.15)	21 (1.02)	21 (0.98)	12 (0.72)	28 (0.91)	143
3	1995-1999	30 (1.56)	9 (0.61)	22 (1.18)	18 (0.89)	19 (0.91)	19 (1.17)	23 (1.77)	140
4	2000-2004	20 (1.12)	16 (1.18)	15 (0.86)	18 (0.96)	22 (1.13)	16 (1.06)	23 (0.82)	130
5	2005- 2009	6 (0.20)	22 (0.99)	24 (0.84)	29 (0.84)	29 (0.91)	30 (1.21)	73 (1.60)	213
Total		105	80	102	110	114	89	164	764

Table 3 depicts the distribution of authorship pattern year- wise like single, two, three, four and so on. Table 3 provides contributions by a single author, during the period 1995-1999 which has 30 articles the highest percentage. Regarding two authors' contributions, during the periods 1985-1989 and 2005-2009 shows the maximum percentage (2.88%). Regarding three authors, four authors, five authors, six authors and more than six authors the maximum contribution is in the year 2005-2009 respectively.

Table 4 Authorship Pattern

Sl. No.	Authorship Pattern	No. of Papers	%
1	Single	105	13.74
2	Two	80	10.47
3	Three	102	13.35
4	Four	110	14.40
5	Five	114	14.92
6	Six	89	11.65
7	More than Six	164	21.47
Total		764	100

Table 4 shows the authorship pattern of contributions in tuberculosis research centre at Chennai. Out of 764 papers, more than six authors have contributed 21.47 % of the total publications, 14.92% of the publications were contributed by five authors, 14.40% of the contributions were published with four authors, 13.74% of the contribution was contributed by single author and 13.35 % of the contribution was contributed by three authors respectively. This shows that scientist have a tendency to publish their research work with two or three authors or individually instead of sharing the authorship among more than three scientists. This shows the significant note of the study that the majority of the papers were contributed by co-authorship pattern.

The analysis of the data in Table 5 indicates that from 1985 to 2009 there is some relation between single authored papers and multi-authored papers except for the periods 1995-1999 and 2000-2004. As the numbers of research papers contributed by single authors are increasing or decreasing, the multi authored papers for these periods 1990-1994 were decreased. Further the Table 5 showed that no difference (16.69%) in both the periods 1995-1999 and 2000-2004. However the total research papers contributed by multi authors occupied the maximum precentage (86.26%) leaving single authored papers much below to 13.74% of the total research papers (764). This shows that the TRC scientist preferred to work and publish in joint collaboration instead of single handedly. This has been further testified with derivation of specific degree collaboration, which was found to be ranging fairly high between 0.80 to 0.97 during the period of study (1985- 2009). The high side of specific degree of collaboration (0.85 to 0.97) and multiple authorship (95.32%) demonstrates the team spirit in TRC and close association among tuberculosis researchers.

Table 5 Single Vs. Multiple Authorship and Degree of Collaboration

Sl. No.	Year	Single Authored Papers	%	Multi Authored Papers	%	Total No. of Papers	Degree of Collaboration
1	1985-1989	21	20.00	117	17.75	138	0.85
2	1990-1994	28	26.67	115	17.45	143	0.80
3	1995-1999	30	28.57	110	16.69	140	0.79
4	2000-2004	20	19.05	110	16.69	130	0.85
5	2005-2009	6	5.71	207	31.41	213	0.97
Total		105	13.74	659	86.26	764	0.86

Table 6 Top Fifteen Rank List of Scientists Contributing Journal Articles, Conference Proceedings and Books in TR

Sl. No.	Authors Name	No. of Papers Published	Rank
1	Narayanan P R	186	1
2	Prabhakar R	155	2
3	Paramasivan CN	117	3
4	Venkatesan P	85	4
5	Swaminathan S	79	5
6	Vijayan VK	73	6
7	Kumaraswami V	68	7
8	Selvakumar N	57	8
9	Gopi P G	54	9
10	Santha T	53	10
11	Subramani R	48	11
12	Selvaraj P	45	12
13	Balasubramanian R	41	13
14	Chrasekaran V	40	14
15	Rajeswari R	36	15

Table 6 indicates the top fifteen rank list of scientists contributing their articles during the study period. Narayanan P R, with 186 articles is the most prolific author during the period under study followed by Prabhakar R with 155 articles. Paramasivan C N (117 articles) is in the third position followed by Venkatesan P (85 articles).

Table 7 provides a rank list of the journals most preferred by the scientists of TRC for publishing articles. The journals most preferred by the scientists are Indian Journal of Tuberculosis (104 papers), Indian Journal of Medical Research (73 papers) in India and International Journal of Tuberculosis and Lung Diseases (64 papers) in foreign journal.

6. CONCLUSION

The analysis of literature in tuberculosis contributed by scientists of TRC of Chennai brings to light some interesting facts about the literature as well as the scientists. The pattern of year-wise output is much skewed. It registers an increase in one year and goes down the next year. Research output of TRC scientist preferred source -wise on the top followed by that Indian Journals (48.30%) and (43.06%). Collaboration in research is evident by the fact that 14.92%, 14.40% and 13.74% of articles have been written by five, four and single author respectively. Though contributions of scientists are fairly collaborative, the nature of collaboration is the most of the time at local. It is found that major individual scientists contributions are Narayanan *P R* (186 papers), Prabhakar *R* (155 papers) and Paramasivan *CN* (117papers) of publications have been written by first, second and third respectively. Scientists prefer to publish their papers in Indian Journal of Tuberculosis (104 articles), Indian Journal of Medical Research. (73 articles), and International Journal Tuberculosis and Lung Diseases (64 articles). They tried to publish their articles in international journal. Majority of journals related to lung disease and medical sciences oriented.

Table 7 Top Ten Ranked List of Journals Most Preferred for Publishing Articles in TRC at Chennai

Sl. No.	Name of Journal	No. of Publications	Rank
1	Indian Journal of Tuberculosis	104	1
2	Indian Journal of Medical Resource	73	2
3	International Journal of Tuberculosis Lung Diseases	64	3
4	Lung India	33	4
5	Tuber Lung Diseases	18	5
6	Current Sciences	16	6
7	Indian Journal of Pediatrics& American Journal Immunology	13	7
8	Indian Journal of Chest Diseases Allied Sciences	12	8
9	Indian Pediatrics & Annals of Tropical Medicine and Parasitology	11	9
10	SAARC Journal of TB Lung Diseases HIV/AIDS	10	10

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