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## Research Performances of NIRT, Tamil Nadu: A Scientometric Assessment

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#### Abstract

*The present study analyzes the publication trend of the National Institute for Research in Tuberculosis (NIRT) from 2009 to 2018. Five hundred ninety-six articles were published, more number of records published in the year of 2018 as 85 (14.2%) and the average output per year is 59.6%. The highest number of papers published in the category of 'Immunology' with 225 (38.07%) and PLOS One is the most preferred journal as 58 (9.7%) to NIRT researchers; Cited records- wise, 504 documents cited 92 were yet to cite. The researcher Swaminathan, S. in the most prolific author with 184 (31.13%) papers and H-index value is 51. 126 (21.14) articles published with the financial support of the Department of Health Human Services, USA and country-wise, USA researchers contributed more number of articles as 180 (30.2%) of papers.*

#### Keywords

NIRT Publications; Tuberculosis Research;  
Scientometrics; Authorship Pattern; Citation  
Analysis; VOS Viewer

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## Introduction

The National Institute for Research in Tuberculosis (NIRT), Chennai, is an internationally recognized premier institute for Tuberculosis (TB) research. It's formerly known as the Tuberculosis Research Centre (TRC), initiated as five years project in 1956 and permanent establishment made in 1964 under the Indian Council of Medical Research (ICMR). During the past 50 years, the Institute screened more than 100000 TB patients and 15,000 patients enrolled in various clinical trials. Institute is having collaboration with the World Health Organization (WHO), National Institute for Health (NIH), and the British Medical Research Council (BMRC). NIRT is conducting the various courses as post-graduate training and Ph.D. degrees in the specialization of bacteriology, biochemistry, immunology, and statistics recognized by Madras University. The Centre functions from three different campuses as Chennai, Tiruvallur, and Madurai, the main campus in Chetput, the heart of Madras city. Institute has a supranational Reference Laboratory and a WHO Collaborating Centre for TB Research and Training. Recently, an International Centre for Excellence in Research (ICER) established at the Centre with the collaboration of NIH. Bibliometrics is one of the techniques to evaluate qualitatively as well as quantitatively. The present study reveals the publication's status of NIRT from 2009 to 2018 and data accessed from Web of Science, Hiscite, MS-Excel, and VOS Viewer used for further analysis.

## Objectives

1. To show the year-wise publications of NIRT
2. To display the document-wise distributions
3. To know the journal-wise distribution of records
4. To reveal the research areas of NIRT publications
5. To find the most productive authors
6. To analyze the year-wise cited and not cited records
7. To find out the length of the articles
8. To reveal the collaborative institutions
9. To visualize the co-authorship and co-occurrence network using VOS Viewer
10. To show the geographical distribution
11. To examine the highly cited papers

## Literature Survey

Garg, K.C., and Tripathi, H.K. (2017) examined the bibliometrics and scientometrics publications in India

from 1995 to 2014. It found that 801 records, 289 papers from academic communities followed by 258 records from CSIR institutes. Two authorship records are more 361 (45%) than single-authored documents 221 (27.6%); B.M. Gupta is the most prolific author (70) with 11.9 citations per paper is. The researcher S. Arunachalam from MS Swaminathan Research Foundation (MSSRF), Chennai, published 12 records in the area of bibliometrics/scientometrics and his Citation per Paper (CPP) noted as 30.9. Bebi and Kumar, Shaieldendra (2017) revealed the publication pattern of women faculties from the Physics department of select academic and RD institutions belongs to Delhi from 2011 to 2015. Three hundred faculties from 7 different organizations of Delhi published 802 papers, 463 are journal articles followed by conference proceedings as 130 documents. Among the 463 articles, three-authorship are 98 records followed by two authorship records (86) and two only solo authorship records, which proves that women researchers are interested in co-authorship patterns. Kor, Burcu (2017) studied the publication status of knowledge management (KM) between 2010 and 2015. The maximum number of papers published in 2010 as 40, followed by 2011 with 37 records and two articles only in the year of 2015. Among 109 papers, 50 papers used survey method and other qualitative methods used in 27 documents; based on the theme of papers, performance-based articles are being in first place with 19 (9.3%) followed by information technology as 17 (8.3%), etc. Mohanty, Rasmita (2018) studied the development of library and information science research in India for the period of 2010 to 2014,. In all, 69 papers indexed in Scopus; more records (21, 30.43%) published in 2014, and fewer articles noted in 2013 with 7 (10.14%). 9 articles from Annals of Library and Information Studies (ALIS) and five articles from the DESIDOC Journal of Library and Information Technology (JLIT) indexed in Scopus. Banshal, Sumit Kumar; Solanki, Tanu, and Singh, Vivek Kumar (2018) examined the NITs research performance between 2005 and 2016., NITP output (2749) is more NIT Rourkela (2621), and the publications between 2010-16 are 3.5 times more than the study period of 2005-10 records; the h-index and average citation per paper of IITB are 47 and 13.91 respectively. The h-index value of IISc (52) is more than IITB (47); the average citation per paper of IITB and IISc are 13.91 and 13.77, respectively.

**ANALYSIS AND RESULTS**

**Year-wise distribution:**

Table 1 reveals the year-wise distribution of NIRT researchers during the study period from 2009 to 2018. Five hundred ninety-six records published in 10 years; more number of papers published in the year of 2018 as 85 (14.2%) followed by 2016 with 79 (13.2%) articles; fewer records absorbed in the year of 2013 as 42 (7%) and the average output per year is 59.6%.

**Table 1.** Year-wise Distribution

S.No.	Publication Year	Records	Percent	TLCS	TGCS
1	2009	54	9	105	
2	2010	45	7.5	94	29
3	2011	44	7.4	52	803
4	2012	57	9.6	81	1178
5	2013	42	7	56	891
6	2014	56	9.5	68	1394
7	2015	62	10.5	77	5954
8	2016	79	13.2	88	1182
9	2017	72	12.1	18	509
10	2018	85	14.2	7	409
<b>Total</b>		<b>596</b>	<b>100</b>	<b>646</b>	<b>12349</b>
<b>Average Output Per Year - 59.6%</b>					

**Document-wise Distribution:**

Table 2 describes the document-wise publications of NIRT publications during the study period. Maximum numbers of records are published as article 400 (67%) followed by unknown records with 97 (16.2%), reviews stand in the third position with 49 (8.2%), and minimum documents noted on bibliographical item and book chapter as a single record only in each type.

**Table 2 -** Document-wise Distribution

S.No.	Document Type	Records	Percent	TLC S	TGCS
1	Article	400	67	377	11375
2	Unknown	97	16.2	198	
3	Review	49	8.2	60	862
4	Meeting Abstract	17	2.8	0	0
5	Letter	16	2.7	2	25
6	Editorial Material	13	2.2	8	56
7	Correction	1	0.2	0	0
8	Article; Proceedings	1	0.2	1	3

	Paper				
9	Biographical-Item	1	0.2	0	0
10	Review; Book Chapter	1	0.2	0	28
	<b>Total</b>	<b>596</b>	<b>100</b>	<b>646</b>	<b>12349</b>

**Research Area-wise Distribution:**

Table 3 explains the top 20 research area-wise distribution of NIRT articles between 2009 and 2018. The maximum number of articles published in the category of 'Immunology' as 225 (38.07%), followed by 'Infectious Diseases' with 179 (30.29%). 'Microbiology' in the third position with 109 (18.44%) papers and the minimum number of papers published in the area of 'Computer Science' with seven articles (1.18%) only.

**Table 3.** Top 20 Research Area-wise Distribution

S.No.	Research Areas	Record Count	Percentage
1	Immunology	225	37.75
2	Infectious Diseases	179	30.03
3	Microbiology	109	18.29
4	General Internal Medicine	71	11.91
5	Science Technology other Topics	66	11.07
6	Respiratory System	64	10.74

7	Research Experimental Medicine	52	8.72
8	Biochemistry Molecular Biology	41	6.88
9	Tropical Medicine	37	6.21
10	Pharmacology Pharmacy	34	5.70
11	Public Environmental Occupational Health	32	5.37
12	Virology	24	4.02
13	Parasitology	20	3.36
14	Cell Biology	19	3.19
15	Pediatrics	17	2.85
16	Chemistry	15	2.52
17	Biotechnology Applied Microbiology	13	2.18
18	Biophysics	8	1.34
19	Genetics Heredity	8	1.34
20	Computer Science	7	1.17

**Most Preferred Journals:**

Table 4 reveals the most preferred journals for NIRT publications, PLOS One stands in first place with 58 (9.7%) records followed by the Indian Journal of Medical Research as 36 (6%) papers. Lancet journal being in the last place with 12 articles, which is only 2% of total publications but impact factor-wise, Lancet impact factor is high (59.102) than other journals; for example, the impact factor of the leading journal PLOS One is 2.776 only.

**Table 4.** Top 10 Most Preferred Journals

S. No.	Journal	Records	Percent	TLCS	TLCS/t	TGCS	TGCS/t	TLCR
1	PLOS One	58	9.7	0	0	743	124.37	41
2	Indian Journal of Medical Research	36	6	23	3.14	281	42.92	27
3	International Journal of Tuberculosis and Lung Disease	36	6	44	7.24	190	34.14	18
4	Tuberculosis	22	3.7	30	4.91	148	30.86	32
5	Clinical Infectious Diseases	19	3.2	65	11.39	276	56.59	49
6	Aids Research and Human Retroviruses	14	2.3	12	1.7	12	3.1	2
7	Journal of Infectious Diseases	13	2.2	60	7.78	553	72.16	16
8	PLOS Neglected Tropical Diseases	13	2.2	0	0	86	15.55	10
9	Cytokine	12	2	28	4.39	101	19	14
10	Lancet	12	2	17	4.59	6154	1288.4	11

**Cited & Not Cited Records:**

Table 5 denotes the cited and not cited records of NIRT as on the data accessed from WoS. Among

596 papers, 504 documents cited 92 were yet to cite. Maximum records (65) from 2016 publications cited and minimum records cited during the years of 2010 and 2013 equally as 38. More records (27) from

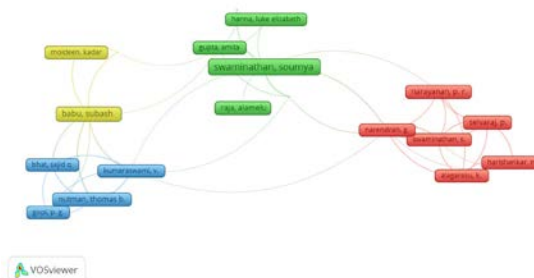
2018 publications are yet to cite it because of the latest papers in the concerned period.

**Table 5.** Cited & Not Cited NIRT records

Year	No. of Cited Articles	No. of Not Cited Articles	Total
2009	50	3	53
2010	38	11	49
2011	44	4	48
2012	53	3	56
2013	38	4	42
2014	50	6	56
2015	56	5	61
2016	65	14	79
2017	55	15	70
2018	55	27	82
<b>Total</b>	<b>504</b>	<b>92</b>	<b>596</b>

**Most Prolific Authors:**

Table 6 reveals the most prolific authors of NIRT and their H-index values. The researcher Swaminathan, S. in the first position with 184 (31.13%) papers and 51 as H-index value. Babu S. stood in the second position with 110 (18.61%) records and 26 as H-index. The researcher, Nutman T.B., with 58 (9.81%) records and his H-index, is 75, which shows that Nutman T.B. is published a notable article than other researchers. Less H-index observed to the researchers Narayanan S. and Kumar V. as one only.



**Fig.1.** VOS Viewer Co-Authorship Network Visualization

**Table 6.** Most Prolific Authors

S. No.	Authors Name	No. of Papers	Percentage	H-Index
1	Swaminathan S	184	30.87	51
2	Babu S	110	18.46	26
3	Nutman T B	58	9.73	75
4	Kumar N P	53	8.89	18
5	Hanna L E	51	8.56	14
6	Ramachandran G	43	7.21	19
7	Raja A	39	6.54	16
8	Narayanan S	36	6.04	1
9	Kumar V	32	5.37	1
10	Banurekha V V	31	5.20	13
11	Nair D	31	5.20	10
12	Selvaraj P	31	5.20	22
13	Anuradha R	30	5.03	13
14	Narendran G	29	4.87	18
15	Kumaraswami V	28	4.70	34
16	Kumar A K H	27	4.53	10
17	Kumaran P	24	4.03	12
18	Selvakumar N	24	4.03	24
19	Dolla C	23	3.86	9
20	Padmapriyadarsini C	22	3.69	10

**Table 7.** Top 10 Collaborative Organizations

S.No.	Name of the Institution	Records	Percent	TLCS	TGCS
1	National Institute for Research in Tuberculosis	330	55.3	275	9758
2	Indian Council Med Research	117	19.6	108	1475
3	Unknown	97	16.2	198	
4	NIAID	83	13.9	126	2049
5	International Centre Excellence Research	36	6	33	750
6	TB Research Centre	35	5.9	30	479

7	Johns Hopkins University	31	5.2	50	6618
8	National Institute for Health	30	5	28	2938
9	University of Cape Town	29	4.9	63	7121
10	Harvard University	25	4.2	40	6618

**Collaborative Organizations:**

Table 7 explains the top 10 cooperative organizations of NIRT publications during the concerned period of study. Indian Council of Medical Research (ICMR) stood in the second position with 117 (19.6%) records, National Institutes of Health (NIH), USA collaborated with 30 papers, which is 5% of total publications. There are 22 (3.7%) records published with the collaboration of the World Health Organization (WHO), the world’s premier health organization that observes the country’s health matters and provides its support in time to time

**Length of Articles:**

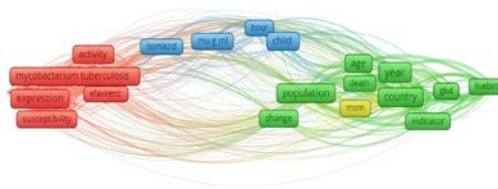
Table 8 shows the length of the NIRT publications with different page ranges, and it found that the 2018 records published with more number of pages 538 (16.18%) followed by 2015 papers with 447 pages (13.44%). The articles published in 2010 are with fewer pages as 220 (6.61%). An average page per record is 5.63.

**Table 8 – Article Length of NIRT Publications**

Years	No. of Records	Total Pages	Percentage
2009	54	295	8.87
2010	45	220	6.61
2011	44	248	7.46
2012	57	263	7.91
2013	42	190	5.71
2014	56	362	10.88
2015	62	447	13.44
2016	79	355	10.67
2017	72	408	12.27
2018	85	538	16.18
<b>Total</b>	<b>596</b>	<b>3326</b>	<b>100.00</b>
<b>Average Pages Per Record - 5.58</b>			

**VOS Viewer Co-Occurrence Map:**

The VOS viewer co-occurrence terms map for NIRT publications during the study period has presented for better understanding.



*Fig.2. VOS Viewer Co-Occurrence Map Network Visualization*

**Book Series Titles:**

Table 9 presents the book series of NIRT publications between 2009 and 2018. Totally four books published among that 'Proceedings of SPIE' with two records followed by 'Recent advances in biology and biomedicine' and 'Vitamins and hormones' each one book.

**Table 9. Book Series of NIRT Publications**

S.No.	Book Series Titles	Records	Percentage
1	Proceedings of SPIE	2	0.33
2	Recent Advances in Biology and Biomedicine	1	0.17
3	Vitamins and Hormones	1	0.17
	<b>Total</b>	<b>4</b>	<b>0.67</b>

**Funding Organizations:**

Table 10 reveals the top 10 funding organizations of NIRT during the study period i.e., 2009 to 2018. Department of Health Human Services, United States of America, supported publishing 126 records which are 21.14% of total publications followed by National Institutes of Health (NIH, USA) with 125 papers

(20.97%). Indian organizations such as the Department of Biotechnology (DBT) and Department of Science Technology (DST) contributed on 18 and 14 records, respectively.

**Table 10.** Funding Agencies of NIRT Publications

S.No.	Funding Agencies	Record Count	Percentage
1	United States Department of Health Human Services	126	21.14
2	National Institutes of Health (NIH), USA	125	20.97
3	Indian Council of Medical Research (ICMR)	111	18.62
4	NIH National Institute of Allergy Infectious Diseases (NIAID)	96	16.11
5	United States Agency for International Development (USAID)	56	9.40
6	Council of Scientific Industrial Research (CSIR) India	37	6.21
7	World Health Organization (WHO)	30	5.03
8	Department of Biotechnology (DBT) India	18	3.02
9	Department of Science Technology (DST) India	14	2.35
10	Medical Research Council, UK MRC	13	2.18

**Country-wise Distribution:**

Table 11 shows the top 15 global researcher's contributions to NIRT output. One hundred thirty-one country researchers contributed to NIRT publications. Indian authors contributed to 498 (83.4%) records followed by USA scientists with 180 (30.2%) articles; Canada, Italy, and Saudi Arabia published 17 (2.8%) papers each.

6	Switzerland	35	5.9	37	6572
7	France	23	3.9	24	6628
8	Sweden	22	3.7	22	6865
9	Australia	21	3.5	42	7230
10	Brazil	21	3.5	16	6743
11	Netherlands	21	3.5	26	6674
12	Germany	20	3.4	29	6871
13	Canada	17	2.8	15	6442
14	Italy	17	2.8	21	6768
15	Saudi Arabia	17	2.8	21	6566

**Table 11.** Country-wise Distribution

S. No.	Country	Records	Percent	TLCS	TGCS
1	India	498	83.4	438	12281
2	USA	180	30.2	224	9719
3	Unknown	97	16.2	198	
4	UK	41	6.9	44	7546
5	South Africa	38	6.4	73	7540

**Highly Cited Articles:**

Table 11 presents the list of top 20 highly cited articles of NIRT publications during the study period.

**Table**

**11.Top 10 Highly Cited articles**

Rank	Bibliographic Details	Impact Factor (2019)	Times Cited
1	Global, regional, and national age-sex specific all-cause and cause-specific mortality for 240 causes of death, 1990-2013: a systematic analysis for the Global Burden of Disease Study 2013 By: Naghavi, Mohsen; Wang, Haidong; Lozano, Rafael; et al. Lancet, 2015, 385 (9963), Pages: 117-171.	59.102	3,344
2	Global, regional, and national comparative risk assessment of 79 behavioral, environmental and occupational, and metabolic risks or	59.102	1,087

	clusters of risks in 188 countries, 1990-2013: a systematic analysis for the Global Burden of Disease Study 2013 By: Forouzanfar, Mohammad H.; Alexander, Lily; Anderson, H. Ross; et al. Lancet, 2015, 386 (10010), Pages: 2287-2323.		
3	Global, regional, and national disability-adjusted life years (DALYs) for 306 diseases and injuries and healthy life expectancy (HALE) for 188 countries, 1990-2013: quantifying the epidemiological transition By: Murray, Christopher J. L.; Barber, Ryan M.; Foreman, Kyle J.; et al. Lancet, 2015, 386 (10009), Pages: 2145-2191.	59.102	767
4	Global, regional, and national incidence and mortality for HIV, tuberculosis, and malaria during 1990-2013: a systematic analysis for the Global Burden of Disease Study 2013 By: Murray, Christopher J. L.; Ortblad, Katrina F.; Guinovart, Caterina; et al. Lancet, 2014, 384 (9947), Pages: 1005-1070.	59.102	476
5	Host-directed therapy of tuberculosis based on interleukin-1 and type I interferon crosstalk By: Mayer-Barber, Katrin D.; Andrade, Bruno B.; Oland, Sandra D.; et al. Nature, 2014, 511 (7507), Pages: 99-U491.	43.070	318
6	Epidemiology of antituberculosis drug resistance 2002-07: an updated analysis of the Global Project on Anti-Tuberculosis Drug Resistance Surveillance By: Wright, Abigail; Zignol, Matteo; Van Deun, Armand; et al. Lancet, 2009, 373 (9678), Pages: 1861-1873.	59.102	279
7	Estimates of global, regional, and national incidence, prevalence, and mortality of HIV, 1980-2015: the Global Burden of Disease Study 2015 By: Wang, Haidong; Wolock, Tim M.; Carter, Austin; et al. Lancet HIV, 2016, 3 (8), Pages: E361-E387.	59.102	245
8	Evaluation of Tuberculosis Diagnostics in Children: 1. Proposed Clinical Case Definitions for Classification of Intrathoracic Tuberculosis Disease. Consensus From an Expert Panel By: Graham, Stephen M.; Ahmed, Tahmeed; Amanullah, Farhana; et al. Journal of Infectious Diseases, 2012, 205 (Supplement 2) Pages: S199-S208.	5.045	184
9	Pediatric Tuberculosis: Global Overview and Challenges By: Swaminathan, Soumya; Rekha, Banu Clinical Infectious Diseases, 2010, 50 (Supplement 3), Pages: S184-S194.	9.055	176
10	Nations within a nation: variations in epidemiological transition across the states of India, 1990-2016 in the Global Burden of Disease Study By: Dandona, Lalit; Dandona, Rakhi; Kumar, G. Anil; et al. Lancet, 2017, 390 (10111), Pages: 2437-2460.	59.102	136

### Findings and Conclusions

An internationally recognized premier institute for Research in Tuberculosis, namely NIRT, was established in Chennai during 1964. Institute screened more than 100000 TB patients and 15,000

patients enrolled in various clinical trials for the past 50 years. Institute having the collaboration with esteemed organizations such as National Institute for Health (NIH), USA, British Medical Research Council (BMRC), and World Health Organization (WHO), etc. for the TB research and development

activities. Totally 596 articles published during the period, the maximum number of items (85) published in the year 2018, which is 14.2% of total output. The average production per year is 59.6%, and document-wise, the maximum of NIRT publications are articles as 400 (67%). Among the 596 papers, 504 records cited 92 were yet to cite. The total number of pages for 596 reports is 3326, and the average pages per document are 5.58. PLOS One is the most preferred journal (58 articles) to NIRT scholars. The researcher Swaminathan, S. published 184 (31.13%) papers with H-index value is 51. The H-index value of the author Nutman T.B. is 75 for 58 records, which shows that the researcher published more number of notable records. The United States of America contributed to 180 articles, which is 30.2% of total publications.

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