

## RESEARCH PERFORMANCE OF HEALTH CARE PROFESSIONALS IN TAMILNADU, INDIA

*Mohamed Idhris  
Manuelraj Peter*

**Dr. Mohamed Idhris**

Assistant Professor, Deanship  
of Library Affairs  
Imam Abdulrahman Bin Faisal  
University, Dammam  
Kingdom of Saudi Arabia  
Email: midhris@iau.edu.sa  
(Corresponding Author)

**Dr. Manuelraj Peter**

Assistant Professor & Head of  
Library Systems, Deanship of  
Library Affairs  
Imam Abdulrahman Bin Faisal  
University  
Imam Abdulrahman Bin Faisal  
University, Dammam  
Kingdom of Saudi Arabia  
Email: mrpeter@iau.edu.sa

This paper contains a bibliometric analysis of healthcare professionals' research performance in Tamil Nadu between 2009 and 2018. Over 10 years, the Tamil Nadu scientific community has published 23,892 articles, which have been published in authoritative journals indexed by the web of science. The Data was collected on November 20, 2019, from the WoS Core Collection; the quantitative research was carried out. Co-citation analysis, collaboration analysis, is carried out using the Excel and VOSviewer. A total of 23,892 references have been received, the most active publication year was 2016 and a minimum number of publications in the year of 2009. The number of publications has increased steadily until 2016 after that publication count is decreased. Ramasamy, Jegadeesh, was the most prolific and influential researcher with 240 publications and 80 citations, the most collaborative productive countries are United States (n=2606) and UK (n=877). Christian Med College and Hospital got the highest publication count (n=3320) during the study period. From 2009 to 2016 the number of publications is increased steadily, but research output has shown a gradual decline in the number of publications behind 2016, this seems to show a lack of interest in health professionals' research during the last few years.

**Keywords:** Bibliometrics study, Tamil Nadu, Health Professionals, research output, Health Care, Research Productivity

### INTRODUCTION

This article analyses recent research activities in Tamil Nadu in the development of the health care system. Healthcare in India, rather than the central federal government, is the responsibility of the state governments. It makes that state responsible for "growing its people's nutritional and living standards and improving public health as one of its primary responsibilities.(Kishore, Retrieved 2 September 2012.; *National Health Policy*, January 2017) The Indian Health Policy was approved by the Indian Parliament in 1983, revised in 2002 and modified in 2017. The Indian Medical Research Council (ICMR), India's apex body for biomedical

research-creation, coordination, and promotion, is one of the world's oldest and largest medical research organizations. The ICMR is funded by the Government of India through the Ministry of Health and Family Welfare, Department of Health Research (Bhargava, NOVEMBER 20, 2011; Dhar, AUGUST 18, 2016) The Council goals of the coincide with national health priorities such as control and management of communicable diseases, control of fertility, maternal and child health, control of dietary disorders, and the development of alternative health care approaches. (Bhargava, 2011).

ICMR promotes extramural research by setting up Advanced Research Centers in various research areas around existing expertise and infrastructure in selected departments of medical colleges, universities and other non-ICMR research institutes. Open-ended research is carried out the basis of grant applications obtained from scientists at non-ICMR research institutes, medical colleges and universities across the country.(ICMR, 3 December 2007)

ICMR also provides an international research and training fellowship program for Indian biomedical scientists in different countries and offers opportunities for researchers from developed countries to work in Indian institutes/laboratories. It also supports the development of human resources in biomedical research through Research Fellowships, Short-Term Visiting Fellowships, Short-Term Research Studentships, and various training programs and workshops provided by ICMR institutions and headquarters.

Tamil Nadu council for Science and Technology (TNSCST) maintain mediator

between the Government of India and the Government of the State and initiate, guide and coordinate research activities of government departments, universities and other professional bodies to support the development of science in the State. TNSCT Promote science and technology through awareness programs, Training Programs, Exhibitions, Lectures including visual presentation.(TNSCT, 2019). Tamil Nadu has become more interested in healthcare research through the above government and non-government organizations. There are 323 Government and non-Government Medical & Medical based Colleges and Institutions are successfully running in Tamil Nadu (Healthcare, 2019). Approximately 13200 students are pass out of medical and medical-related courses every year(Healthcare, 2019). Medical research articles appear to be very low compared to the rate of medical students passing out and the way medical research articles appear.

## REVIEW OF LITERATURE

Fernandes et al., 2018 in their findings given in the work demonstrate a significant increase in systematic reviews of vaccination research over the last nine years, with annual numbers more than doubling from 2008 to 2016. This growth could be attributed to a variety of things. Primary research expansion may have increased the number of prospective systematic reviews. Over the last decade, there has been a surge in interest in vaccination research, fueled by increased research funding and increased vaccine availability worldwide. Systematic reviews are becoming more popular, with more being undertaken in many domains, not only vaccinations. This could be due

to a broader appreciation of the importance of systematic reviews.

Xing et al., (2019) used data taken from numerous information sources to conduct a systematic analysis of CI technologies for health objectives. Our findings gave an overview of countries, organisations, and topic terms in funding activities, as well as authorship, collaboration, substance, and associated information in research papers and patents. Overall, the inclusion of grants and patents, as well as publications, has provided additional insights into the R&D environment of the application of CIs for health purposes. Our findings indicate a lack of cross-sector collaboration among grantees in the United States. Husain et al., (2020) provide a quantitative breakdown of the most prolific journals, authors, countries, and institutions. In the future, the authors advocate for more effective cooperation between diverse countries, institutions, and authors involved in Ramadan and health research in order to support research-based quality expansion of the body of knowledge in this field. Farooq et al., (2019) study reveal that their findings are positive, as quantitative and qualitative indicators of mental health research in Pakistan have improved steadily over the last decade. Certain policy changes, however, are required to foster a better research culture in Pakistan. The most important adjustment is to create a framework for funding research in medical education institutions. Hernandez-Villafuerte et al., (2016) study identify the significant barriers and potential in the sharing of HTA information between Sub-Saharan African countries. Collaboration among

Sub-Saharan African academics is critical in the development and transfer of knowledge to assist decision making for health priority setting. However, collaboration among African institutions is currently limited, and research appears to rely primarily on collaboration with Europe and North America.

Sweileh, (2018) in his findings globally and within countries, there are still many underprivileged nations or marginalized groups of people that do not have access to health care. There are hundreds of millions of refugees in the Middle East, children in Africa, abused women all over the world, and HIV-positive people who continue to be denied the fundamental human right to healthcare and health services. Researchers can help achieve HHR by drawing attention to critical neglected health topics or the health needs of marginalised populations both worldwide and within countries. Sweileh et al., (2018) findings may be valuable to health authorities, funding agencies, donors, and UN organisations interested in mapping research topics and identifying gaps in the GMH research landscape. The recent Global Compact on Migrants and Refugees, which tries to create global foreign policy goals and action plans on migration, must account for knowledge shortages in order to advance an evidence-informed migration and health research agenda. The heat map demonstrates how GMH research fails to accurately reflect worldwide migration patterns. Despite large migrant patterns within these regions, Asia, Latin America, Africa, the Middle East, and Eastern Europe contributed relatively.

## METHODOLOGY

The data downloaded from Clarivate Analytics (formerly known as the Thomson Reuters and the Institute for Scientific Information) Web of Science (WOS) Core Collection database (Science Citation Index Expanded) database (SCI-EXPANDED) and imported into Microsoft Excel 2013. A total of 23,892 documents were identified in the Tamil Nadu Healthcare Professionals group of the SCI-EXPANDED publication from 2009 to 2018 using the name of all district in Tamil Nadu and refined all medical and Pharmacy related research areas were assessed by following aspects Publication Trends, Distribution of Journals, Research Areas, Institution based on publications, Country collaboration, Author Keyword. Some of the data taken from the Web of Science Core Collection is the data source for InCites Benchmarking & Analytics.

The keywords entered in web of science to accomplish the objective of this study were (AD=Tamilnadu OR AD=Tamil Nadu OR AD=Chennai OR AD=Vellore OR AD=Tiruvannamalai OR AD=Cuddalore OR AD=Villuppuram OR AD=Kancheepuram OR AD=Tiruvallur OR AD=Kallakurich OR AD=Chengalpattu OR AD=Tirupattur OR AD=Ranipettai OR AD=Coimbatore OR AD=Nilgiris OR AD=Dharmapuri OR AD=Erode OR AD=Dindigul OR AD=Karur OR AD=Namakkal OR AD=Krishnagiri OR AD=Tirupur OR AD=Thanjavur OR AD=Tiruchirappalli OR AD=Trichy OR AD=Pudukkottai OR AD=Nagapattinam OR

AD=Tiruvarur OR AD=Perambalur OR AD=Ariyalur OR AD=Kanyakumari OR AD=Madurai OR AD=Ramanathapuram OR AD=Tirunelveli OR AD=Virudhunagar OR AD=Sivagangai OR AD=Thoothukudi OR AD=Theni OR AD=Tenkasi OR AD=(Salem AND India) in the Advance search area than respected by medical field in the research areas.

**Refined by: RESEARCH AREAS:** (PHARMACOLOGY PHARMACY OR GENERAL INTERNAL MEDICINE OR IMMUNOLOGY OR OPHTHALMOLOGY OR ONCOLOGY OR SURGERY OR NEUROSCIENCES NEUROLOGY OR INFECTIOUS DISEASES OR PEDIATRICS OR CELL BIOLOGY OR RADIOLOGY NUCLEAR MEDICINE MEDICAL IMAGING OR GENETICS HEREDITY OR TROPICAL MEDICINE OR CARDIOVASCULAR SYSTEM CARDIOLOGY OR DENTISTRY ORAL SURGERY MEDICINE OR HEMATOLOGY OR ORTHOPEDICS OR UROLOGY NEPHROLOGY OR RESPIRATORY SYSTEM OR OBSTETRICS GYNECOLOGY OR INTEGRATIVE COMPLEMENTARY MEDICINE OR DERMATOLOGY OR MEDICAL INFORMATICS OR NUTRITION DIETETICS OR HEALTH CARE SCIENCES SERVICES OR VIROLOGY OR ENTOMOLOGY OR RHEUMATOLOGY OR MEDICAL LABORATORY TECHNOLOGY OR GEOCHEMISTRY GEOPHYSICS OR ANESTHESIOLOGY OR OTORHINOLARYNGOLOGY OR EMERGENCY MEDICINE OR NURSING OR ALLERGY OR MEDICAL ETHICS) Timespan: 2009-2018. Indexes: SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, ESCI, CCR-EXPANDED, IC.)

## RESULTS

The total amounts of Tamil Nadu Health Professionals articles during the research period were counted and displayed in Table 1. The trend is healthcare professionals the number of articles increased with multiply, even though

growth rate percent has little fluctuated and the average publication per year research output 2389 publications per year. During this review, 2016 had the largest number of publications. The growth rate for the three years 2011, 2017 and 2018 was much lower than the previous year.



**Table 1: Trend in Tamil Nadu Healthcare Professionals**

Publication Years	records	% of 23892	Trend
2009	1276	5.34	
2010	1449	6.07	0.73
2011	1425	5.96	-0.11
2012	1745	7.30	1.34
2013	1889	7.91	0.61
2014	1978	8.28	0.37
2015	3129	13.10	4.82
2016	3692	15.45	2.35
2017	3669	15.36	-0.09
2018	3640	15.24	-0.12
Total	23892	100.00	

The health professionals of Tamil Nadu who has contributed more papers included in WOS database has been analyzed and the listed

top ten productive authors have been shown in Table No.2. Author Ramasamy, Jegadeesh (n=240) 1% working in Shri Sathya Sai Medical College & Research Institute, Kancheepuram, got highest rank during the period of study. Christian Medical College & Hospital (CMCH) Vellore has four authors and Shri Sathya Sai Medical College & Research Institute has three authors among the top ten research results from Tamil Nadu medical professionals. Mohan, Viswanathan working at Madras Diabetes Research Foundation Dr Mohans Diabet Special Ctr, Chennai, Tamil Nadu, India got highest h-index (h-71) in the overall his publications.

**Table 2 : Author Contribution**

Sl. No	Label	Organization	WOS				TN HealthCare 2009-18	
			T.P	H-Index	Times Cited	Citing Articles	P	%
1.	Ramasamy, Jegadeesh	Shri Sathya Sai Medical College & Research Institute, Kancheepuram, India	296	7	355	344	<b>240</b>	<b>1%</b>
2.	Srivastava, Alok	Christian Medical College & Hospital (CMCH) Vellore Tamil Nadu, India	346	24	2891	2474	<b>215</b>	<b>0.90%</b>
3.	Kang, Gagandeep	Christian Medical College & Hospital (CMCH) Vellore Tamil Nadu, India	381	45	7748	5141	<b>194</b>	<b>0.81%</b>
4.	Mathews, Vikram	Christian Medical College & Hospital (CMCH) Vellore Tamil Nadu, India	298	24	2039	1670	<b>165</b>	<b>0.69%</b>
5.	George, Biju	Christian Medical College & Hospital (CMCH) Vellore Tamil Nadu, India	374	31	3649	3154	<b>164</b>	<b>0.69%</b>
6.	Shrivastava, Prateek S.	Shri Sathya Sai Medical College & Research Institute, Kancheepuram, India	206	8	366	356	<b>148</b>	<b>0.62%</b>
7.	Shrivastava, Saurabh R.	Shri Sathya Sai Medical College & Research Institute, Kancheepuram, India	329	9	438	426	<b>147</b>	<b>0.62%</b>
8.	Swaminathan, Soumya	Indian Council of Medical Research, New Delhi, India	344	51	22132	18496	<b>123</b>	<b>0.51%</b>
9.	Mohan, Viswanathan	Madras Diabetes Research Foundation Dr Mohans Diabet Special Ctr, Chennai, Tamil Nadu, India	669	71	27670	22194	<b>113</b>	<b>0.47%</b>
10.	Kumarasamy, Nagalingeswaran	CART CRS YRGCARE Med Ctr, VHS Infect Dis Med Ctr, Chennai, Tamil Nadu, India	319	39	9901	8248	<b>112</b>	<b>0.47%</b>

**Table 3: Ranking of Journals**

Sl. No.	Source Titles	IF 2018	H-Index	SJR 2018	Quartile	records	% of 23892
1.	Journal of Evolution of Medical and Dental Sciences -JEMDS	N/A	N/A	N/A	N/A	888	3.71
2.	Journal of Clinical and Diagnostic Research	N/A	28	0.35	Q3	721	3.01
3.	Indian Journal of Ophthalmology	0.977	43	0.42	Q3	457	1.91
4.	International Journal of Pharmaceutical Sciences and Research	0.83	N/A	N/A	N/A	315	1.31
5.	Indian Journal of Medical Research	1.251	75	0.62	Q2	309	1.29
6.	Journal of Pharmacy and Bio Allied Sciences		27	0.32	Q2	272	1.13
7.	Indian Pediatrics	1.163	46	0.34	Q3	247	1.03
8.	Neurology India	2.708	43	0.38	Q3	236	0.98
9.	Indian Journal of Pediatrics	1.136	43	0.36	Q3	231	0.96
10.	Investigative Ophthalmology Visual Science	3.812	196	1.93	Q1	198	0.82

The IF was reported according to Web of science Incites journal citation reports 2018 & SJR Top 10 journals are displayed in the table no 3. Journal of Evolution of Medical and Dental Sciences -JEMDS got the highest score (n=888) with the first rank and some of the journal citation reports are not available in the Incites journal

citation report. Most of the journals based on Q3 Indian journals. n=721 articles (3.01%) were published in the Journal of Clinical and Diagnostic Research whereas n=457 (1.91%) were published in the Indian Journal of Ophthalmology.

**Table 4: Research Areas**

Research Areas	Incites			TN HealthCare 2009-18	
	WOS Doc	Times Cited	% Docs Cited	records	% of 23892
Pharmacology Pharmacy	1450579	24,888,836	72.98%	4542	19.011
General Internal Medicine	707006	6,263,921	43.25%	3047	12.753
Immunology	1061235	26,607,503	71.50%	1805	7.555
Ophthalmology	468144	5,154,115	57.01%	1580	6.613
Oncology	1604787	29,410,949	59.93%	1476	6.178
Surgery	1413710	18,235,897	66.13%	1356	5.676
Neurosciences Neurology	1545603	41,182,154	69.64%	1349	5.646
Infectious Diseases	457334	8,493,396	75.46%	1116	4.671
Pediatrics	666914	7,580,836	63.61%	1103	4.617
Cell Biology	1271284	39,639,853	65.10%	1036	4.336

The top ten research areas related to medical subjects are shown in table no.4. ‘Pharmacology Pharmacy’ area is used in the majority of n=4542 (19.01%) articles followed by the research areas ‘General Internal Medicine’ that appears in n=3047 (12.75%) articles and ‘Immunology’ that appears in n=1805 (7.55%)

articles. The total number of documents and times cited counts are collected from WoS incites related to medical subjects. In this incites data the research areas ‘Infectious Diseases’ (75.46%) got the most cited count by authors than ‘Pharmacology Pharmacy’ got second highest cited (75.98%) in the top ten research areas.

**Table 5 : Prolific Organizations**

Sl. No.	Organization	Incites				TN HealthCare 2009-18	
		T.P.	Category Normalized Citation Impact	Times Cited	% Docs Cited	T.P	%
1.	Christian Med Coll & Hosp	7792	0.93	88878	69.66%	<b>3320</b>	<b>13.90</b>
2.	Annamalai Univ	7570	0.75	98627	81.1%	<b>852</b>	<b>3.57</b>
3.	Univ Madras	9956	0.62	119529	80.26%	<b>787</b>	<b>3.29</b>
4.	VIT Univ	11660	0.97	75317	62.38%	<b>674</b>	<b>2.82</b>
5.	Sri Ramachandra Univ	1357	2.49	32883	65%	<b>664</b>	<b>2.78</b>
6.	Sankara Nethralaya	N/A	N/A	N/A	N/A	<b>581</b>	<b>2.43</b>
7.	Bharathiar Univ	6099	0.93	72475	76.16%	<b>553</b>	<b>2.31</b>
8.	Anna Univ	16957	0.72	165584	69.35%	<b>476</b>	<b>1.99</b>
9.	SRM Univ	3249	0.81	19735	58.11%	<b>418</b>	<b>1.75</b>
10.	Bharathidasan Univ	4916	0.82	65227	82.49%	<b>407</b>	<b>1.70</b>

**Table 6: International collaboration**

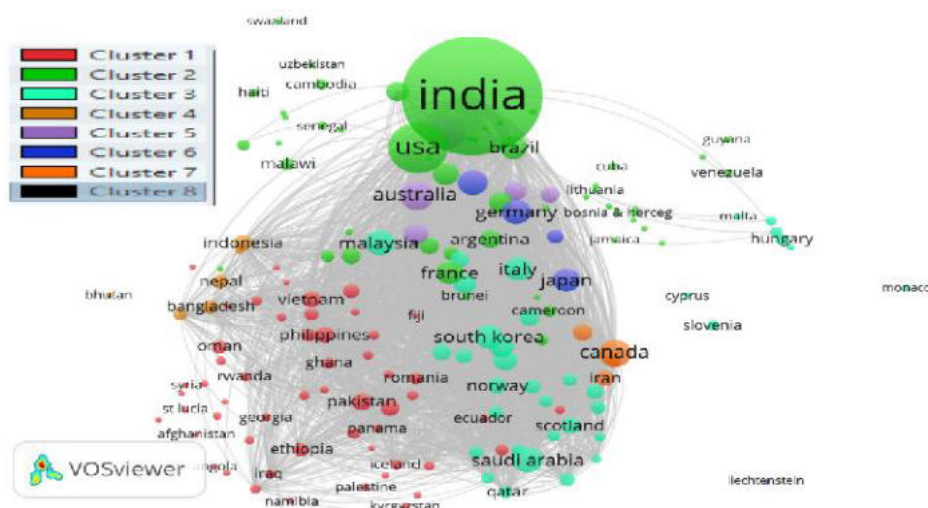
Country	Continent	Total Link Strength	Cluster	Documents	% of 23892
<b>India</b>	<b>Asia</b>	<b>171</b>	2	<b>23849</b>	99.82
<b>USA</b>	America	171	2	2606	10.91
<b>England</b>	Europe	171	5	877	3.67
<b>Australia</b>	Oceania	170	5	583	2.44
<b>Canada</b>	America	170	7	550	2.30
<b>Peoples R China</b>	Asia	171	6	463	1.94
<b>Saudi Arabia</b>	Asia	168	3	446	1.87
<b>Malaysia</b>	Asia	170	3	431	1.80
<b>Germany</b>	Europe	168	6	419	1.75
<b>South Korea</b>	Asia	165	3	419	1.75
<b>Japan</b>	Asia	168	6	386	1.62



Table 5 shows that Christian Med College & Hospital, Vellore is the most productive organization with n=3320 (13.90%) articles followed by Annamalai Univ with n=852 (3.57%) articles and the University of Madras with n=787(3.29%) articles. As per the incites data Anna University to have the highest total publication

n=16957 followed by the University of Madras (n=119529). Annamalai University got the highest percent of the document cited 81.1% followed by the University of Madras 80.26%. Sri Ramachandra University has the highest category Normalized citation impact with 2.49% followed by VIT University 0.97%.

Cluster	No of Country
1	60
2	54
3	35
4	8
5	7
6	6
7	5
8	1
Total	176



Top 10 collaborated countries are listed in table 6. A total of 176 countries are published in the above-mentioned publications. Countries are divided into eight clusters, (cluster no 1=60 countries, 4=8 countries,8=1 country) are not in the top ten countries. The United States is the most collaborated country with India with n=2606(10.91%) followed by England n=877(3.67%). India, United States, England and Peoples R China those countries got high total link strength with 171. Most of the Asian continent countries have collaborated with India.

### DISCUSSIONS

Many countries, the development of research culture is hampered by low priority and budgetary constraints. An evaluation of the overall status of

research related to Tamil Nadu health can serve as an important measure of whether the policy goals and objectives of a state have been achieved. This study highlights the accomplishments of Tamil Nadu in the past years in his medical education institutions based on medical science and medical research culture.

The results of this study show a gradual improvement in the parameters of a research society of quality. However recently there has been s steady decline in the publication of medical and medical reseated research publications. The most important issue here is the distribution of budgets for health and medical studies, which may represent low access to research funding by Tamil Nadu medical professionals. This may indicate a

lack of interest on the part of health professionals and government sector funding agencies in creating an atmosphere that facilitates grant securing.

The Indian government has been taking a lot of steps to promote medical and medical research during the past decades. Indian Institute of Technology-Madras (IIT-M) and Ricovr Inc (US-based medical device manufacturing company) planning to collaborate for research on point-of-care medical device development in Dec 2019. ("Times of India," 2019). The government's apex research body Indian Council of Medical Research (ICMR) planning to bring new medical regulations for stem cell therapy research for the development of stem cell research and creates a new task for gene therapy research also. ("The Hindubusinessline," 2019; "Times of India," 2019).

There was a lack of adequate awareness and positive attitude is potential barriers and difficulties in carrying out the research (Chellaiyan, Manoharan, Jasmine, & Liaquathali, 2019) There are a range of challenges that need to be tackled to enhance student involvement in clinical research such as lack of interest, funding, and limited availability of research mentors and access to scientific repositories to enhance clinical research participation.(Kumar et al., 2019) There is a need for a safe and encouraging atmosphere to develop research skills and knowledge and to address obstacles to scientific research.(Kyaw Soe et al., 2018) Improving research methodology teaching and dedicating structured-protected scholarship time are strategies to improve research output in

international medical academic centers.(Nair, Ibrahim, Almarzoqi, Alkhemeiri, & Sreedharan, 2019) Currently, there are several social media like WhatsApp, Facebook, Twitter, and Tiktok are barriers to undertaking international research.

## CONCLUSION

There was a lack of adequate awareness and a positive attitude in most medical students, so we must create awareness through training programs and workshops. The obstacles can be partially reduced by improving the mindset and attitude towards research and collaboration and proper preparation of the education budget and the management of the university is promoting medical research. The students must involve with a moderately high positive attitude toward medical research.

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