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India's Contribution in Neglected tropical diseases: A Scientometrics Study

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Abstract

Neglected Tropical Diseases (NTDs) are a group of parasitic and bacterial infections that are prevalent in tropical and subtropical regions. These diseases mainly affect improvised people of developing countries living in abject poverty. These are called "neglected" because they are often overlooked by the mainstream healthcare systems, despite their significant impact on public health. India has a large burden of NTDs and has made significant progress in developing and implementing interventions to control and eliminate these diseases. It is important to note that Indian researchers and institutions contribute to global research efforts in various fields, including neglected tropical diseases (NTDs). In this context, this paper is a scientometric assessment of Indian authors' contribution in NTDs. For this purpose, scholarly publication data was downloaded form the Scopus® database of Elsevier science. The study observed developed countries particularly the US and UK are predominant in research on NTDs. Among the 'Global South' Brazil and India ranked third and fourth respectively. Indian scholarly output contributes about 6 percent of global contribution. For some diseases, Indian researchers contributes significantly. For example, in Leprosy research India is at the top with 18 percent of publication. For some diseases Indian contributions are comparatively less. This is due to the variation in disease conditions and also in local or regional focus in research. Hence a south-south cooperation is required for a detail investigation and preventions of NTDs.

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1. Introduction

According to World Health Organization, Neglected Tropical Diseases (NTDs) are a diverse group of 20 disease conditions that are mainly prevalent in tropical areas of the globe[1]. Neglected Tropical Diseases are identified as 'neglected' because in global health agenda these diseases are almost absent or neglected. These diseases are never got much attention from past, and are mostly seen in the poor and under-developed countries of global south. These diseases are thriving in the regions where water quality, sanitation and access to health care are very poor standard, and are also ignored by global funding agencies. India being a developing country also suffer from various neglected diseases. These diseases are caused by a variety of pathogens including viruses, bacteria, parasites, fungi, and toxins. NTDs affect more than one billion people from the impoverished communities globally. These diseases cause devastating health, social and economic consequences as there are no available or affordable products for prevention or treatment. Research and development (R&D) for these diseases is still a low priority on the global health agenda[1].

Research on NTDs is critical for the development of effective treatments and prevention strategies. There are ongoing efforts to improve understanding of the biology and transmission of NTDs, as well as to develop new drugs, vaccines, and diagnostic tools. Research on NTDs is often carried out through collaborative efforts involving government agencies, non-governmental establishments, universities and academic institutions, pharmaceutical companies, and the private sector. Funding for NTD research is provided by verities of sources, including government agencies, philanthropic organizations, and private industry. The World Health Organization (WHO) has also established a Global Health Observatory[2] to monitor the progress towards NTD control and elimination of the diseases and facilitate the sharing of research findings and best practices.

There are several Scientometrics research available on Neglected Tropical Diseases (NTDs) covering various countries. There are many studies dealt with NTDs on a particular country's context. However, there are no significant studies covering all NTDs mainly in Indian context. In this background, this paper is adding value to the existing filed of knowledge by investing the global research trends in terms of scholarly literature publication patterns and Indian contribution in this area.

The article has the following sections; literature review, objectives, methodology, results and concluding remarks.

2. Literature Review

There are several bibliometrics studies available on neglected diseases. For example, there are studies on global research trend on Mycetoma[2], publication trends of NTDs from Latin America and the Caribbean[3] leishmaniasis[4] schistosomiasis research in Southeast Asia[5] and so on. In terms of productivity, the bibliometric studies on Neglected Tropical Diseases (NTDs) shows that Sudan, India, the Netherlands, and Mexico were the top-ranking productive countries[1]. The publication trend of NTDs globally increasing in recent years. For example, schistosomiasis research shows that between 1908 and 2020 from the South-East Asian (SEA) countries shows that the number of publications have increased[5].

In the field of neglected tropical disease India is the most extensive hotspots. However, among the developing countries Brazil came in second position in terms of scholarly publication[1] There are some significant researches on dengue and Scientometrics measurements shows that the research on dengue is consistant[6]; and USA, India, Brazil, UK published highest number of articles[7][8]. There was a negative growth rate shows in Buruli ulcer from past few years[9]. On chagas disease[10] Brazil and the USA are currently leading the research on this subject, with very little contributions from the developin countries[11].

On leishmaniasis, Brazil has the most scientific production, followed by USA and India[12]. NTDs with the highest number of publications in the world were dengue and leishmaniasis, in the last decade; US, UK, had the most collaboration in performing the studies of this disease with each other[3][4]. Especially Canadian researcher have produced significant numbers of researches on leishmaniasis, African sleeping Sickness and Leprosy[13][14].

Although there are many Scientometrics research articles on various disease conditions in global context. There are comparatively less number of research articles available from Indian on various disease conditions. In Indian context, there are studies on leishmaniasis[12]. Dengue [8][15], rabies[16]. Further analysis shows that a strong growth of publications observed on lymphatic filariasis during 2009 to 2018[17]. Studies shows that Indian researchers did significant research on Mycetoma. India was the second most producing country followed by Sudan. For the neglected disease rabies, National Institute of Mental Health, and Neurosciences (NIMHANS) Bangalore was the most productive institution from India[16].

Scientometrics assessment involves analysis and quantification of scientific research, such as publication patterns, citation analysis, authorship, and collaboration and so on. Although there are many Scientometrics research available on this topic, comprehensive research including all neglected diseases in Indian context is significantly limited. In this context this research is a Scientometrics assessment of all tropical neglected disease in Indian context. Scientometrics study on this topic aims at a deep understanding the dynamics of scientific research in this field. While doing so, this study is going to ask the following research question: What is the total publication count of all the NTDs? What is the year wise trends in publications? What are the trends of publications from India and where Indian research situated in NTD research?

3. Objectives

To address those research questions raised above, this study will be guided by the following research objectives:

- Global growth of scholarly literature in all identified NTDs
- Year wise cumulative growth of publications globally
- Year wise publication growth from India in all NTDs.
- India’s publication ranking in various diseases.

4. Methodology

Scholarly literature data for this research was searched and retrieved form the Scopus® database of Elsevier science. Scopus is a bibliographic database of peer-reviewed scholarly literature, indexing articles, book series, conference proceedings, and trade publications and so on. Scopus has a very vide coverage encompassing many scholarly journals books and other forms of publications from the universe of subjects, including science, technology, medicine, social sciences, and humanities. The database provides information on citations, abstracts, and references from over 24,000 peer-reviewed journals from more than 5,000 publishers, as well as other types of content, such as books and conference proceedings. Scopus is widely used by researchers, universities, and institutions to search, track, and evaluate research literature. From World Health Organization's website (https://www.who.int/health-topics/neglected-tropical-diseases#tab=tab_1) the list of NTDs were collected and records were searched for each disease and the disease-causing microorganisms. The Boolean Logic "OR" applied to combine search strings to retrieve the publications records of the respective disease conditions. The total publication records both form global as well as Indian context were searched by combining the search strings. The detail search strings is presented in Appendix I.

5. Results

Scholarly literature was searched for the respective disease conditions using "Keyword" search field. The search was refined from the search results using various search filters. For example, the publication records for the year 2023 were removed because the year is not complete. Finally, a total of 523,389 records were retrieved using the search terms for each disease and the causative microorganism for each disease. The country wise contribution of articles shows that the United States has 115,624 (22.09%) articles followed by United Kingdom 42,466 (8.11%) and Brazil 36,964 (7.06%). For an in-depth analysis, Indian records were filtered. A total of 30,694 (5.86%) records were retrieved from the publications of Indian authors. With this number India's contribution is 4th globally. The results are presented in Table 1

Table 1. The number of records for each disease and the records from India

Sl. No	Name of the neglected disease	Total records globally	Top producer country (Number of records)	Records from India	Indian rank with respect to global publication	% of publications from India
1	Buruli Ulcer	1,898	United States (487)	48	14th	2.53
2	Chagas Disease	27,942	Brazil (9670)	266	19th	0.95
3	Dengue	51,707	United States (14925)	5295	2nd	10.24
4	Chikungunya	7793	United States (2167)	1098	2nd	14.09
5	Dracunculiasis (Guinea Worm Disease)	1273	United States (278)	84	4th	6.60
6	Echinococcosis	27,541	Turkey (2253)	1325	4th	4.81
7	Food born trematodiases	11,621	United States (1132)	433	10th	3.73
8	Human African Trypanosomiasis (African Sleeping Sickness)	16,517	United States (4400)	219	22nd	1.33
9	Leishmaniasis	48,684	United States (8741)	4448	3rd	9.14
10	Leprosy (Hansen's Disease)	34,016	India (6137)	6137	1st	18.04
11	Lymphatic Filariasis	37,339	United States (8518)	2962	3rd	7.93
12	Mycetoma	2991	United States (494)	311	2nd	10.40
13	Chromoblastomycosis and other deep mycoses	74,461	United States (21537)	3221	8th	4.33
14	Onchocerciasis (river blindness)	8,131	United States (2154)	148	17th	1.82
15	Rabies	20,555	United States (4780)	1053	5th	5.12
16	Scabies and other ectoparasitoses	7,188	United States (1403)	482	3rd	6.71
17	Schistosomiasis	42,891	United States (8849)	440	22nd	1.03
18	Soil-transmitted Helminths (STH)	46,314	United States (10788)	1867	8th	4.03
19	Snake bite envenoming	5,339	United States (942)	598	2nd	11.20
20	Taeniasis/Cysticercosis	13,360	United States (2066)	1288	2nd	9.64
21	Trachoma	38,469	United States (11642)	707	13th	1.84
22	Yaws and other endemic treponmatoses	47,907	United States (11265)	1338	6th	2.79

As seen from the table 1 Chromoblastomycosis and other deep mycoses have the highest number of publication (74,461) followed by Dengue (51,707), Leishmaniasis (48,684), Yaws and other endemic treponmatoses (47,907) and so on. However, from India, Leprosy (Hansen's Disease) tops with (6,137) publications followed by Dengue (5,295), Leishmaniasis (4,448), and Chromoblastomycosis and other deep mycoses (3,221). With respect to the global publications, in terms of percentage, research articles on Leprosy (Hansen's Disease) constitute about 18.04 % followed by Chikungunya 14.09 %, Snake bite envenoming 11.20 % Mycetoma 10.40 % Dengue 10.24 %.

Hence, there is a clear trend emerged form the publication pattern. Indian research focus is not aligned with the global research trends. This is because of the Indian research may have a local or regional focus. However, Indian researchers and institutions contribute to global research efforts, including research on neglected tropical diseases. In this context, collaboration and partnerships between Indian and international researchers are critical to advancing research and control

efforts for NTDs and improving public health outcomes globally.

5.1. Growth of publications

Among the total 523, 389 research articles available globally on these diseases, the earliest record was available in the year 1829. Significant numbers of publications are available from the year 1945 onwards. So, it can be observed from the literature growth pattern, the research on NTDs is quite old and get world focus even before the term “Neglected Tropical Disease” was used by the WHO in early the early 2000s.

Form India, the three research articles were available in the year 1946. The year between 1946-1972 there was not much growth in research articles. Perhaps, at that time Indian research was not that much emphasized or Research and Development infrastructure was not that developed. However, it is perhaps an inconclusive and requires further investigations. After that there was a visible growth of publication from India as well as globally. From the last a couple years trends it can be concluded that India is contributing about 1,700 articles annually in the global research landscape (Table 2).

Table 2. Year wise growth of publication

Year	Number of publications globally	Number of publications from India
2022	18946	1701
2021	21142	1753
2020	19417	1525
2019	17325	1358
2018	16902	1368
2017	16221	1401
2016	15802	1329
2015	15714	1341
2014	15283	1295
2013	14800	1213
2012	14419	1228
2011	13850	1162
2010	12882	923
2009	12567	803
2008	11877	808
2007	10919	697
2006	11145	662
2005	10161	600
2004	9776	594
2003	9599	517
2002	8813	439

2001	8218	386
2000	7744	366
1999	7833	368
1998	7504	354
1997	7051	307
1996	6418	286
1995	6602	303
1994	6645	313
1993	6425	326
1992	6475	335
1991	6285	349
1990	6530	396
1989	6116	299
1988	5996	259
1987	5475	204
1986	5564	178
1985	5732	243
1984	5348	223
1983	5069	219
1982	5247	211
1981	4652	227
1980	4502	202
1979	4867	241
1978	4497	195
1977	4137	189
1976	4126	177
1975	4110	187
1974	4541	190
1973	4605	195
1972	3537	52
1971	3203	20
1970	2990	14
1969	3212	18
1968	3093	27
1967	2967	16
1966	2611	16
1965	2663	10
1964	2818	12
1963	2348	5
1962	1648	8
1961	1616	5

1960	1573	5
1959	1474	5
1958	1577	8
1957	1764	5
1956	1706	6
1955	1777	4
1954	1722	1
1953	1863	1
1952	1907	
1951	1975	1
1950	1703	1
1949	1147	2
1948	1443	1
1947	1349	3
1946	1247	3
1945	574	

5.2. Growth Pattern

The year wise growth patterns of literature of the NTDs shows that there was an initial incubation stage. After that there was an exponential growth of literature globally. The drop in publication in the last year was due to the incomplete coverage of the database (Figure 1).

The growth of publication from India was always a linear (Figure 1). Indian researchers have contributed to important discoveries and advancements in NTD research. Indian researchers have also been involved in the development of a new vaccine and diagnostic tools for many NTDs.

It has been observed from various studies that Indian institutions and researchers are also involved in global partnerships and collaborations focused on various diseases. For example, the Indian Council of Medical Research (ICMR) collaborates with the World Health Organization (WHO) on research and control initiatives for NTDs [18]. Studies have observed that about one third of new drugs and two thirds of new vaccines (including the world's first leprosy vaccine) for NTDs are registered since 2000 are contributed by Indian researchers[19].

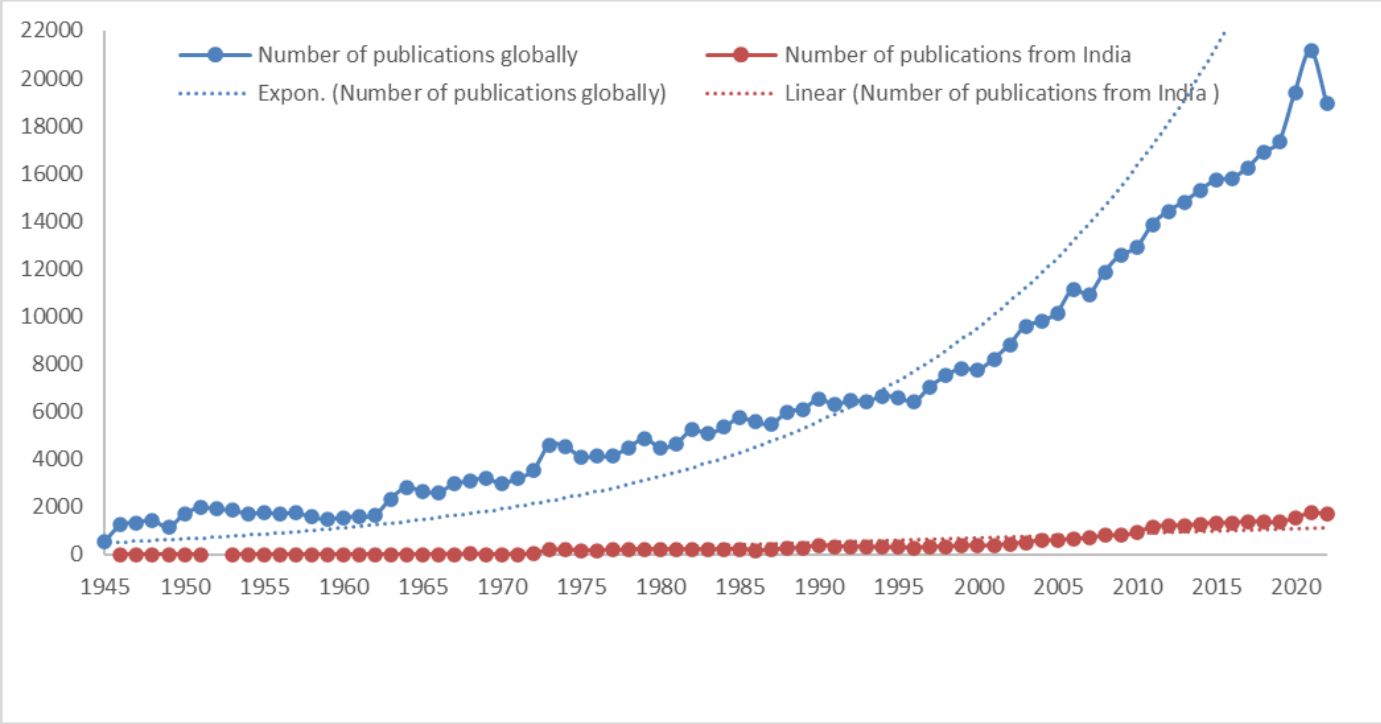

Figure 1. Research publication trends of NTDs

6. Concluding remarks

The term "neglected diseases" was coined in the early 2000s by the WHO to describe a group of infectious diseases. These types of diseases disproportionately affect people in developing countries particularly in the low-income countries located particularly in the global south. For these types of disease there are inadequate prevention and treatment options. NTDs pose significant burden on public health globally. Predominantly in developing and low-income countries, these diseases often cause deformity, disability, and loss of productivity. This in the long run causes heavy increase in healthcare costs for the nation. Efforts to control and eliminate these diseases require a multidisciplinary approach, including improved access to healthcare, preventive measures, and effective treatments.

Research articles published in the peer reviewed journals are one of the indicators of research and development (R&D) activities. From the scholarly publication record of Scopus database, it is observed that globally there is a significant growth in the scholarly publications on NTDs. So, it can be said that research on NTDs is getting world attention. However, as it is evident from the analysis of scholarly publication data that US and UK are the two top most countries of publication. Brazil and India are the countries ranked second and third respectively in terms of publication. As these types of diseases affect developing countries' population, focused research might be emphasized to solve local problems with local solution. The countries where these types of diseases are prevalent, should put more research emphasis and research funding.

While it is true that research conducted in India may have a more local or regional focus, as seen from the research productivity of various diseases. It is important to note that Indian researchers and institutions also contribute to global

research efforts in various fields, including neglected tropical diseases (NTDs).

Developing countries in Global South has a large burden of NTDs hence a concentrated south-south cooperation is required to make progress in developing and implementing interventions to control and eliminate these diseases. Particularly South-south cooperation between India and Brazil is required to promote research and other development programs to address the challenges of NTDs. Various form of partnership and solidarity between countries in Global south particularly among the Brazil, Russia, India, China, and South Africa (BRICS) group of countries, which share similar socio-economic backgrounds will help to address the issue further.

The study is a Scioentometric study of NTDs in terms of growth of literature and the publication pattern. It also further analyzed India's contribution in this field of research. A further study using various bibliometrics tools including the core journals, author's productivity patterns, collaboration patters (using social network analysis tools), major funding agencies and other issues will add further value to understand the dynamics of the NTD research globally as well as country specific.

Footnotes

[1] Neglected tropical diseases, World Health Organization available at: https://www.who.int/health-topics/neglected-tropical-diseases#tab=tab_1

[2] The Global Health Observatory, Available at: https://www.who.int/data/gho

Appendix I: Search string

(KEY (buruli AND ulcer) OR KEY (mycobacterium AND ulcerans)) OR (KEY (chagas AND disease) OR KEY (trypanosoma AND cruzi) OR KEY (american AND trypanosomiasis)) OR KEY (dengue OR aedes) OR KEY (chikungunya) OR (KEY (guinea AND worm AND disease) OR KEY (dracunculus AND medinensis) OR KEY (dracunculiasis)) OR (KEY (echinococcosis) OR KEY (echinococcus) OR KEY (cystic AND echinocccosis) OR KEY (alveolar AND echinococcosis)) OR (KEY (foodborne AND trematodes) OR KEY (clonorchis OR opisthorchis OR fasciola OR paragonimus)) OR (KEY (african AND trypanosomiasis) OR KEY (sleeping AND sickness) OR KEY (trypanosoma AND brucei)) OR (KEY (leishmaniasis) OR KEY (leishmania)) OR (KEY (leprosy) OR KEY (hansen's AND disease) OR KEY (mycobacterium AND leprae)) OR (KEY (lymphatic AND filariasis) OR KEY (filariasis) OR KEY (lymphedema OR elephantiasis OR hydrocele)) OR (KEY (mycetoma) OR KEY (actinomycetoma) OR KEY (eumycetoma)) OR (KEY (chromoblastomycosis) OR KEY (fonsecaea AND pedrosoi) OR KEY (cladophialophora AND carrionii) OR KEY (phialophora AND verrucosa) OR KEY (mycoses)) OR (KEY (onchocerciasis) OR KEY (river AND blindness) OR KEY (onchocerca AND volvulus) OR KEY (blackflies) OR KEY (simulium)) OR KEY (rabies) OR (KEY (scabies) OR KEY (ctoparasitoses) OR KEY (sarcoptes AND scabiei AND mite)) OR (KEY (schistosomiasis) OR KEY (bilharzia) OR KEY (cercariae) OR KEY (schistosoma)) OR (KEY (soil-transmitted AND helminths) OR KEY (helminth) OR KEY (ascaris) OR KEY (whipworm) OR KEY (trichuris AND

trichiura) OR KEY (hookworm) OR KEY (ancylostoma AND duodenale) OR KEY (necator AND americanus)) OR (KEY (snake AND bite AND envenoming) OR KEY (snake AND bite)) OR (KEY (taeniasis) OR KEY (taenia AND saginata) OR KEY (taenia AND solium) OR KEY (taenia AND asiatica) OR KEY (cysticercosis) OR KEY (taenia)) OR (KEY (trachoma) OR KEY (chlamydia AND trachomatis) OR KEY (chlamydia)) OR (KEY (yaws) OR KEY (endemic AND treponematoses) OR KEY (treponema) OR KEY (syphilis OR bejel OR pinta)) AND (EXCLUDE (PUBYEAR, 2024) OR EXCLUDE (PUBYEAR, 2023))

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