Original Article

Emerging Trends, Collaboration, and Impact of Global Scientific Production on Tuberculosis and Human Immunodeficiency Virus Coinfection: A Bibliometric Study

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Abstract

Background: Human immunodeficiency virus (HIV) and tuberculosis (TB) coinfection represents a serious public health problem that requires new approaches for its prevention and comprehensive management. Therefore, the aim of this study was to analyze the bibliometric profile of the worldwide scientific production on TB and HIV coinfection. **Methods:** Bibliometric study that retrieved publications indexed in Scopus, from the design of a search strategy based on Medical Subject Heading terms and logical operators. The sample consisted of 219 articles, whose metadata were analyzed with SciVal, VOSviewer, and RStudio. **Results:** Between 2017 and 2018, there was a notorious interest in the interrelationship between HIV and TB, as well as in the role of *Mycobacterium tuberculosis* in the context of acquired immunodeficiency syndrome. The United States and South Africa clustered the most publications. On the other hand, the most productive authors have a US Institution affiliation, Brust James CM and Gandhi Neel R had seven publications. The categories of "Infectious Diseases" and "Microbiology (medical)" accumulated 94 and 35 publications. In addition, the most productive journals were PLOS One and the International Journal of TB and Lung Disease, while clinical infectious diseases had the best CiteScore 2021 (17.3). **Conclusions:** Scientific production has been mainly disseminated in high-impact journals, with a slight increase in recent years. The United States is the leading and most influential country, followed by South Africa; in addition, Brust James CM, an American National, is recognized as the most productive.

Keywords: Bibliometric analysis, human immunodeficiency virus coinfection, tuberculosis

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Introduction

Tuberculosis (TB) is an infectious pathology caused by *Mycobacterium tuberculosis* (Mtb) and represents a major public health problem for several countries, especially drug-resistant TB and multidrug-resistant TB.[1] Treatment regimens are the main mechanisms for the effective control of this disease; therefore, lack of adherence to treatment has a negative impact on people's health,[2] generating greater morbidity and earlier mortality, especially in regions with poor socioeconomic, clinical, and therapeutic conditions.[3]

In addition, it is recognized that human immunodeficiency virus (HIV) infection is one of the main factors for developing TB,[4] since it contributes to a decrease in immune capacity that leads to an increased risk of infection, reinfection, or reactivation.[5] On the immunological side, CD4 T-cell depletion and multiple pathways of macrophage dysfunction occur due to HIV progression, increasing the risk of active TB, although this synergy is not entirely clear.[6]

By the year 2020, there were estimated to be 37.7 million HIV cases and 9.9 million new cases of TB;[7,8] furthermore, approximately 8% of these new cases occurred in HIV-infected

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persons.[8] As pointed out by Pawlowski *et al*.,[9] over time TB/HIV coinfection has placed a great burden on health systems and presents new therapeutic and diagnostic challenges, especially in a scenario, in which this coinfection is more prevalent in children and adults living in poverty, with a greater risk of death or hospitalization.[10]

Currently, the supply of HIV services and programs is in a transcendental dilemma to improve the quality of care while incorporating efforts to reduce TB cases.[11] In this context, the identification and treatment of people with TB are essential to interrupt transmission,[12] therefore, it is necessary to strengthen its control and prevention, especially in patients with HIV due to their immunosuppression, and especially if they are exposed to health-care settings, due to nosocomial transmission.[10]

The scientific production in this area is increasingly relevant for public health, so its bibliometric exploration is necessary. This methodology allows an understanding of the impact of publications, their scope, new trends in each field of research, and the dynamics of scientific activity.[13] Therefore, this study aims to analyze the bibliometric characteristics of scientific publications worldwide on TB and HIV coinfection.

Methods

Study design and data source

A descriptive, retrospective study with bibliometric methodology was carried out to analyze the current state of the global production indexed in Scopus on TB and HIV coinfection.

Search strategy

In principle, the search and selection of appropriate keywords for the systematic search were carried out; in this regard, terms available in the Medical Subject Heading thesaurus were included, which, together with the Boolean operators AND and OR, allowed the following search equation to be defined:

TITLE-ABS ([“Tuberculosis” OR “Tuberculoses” OR “Koch disease” OR “Koch’s Disease” OR “Koch Disease” OR “*Mycobacterium tuberculosis* Infection” OR “Infection *Mycobacterium tuberculosis*” OR “Infections *Mycobacterium tuberculosis*” OR “*Mycobacterium tuberculosis* Infections”] AND [“HIV coinfection*” OR “coinfection* HIV”]) AND (LIMIT-TO [PUBYEAR, 2022] OR LIMIT-TO [PUBYEAR, 2021] OR LIMIT-TO [PUBYEAR, 2020] OR LIMIT-TO [PUBYEAR, 2019] OR LIMIT-TO [PUBYEAR, 2018] OR LIMIT-TO [PUBYEAR, 2017]). The query date was May 8, 2023, limiting the search to the title and abstract fields.

Selection of studies

The result of the search was 271 publications. The criteria for including publications were (1) original publications on TB and HIV coinfection, (2) publications indexed in Scopus between 2017 and 2022, and (3) from all languages; whereas the exclusion criteria were (1) being review articles (33), book chapters (8), errata (5), conference article (2), notes (2), and short surveys (2). After the selection process, the study sample was 219 articles [Figure 1].

Data analysis

Before the analysis, the data from the selected articles were exported to generate the bibliometric indicator reports with the SciVal tool. Visibility, impact, and productivity parameters were estimated according to authorship, research subarea, and scientific journal. The metadata exported in comma separated value (CSV) format were analyzed with the bibliométrix module of the RStudio software version 4.2.3. In addition, citation visualization networks by country were designed with the VOSviewer version 1.6.19 program.

Results

Sankey plot on the flow of scientific production

During the period from 2017 to 2018, there was a noticeable interest in the interrelationship between HIV and TB, as well as the role of Mtb in the context of acquired immunodeficiency syndrome. In addition, a specific focus on the connection between Mtb and Colombia was observed during that time range. TB remained a relevant research topic throughout 2017–2019. In 2019, the interaction between HIV and TB was highlighted, as well as the connection between Colombia and TB. In 2020, a particular focus on Ethiopia was evident, both in relation to HIV infection and TB [Figure 2].

Three-field-plot analysis

Scientific production on TB and HIV coinfection was mainly represented by Gandhi NR, Brust JCM, and Mlisana K who showed participation and links with the productivity of countries such as the United States and South Africa. The

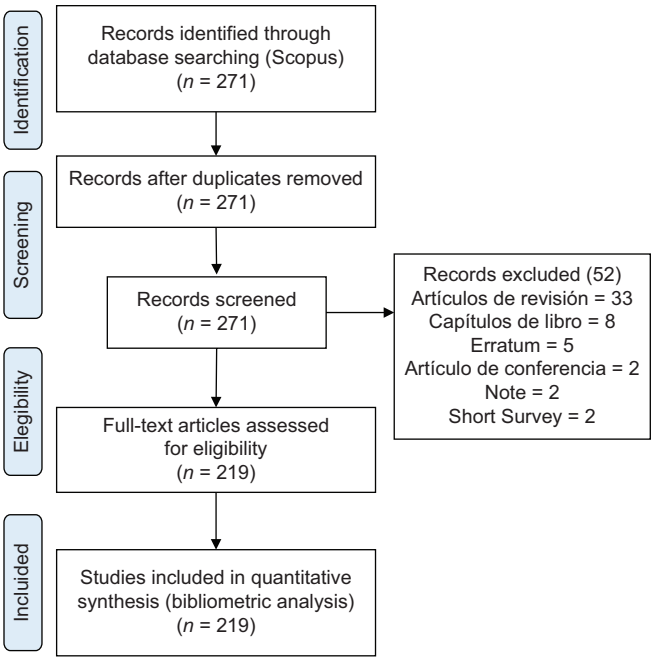


Figure 1: Flowchart for the selection of scientific publications

journals Antimicrobial Agents and Chemotherapy, Clinical Infectious Diseases, and PLOS One were the most influential in this field of knowledge [Figure 3].

Co-citation by country

The citation network by country shows seven clusters, of which the purple and yellow ones are headed by the United States and South Africa, respectively, which in turn grouped the most publications and show citations among their documents. In addition, the role of Brazil, in the red cluster, in the citation of published articles stands out [Figure 4].

Top 5 authors with the largest production

The most productive authors are affiliated to an American Institution, both Brust James CM and Gandhi Neel R had five publications, although the former had a greater impact, with 13% more expected citations compared to the average number of global citations. The University of Cape Town, South Africa, had two authors in the top five with the highest output, although Mlisana, Koleka *P* had the most citations per publication [Table 1].

Top 10 subcategories with the highest production

Among the subcategories, in which publications on TB and HIV coinfection were positioned, "Infectious Diseases" and "Microbiology (medical)" accumulated 94 and 35 articles publications, the latter having the highest impact (10.3 citations per publication). On the other hand, articles in the subcategories of "Pharmacology (medical)" and "Health Policy" had a better weighting of citations received, with 1.01 and 1.25, respectively [Table 2].

Top 10 scientific journals with the highest production

Among the scientific journals with the highest predilection for dissemination, the US journals were positioned in the Q1 quartile and the most productive were PLOS One (10) and Antimicrobial Agents and Chemotherapy (7), which is one of the journals with the best SCImago Journal Rank (1.546). The UK Journal of Clinical Infectious Diseases has the best CiteScore 2021 (17.3) and Source-Normalized Impact per Paper (3.151). The *Revista Chilena de Infectologia* and Biomedica, from Latin America, achieved a good position among the leading journals in this field [Table 3].

Discussion

The control of the spread of TB, as well as the management of complications in people infected with HIV, has become a global research priority, since it represents a serious threat to people's health, as both infections have a synergic and bidirectional interaction, which leads to an accelerated mutual progression.[14,15]

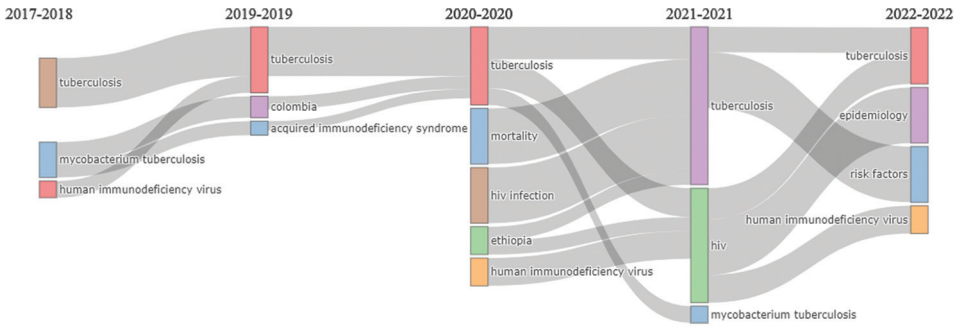


Figure 2: Sankey plot on the flow of scientific production. MTB: *Mycobacterium tuberculosis*, HIV: Human immunodeficiency virus, TB: Tuberculosis, AIDS: Acquired immunodeficiency syndrome

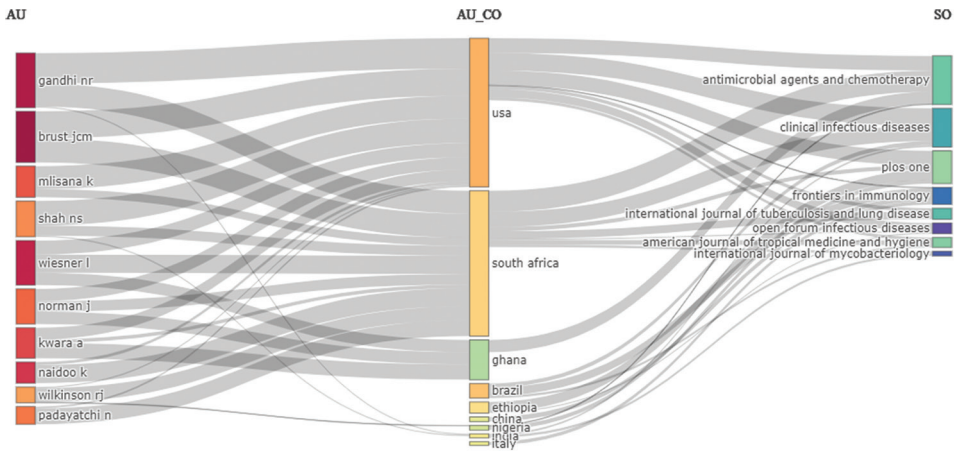


Figure 3: Three-field-plot

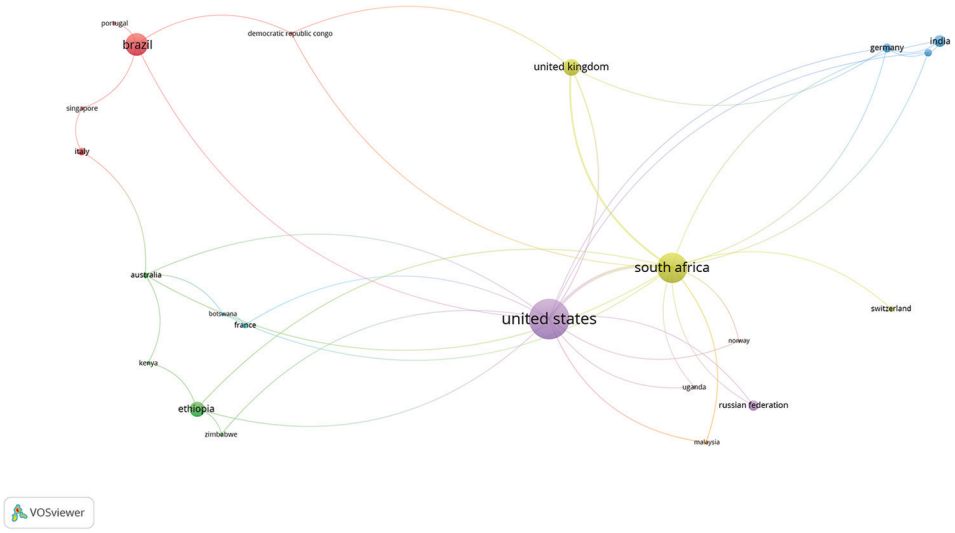


Figure 4: Co-citation by country

Table 1: Top 5 authors with the largest production

Author	Filiation	Country	Scholarly output	Citations per publication	Field-weighted citation impact	h-index
Brust, James CM	Albert Einstein College of Medicine of Yeshiva University		7	13	1.13	21
Gandhi, Neel R	Emory University School of Medicine		7	11.3	1	34
Wiesner, L	University of Cape Town		6	10	1.52	31
Norman, Jennifer	University of Cape Town		4	11.8	1	15
Mlisana, Koleka P	University of KwaZulu-Natal		4	14.8	1.12	42

Table 2: Top 10 subcategories with the highest production

Subcategory	Scholarly output	Citations	Citations per publication	Field-weighted citation impact
Infectious diseases	94	617	6.6	0.57
Microbiology (medical)	35	361	10.3	0.77
Public health, environmental and occupational health	33	144	4.4	0.49
General medicine	31	201	6.5	0.97
Pharmacology (medical)	21	195	9.3	1.01
Pulmonary and respiratory medicine	21	150	7.1	0.65
Immunology and allergy	17	91	5.4	0.52
Health policy	10	87	8.7	1.25
Epidemiology	6	12	2	0.15
Neurology (clinical)	5	38	7.6	0.43

TB, besides being recognized as a public health problem, represents a research field that has gained relevance in the scientific community. In fact, a study has shown that, in the last decade, the number of publications on TB has increased considerably,[16] evidencing an approach to different topics and approaches, as shown by Abdullah *et al*.[17] in their network analysis, which highlights the frequent occurrence of the term HIV and positioning TB and coinfection as an important line of research.

Table 3: Top 10 scientific journals with the highest production

Scopus source	Country	Quartile	Publications	Citations per publication	Source-normalized impact per paper	Cite score 2021	SCImago journal rank
PLoS One		Q1	10	10.8	1.368	5.6	0.852
International Journal of Tuberculosis and Lung Disease		Q1	7	14.3	0.903	4.5	0.845
Antimicrobial Agents and Chemotherapy		Q1	7	8.7	1.403	9.3	1.546
American Journal of Tropical Medicine and Hygiene		Q1	7	4.6	1.09	4.4	1.013
Clinical Infectious Diseases		Q1	6	19	3.151	17.3	4.394
Revista Chilena de Infectologia		Q4	5	2.8	0.382	0.9	0.19
Biomedica		Q3	4	2.5	0.421	1.2	0.233
Frontiers in Immunology		Q1	4	6.8	1.776	9.8	2.331
International Journal of Mycobacteriology		Q3	4	1.5	0.846	2.2	0.426
Open Forum Infectious Diseases		Q1	4	6.8	1.215	5.3	1.317

The findings of this study show a notable interest in the interrelationship between HIV and TB. Consistent with this aspect, studies that explored the scientific production on TB have shown that HIV coinfection is one of the categories of research of greatest interest in scientific dissemination.[18,19] This contrasting evidence highlights the importance of understanding the interconnections between these diseases and how they have evolved over the years.

Regarding the productivity of the countries in the subject of this study, the United States and South Africa were identified as one of the most influential countries with the highest scientific production in Scopus. Similarly, another study showed that the United States led the scientific activity;[20] in addition, although in another database, Liu *et al*.[21] found that this country had a marked dominance in production, followed by South Africa. It is necessary to highlight the role of these two countries in the generation of new knowledge and in positioning themselves at the forefront of this area of research, especially if we consider that in another field such as TB associated with COVID-19, they also led the ranking of productivity.[22]

A study that explored the scientific literature on TB and HIV coinfection indexed in the Web of Science showed a gradual decrease in the number of articles published between 2017 and 2021.[21] On the contrary, the evaluation of this topic in the production indexed in Scopus showed a slight increase in publications, which are mainly disclosed in high-impact scientific journals, such as PLOS One (Q1) and the International Journal of TB and Lung Disease (Q1), the latter having the most publications identified by the study of Liu *et al*.,[21] while PLOS One ranked 5th in this ranking.

TB-HIV coinfection represents a great challenge for health systems, in this field, the human resource that provides services has an overwhelming task in its prevention and treatment.[23] Thus, the development of scientific research[24,25] should be a key pillar for the improvement of this situation, especially in developing countries, especially in categories, as demonstrated by this research, oriented to Public Health, Environmental and Occupational Health, as well as Health Policy, for which it would also be necessary to promote and guide research cooperation between public and private institutions most involved in this problem.

Conclusions

It is concluded that there is a notorious interest in the coinfection between HIV and TB, and the scientific production related to it has slightly increased; in addition, it is recognized that South Africa is the most productive country after the United

States; and one of the most productive authors, Brust James CM, is of this nationality. The main scientific journals for the dissemination of this field of knowledge are of high impact.

Limitation of the study

This study had limitations such as the search in a single database; therefore, it is necessary that subsequent studies explore the productivity, visibility, and trend of the global scientific production of this topic by searching in various databases such as PubMed and Web of Science, among others. In addition, it should be considered that there may be errors in the indexing of metadata, which may affect the estimation of certain bibliometric indicators, also, it is possible that the loss of indexing of scientific journals, as well as self-citation may have affected the productivity and impact indexes. Despite these limitations, it is recognized that the study generates a valuable contribution to this field of knowledge since it allows us to understand trends and new research horizons, as well as to identify the most productive actors.

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Conflicts of interest

There are no conflicts of interest.

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