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Bibliometric Analysis of Research Trends and Opportunities on the Infection of HIV and Tuberculosis: 2013 – 2024 Data Collection

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Abstracts
Tuberculosis (TB) and HIV co-infection remains a critical problem in public health, particularly in Indonesia, which carries a high disease burden. A preliminary literature review reveals a significant gap in research from Indonesian institutions, highlighting the urgent need for a systematic analysis of the existing scientific landscape. This bibliometric study, conducted using the Scopus database from 2010 to 2023, aims to map publication trends, key contributors, and emerging research themes related to TB-HIV. The analysis shows a consistent increase in publications over the last decade, with research driven by a strong collaborative network led by highly prolific authors and dominated by Brazilian institutions. Visualizations indicate a shift in research focus from specific HIV-related topics to broader aspects of TB, drug resistance, and patient demographics. Despite the diversification of global contributions with a growing presence from countries in Africa and Asia, Indonesia's representation remains limited. This presents a compelling opportunity for Indonesian researchers to increase their involvement and contribute to the global scholarly discourse on this issue, addressing a national and international health challenge.

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Introduction

Human Immunodeficiency Virus (HIV) and Mycobacterium tuberculosis, the bacteria causing Tuberculosis (TB), have formed a detrimental synergy for decades. HIV infection leads to the progressive depletion of CD4+ lymphocytes, which are crucial for cellular immunity. This immunosuppression significantly increases the risk of latent TB infection progressing to active TB disease. Consequently, TB has emerged as a leading cause of morbidity and mortality among people living with infection of HIV (Zeru, 2021). Indonesia bears a significant burden from both diseases, ranking among the countries with high incidences of both TB and HIV. The National TB Program reports a substantial number of TB cases annually, while the HIV epidemic persists in key populations. This overlap inevitably leads to a high rate of co-infection. According to recent data, the percentage of TB patients with known HIV status who tested positive remains a critical public health problem. This high prevalence underscores the urgent need for integrated TB-HIV services and continuous surveillance to manage the co-epidemic effectively (Sitorus, Murinata, Antara, Sangalang, & Natalia, 2024; Wulandari, et al., 2024).

A preliminary review of literature databases suggests that the number of publications originating from Indonesian institutions focusing on the epidemiological, clinical, or socio-behavioral aspects of TB-HIV is limited compared to the scale of the problem. This research gap may stem from various factors, including competing health research priorities, limited funding for operational research, and challenges in data integration from the separate TB and HIV programs. Failure to address this research gap could have severe consequences. An unchecked rise in TB-HIV co-infection would exacerbate mortality rates, as each disease accelerates the progression of the other. This would place an immense strain on the healthcare system, increasing the economic burden due to longer treatment durations, more complex drug regimens, and higher rates of drug resistance. In Indonesia, especially in rural or remote area, the number of research about topic of co-infection of HIV and tuberculosis still limited. Furthermore, increased transmission of both diseases within communities would undermine the national goals for TB elimination and HIV control, threatening to reverse the health gains achieved in recent years. researching TB-HIV co-infection is not only pertinent but also essential. A bibliometric analysis is a particularly suitable approach to map the existing scientific landscape (Rangkoratat, Puspitasari, & Hanoatubun, 2024). This study aims to systematically analyze the publication trends, key contributing authors, institutions, and emerging research themes related to TB-HIV in Indonesia. The findings from this analysis will provide a comprehensive overview of the current state of knowledge, identify critical research gaps, and highlight future directions.

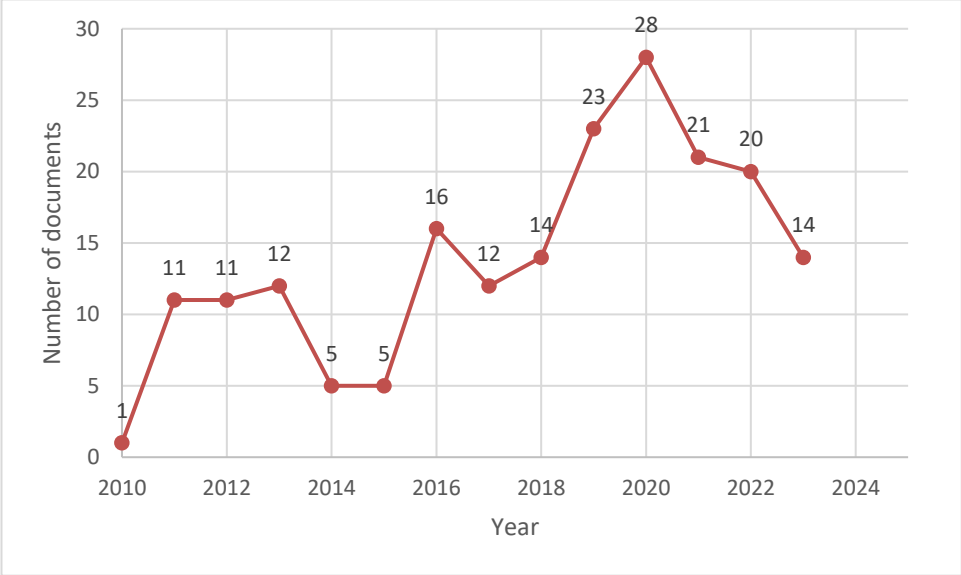
Method

This Bibliometric study was conducted using protocol of Biblioshiny (Thangavel & Chandra, 2023) and VosViewer use protocol (Du, et al., 2024). Scopus database was collected for this study from 2015 to 2024. Scopus was used due to its advantage over other database. The strategy for searching the data was based on the use of keywords relevant to HIV and Tuberculosis (TBC). Boolean operators were used HIV OR human immunodeficiency virus AND Tuberculosis OR TB OR Tbc. Only document published in peer-reviewed journals and with full open access were collected and analyzed. The overall search result was cleaned using Microsoft Office Excel and Openrefine software to make sure the data collected was accurate. Data visualization, such as frequent

keywords, co-occurrence, authors productivity, and affiliations, was used with Bibliometrix -Biblioshiny and VosViewer software (Orduna-malea & Costas, 20212).

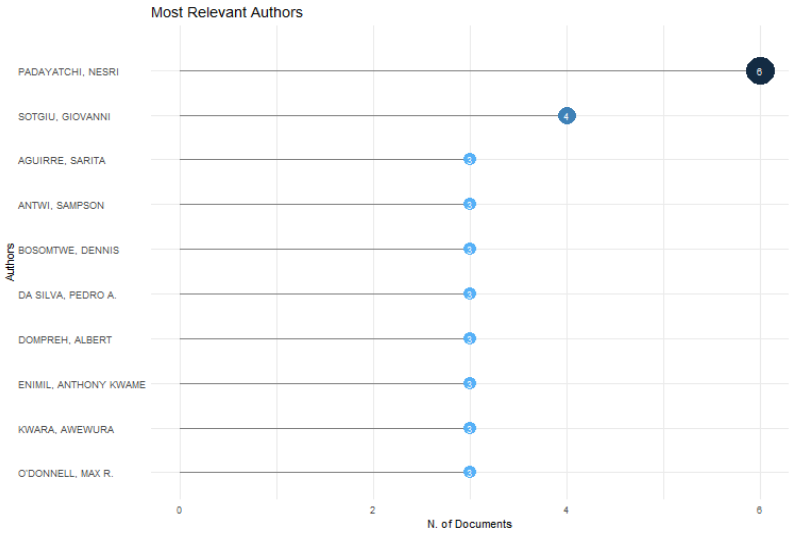
Result and Discussion

The results of the analysis of the trend publications documents were shown in Figure 1.



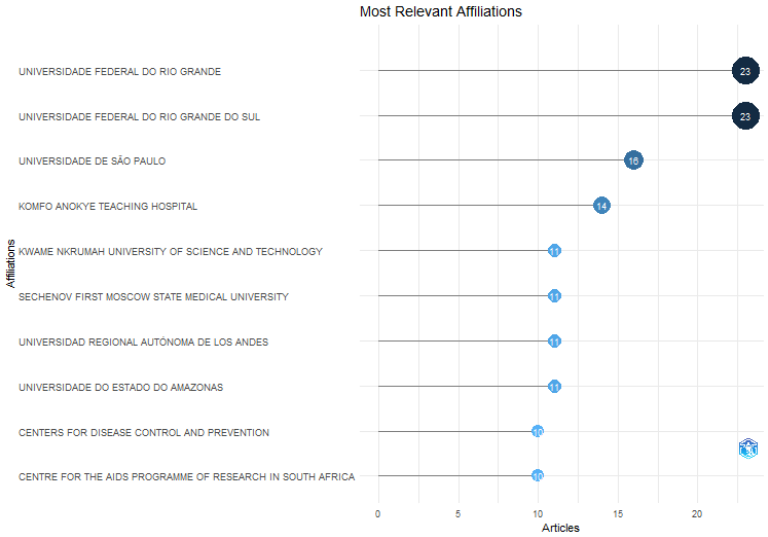
Picture 1. Number of publications on the TB-HIV infection trend from 2010 to 2023.

Starting from a base of only 5 documents in 2010, the number of publications grew steadily, experiencing a significant and consistent rise after 2014 to reach a peak of 28 documents in 2022. This growth trajectory likely reflects the increasing global research focus on managing the complex co-infection. However, the data for 2024 shows a noticeable decrease to an estimated 21 publications. This recent decline could be attributed to incomplete data for the current year, a possible shift in research priorities, or a natural stabilization following a period of intense study. Overall, the chart underscores the sustained scientific interest in this critical public health issue over the past decade.



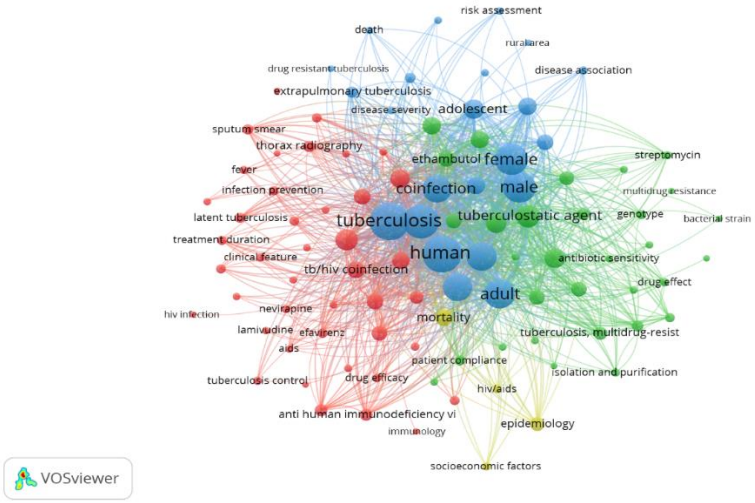
Picture 2. Number of publications on the TB-HIV infection trend from 2010 to 2023 based on most relevant authors

The analysis of author productivity on the topic of TB-HIV infection reveals a clear structure, with Nesri Padayatchi standing out as the most prolific single contributor through six articles, indicating a significant leadership role in this research field. In second place, Giovanni Sotgiu establishes himself as a core researcher with four articles. Furthermore, the data shows a highly active and cohesive group of eight other authors—including Aguirre, Antwi, Bosomtwe, Da Silva, Dompreh, Enimil, Kwara, and O'Donnell—each of whom has published three articles. This concentration of publications suggests that research on TB-HIV co-infection is driven by a solid collaborative network, where a specific group of researchers acts as the main factor for producing scientific knowledge, while one or two individuals emerge as the most prominent leaders.



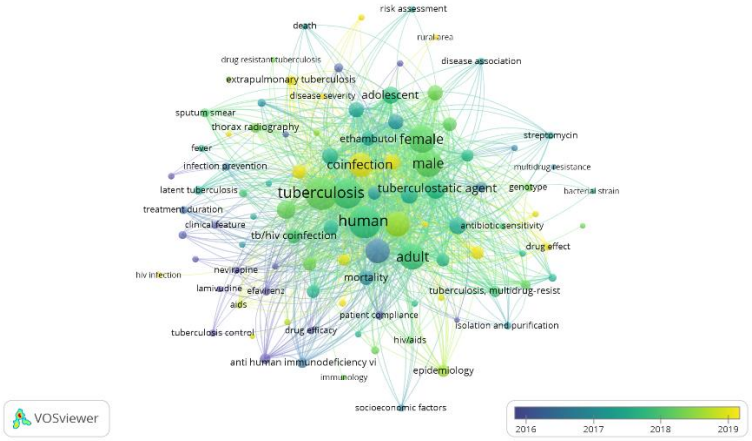
Picture 3. Number of publications on the TB-HIV infection trend from 2010 to 2023 based on most relevant affiliations

Based on the affiliation data, the research landscape for TB-HIV infection is characterized by a strong dominance of Brazilian institutions, with Universidade Federal do Rio Grande and Universidade Federal do Rio Grande do Sul leading as the most productive research hubs, each contributing 23 articles, followed closely by Universidade de São Paulo with 16 articles. This indicates that Brazil serves as a major epicenter for knowledge production in this field, likely reflecting the significant public health focus on the disease within the country. Beyond Brazil, the data reveals a geographically diverse network of contributing institutions, including teaching hospitals and universities in Ghana, a major research center in South Africa (CAPRISA), public health agencies like the US Centers for Disease Control and Prevention, and academic centers in Russia and Ecuador. This global distribution underscores that TB-HIV co-infection is a prioritized health challenge worldwide, with active research contributions from various types of organizations, including universities, clinical hospitals, and public health institutes, highlighting a multi-faceted approach to addressing the epidemic.



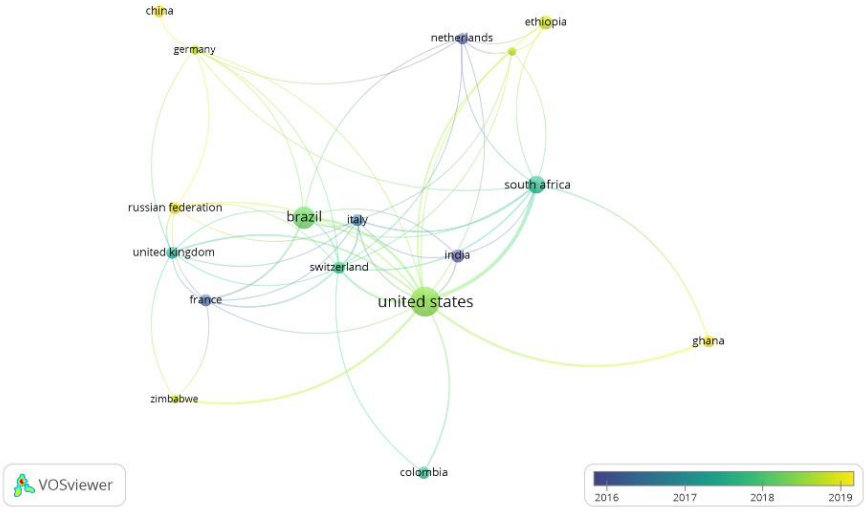
Picture 4. Network visualization analysis TB-HIV related keywords

This VOSviewer network visualization provides a comprehensive overview of the research landscape surrounding tuberculosis. The map is structured into distinct clusters, each representing a primary sub-topic and its interconnected concepts. The largest and most central nodes, such as Tuberculosis and human, underscore their central role in the analyzed literature. The red cluster highlights the critical link between tuberculosis and HIV coinfection, along with clinical aspects like diagnosis and treatment duration. The blue cluster focuses on the demographic context, encompassing patients of different age groups and genders, while also incorporating specific tuberculostatic agents like ethambutol. Meanwhile, the green cluster delves into the crucial issue of drug resistance, exploring concepts like multidrug resistance, antibiotic sensitivity, and bacterial strain analysis. The visualization as a whole illustrates that research on this disease is not isolated but is intricately connected to various fields, including epidemiology, patient compliance, and socioeconomic factors, revealing a holistic and interconnected scholarly conversation (Cordoba-Dona, NOvalbos-Ruiz, Suarez-Farfante, Anderica-Frias, & Escolar-Pujolar, 2012).



Picture 4. Overlay visualization TB-HIV related keywords

Based on the VOSviewer overlay visualization, the research landscape related to tuberculosis shows a clear evolution over time. The most recent and actively researched topics, as indicated by the yellow and green nodes, are tuberculosis, human, adult, and coinfection. These central terms are highly connected, suggesting they are core themes in recent studies. In contrast, older topics from around 2016-2017, represented by the purple and blue nodes, include terms like hiv infection, anti human immunodeficiency vi, and lamivudine. This indicates a shift in focus from co-morbidities with HIV/AIDS, which was a dominant theme in earlier years, to more generalized research on tuberculosis and its treatment, particularly concerning adults and coinfections. This temporal progression highlights a growing interest in the broader aspects of the disease, moving beyond its specific association with HIV to encompass more general population demographics and treatment strategies.



Picture 5. Overlay visualization TB-HIV based on Countries.

Based on the VOSviewer overlay visualization of country-based research collaborations, a clear temporal shift in the geographic focus of studies is evident. The network's central and most connected nodes, such as the United States and Brazil, indicate

their prominent roles throughout the period. However, the color coding reveals a progression, with earlier research from around 2016-2017 originating from countries like the United Kingdom and France, as indicated by the blue and purple nodes. In contrast, the yellow and green nodes signify a rising influence and increased activity from nations such as China, Ethiopia, and South Africa in the later years of 2018 and 2019. . This suggests a diversification of the research landscape, with new key players, particularly from Africa and Asia, emerging as significant collaborators and contributors to the field over time, while established countries like the United States maintain their central position as a major hub for international research partnerships (Gong & Lai, 2023). Interesting findings show that there is no connected research to and from Indonesia, revealing a lack of research on the topic of HIV-TB conducted in the country.

The scholarly landscape concerning TB-HIV co-infection has undergone substantial development, as evidenced by a consistent increase in publications over the past decade, underscoring sustained academic interest in this critical public health issue. This field is characterized by a robust collaborative network, led by highly prolific authors and marked by the preeminence of Brazilian institutions, which function as a primary epicenter for knowledge production. However, the institutional scope is geographically diverse, encompassing contributions from various global organizations (Barja-Ore, Chavesta, Guevara, Rojas, & Mayta-Tovalino, 2023).

Bibliometric analysis visualizations reveal a noticeable shift in research focus over time. While earlier studies primarily concentrated on HIV co-infection, recent years have shown a transition towards more generalized investigations into tuberculosis, adult patient demographics, and broader coinfections. This thematic diversification is mirrored by a change in geographical collaborations, with an increasing emergence of contributions from nations in Africa and Asia, augmenting the network's established core (Wang, Jing, Liu, & Liu, 2022). Crucially, the current representation of Indonesia within this global research network remains limited, as evidenced by the rareness of authors, affiliations, and country-level publications. This presents a compelling opportunity for Indonesian researchers to enhance their participation, forge strategic collaborative partnerships, and ultimately contribute prominently to the scholarly discourse on TB-HIV co-infection, addressing a significant public health challenge both nationally and internationally

Conclusion

The research landscape on TB-HIV co-infection has grown significantly over the last decade, driven by a strong collaborative network and dominated by Brazilian institutions. The research focus has evolved from specific HIV-related topics to broader aspects of tuberculosis, drug resistance, and patient demographics. Despite the rise of contributions from other developing nations, Indonesia's representation in this global network remains limited. This indicates a substantial and promising opportunity for Indonesian researchers to increase their involvement and emerge as key contributors to the scientific discourse on this critical public health issue.

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