ORIGINAL RESEARCH ARTICLE

Overview, Trends and Mapping of The Scientific Production on Childhood Tuberculosis: A Scientometric Study

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ABSTRACT

Background: Tuberculosis in children is highly prevalent and is considered community transmission by an infected adult. This study analyzed childhood tuberculosis literature from 2018 to 2023 on Scopus.

Methodology: The study was an observational, retrospective design with a bibliometric approach focusing on the scientific production on childhood tuberculosis. A trend analysis and mapping of the literature published in Scopus was performed. The following selection criteria were applied: All types of papers published in Scopus during the study period were included. Papers published between 2018 and 2023 were included. Papers had to be focused on childhood tuberculosis.

Results: Antoni Diez Noguera-Julián from SJD Barcelona Children's Hospital had a field-weighted citation impact of 10.89. Anneke Catharina Hesseling and James Alexander Seddon had the highest output. The University of Melbourne and the University of Barcelona had high field-weighted citation impacts. Despite the United States' high production, Spain and Australia showed significant influence. The "International Journal of Tuberculosis and Lung Disease" led in production.

Conclusions: A bibliometric study on childhood tuberculosis literature from 2018-2023 highlighted Antoni Diez Noguera-Julián's significant citation impact and the high output of Anneke Catharina Hesseling and James Alexander Seddon. Despite the U.S.'s high production, Spain and Australia showed significant influence.

Keywords: Bibliometrics, Childhood, Children, Tuberculosis

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INTRODUCTION

Tuberculosis (TB) is the leading cause of infectious disease mortality worldwide (surpassed only in recent years by COVID-19) and, in recent years, has affected as many as ten million people and caused more than 1 million deaths worldwide.[1] TB is mainly spread in Southeast Asia, Africa and the Western Pacific regions[1,2] and affects all ages with the greatest population impact among the adult population (88% of cases).[1] However, TB also largely affects the child population as more than 1 million children under 5 years of age are reported to be household contacts of TB patients and of these less than one third receive preventive therapy.[2]

TB has resulted in the deaths of 239 000 (95% uncertainty interval [UI]: 194 000-298 000) children under 15 years of age, with 80% of these deaths occurring in children under 5 years of age, placing it among the top ten causes of childhood death worldwide.[3] Although the diagnosis of TB in adults has been extensively studied, in children the situation is often complicated by the lack of an accurate method of early diagnosis to ensure timely treatment[4] and also because there is a particularly high risk of progression to active TB following exposure,[5] all of which creates a challenge for confirmatory diagnosis and highlights the urgency of drugs adapted to children. This scenario highlights the importance of having a clear context in the medical literature on the impact of TB infection in the pediatric population. To achieve this goal, bibliometric studies are a very good option as they comprise a quantitative analysis of a given topic and evaluate the predominant trends in research.[6] In order to achieve this goal, bibliometric studies are a very good option as they comprise a quantitative analysis of a given topic and assess the predominant trends in research.

The results will allow us to obtain a general and current overview of the medical literature on TB in children and to know which topics are more and less relevant, which in turn will help to guide future research and to propose various health policies by the countries most affected by this disease. Bibliometric studies to date have evaluated TB in general[7] or associated with some other disease[8] without making a distinction by age group; and even though there are studies that make this distinction, they only focus on some associated comorbidity.[9]

In this study, therefore, in the present study, we have evaluated TB in general[7] or associated with some other disease[8] without making a distinction by age group; and even though there are studies that make this distinction, they only focus on some associated comorbidity.[10]

Therefore, in this study, a scientometric analysis was performed with the aim of describing the publication trends and bibliometric indicators of publications related to TB in the pediatric population.

METHODOLOGY

Study design and database: The study was observational, retrospective with a bibliometric approach focusing on the scientific production on childhood tuberculosis. A trend analysis and mapping of the literature published in Scopus during the period from 2018 to 2023 was performed.

Selection criteria: The study included all types of documents on childhood tuberculosis published in Scopus between 2018 and 2023, such as articles, reviews, letters, book chapters, errata, editorials, short surveys, notes, and conference papers. Excluded were papers lacking complete data for analysis, such as those missing information on authors, institution, or country of origin, papers not in English, and that could not be accessed in full text in Scopus.

Search Strategy: The search was conducted in the Scopus database on February 23, 2024. A combination of keywords and MeSH terms related to childhood tuberculosis was used to obtain the most relevant results. The following formula was used: TITLE-ABS (“childhood tuberculosis" OR "pediatric tuberculosis" OR "tuberculosis in children”) AND PUBYEAR > 2017 AND PUBYEAR < 2024. A total of 699 papers were found, including 545 articles, 99 reviews, 14 letters, 11 book chapters, 8 errata, 7 editorials, 5 short surveys, 5 notes, and 5 conference papers. A detailed analysis of these papers was conducted to identify trends and patterns in the scientific output on childhood tuberculosis. The results of this analysis are presented in the subsequent sections of the article.

Procedures in SciVal and Bibliometrix: SciVal (Elsevier, Netherlands) was used to extract data from Scopus and a bibliometric analysis was performed using Bibliometrix (R studio). This analysis included the identification of publication trends, the most productive authors, the journals most used for publication, and the institutions most active in this field of study.

Data Analysis: Data analysis was conducted considering several key metrics. Academic Output reflects the total volume of papers published on childhood tuberculosis during the study period. View Count provides a measure of the reach and visibility of these papers, indicating how many times they were viewed. The Field-Weighted Citation Impact provides an assessment of the citation impact of published papers, adjusted for field of study and year of publication. Finally, the Citation Count represents the total number of times these papers have been cited in other works.

Ethical Statement: This bibliometric study presents no ethical conflicts as it is based on the analysis of open access secondary data obtained from Scopus. Ethical approval is not required since the data used are anonymous and already publicly available. Therefore, no ethical issues related to privacy, in-

formed consent or confidentiality are raised. The authors of this study declare that they have no conflicts of interest in the conduct of this research.

RESULTS

Noguera-Julián, Antoni Diez of SJD Barcelona Children's Hospital in Spain stood out with a field-weighted citation impact of 10.89 and 83.1 citations per publication, indicating a significant influence in his field. Hesseling, Anneke Catharina and Seddon, James Alexander had the highest academic output with 27 and 23 publications respectively. Schaaf, Hendrik Simon and Marais, Ben J. had a high citation impact weighted by field, suggesting that their work was highly valued by their peers. These findings provided valuable insight into the contribution of these authors to their field. (Table 1)

The University of Melbourne in Australia and the University of Barcelona in Spain stood out with a field-weighted citation impact of 5.3 and 7 respectively, indicating significant influence in their fields. The University of Stellenbosch in South Africa had the highest academic output with 57 publications. The University of London and the University of Cape Town had a high field-weighted citation impact, suggesting that their work was highly valued by their peers. (Table 2).

The United States led in academic production with 198 publications. However, Spain and Australia stood out with a field-weighted citation impact of 4.2 and 3.43 respectively, indicating a significant influence in their fields. Despite having fewer publications, these countries showed a high number of citations per publication, 33.1 and 30.3 respectively. (Table 3).

Table 1: Top 10 authors on scientific production in childhood tuberculosis

Author	Affiliation	Country/ Region	Scholarly Output	Views Count	Field-Weighted Citation Impact	Citations per Publication
Hesseling, Anneke Catharina	Stellenbosch University	SA	27	515	0.86	8.9
Seddon, James Alexander	Imperial College London	UK	23	439	0.83	9.9
Schaaf, Hendrik Simon	Stellenbosch University	SA	15	351	1.41	22.5
Graham, Stephen Michael	University of Melbourne	Australia	13	177	0.99	7
Marais, Ben J.	University of Sydney	Australia	13	371	1.36	18.4
Amanullah, Farhana	NUMS	Pakistan	12	171	1.13	7.7
Garcia-Prats, Anthony J.	UWM	US	12	250	1.27	10.5
Kampmann, Beate B.	CUB	Germany	12	230	1.83	15.1
Mandalakas, A. M.	Baylor College of Medicine	US	12	179	1.1	9.8
Noguera-Julián, Antoni Diez	SJD BCH	Spain	12	609	10.89	83.1

NUMS - National University of Medical Sciences, UWM - University of Wisconsin-Madison, CUB - Charité – Universitätsmedizin Berlin, SJD BCH - Sant Joan de Déu Barcelona Children's Hospital, SA - South Afrika, UK - United Kingdom, US – United States

Table 2: Top 10 productive universities on scientific production in childhood tuberculosis

Institution	Country/Region	Scholarly Output	Views Count	Field-Weighted Citation Impact	Citation Count
Stellenbosch University	South Africa	57	1031	0.96	610
Imperial College London	United Kingdom	35	566	1.01	294
London School of Hygiene and Tropical Medicine	United Kingdom	31	582	1.41	378
Baylor College of Medicine	United States	27	401	0.93	204
Harvard University	United States	27	484	1.15	215
University of Melbourne	Australia	27	671	5.3	1118
University of Cape Town	South Africa	24	492	1.24	327
University College London	United Kingdom	23	813	6.43	1240
Johns Hopkins University	United States	21	361	0.96	200
University of Barcelona	Spain	21	838	7	1194

Table 3: Top 10 countries on scientific production in childhood tuberculosis

Country/Region	Scholarly Output	Views Count	Field-Weighted Citation Impact	Citations per Publication
United States	198	2937	0.94	8
India	109	1216	0.79	6.5
United Kingdom	108	2200	2.12	18.2
South Africa	83	1499	1.01	11.2
Australia	49	1218	3.43	30.3
China	48	571	0.55	5.3
Switzerland	47	963	3.49	30.3
Indonesia	39	589	0.41	2.4
Spain	39	1079	4.2	33.1
Netherlands	38	607	1.07	12.9

Table 4: Top 10 sources on scientific production in childhood tuberculosis

Scopus Source	Scholarly Output	Views Count	Field-Weighted Citation Impact	Citations per Publication
International Journal of Tuberculosis and Lung Disease	38	448	0.82	6.2
Pediatric Infectious Disease Journal	25	310	0.71	5.4
Indian Journal of Tuberculosis	21	186	0.19	1.8
PLoS ONE	18	245	0.55	10.4
BMC Infectious Diseases	16	375	0.49	5.6
Journal of the Pediatric Infectious Diseases Society	13	178	0.89	6.1
BMC Public Health	11	218	1.08	9.6
Indian Journal of Pediatrics	11	135	0.64	5.5
International Journal of Infectious Diseases	11	261	1.31	19.5
Journal of Tropical Pediatrics	11	114	0.84	5.9

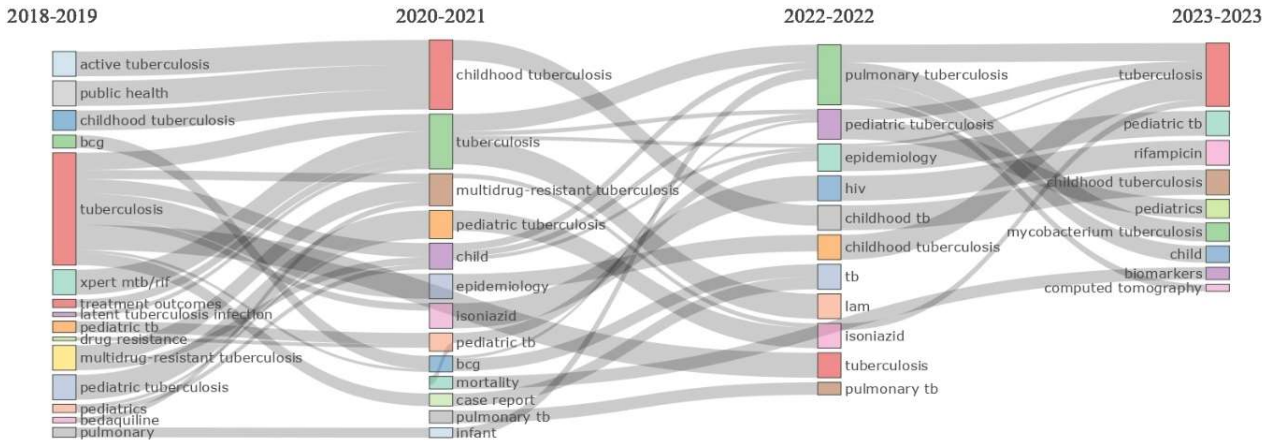

Figure 1: Thematic evolution of scientific production in childhood tuberculosis

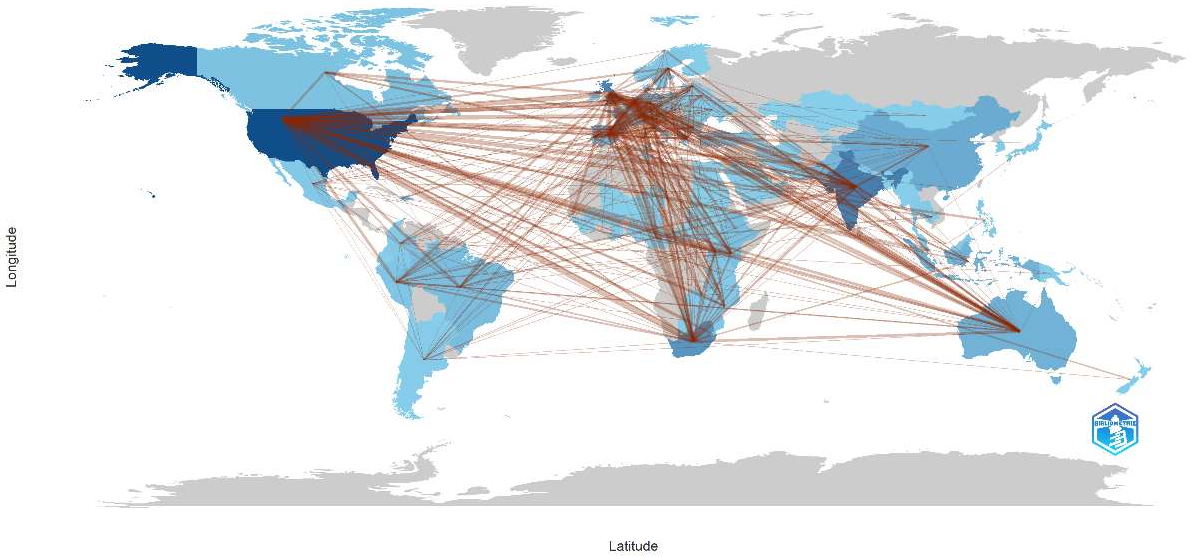

Figure 2: Country collaboration map of scientific production in childhood tuberculosis

The International Journal of Tuberculosis and Lung Disease led in academic production with 38 publications. However, the International Journal of Infectious Diseases stood out with a field-weighted citation impact of 1.31 and 19.5 citations per publication, indicating a significant influence in its field. Despite having fewer publications, PLoS ONE and BMC Public Health showed a high number of citations, 10.4 and 9.6 respectively. (Table 4)

In the bibliometric analysis conducted, a transition in the focus of tuberculosis research was observed. Between 2018 and 2019, the predominant topics included active TB, BCG, bedaquiline, and childhood TB. However, in 2020-2021, the focus shifted to multidrug-resistant TB, pediatric TB, and latent TB infection. In 2022-2023, research topics focused on biomarkers, the relationship between TB and HIV, and the use of rifampicin in TB treatment. These findings reflect the evolution of TB research during this period. (Figure 1).

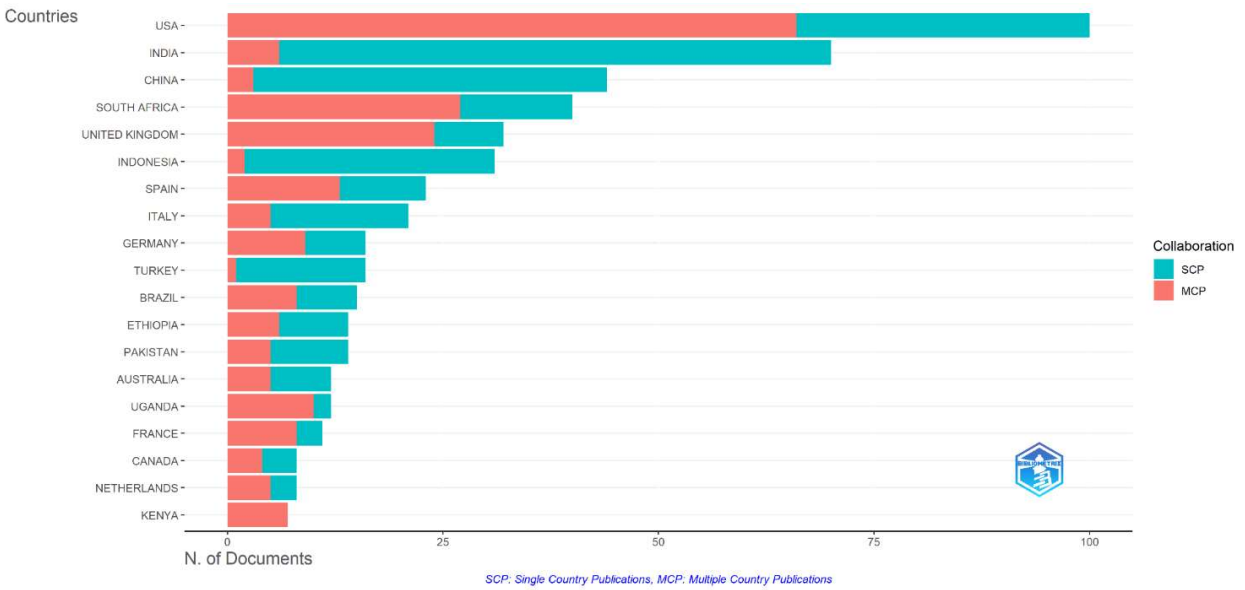

Figure 3: Corresponding author´s countries

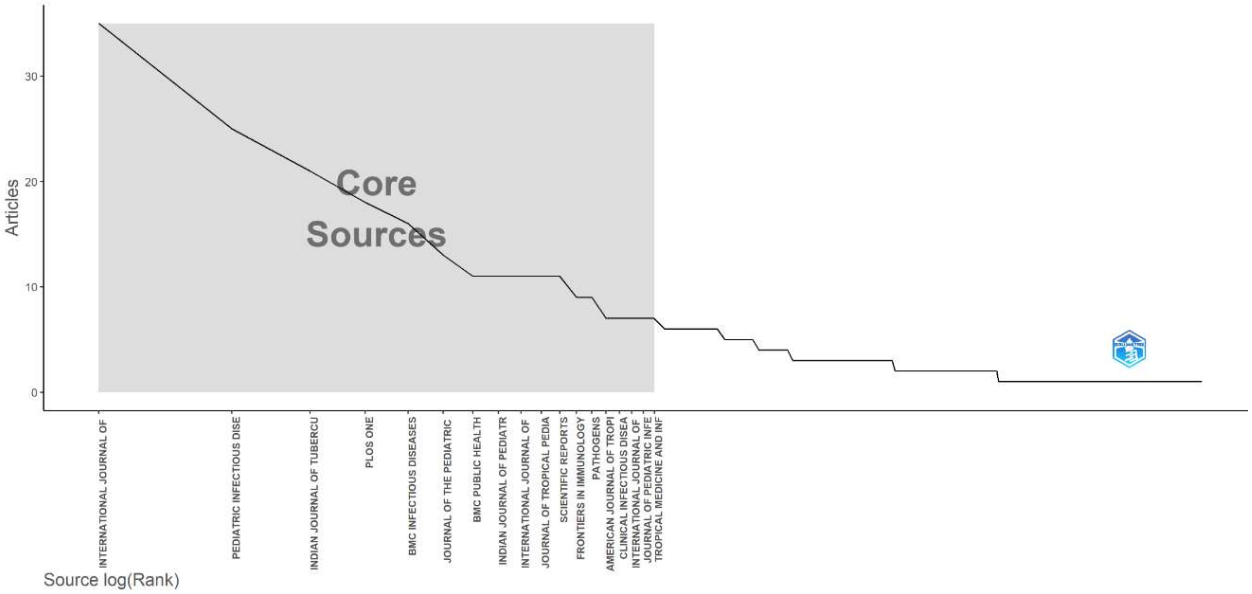

Figure 4: Core sources Country on scientific production in childhood tuberculosis

Significant cross-country collaboration was observed in the research. Australia showed extensive collaboration with countries such as Argentina, Austria, Belgium, Botswana, Bulgaria, among others. Austria and Belgium also showed remarkable collaboration with other countries. Brazil showed diverse collaboration with countries such as Albania, Argentina, Australia, Austria, among others. These findings reflect the global nature of the research and the importance of international collaboration. (Figure2)

The United States led in terms of corresponding authors with 100 articles, followed by India with 70 articles and China with 44 articles. Although South Africa and the United Kingdom had fewer articles, 40 and 32 respectively, they showed significant research collaboration. Indonesia, Spain, Italy, Germany, Turkey, Brazil, Ethiopia, Pakistan, Australia, Uganda, France, Canada, Netherlands, Kenya, Malaysia, Poland, Portugal, Switzerland, Mexico, Philippines, Colombia, Denmark, Gambia, Japan, Nigeria, Norway, Ghana, Russia, Singapore, Zambia, among others, also contributed significantly to the research. (Figure 3)

According to Bradford's law, publications are distributed into three zones, each with an increasing number of journals contributing a decreasing number of articles. In this analysis, the "International Journal of Tuberculosis and Lung Disease" led Zone 1 with 35 articles, followed by "Pediatric Infectious Disease Journal" and "Indian Journal of Tuberculosis". Zone 2 started with "BMJ Open" and continued with journals such as "Chinese Journal of Antituberculosis", "European Journal of Pediatrics", and others. These findings reflect the concentration of literature in a relatively small number of journals, a common phenomenon in many fields of study. Figure 4)

Discussion

An increasing trend was found in the scientific production per year on TB in children, being mostly original articles and reviews. The United States, India and the United Kingdom are the countries that lead the scientific productivity, and this has been done with a mainly international collaboration.

This constant increase in publications on TB in children could be due to the fact that the topics associated with TB have shown a continuous annual growth of up to 7.3%.[7] This increase could also be due to the fact that the World Health Organization (WHO) has for several years not only urged each country to develop TB control and management programs but also to plan research and development activities to improve the tools against the disease.[10] This could also be due to the fact that the World Health Organization (WHO) has for several years not only urged each country to develop TB control and management programs but also to plan research and development activities to improve the tools against the disease.

More than two thirds of TB patients are found in Asian and Middle Eastern countries[1], which could justify why countries such as India, China or Indonesia were among those with the highest productivity in our study. On the other hand, the fact that in the USA the incidence of TB has increased in recent years after a reduction produced by the COVID-19 pandemic,[11] could explain the higher scientific productivity on TB in children in our study. In addition, the broad international collaboration between countries should be highlighted, which would be within the framework of the internationality of TB and in the future would indicate an improvement in global research.

Despite not being the author with the highest number of publications, the Spanish author Noguera-Julián, AD is the author with the highest number of citations and impact. This is explained by the fact that his most highly cited publication on the topic of TB in children is a prospective observational study in children under 5 years of age undergoing tuberculin skin testing (TST) and QuantiFERON-TB Gold In-Tube assays (QFT-GIT) in Spain finding a sensitivity of TST and QFT-GIT with confirmed active TB was 100 % (95 % confidence interval [CI]: 79.4 %-100 %) and 93.7 % (95 % CI: 69.8 %-99.8 %), respectively.[12]

The Spanish institution University of Barcelona was the university with the highest impact with 1194 citations per paper, this may be because their last publication with 44 citations was a systematic review by Martinez et al.[13] on the efficacy of childhood BCG vaccination and TB risk finding that there was no protective effect unless they were children under 5 years of age (OR=0, 54, 95% CI 0.32-0.90) reinforcing the fact that BCG vaccination is effective only at birth to prevent TB in young children, but is ineffective in adolescents and adults. On the other hand, the International Journal of Infectious Diseases had the greatest impact, with the highest number of citations being the review by Marais et al.[14], which discussed the limitations and concerns about the condition of children in the pediatric population and the new advances that can solve this problem.

While the most studied topics on TB in children have varied over the years, between the years 2022-2023, research topics focused on biomarkers, HIV, and rifampicin in TB therapy. In the 2020 WHO report[1], it was reported that in 2019 more than 200 thousand people living with HIV died from TB and that of the estimated 500 thousand people with rifampicin-resistant or multidrug-resistant TB only 41% were identified, which would indicate that both issues were only addressed with greater concern in later years. Regarding biomarkers, although there have been studies evaluating their efficacy for more than a decade, it was only in 2021 that the WHO endorsed the use of biomarkers such as GeneXpert MTB/RIF Ultra and C-Reactive Protein (CRP),[15] so it was not until the following year that their impact on the population could be evaluated through research.

These results aim to present the current picture of the impact of TB in the pediatric population and serve as a basis for future research on the subject. Strong involvement of not only the different health institutions, but also the affected families is needed to promote TB prevention and protect exposed children.[16] Our results also seek to foster governmental commitment to TB control[17-20] as a public health priority and feasible strategies to achieve it.

Limitations

This study has several limitations. First, the search was limited to Scopus, which may have excluded relevant articles from other databases. Second, the search was conducted on February 23, 2024, so any publications after this date were not included. Third, the classification of the articles (articles, review, letter, etc.) may not fully reflect the content of the articles. Fourth, the study was limited to articles published between 2018 and 2023, which may have excluded earlier relevant research. However, it had some strengths as qui considered various types of publications (articles, reviews, letters, book chapters, etc.), which allows for a more complete and diverse view of the field; also, Scopus covers many journals that undergo a strict review process to ensure their high quality compared to other databases. In addition, the study provides an updated view of the research, as the search was conducted recently, on February 23, 2024. Finally, the study provides valuable mapping and trend analysis of scientific production in the field.

Conclusion

This bibliometric study provides valuable insight into tuberculosis research. Authors such as Noguera-

Julián, Antoni Diez and institutions such as the University of Melbourne and the University of Barcelona stand out for their significant impact on the field. The United States led in academic production, but Spain and Australia stood out for their significant influence. A transition in the approach to tuberculosis research was observed during the period studied. Significant international collaboration in research was observed, reflecting the global nature of research. According to Bradford's law, the "International Journal of Tuberculosis and Lung Disease" led in publications. These findings underscore the evolution and impact of tuberculosis research.

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