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Article

Scientific knowledge in the 21st century on social and economic factors that influence mortality due to tuberculosis: A bibliometric review

Samuel Collantes Santisteban[1], Luis Jaime Collantes Santisteban[2,*], Kelly Scarlett Collantes Alvarado[3], Tomasa Vallejos Sosa[4], Luis Alberto Reyes Lescano[1], Bertha Beatriz Peña Pérez[5], Carlos Ulices Vásquez Crisanto[5]

[1] Department of Computing and Electronics, Universidad Nacional Pedro Ruiz Gallo, Lambayeque 14000, Peru
[2] Department of Mathematics, Universidad Nacional Pedro Ruiz Gallo, Lambayeque 14000, Peru
[3] Master's Program in Control of Infectious and Tropical Diseases, Universidad Peruana Cayetano Heredia, Lima 150135, Peru
[4] Nursing Department, Universidad Nacional Pedro Ruiz Gallo, Lambayeque 14000, Peru
[5] Department of Educational Sciences, Universidad Nacional Pedro Ruiz Gallo, Lambayeque 14000, Peru
*** Corresponding author:** Luis Jaime Collantes Santisteban, lcollantes@unprg.edu.pe

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Abstract: This research presents a bibliometric review of scientific production on the social and economic factors that influence mortality from tuberculosis between the years 2000 and 2024. The analysis covered 1742 documents from 848 sources, revealing an annual growth of 6% in scientific production with a notable increase starting in 2010, reaching a peak in 2021. This increase reflects growing concern about socioeconomic inequalities affecting tuberculosis mortality, exacerbated in part by the COVID-19 pandemic. The main authors identified in the study include Naghavi, Basu and Hay, whose works have had a significant impact on the field. The most prominent journals in the dissemination of this research are Plos One, International Journal of Tuberculosis and Lung Disease and The Lancet. The countries with the greatest scientific production include the United States, the United Kingdom, India and South Africa, highlighting a strong international contribution and a global approach to the problem. The semantic development of the research shows a concentration on terms such as "mortality rate", "risk factors" and "public health", with a thematic map highlighting driving themes such as "socioeconomic factors" and "developing countries". The theoretical evolution reflects a growing interest in economic and social aspects to gender contexts and associated diseases. This study provides a comprehensive view of current scientific knowledge, identifying key trends and emerging areas for future research.

Keywords: tuberculosis; socioeconomic factors; mortality; bibliometric review; research trends

1. Introduction

Tuberculosis (TB) remains a significant global challenge, especially in the context of social and economic factors that influence its mortality. Despite advances in diagnosis and treatment, disparities in tuberculosis mortality persist, exacerbated by unfavorable socioeconomic conditions. Understanding these factors is crucial to developing effective intervention strategies and public health policies. According to Kyu et al. (2021), tuberculosis mortality is closely linked to variables such as poverty, limited access to healthcare, and poor living conditions, highlighting the need for comprehensive research in this area.

Interest in the socioeconomic factors that affect mortality from tuberculosis has grown considerably in recent years, reflected in the increase in scientific production

on the subject. Basu et al. (2021) highlight that recent studies have pointed out how economic and social inequalities influence the prevalence and treatment of tuberculosis, with direct implications for health policy formulation. This growth in research underscores the importance of addressing structural inequalities and improving living conditions to reduce the burden of disease.

Scientific production around tuberculosis and its socioeconomic determinants has been documented in several influential journals, including Plos One and The Lancet. Ye et al. (2017) point out that these publications have been fundamental in disseminating key research and advances in the understanding of the relationship between socioeconomic factors and mortality from tuberculosis. Furthermore, recent bibliometric analysis suggests that the participation of new specialized journals reflects a diversification in approaches and thematic coverage.

Globally, major tuberculosis research-producing countries, such as the United States, United Kingdom, India, and South Africa, continue to lead the field, although international collaboration is increasing. According to Nafade et al. (2018), this collaboration between countries with different socioeconomic contexts enriches knowledge and allows for a more complete understanding of the disease. This study seeks to provide a panoramic view of the evolution of scientific knowledge on the social and economic factors that influence tuberculosis mortality, analyzing recent trends and the contributions of the main actors in the field.

However, there is a paucity of bibliometric studies that synthesize and analyze the trends and patterns of research on this topic. Bibliometric analysis can reveal areas of greatest research activity and potential gaps in existing knowledge, thereby facilitating the identification of future directions for research and policy (Ghasemi et al., 2021). In line with this need, according to a bibliometric analysis of the existing literature, the study seeks an answer to the following general research question: What are the patterns and trends of scientific production in the 21st century on the social and economic factors that influence mortality from tuberculosis? This general question involves other specific questions such as: a) How many studies have been published over the years in the 21st century? b) Who are the most active authors in the area? c) What are the journals most important related to the topic? d) In which countries has the research been carried out? e) From what areas of knowledge have they been investigated? f) What is the semantic development around the phenomenon under study? g) What are the driving themes around the phenomenon under study, perspectives, niches, emerging themes? h) What are the historical roots of the concept or central construct to the topic under study?

The present study justifies its relevance by addressing this gap in the literature, proposing a detailed bibliometric analysis of publications in the 21st century on the social and economic factors that influence tuberculosis mortality. This will not only expand understanding of current trends and future directions in research, but is also crucial to understanding the impact of these factors, understanding health disparities, and improving public health intervention. This analysis is crucial to mobilize resources, design informed interventions, and evaluate the impact of existing policies on the social and economic factors that influence tuberculosis mortality.

2. Methodology

Bibliometric analysis was used to study the advance of knowledge about the social and economic factors that influence mortality from tuberculosis, following the proposal of Pant et al. (2024). This method involves systematic steps: formulating questions, identifying databases, developing a search equation, and analyzing metadata.

The research adopted a quantitative approach, at an exploratory and descriptive level. A longitudinal non-experimental design was chosen. A canonical search equation was constructed with key terms: (TITLE-ABS-KEY (mortality) AND TITLE-ABS-KEY (tuberculosis) AND TITLE-ABS-KEY (social OR economic)) AND PUBYEAR > 1999 AND PUBYEAR < 2025 AND (LIMIT-TO (DOCTYPE, "ar") OR LIMIT-TO (DOCTYPE, "re")). It should be noted that this search strategy considered the most important documents such as articles and reviews and a time period from the year 2000, since it sought to understand the development of the topic in the scientific field from the beginning of the 21st century to the date. The Scopus database was used due to its multidisciplinary approach, identifying 1742 scientific publications.

Scopus data were exported in CSV format and converted to Excel for processing. The raw and processed data are available at the following link:

https://drive.google.com/drive/folders/1sJGpLgx4_P_WbGAWq4s-brZzrw8TLKTV?usp = sharing.

Visualizations of scientific maps were created in the form of semantic and co-authorship networks, using specialized software such as Bibliometrix and VOSviewer. Bibliometrix is a tool developed in R, supported by the R Core Team and the R Foundation for Statistical Computing (Bibliometrix, 2023). It requires the installation of R and RStudio. VOSviewer, developed by Leiden University, is an open-source software for creating and visualizing bibliometric networks. It offers text mining functionality to build co-occurrence networks of key terms (VOSViewer, 2023).

3. Results

Table 1 shows that the bibliometric analysis of social and economic factors that influence tuberculosis mortality covered 25 years (2000–2024), examining 1742 documents from 848 different sources. Scientific production showed an annual growth of 6%, with an average age of documents of 9 years and an average of 48 citations per document. These data reflect a growing and sustained interest in the topic, as well as a significant impact of publications in the area.

The research was characterized by its breadth and depth, evidenced by the 73,839 references used and the diversity of keywords (9094 more (ID) and 3065 from the author (DE)). This wealth of terminology facilitated the identification of specific information and reflected the variety of perspectives and approaches in the study of social and economic factors that influence tuberculosis mortality.

The study involved 11,194 authors in total, with an average of 8 co-authors per document, although 203 single-author documents were also recorded. International collaboration was manifested in 35% transnational co-authorship, suggesting the global relevance of the topic and the contribution of diverse geographical and cultural

contexts in its analysis.

Table 1. Main bibliometric indicators of the metadata collection.

Description	Indicator
Main Information About Data	
Time space	2000–2024
Sources (magazines, books, etc.)	848
Documents	1742
Annual growth rate %	6
Average document time	9
Average citations per document	48
References	73,839
Document Content	
More Keywords (ID)	9094
Author's keywords (DE)	3065
Authors	
Authors	11,194
Authors of single-author documents	197
Collaboration of Authors	
Author-only documents	203
Co-authors per document	8
% of international co-authorships	35

Indicators were obtained with Bibliometrix based on the metadata of the identified collection; the presentation as a table corresponds to the process in the Datawrapper application.

Figure 1 shows the evolution of scientific production regarding the social and economic factors that influence mortality from tuberculosis between the years 2000 and 2024. During the initial period, from 2000 to the beginning of 2010, a range is observed of low-level scientific production of annual publications, which indicates a relatively limited interest in the topic during those years. However, after 2010, a progressive increase in the number of publications is evident, marking the beginning of a period of greater dynamism in scientific production. This increase becomes more pronounced starting in 2019, reaching a significant peak in 2021, reflecting a growing recognition of the importance of social and economic factors that influence tuberculosis mortality in the research agenda. After 2021, a decrease in scientific production is observed, probably due to the influence of the COVID-19 pandemic. The sustained increase until 2021 suggests a consolidation of interest and relevance of this topic in the academic community, highlighting a period of intense research activity and scientific production.

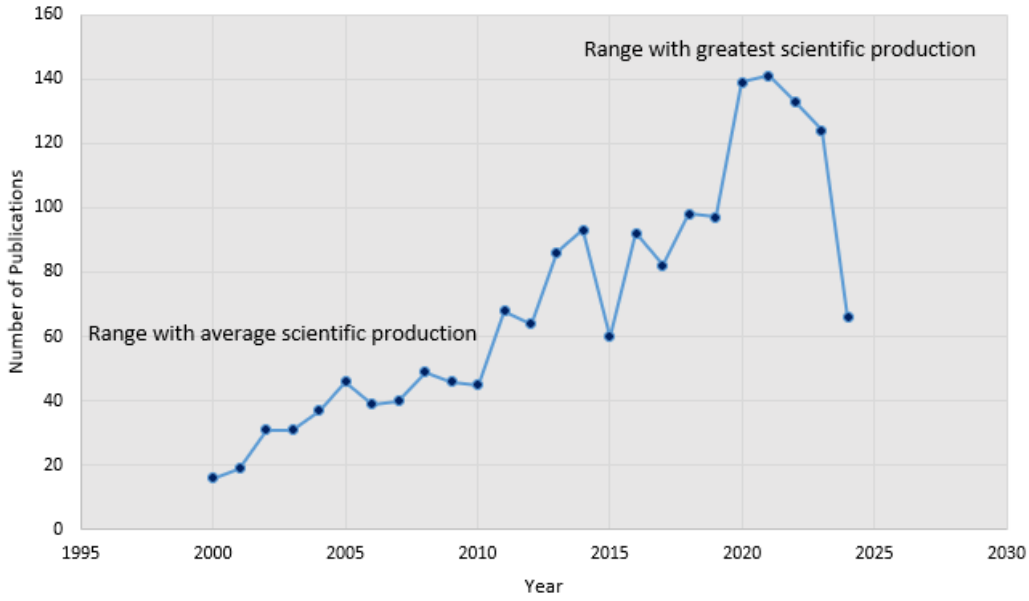

Figure 1. Evolution of publications.

Evolution was obtained with Bibliometrix based on the metadata of the identified collection; the presentation as a figure corresponds to the process in the Datawrapper application.

Table 2. Main authors.

Author	h_index	g_index	m_index	Total Citations	No. Publications	Year or first publication
Naghavi, M.	14	19	1.556	15,276	19	2016
Basu, S.	13	13	0.765	8008	13	2008
Hay, S. I.	12	15	1.333	13,635	15	2016
Kahn, K.	11	11	0.786	712	11	2011
Gupta, R.	10	13	0.625	15,965	13	2009
Mckee, M.	10	11	0.417	7788	11	2001
Murray, C. J. L.	10	12	1.111	8839	12	2016
Salomon, J. A.	10	10	0.526	9935	10	2006
Kyu, H. H.	9	12	1	14,120	12	2016
Lonnroth, K.	9	10	0.563	1553	10	2009
Menzies, D.	9	10	0.45	435	10	2005

Table 2 shows that Naghavi, M., Basu, S., and Hay, S. I. were identified among the most prominent authors, from the Institute for Health Metrics and Evaluation at the University of Washington, the Stanford University School of Medicine in Palo Alto in the United States, and the Department of Zoology at the University of Oxford in the United Kingdom, respectively. Naghavi M. has an h-index of 14, meaning that 14 of his articles have been cited at least 14 times each, his g-index of 19 indicates that his most cited articles have at least 361 total citations, and the m-index of 1.556 suggests that, on average, his h-index has grown by 1.556 each year since his first publication in 2016. Basu S. has an h-index of 13, meaning that 13 of his articles have been cited at least 13 times each, his g-index of 13 indicates that his most cited articles

have at least 169 total citations, and the m-index of 0.765 suggests that, on average, his h-index has grown by 0.765 each year since his first publication in 2008. Hay S. I. has an h-index of 12, meaning that 12 of his articles have been cited at least 12 times each, his g-index of 15 indicates that his most cited articles have at least 225 total citations, and the m-index of 1.333 suggests that, on average, his h-index has grown by 1.333 each year since his first publication in 2016.

Table 3 shows compliance with Lotka's Law. 83.9% of the authors have only contributed 1 article to the collection, 9.9% with 2 articles, 3.6% with 3 articles, 1.4% with 4 articles, 0.6% with 5 articles, 0.2% with 6 articles and only 0.01% have contributed with 7, 8 and 9 articles, each, respectively.

Indicators were obtained with Bibliometrix based on the metadata of the identified collection; the presentation as a table corresponds to the process in the Datawrapper application.

Table 3. Lotka's law.

Written documents	No. authors	Author ratio
1	9397	0.839
2	1103	0.099
3	398	0.036
4	159	0.014
5	62	0.006
6	27	0.002
7	13	0.001
8	10	0.001
9	12	0.001
10	4	0.000
11	3	0.000
12	2	0.000
13	2	0.000
15	1	0.000
19	1	0.000

The indicators in **Tables 2** and **3** were obtained with Bibliometrix based on the metadata of the identified collection; the presentation as a table corresponds to the process in the Datawrapper application.

Table 4 and **Figure 2** show the journals that contributed the most to the dissemination of research results linked to the social and economic factors that influence mortality from tuberculosis. Journals such as Plos One, International Journal of Tuberculosis and Lung Disease and The Lancet are the ones that have had the most publications and at the same time are in zone 1 according to Bradford's Law, represented in **Figure 2**.

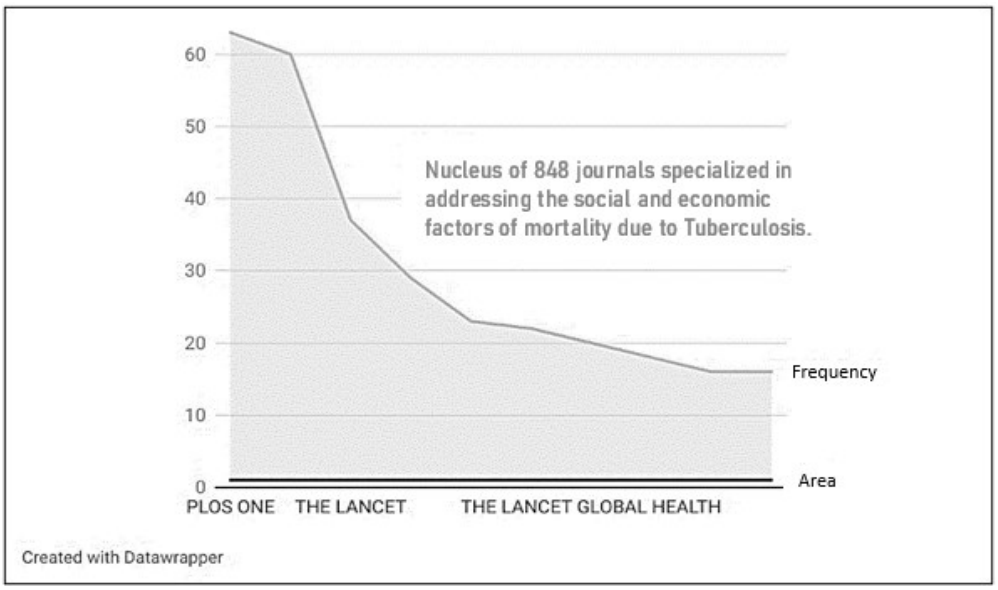

Figure 2. Bradford's law (Biblometrix report processed in Datawrapper).

This representation was obtained with Bibliometrix based on the metadata of the identified collection; the presentation as a figure corresponds to the process in the Datawrapper application.

Table 4. Top 10 trade journals (Bradford law zone 1).

Source	Frequency
Plos One	63
International Journal of Tuberculosis and Lung Disease	60
The Lancet	43
Bmc Infectious Diseases	29
Indian Journal of Tuberculosis	23
BMC Public Health	22
The Lancet Global Health	20
International Journal of Environmental Research and Public Health	28
BMJ Open	16
International Journal of Epidemiology	16

Indicators were obtained with Bibliometrix based on the metadata of the identified collection; the presentation as a table corresponds to the process in the Datawrapper application.

Among the countries that stand out most in scientific production on the social and economic factors that influence mortality from tuberculosis are the following: United States (12%), United Kingdom (9%), India (6%) and South Africa (5%). These proportions reflect the interest of researchers in the topic under study. This approach is carried out from different areas of knowledge, such as: Medicine (62%), Immunology and Microbiology (7%), Biochemistry, Genetics and Molecular Biology (6%) and Social Sciences (5%). This variety of areas involved demonstrates the multidimensional nature of the phenomenon under study (see **Figure 3**, panels **Figure 3a,b**).

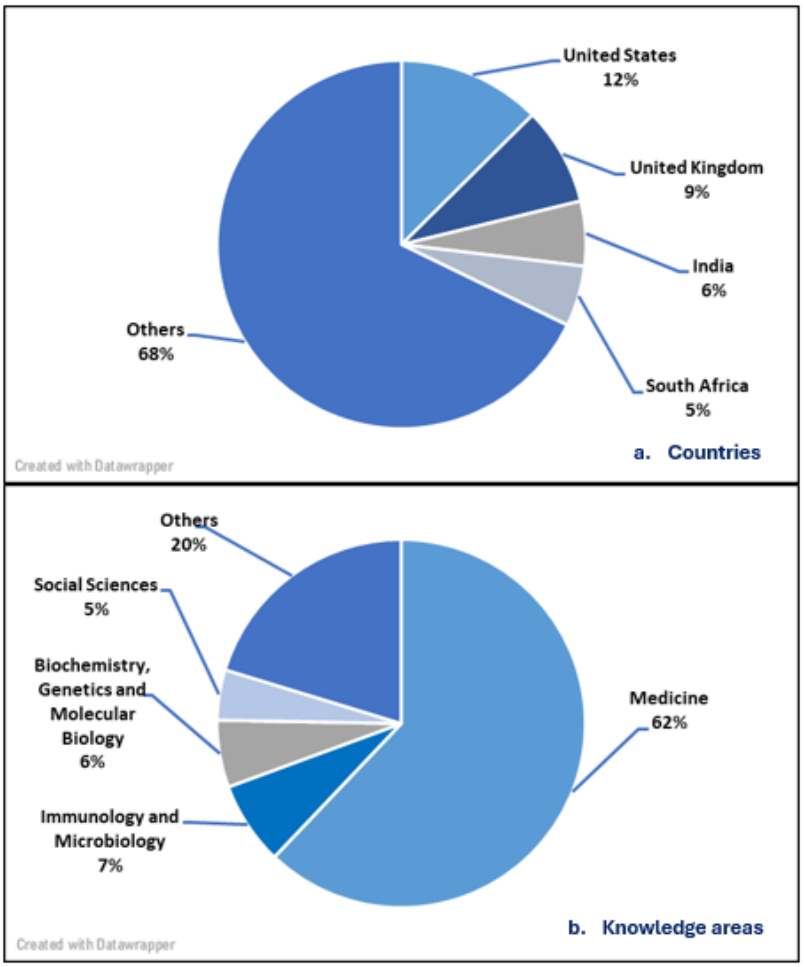

Figure 3. Countries and areas of knowledge linked to addressing the social and economic factors that influence mortality from tuberculosis.

The figure was obtained with Datawrapper, based on the metadata of the collection identified in Scopus.

Regarding semantic development, **Figure 4** is a network with central nodes such as “mortality rate”, “risk factors”, “public health”, “poverty” and “socioeconomics”. Specific colored clusters highlight areas of particular focus: the blue cluster focuses on “adult”, “female” and “male” suggesting a relationship between social and economic factors with age and gender. The red cluster includes terms such as “social status”, “comorbidity”, “HIV infection” and “cost of medical care”, which indicates a relationship between the socioeconomic status and the associated disease. These clusters and connections show that the social and economic factors that influence mortality from tuberculosis constitute a multifaceted topic, with research that addresses everything from economic and social aspects to gender contexts and associated diseases, reflecting the complexity and diversity of perspectives in this area of study.

The words “humans”, “human” and “article” have been removed from the map as they are common and not relevant words.

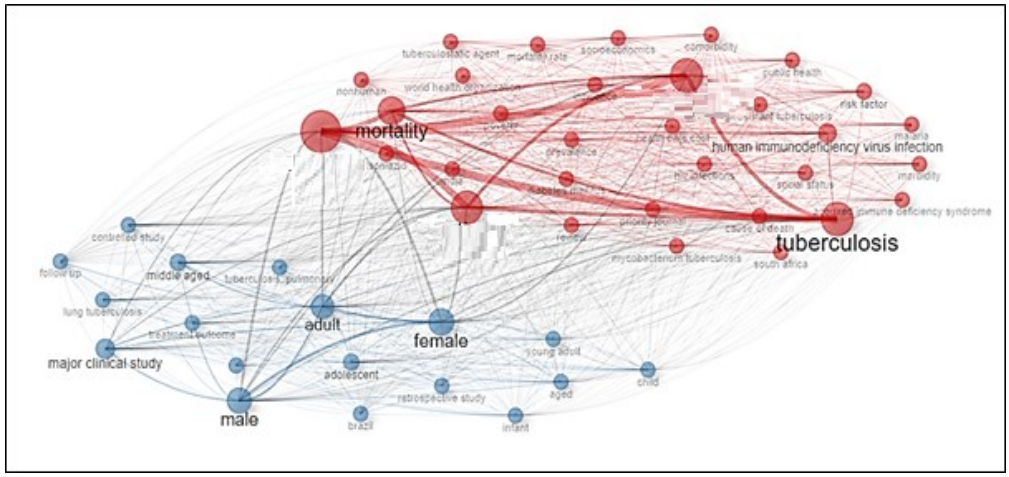

Figure 4. Semantic map on social and economic factors that influence mortality from tuberculosis.

This representation was obtained with VosViewer, from the collection of metadata in CSV format extracted from Scopus and with the corrections made using the thesaurus technique.

The thematic map identified driving themes such as socioeconomic factors and developing countries, with gender studies as an emerging area.

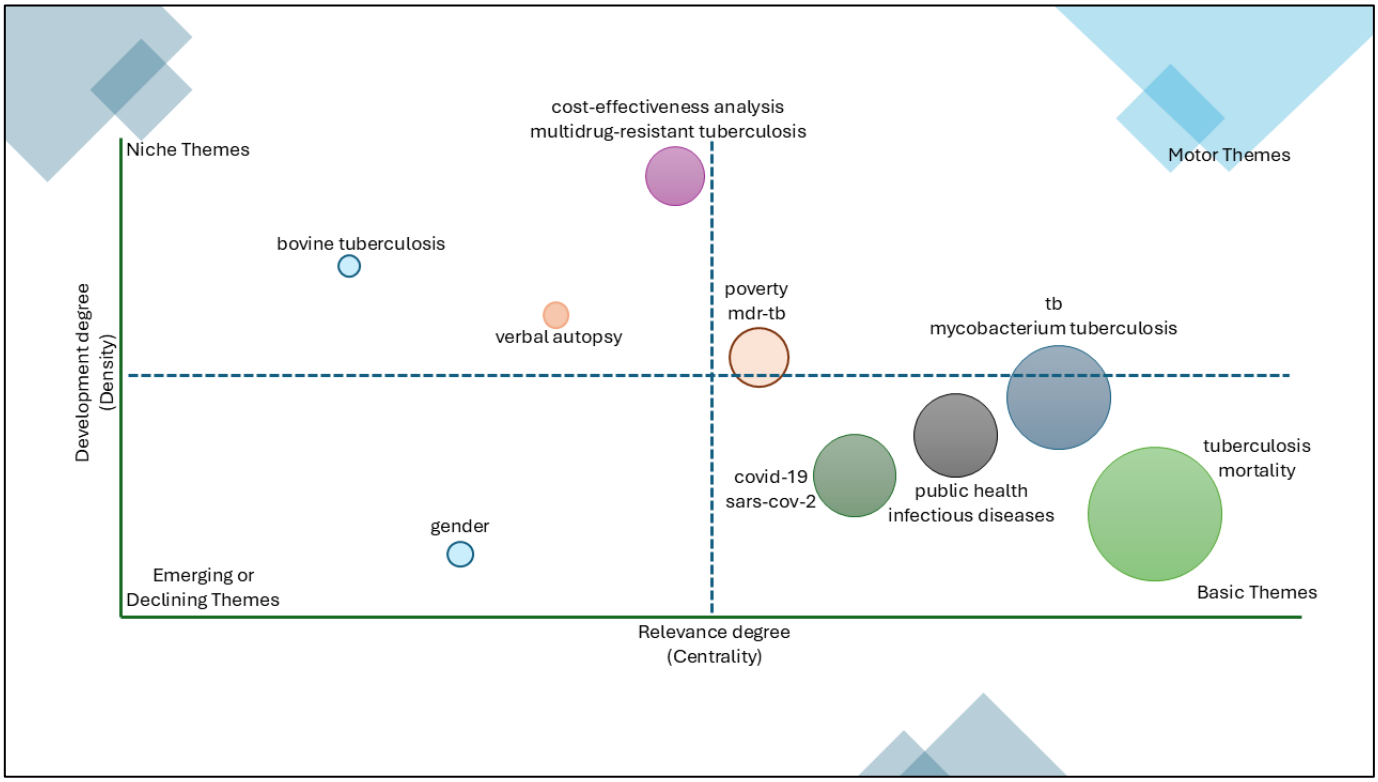

Figure 5. Structural thematic map (Bibliometrix direct report).

The thematic map in **Figure 5** classifies research topics on the social and economic factors that influence tuberculosis mortality into four quadrants based on the degree of development (density) and the degree of relevance (centrality). In the upper right quadrant, driving themes include "socioeconomic factors" and "developing

countries". In the lower right quadrant, the basic topics are "COVID-19", "infectious diseases" and "public health", which are fundamental and continue to be relevant in the study of the social and economic factors that influence tuberculosis mortality; they are central, but still developing, forming the basis for other more specialized studies and providing a broad understanding of the topic.

In the upper left quadrant, niche topics such as "cost-effectiveness analysis" and "multidrug-resistant tuberculosis" represent specialized areas with a high degree of development and depth, offering valuable insights into specific aspects of the social and economic factors that influence mortality due to tuberculosis. In the lower left quadrant, the emerging or declining topic "gender" represents an area that is beginning to receive attention or is losing relevance. Future research will determine whether these areas will grow in importance or continue to decline. Taken together, the thematic map provides a clear guide to identifying priority and potential areas in research on the social and economic factors influencing tuberculosis mortality, highlighting both well-established themes and emerging opportunity for new research.

This representation was obtained with Bibliometrix, from the collection of metadata in CSV format extracted from Scopus.

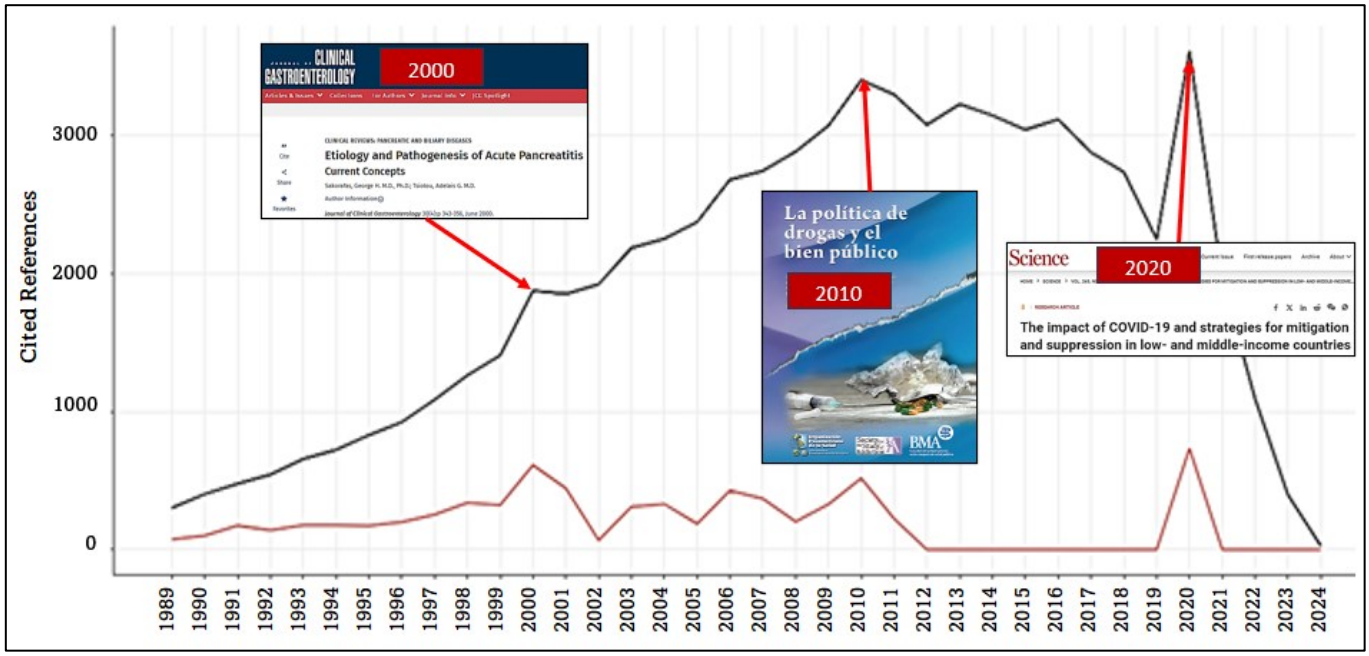

Figure 6. Spectroscopy of the year of the cited reference (historical roots of the topic).

In the evolution of the construct of social and economic factors influencing tuberculosis mortality, several seminal studies have played a crucial role (see **Figure 6**). These studies have contributed significantly to the understanding and theoretical development of the concept. In this study, the Spectroscopy method of the year of the cited reference was used to analyze the historical evolution of the concepts related to the social and economic factors that influence mortality from tuberculosis. This quantitative method allows us to identify the historical roots of research fields and measure their influence on current research. It is based on the analysis of the frequency of citations of references in publications within a specific research area in relation to the years of publication of those references. The origins become evident through

notable peaks, which are usually the result of individual publications that are frequently cited (Nafade et al., 2018).

Mortality from tuberculosis can be caused by various associated diseases, for example acute pancreatitis, which is a disorder that has numerous causes and an unclear pathogenesis. Gallstones and alcohol abuse together account for approximately 80% of acute pancreatitis cases. Some causes of acute pancreatitis are various toxins, drugs, metabolic abnormalities, trauma, ischemia, infections, autoimmune diseases, among others (Sakorafas and Tsiotou, 2000).

Babor (2010) examines drug policies that have included issues related to tuberculosis, some of which have produced positive change. Important is the fact that drug policy has been transcendent even in cases where it has not produced the desired results. Even more illustrative examples can be offered from policies that appear to have made a drug problem considerably worse. In the early 1990s, Iran imprisoned thousands of drug users and did not provide them with health services. Prisons became incubators for needle exchange, HIV infection and tuberculosis.

Walker et al. (2020) states that the COVID-19 disease pandemic poses a serious threat to public health worldwide. Data on demographics, contact patterns, disease severity and capacity and quality of care are combined to understand its impact and inform strategies for its control. Younger populations in lower-income countries may reduce overall risk, but limited health system capacity coupled with closer intergenerational contact largely negates this benefit. Mitigation strategies that slow but do not interrupt transmission will still lead to COVID-19 epidemics that quickly overwhelm health systems, with substantial excess deaths in lower-income countries as a result of the worse available health care. In low-income and lower-middle-income countries, the burden is higher of infectious diseases such as HIV/AIDS and tuberculosis (TB) and of poverty-related determinants of worse health outcomes, such as malnutrition, than in countries high income. These generally occur in younger populations.

Together, these studies have contributed significantly to the consolidation of the construct of the social and economic factors that influence mortality from tuberculosis, providing key pieces to the puzzle of this topic.

This representation was obtained with Bibliometrix, from the collection of metadata in CSV format extracted from Scopus and adapted by the authors including images of seminal documents on the social and economic factors that influence mortality from tuberculosis.

4. Discussion

The evolution in scientific production on the social and economic factors that influence mortality from tuberculosis shows a notable increase since 2010, with a peak in 2021, followed by a decrease in subsequent years. This pattern reflects a growing interest in the topic, which coincides with the observation of recent studies. For example, a recent literature review shows a continued increase in tuberculosis research, with an emphasis on socioeconomic factors during and after the COVID-19 pandemic (Erdem et al., 2022). This growth may be associated with increased awareness and urgency around health inequalities exacerbated by the pandemic.

Prominent authors such as Naghavi, Basu, and Hay have demonstrated significant influence on the field, as indicated by their high citation rates. Comparatively, recent studies also recognize prominent researchers as leaders in the analysis of socioeconomic factors in tuberculosis (Nafade et al., 2018). This continuity in the contribution of certain authors suggests a consolidation of knowledge and a persistent recognition of their impact on the discipline.

The journals that have published the greatest amount of research, such as Plos One and The Lancet, continue to be relevant in the dissemination of results on tuberculosis. However, recent studies suggest that new journals specializing in global health and infectious diseases are gaining prominence (Xiong et al., 2022). This expansion in publishing platforms reflects the diversification of research and the need for specific spaces to address emerging topics.

Research shows that the United States, the United Kingdom, India and South Africa are leaders in scientific production on tuberculosis. This is consistent with recent literature, which highlights the importance of these countries in research due to their high tuberculosis burden and diverse socioeconomic contexts (Cabanillas-Lazo et al., 2022). However, there is growing participation from countries in Asia and Latin America, reflecting a more inclusive global approach.

The study identifies that the majority of the research comes from the field of Medicine, followed by Immunology and Social Sciences. Recently, research has begun to integrate more interdisciplinary approaches, combining public health aspects with socioeconomic studies (Minnaard and Elbaba, 2024). This trend towards interdisciplinarity suggests a recognition of the complexity of the problem and the need for integrated solutions.

The study's semantic network reveals key terms such as "risk factors" and "public health". Comparatively, recent studies also highlight the importance of terms related to social determinants of health and economic inequalities (Daniel et al., 2022). This commonality in terminology highlights a convergence in understanding the impact of socioeconomic factors on tuberculosis mortality.

The thematic map identifies driving themes such as "socioeconomic factors" and "developing countries". This categorization aligns with recent research, which also highlights the relevance of these topics in the global context (Al-Worafi, 2024). However, recent studies show growing interest in topics such as the impact of COVID-19 and cost-effectiveness analysis, indicating an evolution in the thematic approach.

The theoretical evolution of the construct of social and economic factors influencing tuberculosis mortality has been influenced by seminal studies. The literature also reflects a continued refinement of these constructs, with an increasing focus on community empowerment and local-level interventions (Machmud et al., 2015). This evolution suggests an adaptation of theoretical approaches to more effectively address health disparities.

This study provides a comprehensive view of the evolution of knowledge on social and economic factors in tuberculosis mortality, highlighting both historical trends and emerging areas. The bibliometric review offers a framework for understanding how research has changed and how approaches have diversified, especially in response to global events such as the COVID-19 pandemic.

A major limitation of this study is the use of a single database, which may have

restricted the inclusion of some relevant publications. Additionally, analysis of collection metadata may not capture the full complexity of the topic. Future research could benefit from a broader review of databases and a focus on context-specific studies to offer a more complete view. Directions for future researchers include exploring new emerging areas and conducting interdisciplinary studies to address the complexity of the problem more effectively.

5. Conclusion

The bibliometric review reveals a significant increase in scientific production on the social and economic factors that influence mortality from tuberculosis, especially from 2010 to 2021, coinciding with greater interest and awareness around health inequalities. After 2021, some disruptions caused by the COVID-19 pandemic are noticeable.

The most influential authors on the topic of tuberculosis are Naghavi, Basu and Hay, whose contributions have been fundamental in shaping current knowledge and whose predominance remains relevant in recent studies.

Regarding the most prominent journals, Plos One and The Lancet continue to be the main platforms for the dissemination of research on tuberculosis, taking into account that new specialized journals are appearing, which reflects an expansion in the field of study and a greater emphasis in specialization and multidisciplinary approach.

Leading countries in tuberculosis science production, such as the United States, the United Kingdom, India and South Africa, continue to play a crucial role in advancing knowledge. However, a more inclusive global approach is reflected with the growing participation of countries in Asia and Latin America.

Interdisciplinarity and community empowerment have marked the theoretical evolution of the construct of social and economic factors that influence mortality from tuberculosis. The review shows that, despite the consolidation of traditional approaches, there is growing interest in exploring new constructs and approaches, especially in relation to the impact of the pandemic and the social determinants of health.

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Conflict of interest: The authors declare no conflict of interest.

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