

A scientometric analysis and visualization of Pott's disease; 2000-2021

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ABSTRACT

Aims: Spinal tuberculosis, or Pott's disease, is a bacterial infection of the spine, which is primarily brought on by the bacterium *Mycobacterium tuberculosis*. In this study, Pott's disease-related research papers from the Web of Science database were examined scientometrically. The study's time frame is between 2000 and 2021. To shed light on the trends and advancements in research on Pott's disease, bibliometric techniques are used in the analysis.

Methods: A literature search on spinal tuberculosis was carried out in November 2022 using the WOS search engine. Using specific retrieval keywords, the search covered the years 2000 through 2021. Titles, document types, publication years, author details, affiliations, keywords, funding sponsors, journal names, abstracts, and citations were examined. The data was further processed for both quantitative and qualitative analysis using VOSviewer (1.6.18).

Results: A total of 892 papers from 2000 to 2021 were examined based on search parameters. 430 of these were released as Open Access articles. 81.0% of them were in the Science Citation Index Expanded. The publications came from 77 different nations, China dominated research on Pott's disease with 306 papers, followed by India with 147 and the United States with 86. The investigation revealed a rising trend in recent years, pointing to a rise in interest in Pott's disease. Research fields like neurology and orthopedics made important advances. Notably, 7.7% of the research' funding for Pott's disease publications came from the Chinese National Natural Science Foundation. The leading publishing journal has become the European Spine Journal.

Conclusion: The data shows that China has played a significant role in Pott's disease research, followed by India and the United States. The survey also reveals a growing need for PD research, notably in the disciplines of orthopedics and neurology.

Keywords: Pott's disease, Scientometrics analysis, spinal tuberculosis

INTRODUCTION

Spinal tuberculosis (TB) is the term for TB that affects the vertebra.^{1,2} The disease is popularly known as Pott's disease (PD).³ The Pott name may be attributed to British surgeon Sir Percival Pott's monograph from 1779, which described TB infection of the spine.⁴

The main cause of human tuberculosis is *Mycobacterium tuberculosis*.^{1,2} This disease has a long history; 9000-year-old Egyptian mummies had spinal TB characteristics.^{1,2} Spinal TB is the most prevalent type of osteoarticular TB, with 50% of all cases.⁵ PD primarily affects the lower thoracic and upper lumbar regions; involvement of the cervical and upper thoracic regions is less common.^{6,7} Although uncommon, PD can have serious effects, including as persistent deformities and neurological abnormalities, if it is not detected and treated promptly.⁸

The exact incidence and prevalence of PD are unknown due to underreporting.³ Given that the disease frequently affects young persons during their most productive entire working life, early detection and diagnosis are crucial. Although it is fortunately still rare, there have been case reports of PD that is multidrug resistant. PD is still quite uncommon in the developed world and is typically diagnosed in people who have immigrated from or have spent a lot of time in endemic nations.⁹ Since the beginning of the Human Immunodeficiency Virus (HIV) era, the chance of acquiring PD has grown. Over 90% of all new tuberculosis infections are centered in sub-Saharan Africa and Southeast Asia.¹⁰ Preventing long-term morbidity, deformity, and impairment from the condition requires early identification and treatment.^{9,10}

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The purpose of this study was to provide a scientometric analysis of research papers on PD that were taken from the Web of Science (a Thomson Reuters Company) database and covered the years 2000 through 2021. This analysis made use of the bibliometric methodology to provide a more thorough understanding of the development of PD-related research. Furthermore, it made it easier to identify potential future focal points that could become well-known areas of investigation in the field of PD research. Additionally, this study may examine the dominance in terms of the most popular countries, journals, and affiliations.

METHODS

As it is not a human or animal study there is no need for ethical approval. All procedures were carried out in accordance with the ethical rules and the principles.

A literature search was performed in the WOS search engine in November 2022. The fact that the data were taken from open databases eliminated the need for ethical approval. We took "tuberculosis, spinal"[MeSH Terms] OR Spinal Tuberculosis OR Spinal Tuberculosis OR Tuberculosis, Spinal OR Pott's Disease OR Disease, Pott's OR Potts Disease OR Pott Disease OR Disease, Pott OR Pott's Paraplegia OR Tuberculous spondylitis OR vertebral Tuberculosis (Title)" as topical retrieval keywords and time span limited to 2000-2021.

The titles, document types, years of publication, names of authors, affiliations, keywords, funding sponsors, names of publishing journals, abstracts of each record, and citations within the WOS publications were saved as TXT files and imported into Microsoft Office Excel 2019 (Los Angeles, CA, USA).

All document types were selected in this study.

Two authors independently checked the data collection and entry.

The WOS website was utilized to retrieve the literature data for this study.

Data Analysis and Visualization

The Web of Science txt data were imported into VOSviewer (1.6.18 for Microsoft Windows) (<https://www.vosviewer.com>) developed by Nees Jan van Eck and Ludo Waltman. Both a quantitative and qualitative analysis of the data was performed. For bibliometric analysis, The VOSviewer was used to create the visualization maps. The H-index were added to the table for a more complete scientometric results analysis.

Microsoft Office Excel 2019 was used for tabulation. The percentage and frequency values were given for data expression. Advanced statistical analysis not used.

RESULTS

A total number of 1298 publications published between 1970-2022. 892 of these were published between 2000-2021. We only analyzed these 892 publications according to the search criteria. 430 of the documents were published as Open Access. %81.0 of them were published in the Science Citation Index Expanded (SCI-EXPANDED) index and %17.9 of them in Emerging Sources Citation Index (ESCI) index (Table 1). There were 844 records in these publications, the majority of which were in English. There were also 21 publications in French, 14 in Spanish, 5 in Turkish, 3 in Portuguese, 2 in German, 1 in Indonesian, Japanese, and Korean, in addition to the other languages. The fact that these publications are distributed internationally demonstrates how popular and engaged the topic under study is throughout the world. A total 68.2% of these documents were articles (Table 2).

Table 1. Web of science index

Web of Science Index	Record Count	% of 892
Science Citation Index Expanded (SCI EXPANDED)	723	81.0
Emerging Sources Citation Index (ESCI)	160	17.9
Conference Proceedings Citation Index - Science (CPCI-S)	40	4.4
Social Sciences Citation Index (SSCI)	14	1.5
Arts & Humanities Citation Index (A&HCI)	3	0.3
Book Citation Index - Science (BKCI-S)	3	0.3

Table 2. Document types

Document Types	Record Count	% of 892
Article	609	68.2
Book chapters	3	0.3
Book review	1	0.1
Correction	2	0.2
Early access	2	0.2
Editorial material	83	9.3
Letter	72	8.1
Meeting abstract	63	7.1
Proceeding paper	4	0.4
Retracted publication	1	0.1
Retraction	2	0.2
Review article	57	6.3

The publications examined in this study came from 77 different nations, representing a wide range of geographic origins. The People's Republic of China topped the list of publishing nations with 306 publications, followed by India with 147 publications and the United States of America with 86 publications. These countries were identified through the analysis of publications in the field of PD. Other noteworthy contributors included the following: Turkey, with 54 publications, England, with 37 publications, South Africa, with 27, France, with 21, Pakistan, with 19, Spain, with 16, and Germany, with 14.

These findings demonstrate the disparities in scientific output and research interest in PD among different countries, with China and India significantly advancing the body of knowledge on this topic.

The distribution of research output over time is shown by analyzing publications in the field of PD. Recent years show a higher level of research activity, such as 2021 with 95 publications and 2020 with 80 publications. This upward trend in publications, which began in 2017 with 67 publications and has continued since then, points to an increase in attention being paid to research into and management of PD. Recent years have seen an increase in scientific contributions, which may reflect a growing understanding of the importance of PD and efforts to improve knowledge and treatment options for this condition (Figure 1, Table 3).

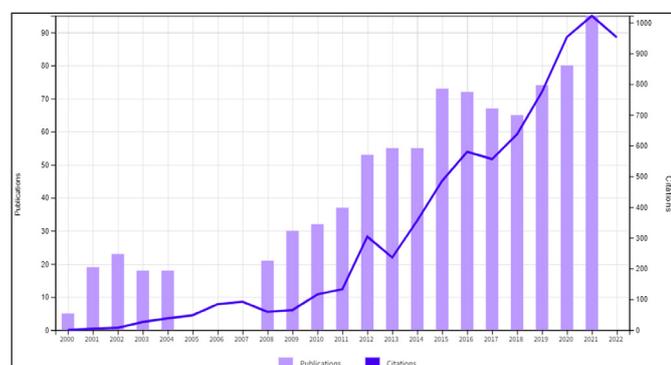


Figure 1. The citations and documents on PD between 2000-2021.

Table 3. Number of documents by years		
Publication Years	n	% of 892
2021	95	10.6
2020	80	8.9
2019	74	8.2
2018	65	7.2
2017	67	7.5
2016	72	8.1
2015	73	8.1
2014	55	6.1
2013	55	6.1
2012	53	5.9
2011	37	4.1
2010	32	3.5
2009	30	3.3
2008	21	2.3
2004	18	2.0
2003	18	2.0
2002	23	2.5
2001	19	2.1
2000	5	0.5

The publications selected for this study's analysis came from a diverse range of 61 different research fields. With 224 publications, orthopedics had the most among these research specialties, closely followed by neurosciences

and neurology with 210 publications. With 157 and 147 publications, respectively, general internal medicine and surgery also demonstrated significant contributions. Other noteworthy research areas with 56 publications each were experimental medicine and infectious diseases. Additionally, radiology, nuclear medicine, medical imaging, rheumatology, pediatrics, and the respiratory system each contributed 49, 33, 29, and 29 publications, respectively. This broad range of research fields demonstrates the interdisciplinary nature of the PD research and its relevance to numerous medical and scientific fields.

National Natural Science Foundation of China (NSFC) funded 7.7% of the studies and this funding agency was the main funder of PD publications.

Numerous prestigious publishing publications made significant contributions to the subject of Pott's disease research. Notably, the European Spine Journal, which has 33 papers on this subject, has become a well-known venue. With 30 articles, International Orthopaedics came in second, while World Neurosurgery also made a strong showing with 27 publications. In addition, 23 articles about Pott's illness were published in the journal Medicine. Additionally, by publishing 20 articles each about this medical disease, the Asian Spine Journal and the International Journal of Clinical and Experimental Medicine both performed key roles. The most publishing journals were summarized in Table 4.

Table 4. Most publishing journals on Pott disease		
Journals	Record Count	% of 892
European Spine Journal	33	3.7
International Orthopaedics	30	3.3
World Neurosurgery	27	3.0
Medicine	23	2.5
Asian Spine Journal	20	2.2
International Journal of Clinical and Experimental Medicine	20	2.2
Spine	14	1.5
Bmc Musculoskeletal Disorders	13	1.4
Journal of Orthopaedic Surgery and Research	13	1.4
Spine Journal	12	1.3

*Showing 10 out of 383 entries

The research productivity and impact of PD publications varied among different countries. China exhibited the highest number of publications, with 306 articles, and also achieved a substantial number of citations, totaling 2,978. The average number of citations per document was 9.73, and the H index, a measure of both productivity and impact, was 27. India followed with 147 publications and 1,574 citations, resulting in an average of 10.71 citations per document and an H index of 19 (Table 5).

Table 5. The research productivity and impact of most publishing countries

Country	Number of publications	Number of citations, total	Number of citations, per document	H index
China	306*	2978*	9.7	27*
India	147	1574	10.7	19
The USA	86	941	10.9	17
Turkey	54	614	11.3*	11
England	37	176	4.7	8

*Shows the higher number

Figure 2 shows the overlay visualisation of mostly cited countries on PD. The distribution of citations throughout time is depicted by colors. The countries with the most publications are represented by the biggest bubbles. Greater numbers of citations transferred between various nations are shown by thicker gray linkages between bubbles (Figure 2).

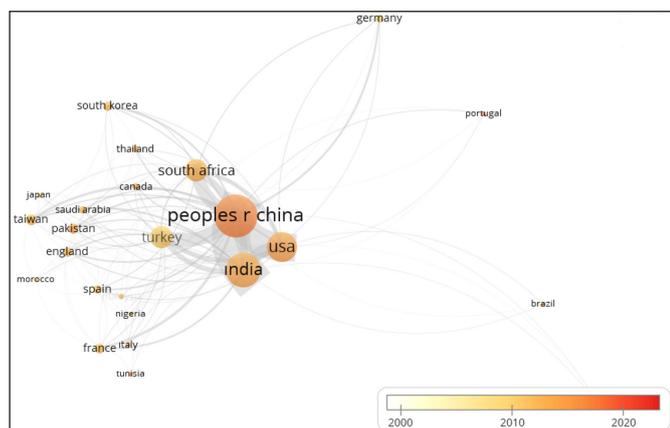


Figure 2. Overlay visualisation of mostly cited countries on PD

Figure 3 shows the overlay visualisation of co authorship between countries by years between 2000-2021. The colors depict the distribution of citations throughout time. The countries with the most publications are represented by the biggest bubbles. Stronger links between bubbles imply that those nations have worked together and co-authored articles.

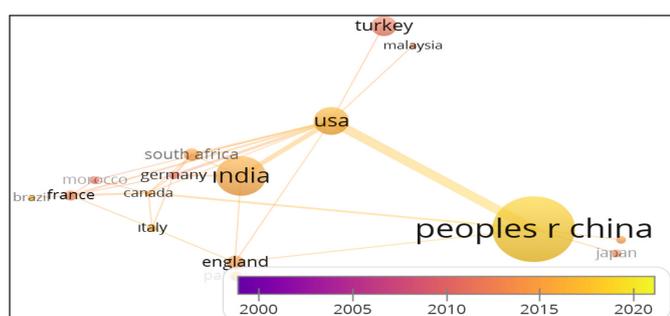


Figure 3. Overlay visualisation of co authorship between countries by years between 2000-2021

The keyword analysis is shown in Figure 4. In the figure, keywords that are frequently used together in publications

are depicted by collaborative colors. The biggest bubbles correspond to the keywords that were used the most in the publications under study. This analysis aids in determining the prevalence of particular keywords in the topical research as well as patterns of keyword co-occurrence.

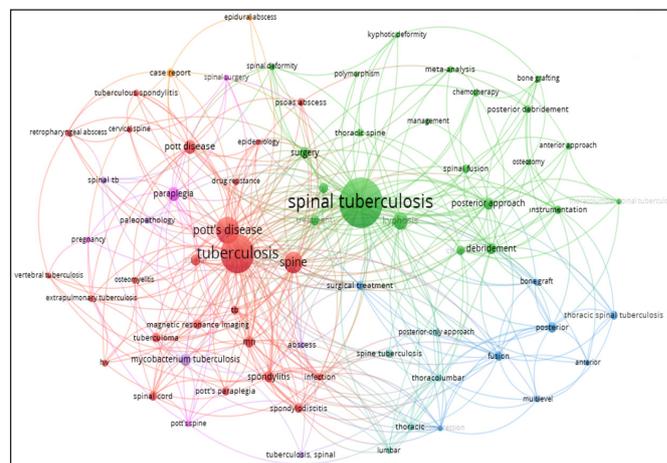


Figure 4. Keyword analysis

DISCUSSION

Based on the scientometric analysis provided, it is evident that research on spinal tuberculosis (Pott's disease) has gained significant attention in recent years. Spinal tuberculosis is the most common form of extrapulmonary tuberculosis, and an increase in tuberculosis cases is observed due to factors such as the rapid growth of the world population and increased migration.¹¹ A study conducted in China between 2001 and 2016 showed an increasing annual incidence of spinal tuberculosis.¹² Similarly, in our study, we also observed an increase in research related to spinal tuberculosis.

Our study, which focused on studies between 2000 and 2021, shows that PD has remained important in the last 20 years. There is still an increasing number of studies as we approach the present that supports this trend.

A significant portion of the studies have been conducted in China, India, the USA, and Turkey, with 94.6% of them being published in English. The majority of publications were in English, but there were also contributions in various other languages, indicating the international significance of the topic. Nearly 50% of these studies were carried out by orthopedic and neurological disciplines. The rise in the number of studies conducted by these two disciplines might be indicative of the neurological complications caused by spinal tuberculosis and the common clinical symptoms such as spinal deformities, spinal tenderness, and back pain.^{3,13}

In a previous similar study by Wang et al.¹⁴ covering the years 1994 to 2015 in the WOS database, 1558

papers were found, and by January 2016 these papers had accumulated 16,152 citations. With 15.1% of articles, 22.3% of citations, and an H-index of 33, the United States was in first place. In terms of articles, citations (815), and H-index (13), China came in third. The literature on spinal tuberculosis indicated a slow progression. The quality of articles needs to be raised despite China's increasing output, and the USA continues to dominate research. This study suggests that "bone fusion" is a new area of interest. In our study, a significant portion of the studies have been conducted in China, India, the USA, and Turkey. Also, India and China are the leading countries in terms of the number of publications on spinal tuberculosis, ranking third and fourth in terms of citation frequency and first and second in terms of h-index. This indicates the need for improvements in the quality of articles coming from China and India. While the USA ranks third in terms of the number of publications, it ranks second in citation frequency and third in h-index. Turkey ranks fourth in terms of the number of publications, following China, India, and the USA, but it ranks first in terms of citation frequency. This increase in citation frequency seems to be the result of high-quality publications in recent years.

The "Spine" journal has previously published a significant portion of the studies related to spinal tuberculosis.^{14,15} In our new study, we found that most of the research on spinal tuberculosis was published in European Spine Journal, International Orthopaedics, World Neurosurgery, Medicine, and International Journal of Clinical And Experimental Medicine. This suggests that future studies on Pott's disease are likely to be published in these journals as well.

South Africa is among the top 10 countries with the highest incidence of spinal tuberculosis in the world.¹⁶⁻¹⁸ However, the low number of publications and low citation rate indicate the need for both qualitative and quantitative research in the region.

Limitations

This study is a single database study and also the study's time span was 2000-2021. The main goal of this study, which was to understand advancements within the last two decades, is at the core of the justification for not including data before the year 2000. It's possible that a similar study to the one you've suggested will be developed in the future with a different focus and may make use of different databases. By incorporating a wider temporal range and utilizing alternative data sources, such an endeavor could produce insightful findings that would ultimately contribute to a more thorough investigation of the subject.

CONCLUSION

Our analysis shows that China still leads in terms of the number of publications, but improvements in the quality of their research are needed. Turkey has shown an increase in high-quality publications in recent years. Overall, this scientometric analysis highlights the importance and growing interest in research on spinal tuberculosis. It also points out the significant contributions of certain countries and the need for international collaboration to tackle the challenges associated with PD effectively. The results of this analysis serve as a valuable resource for researchers, policymakers, and healthcare professionals working in the field of spinal tuberculosis.

The improved prognosis associated with prompt identification and treatment in spinal tuberculosis cases highlights the importance of early diagnosis, a current research focus, according to an extensive review of relevant literature on the disease. The complex relationship between vaccination and tuberculosis is highlighted by new perspectives, underscoring its crucial function as a catalyst for further research into the subject of spinal tuberculosis. There have been investigated a number of diagnostic modalities, including clinical presentation, laboratory assays, surgical methodologies, and imaging methods. Furthermore, to prevent cases of misdiagnosis, a thorough understanding of differential diagnostic criteria is essential.

ETHICAL DECLARATIONS

Ethics Committee Approval: As it is not a human or animal study there is no need for ethical approval.

Informed consent: As it is not a human or animal study there is no need for written informed consent.

Referee Evaluation Process: Externally peer reviewed.

Conflict of Interest Statement: The authors have no conflicts of interest to declare.

Financial Disclosure: The authors declared that this study has received no financial support.

Author Contributions: All the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

REFERENCES

1. Daniel TM, Bates JH, Downes KA. History of tuberculosis. In: Tuberculosis: Pathogenesis, Protection, and Control, Bloom BR (Ed), American Society for Microbiology, Washington 1994. p.13.
2. Hershkovitz I, Donoghue HD, Minnikin DE, et al. Detection and molecular characterization of 9,000-year-old Mycobacterium tuberculosis from a Neolithic settlement in the Eastern Mediterranean. *PLoS One*. 2008;3(10):e3426. doi:10.1371/journal.pone.0003426

3. Garg RK, Somvanshi DS. Spinal tuberculosis: a review. *J Spinal Cord Med.* 2011;34(5):440-454. doi: 10.1179/2045772311Y.0000000023
4. Dobson J. Percivall pott. *Ann R Coll Surg Engl.* 1972;50(1):54-65.
5. Jain AK. Tuberculosis of the spine: a fresh look at an old disease. *J Bone Joint Surg Br.* 2010;92(7):905-913. doi:10.1302/0301-620X.92B7.24668
6. Lifeso RM, Weaver P, Harder EH. Tuberculous spondylitis in adults. *J Bone Joint Surg Am.* 1985;67(9):1405-1413.
7. Weaver P, Lifeso RM. The radiological diagnosis of tuberculosis of the adult spine. *Skeletal Radiol.* 1984;12(3):178-186. doi:10.1007/BF00361084
8. Kalamara E, Ballas E, Petrova G. Pott disease: when lumbar pain is not innocent. *Adv Respir Med.* 2020;88(6):608-611. doi:10.5603/ARM.a2020.0154
9. Colmenero JD, Ruiz-Mesa JD, Sanjuan-Jimenez R, Sobrino B, Morata P. Establishing the diagnosis of tuberculous vertebral osteomyelitis. *Eur Spine J.* 2013;22(Suppl 4):579-586. doi:10.1007/s00586-012-2348-2
10. Jain AK, Rajasekaran S. Tuberculosis of the spine. *Indian J Orthop.* 2012;46(2):127-129. doi:10.4103/0019-5413.93671
11. Khanna K, Sabharwal S. Spinal tuberculosis: a comprehensive review for the modern spine surgeon. *Spine J.* 2019;19(11):1858-1870. doi:10.1016/j.spinee.2019.05.002
12. Yao Y, Song W, Wang K, et al. Features of 921 patients with spinal tuberculosis: a 16-year investigation of a general hospital in southwest China. *Orthopedics.* 2017;40(6):e1017-e1023. doi:10.3928/01477447-20171012-03
13. Saylor D. Neurologic complications of tuberculosis. *Continuum (Minneapolis Minn).* 2021;27(4):992-1017. doi:10.1212/CON.0000000000001005
14. Wang Y, Wang Q, Zhu R, et al. Trends of spinal tuberculosis research (1994-2015): a bibliometric study. *Medicine (Baltimore).* 2016;95(38):e4923. doi:10.1097/MD.0000000000004923
15. Pu X, Zhou Q, He Q, et al. A posterior versus anterior surgical approach in combination with debridement, interbody autografting and instrumentation for thoracic and lumbar tuberculosis. *Int Orthop.* 2012;36(2):307-313. doi:10.1007/s00264-011-1329-0
16. Siwele BA, Makhado NA, Mariba MT. Late diagnosis of multidrug-resistant tuberculosis in a child at Dr George Mukhari Academic Hospital, Ga-Rankuwa, South Africa: a case report. *Afr J Lab Med.* 2019;8(1):783. doi:10.4102/ajlm.v8i1.783
17. Pereira-Neves A, Vilaça I. Pott's disease. *Eur J Vasc Endovasc Surg.* 2022;63(1):32. doi:10.1016/j.ejvs.2021.09.021
18. Fu JW, Chen Z, Wu JB, Yu DM. [Progress on early diagnosis of spinal tuberculosis]. *Zhongguo Gu Shang.* 2015;28(1):828-824.