



Pneumoconiosis: Cumulative global research output

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Received 07 September 2021; revised 15 February 2022

Due to continuous exposure to airborne respirable dust, miners are in danger of acquiring pneumoconiosis, a lung illness. Extra tiny particles in this sort of dust can be ingested into lung tissue which can result in pneumoconiosis creating disease conditions of disability with associated medical complications leading to premature death. This study tries to establish the current trends in pneumoconiosis research globally. A total of 950 results in the scholarly peer-reviewed publications from 2011-2020 curated from Web of Science Core Collection showed India to have contributed 20 records. This analysis also revealed that the most opted or chosen journal by the authors for the publication was the American Journal of Industrial Medicine. Apart from this, it was also seen that the scholars from Peoples R China and USA ranked highest in the list with almost half of the publications achieved alone. However, for Indian scholars to be counted among the lead global leaders, it is imperative that a more concerted effort is made in the specific area of pneumoconiosis research.

Keywords: Black lung, Miners' health, Occupational hazards, Occupational health, Pnuemoconiotic lung

Due to the rapid growth and development in global industry, occupational diseases have always been a challenge to be dealt with by health professionals all around the world^{1,2}. Occupational health is defined as the highest degree of physical, mental, and social well-being of workers in all occupations. It is the branch of healthcare that deals with all aspects of health and safety at the workplace. It lays strong emphasis on the prevention of hazards at a primary level. Though occupational health is regarded essentially as preventive medicine³, it is evident enough that the aspects of correctly diagnosing a specific occupational disease holds out hope for millions suffering from a variety of ailments owing primarily to dust exposure originating from silica, asbestos or coal and even mixed dust.

Humans have likely suffered from occupational lung disease since the change from hunting to agriculture as a means of providing food. In Roman times it was recorded that mining was a dangerous trade, fit only for convicts and slaves. The first recorded mention of breathlessness among handlers of grain was observed in 1713 by the father of occupational medicine⁴. In the eighteenth and early nineteenth centuries, it was thought that the symptoms from black lung disease were asthma-related. The

term "black lung" was coined when medical professionals discovered the blackening of miners' lungs post-mortem. The first documented case of an asbestos-related death was reported in 1906 when the autopsy of an asbestos worker revealed lung fibrosis⁵. In the early twentieth century, it was observed that many asbestos workers were dying unnaturally young⁶. As per International Labour Organization (ILO) – The term "occupational disease" covers any disease contracted as a result of exposure to risk factors arising from work activity.

In India, major occupational diseases are pneumoconiosis (including silicosis, bagassosis, anthracosis, and byssinosis), asbestosis, other chronic lung diseases, musculoskeletal injuries, noise-induced hearing loss, pesticide poisoning, and accidents. Occupations related to construction, mining, and agriculture have high levels of related diseases⁷. As per NIMH, the prevalence of pneumoconiotic opacities in chest radiographs in open cast mine workers in 2005 and 2011 were 5.7% to 12% and 5.3% to 13%, respectively⁸. The Ministry of Labour and Employment, Government of India, approved the national policy on safety, health, and environment at workplaces in February 2009⁹.

Pneumoconiosis is a major occupational lung disease with increasing prevalence and severity worldwide. The term "pneumoconiosis" summarizes all lung diseases caused by excessive exposure to dust

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(e.g., silica, asbestos, coal, and mixed dust), which often occurs in the workplace. It is an irreversible disease with no cure¹⁰. The term pneumoconiosis derives its meaning from the Greek words: *pneuma* = air and *konis* = dust and was coined by Zenker in 1867¹¹. The International Labour Organization defines pneumoconiosis as “the accumulation of dust in the lungs and the tissue reactions to its presence”. Pneumoconiosis can be defined as the non-neoplastic reaction of lungs to inhaled minerals or organic dust and the resultant alteration in their structure excluding asthma, bronchitis, and emphysema. Coal lung is the fibrosis of lung tissues caused by long-term inhalation of coal dust (containing 5% free silica)¹². Other dust such as aluminium, barium, antimony, graphite, kaolin, and mica can also cause pneumoconiosis (Table 1).

Black lung disease can develop when coal dust is inhaled over a long period of time. Coal dust is made of dangerous carbon-containing particles that coal miners are at risk of inhaling, which is why it is mostly considered as an occupational disease. When the coal dust is inhaled, the particles can travel through the airways all the way into the alveoli (air sacs) that are deep in the lungs. After the dust particles land and settle in the lung, lung tissue, in its natural response, may try to get rid of the dust particles, causing inflammation as the body tries to fight the foreign particles. In some cases, the inflammation could be severe enough to cause scar

tissue to form. What is frighteningly dangerous is the fact that the damaging effects of the inhaled coal dust may not show up for many years, and many patients don't even develop primary symptoms until long after their initial exposure. For coal worker's pneumoconiosis, the scarring can be separated into two types: simple or complicated. In simple pneumoconiosis, a chest X-ray or CT scan will reveal small amounts of scar tissue, seen as tiny, circular nodules on the lungs. Complicated pneumoconiosis, also called progressive massive fibrosis, involves more severe scarring over a larger area of the lung tissue. In both types, breathing would get negatively affected. Coal miners may also be exposed to silica-containing dust because coal mining may involve some drilling into silica-containing rock. However, not all workers will develop the disease¹³. This quantitative analysis attempts to explore the current trends in the field of pneumoconiosis which includes research areas, document types, sources, countries, publications, *etc.* The large number of papers must be analysed in order to determine their influence on the scientific community¹⁴.

Materials and Methods

For this analysis, our search approach was to use the associated key phrase “pneumoconiosis” to discover all published scientific publications related to pneumoconiosis that were indexed in Web of Science (WoS) between 2011 and 2020. In the “All fields” category, total of 950 results were retracted including articles (687), meeting abstracts (84), review articles (84), proceedings paper (47) and others. The data was saved and imported into Microsoft Excel for analysis and visualisation. Tables, figures, and maps have been used to present our findings.

The bibliographic details of the reference database were exported and analysed using scientometric methods, including the list of authors, title, year of publication, source title, volume, issue, page numbers, author affiliations, abstracts, author keywords, index keywords, list of references, document type, and other details.

Results

Most prolific research areas

The top 10 most prolific research areas in publications on Pneumoconiosis research are shown in (Table 2). These research areas are arranged in records mined, top 5 areas include Public Environment Public Environmental Occupational health (253), Respiratory system (173), General

Table 1 — Major dust linked diseases¹⁵

Disease	Type of Dust responsible
Silicosis	Silica
Asbestosis	Asbestos
Coal workers Pneumoconiosis (Anthracosis)	Coal
Byssinosis	Cotton
Bagassosis	Sugarcane
Farmer's Lung	Hay dust or mold spores or other agriculture products
Berylliosis	Beryllium
Siderosis	Iron oxide
Tanosis	Tin oxide
Talcosis	Talc (hydrated magnesium silicate)
Bauxite Fibrosis	Bauxite
Mixed dust Pneumoconiosis	Mixture of dust
Hard metal Pneumoconiosis	Certain metals like cobalt

internal medicine (123), Environmental Sciences Ecology (100) and Toxicology (87), etc.

Decadal Vogue in publications

From Figure 1, it can be inferred that the trend of pneumoconiosis research have registered a uniformly sustained increase. In 2015 and 2016, a constant research pattern was observed by the publications. Furthermore, a sharp jump or rise in the publication pattern was also not observed. The year 2019 was the most productive in the decade of pneumoconiosis research.

Document types

The Figure 2 highlights the ever-popular type of publication chosen by the authors or researchers. It can be observed that authors preferred to publish article types among other types of document types. The article itself covered the majority of the portion with 687 records followed by Meeting records, Review articles, proceedings papers, and editorial materials with 84, 84, 47 & 33 records, respectively.

Most popular journals

The quality of research is often reflected by the journals in which the study has been published.

Table 2 — Top 10 research areas

S. No	Research areas	Records	% of 950
1	Public Environmental Occupational health	253	26.63
2	Respiratory system	173	18.21
3	General internal medicine	123	12.94
4	Environmental Sciences Ecology	100	10.52
5	Toxicology	87	9.15
6	Engineering	53	5.57
7	Radiology Nuclear Medicine Medical Imaging	51	5.36
8	Research Experimental Medicine	43	4.52
9	Oncology	36	3.78
10	Science Technology other topics	30	3.15

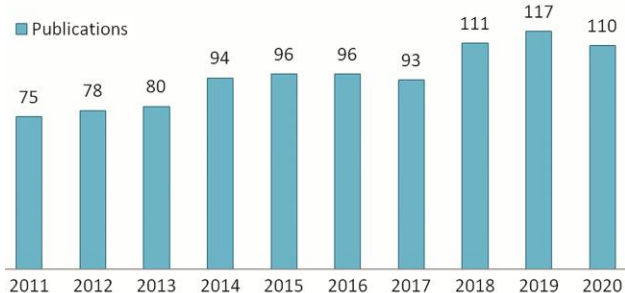


Fig. 1 — Publication trend

Similarly, the figure shows that a good amount of scholarly communications has been published in the American Journal of Industrial Medicine with 40 records as a whole (Table 3). Not only this journal but several other journals are also in the list which was most preferred by the authors for their publications which includes the American Journal of Respiratory & Critical Care Medicine, Occupational and Environmental Medicine, and Journal of Occupational and Environmental Medicine.

Most productive countries

Figure 3 shows the contribution from different countries in Pneumoconiosis research across the length and breadth of the globe. It suggests that Peoples R China and the United States of America alone contributed half of the publications and ranks 1 and 2 in the list with 321 & 260 records, respectively. Some other countries like Japan and Turkey are also trying to make their way into global ranking with 73 and 45 records, respectively.



Fig. 2 — Popular publication document type

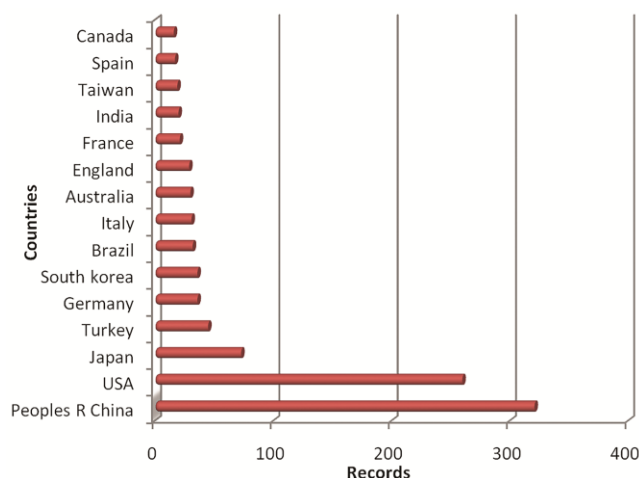


Fig. 3 — Active countries and their participation

Table 3 — Top selected journals

Rank	Source	Records
1	American Journal of Industrial Medicine	40
2	American Journal of Respiratory & Critical Care Medicine	39
3	Occupational and Environmental Medicine	25
4	Journal of Occupational and Environmental Medicine	19
5	International Journal of Environmental Research and Public Health	18
5	Respirology	18
6	Industrial Health	15
7	Chest	14
7	PLoS One	14
8	Current Opinion in Pulmonary Medicine	11
8	Journal of Occupational Health	11
8	Occupational Medicine Oxford	11

Discussion

The results of the study reflect the scholarly output from authors globally on pneumoconiosis from 2011-2020 which have contextualized the trend shown during yesteryears. The current study gained some significant insights that are pointers for future authors and organizations to chart a path of not just undertaking research in areas that need further attention but also to gain a fuller understanding of the yet-to-be discovered and understood aspects of pneumoconiosis.

The results suggest that the research area in which majority of the scholarly communication was done were in occupation health respiratory-related medicine and environment-related that also establishes the linkage of pneumoconiosis with health and medicine as well as environment. The study also provides definite indicators to scholars about a range of journals to consider communicating their findings.

Publication trends reveal that year over year researchers are contributing more as compared to the previous, heralding a positive direction in pneumoconiosis research. Possibilities for researchers are immense in the area where miners' health and safety are concerned, especially in view of the fact that the area has not received the required attention for centuries. Afflictions, ailments and diseases which have their origins in mineral dust need to be foregrounded in the interest of the utterly neglected lives of miners who create amenities and positively affect the quality of life for others, while in the process their own lives vanish without much notice.

In document types, the most adopted type were the article that provided an important insight into a range

of area of pneumoconiosis. The research involved originated more from wet lab research which related to pathology, diagnosis, or other laboratory-related research. The number of research articles over a decade empirically establishes the above fact.

Journals like American Journal of Industrial Medicine and American Journal of Respiratory and Critical care Medicine emerged as the favorite among scholars possibly because of its theme-niche.

The productivity of a country in any research area is gauged by the amount of publication received by the country. The results suggest that the countries like USA and Peoples R China continue to contribute a large portion of research output as compared to other countries. They are also making their contributions more in the knowledge domain in pneumoconiosis research. Some other countries, that include Japan and Turkey, are also fast realizing the criticality of research engagement in this area which is asking for more attention than ever.

Conclusion

Occupational health and hygiene should be among the priorities for any nation. Countries like India where occupational safety, health and hygiene are a great concern, the time is never more opportune than now to rise up and establish itself as one of the global leaders in pneumoconiosis research.

Conflict of interest

All authors declare no conflict of interest.

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